SUB-COMMITTEE ON CARRIAGE OF CARGOES AND CONTAINERS
2nd session
Agenda item 3

CCC 2/WP.3
17 September 2015
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AMENDMENTS TO THE IGF CODE AND DEVELOPMENT OF GUIDELINES FOR LOW-FLASHPOINT FUELS

Report of the working group

GENERAL

1 The Working Group on Amendments to the IGF Code and Development of Guidelines for Low-flashpoint Fuels met on 14 to 17 September 2015 under the chairmanship of Mr. G. Szemler (Sweden).

2 The group was attended by delegations from the following Member Governments:

AUSTRALIA
BELGIUM
BRAZIL
CANADA
CHINA
DENMARK
FINLAND
FRANCE
GERMANY
GREECE
INDONESIA
JAPAN
LIBERIA
MARSHALL ISLANDS
NORWAY
PANAMA
PERU
POLAND
REPUBLIC OF KOREA
RUSSIAN FEDERATION
SINGAPORE
SPAIN
SWEDEN
UNITED KINGDOM
UNITED STATES

and from the following Associated Member:

HONG KONG (CHINA)

observers from the following intergovernmental organization:

EUROPEAN COMMISSION (EC)

and observers from the following non-governmental organizations in consultative status:

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)
INTERNATIONAL ASSOCIATION OF INDEPENDENT TANKER OWNERS (INTERTANKO)
SOCIETY OF INTERNATIONAL GAS TANKER AND TERMINAL OPERATORS LIMITED (SIGTTO)
THE INSTITUTE OF MARINE ENGINEERING, SCIENCE AND TECHNOLOGY (IMarEST)
INTERFERRY
CLEAN SHIPPING COALITION (CSC)

TERMS OF REFERENCE

3 Taking into account the outcomes of MSC 94, SSE 2 and MSC 95, as set out in document CCC 2/3, the IGF Code, as adopted by resolution MSC.391(95), and the comments and decisions made in plenary, the working group was instructed to:

.1 further develop technical provisions for the safety of ships using methyl/ethyl alcohol as fuel, based on annex 1 to document CCC 2/3/1;

.2 consider the need of forwarding any of the safety provisions for ships using methyl/ethyl alcohol as fuel to other sub-committees for review and advise the Sub-Committee accordingly;

.3 prepare draft amendments to the IGF Code regarding fuels cells, based on annex 2 to document CCC 2/3/1;

.4 in the context of the IGF Code, develop a work plan and/or a list of considerations for assessing the risks and the implications of using low-flashpoint oil fuels;

.5 further consider document CCC 2/3/3 and advise the Sub-Committee on how best to proceed;

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

.7 submit a written report by Thursday, 17 September 2015.

DISCUSSION

Technical provisions for the safety of ships using methyl/ethyl alcohol as fuel

4 The group recalled that the Sub-Committee, with a view to deciding whether the safety requirements for ship using methyl/ethyl alcohol as fuel should be developed in the form of interim guidelines or as amendments to the IGF Code, instructed it to further develop technical provisions for the safety of such ships. In this regard, the group agreed to continue following

the format of the draft *Interim guidelines for ships using methyl/ethyl alcohol as fuel*, as set out in annex 1 to document CCC 2/3/1, and, in case of the Sub-Committee's decision to proceed with developing amendments to the IGF Code, to remove the preamble; application provisions; definitions; requirements on alternative design; goal and functional requirements; and general requirements that duplicate general provisions and requirements of the IGF Code.

5 In view of the above, the group agreed to add the reference to definitions of the IGF Code in the chapeau of section 2.2 of the draft Interim guidelines and delete all definitions duplicating the definitions in section 2.2 of part A of the IGF Code.

6 Having reviewed chapters 1 to 4 of the draft Interim guidelines prepared by the Correspondence Group on Amendments to the IGF Code and Development of Guidelines for Low-flashpoint Fuels (CCC 2/3/1, annex 1), the group noted that they were not based on the final text of the IGF Code adopted by MSC 95. In this connection, the group agreed to align the technical provisions for the safety of ships using methyl/ethyl alcohol as fuel with the text of the IGF Code, as adopted by resolution MSC.391(95).

7 In considering the draft Interim guidelines, with a view to identifying draft definitions to be kept in section 2.2, the group noted that some of them could not be finalized before revisiting technical provisions in chapters 5 to 15, and agreed to keep them in square brackets for further review.

8 The group, in revisiting chapter 5 of the draft Interim guidelines, noted the following views expressed during the discussion:

.1 in finalizing the text of paragraph 5.3.2, the requirements of the IBC Code on segregation of cargo and fuel tanks need to be considered, with a view to deciding whether the boundaries between fuel tanks and cargo tanks containing the same substances should be protected by cofferdams; however, the boundaries between two fuel tanks containing the same fuels need not to be protected by cofferdams;

.2 the draft text of paragraph 5.3.2 should be referred to the PPR Sub-Committee for consideration with respect to cargo tanks located adjacent to methyl/ethyl alcohol fuel tanks;

.3 the draft text of paragraph 5.3.6 should be referred to the PPR Sub-Committee for consideration to determine the adequate means of transferring contaminated fuel;

.4 the draft text of paragraph 5.3.3 should be forwarded to the SDC Sub-Committee for review regarding the aft limit for safe location of fuel tank(s);

.5 a new section 15.12 on safety of crew should be developed to address the toxicity of methyl/ethyl alcohols, including provisions for personal protection; and

.6 with regard to further development of section 5.4 on independent tanks, design criteria from the rules of classification societies may be considered and appropriate firefighting systems should be considered further. The provisions of section 5.5 on portable tanks, except for paragraphs 5.5.5 and 5.5.8, are also applicable to independent tanks.

9 In considering chapter 6, the group agreed that prescriptive provisions of the chapter should be checked to verify that all functional requirements are conformed with. The group also agreed that sections 6.3 and 6.4 should include provisions to address cofferdams.

10 Owing to lack of time, the group was unable to revisit sections 6.3 to 6.5 and chapters 7 to 15. However, with a view to establishing a basis for the future work on section 6.4, the group discussed in detail the need for inerting fuel tanks. In this connection, the below comments were recommended for further consideration:

.1 inerting of fuel tanks needs to be considered, bearing in mind that, if not inerted the atmosphere in tanks containing methyl/ethyl alcohol will always be within the explosive range;

.2 the atmosphere in fuel tanks changes during a voyage because the level of fuel changes due to consumption;

.3 the limits for the application of inerting requirements may be set up depending on the size of fuel tanks, i.e. small tanks may not require inerting;

.4 a majority felt that, as a default, inerting should be required with an allowance provided to not inert if approved by the Administration, perhaps based on risk assessment;

.5 if a risk assessment is recommended for deciding on the need for inerting, then very clear criteria for such an assessment need to be defined;

.6 the risk mitigated by inerting methyl/ethyl alcohol fuel tanks should be balanced against operational risk for personnel;

.7 applicable requirements of the IBC Code need to be considered; however, since the risks may be different on a methyl/ethyl alcohol fuelled ship as compared to a chemical tanker, the requirements need not be the same; and

.8 the following factors should be taken into account: type of ship; type of cargo; location of fuel tanks; and passengers on board.

11 The Sub-Committee was invited to note the progress made on the draft text of the technical provisions for the safety of ships using methyl/ethyl alcohol as fuel. The draft text further developed by the group is set out in annex 1.

Draft amendments to the IGF Code

Requirements for fuels cells

12 As instructed, the group proceeded with preparing draft amendments to the IGF Code regarding fuels cells, based on draft measures developed by the correspondence group (CCC 2/3/1, annex 2).

13 With a view to achieving a common understanding on the basic fuel cell process, fuel supply to fuel cells, fuel reforming, fuel cell power system and fuel cell space, the group noted presentations made by the delegations of the United Kingdom and CESA.

14 The group confirmed the understanding that only requirements for fuel cells using natural gas as fuel could be developed at this stage, for inclusion in the new section 10.6 (Requirements for fuel cells) of the existing chapter 10 of the IGF Code.

15 Having considered in detail the draft measures for fuel cells set out in annex 2 to document CCC 2/3/1, the group finalized:

.1 the draft definitions for fuel cell, fuel cell installation, fuel cell power system and fuel cell space, for inclusion in section 2.2 of the IGF Code;

.2 the draft scope of application of the new section 10.6 of the IGF Code, limiting these regulations to fuel cells which do not include the storage of hydrogen; and

.3 the draft requirements for materials within the fuel cell installation, single failure in fuel cell installation, fire safety and system arrangement.

16 Owing to the limited time available, the group was unable to finalize the draft definition for fuel reforming or fully consider draft requirements on exhaust air and residual gases, ventilation system, arrangement of fuel cell spaces and fuel cell control monitoring and safety system. In this connection, the group prepared recommendations for further consideration of the pending issues in square brackets, as set out in the text contained in annex 2.

17 In addition to the draft requirements prepared by the correspondence group, the group agreed upon the need to consider requirements for entrances into/access to fuel cell space.

18 The Sub-Committee was invited to note the progress made on the draft amendments to the IGF Code prepared by the group, as set out in annex 2.

Consideration of proposals in document CCC 2/3/3

19 Owing to time constrains, the group was unable to consider the draft amendments to the IGF Code proposed in document CCC 2/3/3 (China). In this connection, the group requested the Sub-Committee to invite interested Member Governments and international organizations to submit comments and proposals to CCC 3.

List of considerations for assessing the risks and the implications of using low-flashpoint oil fuels

20 The group noted that interested delegations met outside the working hours to prepare the list of considerations for assessing the risks and the implications of using low-flashpoint oil fuels for use by the group as a basis for development of the plan of future work on this matter.

21 However, owing to lack of time, the group was unable to develop the work plan for assessing the risks and the implications of using low-flashpoint oil fuels. However, a list of considerations was developed for consideration by the Sub-Committee, as set out in annex 3, for deciding on what further actions need to be taken.

Establishment of the correspondence group

22 Taking into account the progress made at this session, the group agreed to recommend that the Correspondence Group on Development of Technical Provisions for the Safety of Ships using Low-flashpoint Fuels be established to continue the work intersessionally under the terms of reference set out in paragraph 23.

Terms of reference for the Correspondence Group on Development of Technical Provisions for the Safety of Ships using Low-flashpoint Fuels

23 As instructed by the Sub-Committee, the group prepared draft terms of reference for the established Correspondence Group on Development of Technical Provisions for the Safety of Ships using Low-flashpoint Fuels, under the coordination of Sweden*, as follows:

.1 further develop technical provisions for the safety of ships using methyl/ethyl alcohol as fuel, taking into account paragraphs 4 to 10 of document CCC 2/WP.3 and based on annex 1 to document CCC 2/WP.3;

.2 consider the need of forwarding any of the safety provisions for ships using methyl/ethyl alcohol as fuel to other sub-committees for review and advise CCC 3 accordingly;

.3 finalize the draft amendments to the IGF Code regarding fuels cells, taking into account paragraphs 16 and 17 of document CCC 2/WP.3 and based on annex 2 to document CCC 2/WP.3; and

.4 submit a report to CCC 3.

Action requested of the Sub-Committee

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

.1 note the progress made by the group on the development technical provisions for the safety of ships using methyl/ethyl alcohol as fuel (paragraphs 4 to 11 and annex 1);

.2 note the progress made by the group on the preparation of draft amendments to the IGF Code regarding fuels cells (paragraph 15 to 18 and annex 2);

.3 invite interested Member Governments and international organizations to submit comments and proposals to CCC 3 on the draft amendments to the IGF Code set out in document CCC 2/3/3 (paragraph 19);

.4 consider the list of considerations for assessing the risks and the implications of using low-flashpoint oil fuels and take action as appropriate (paragraph 21 and annex 3);

.5 decide on whether the Correspondence Group on Development of Technical Provisions for the Safety of Ships using Low-flashpoint Fuels, if established, should be instructed to develop a work plan, based on the list of considerations set out in annex 3 to document CCC 2/WP.3 (paragraph 21 and annex 3); and

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.6 consider the recommendation to establish the Correspondence Group on Development of Technical Provisions for the Safety of Ships using Low-flashpoint Fuels and take action as appropriate (paragraphs 22 and 23).

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ANNEX 1*

DRAFT TECHNICAL PROVISIONS FOR THE SAFETY OF SHIPS USING METHYL/ETHYL ALCOHOL AS FUEL

1 PREAMBLE

(**NOTE**: This chapter should be kept for the purpose of the interim guidelines, but deleted for the purpose of amending the IGF Code)

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

(**NOTE**: This section should be kept for the purpose of the interim guidelines, but deleted for the purpose of amending the IGF Code)

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 and section 2.2 of part A of the IGF Code.

2.2.1 [*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.]
(**NOTE**: To be further revisited)

2.2.2 *Ethyl alcohol* means C_2H_5OH, either in liquid or vapour state.

* Available in English only.

2.2.3 [*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**: To be further revisited)

2.2.4 [*Fuel preparation room* means any space containing equipment for fuel preparation purposes, such as fuel pumps, heat exchangers and filters.]
(**NOTE**: To be further revisited)

2.2.5 *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.

2.2.6 *Methyl alcohol* means CH_3OH, either in liquid or vapour state.

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

2.3 Alternative design
(**NOTE**: This section should be kept for the purpose of the interim guidelines, but deleted for the purpose of amending the IGF Code)

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

(**NOTE**: This chapter should be kept for the purpose of the interim guidelines, but deleted for the purpose of amending the IGF Code)

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 minimized 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.

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

(**NOTE**: This chapter should be kept for the purpose of the interim guidelines, but deleted for the purpose of amending the IGF Code)

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[1] 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;

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

.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.

5 SHIP DESIGN AND ARRANGEMENT

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.

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, 3.2.7, 3.2.12, 3.2.15 and 3.2.17. In particular the following apply:

.1 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 fuel, either as vapour or liquid is led to safe locations.

.3 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.

.4 Fuel piping shall be protected against mechanical damage.

.5 The propulsion and fuel supply system shall be so designed that safety actions after any fuel leakage do not lead to an unacceptable loss of power.

.6 The probability of a fire or explosion in a machinery space as a result of a fuel release shall be minimized.

5.3 General requirements

5.3.1 Fuel tanks shall not be located within the accommodation area or engine-room area.

5.3.2 Integral fuel tanks shall be surrounded by protective cofferdams, except on those surfaces bound by bottom shell plating, other [fuel] tanks containing methyl alcohol or ethyl alcohol, or [fuel pump-rooms][fuel preparation room].

5.3.3 The fuel tank(s) and associated cofferdams shall be abaft of the collision bulkhead and forward of the after perpendicular.

5.3.4 Fuel tanks located on open deck shall be protected against mechanical damage.

5.3.5 Fuel tanks on open deck shall be surrounded by coamings and spills collected in a dedicated holding tank.

5.3.6 Means shall be provided for safely transferring contaminated liquids to onshore reception facilities.
(**NOTE:** Proposed to move to 5.9)

5.4 Independent tanks

5.4.1 Independent tanks may be accepted on open decks or in enclosed spaces.

[5.4.2 Independent tanks shall be constructed and tested to the satisfaction of the Administration.]
(**NOTE**: to be further developed)

5.4.3 Independent tanks shall be 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 Independent fuel tanks shall be secured to the ship's structure. 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.

5.5 Portable tanks

5.5.1 The design of the tank shall comply with 5.4. The tank support (container frame or truck chassis) shall be designed for the intended purpose.

5.5.2 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 suitable for methyl/ethyl alcohol.

5.5.3 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.

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

5.5.5 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.

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

5.5.7 The pressure relief system of portable tanks shall be connected to a fixed venting system.
(**NOTE**: Covered by 6.3)

5.5.8 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).

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

5.5.10 When connected 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.

5.6 Requirements for machinery space

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

5.6.2 All fuel piping within machinery space boundaries shall be enclosed in vapour tight and liquid tight enclosure in accordance with 9.8.

5.7 Requirements for location and protection of fuel piping

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

5.7.2 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.

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

.1 The fuel pipes shall be clearly identified and fitted with a shut-off valves at their connections 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; (**NOTE**: further consideration is needed)

.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 fuel preparation room design

5.8.1 Pump-rooms and fuel preparation rooms, if such exist, shall be located outside the engine-room.

5.9 Requirements for bilge systems

5.9.1 Bilge systems installed in areas where methyl alcohol or ethyl alcohol can be present shall be segregated from the bilge system of spaces where methyl alcohol or ethyl alcohol cannot be present.

5.9.1*bis* 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. Such holding tank containing methyl/ethyl alcohol leakage shall be arranged in accordance with 5.3.

5.9.2 The bilge system serving the fuel preparation room shall be operable from outside the fuel 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 tray shall have a sufficient capacity to ensure that the maximum amount of spill according to the risk assessment can be handled.

5.10.3 Each drip tray shall be provided with means to safely drain spills or transfer spills to a dedicated holding tank. Means for preventing backflow from the tank shall be provided.

5.11 Requirements for arrangement of entrances and other openings

5.11.1 Direct access shall not be permitted from a non-hazardous area to a hazardous 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 chapter 5.12 shall be provided.

5.11.3 Fuel tanks and surrounding cofferdams shall have suitable access from open deck, where practicable, for gas-freeing, cleaning, maintenance and inspection.

[5.11.4 The arrangement shall be such that before opening any tank or cofferdam, the tanks and cofferdams can be completely freed from flammable/toxic vapour or any gases that represent a hazard to the crew.

5.11.5 For 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 fuel tank hatch for efficient evacuation and rescue operation;
- Entry from accommodation spaces, service spaces, control stations and machinery spaces of category A 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.

(**NOTE**: Well ventilated needs to be defined in "air changes", also need to specify the spaces from which entry is permitted)]
(**NOTE**: to be further considered after finalizing section 6.3)

5.11.6 The area around independent fuel tanks shall be sufficient to carry out evacuation and rescue operations.

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.

5.12 Requirements for air locks

5.12.1 An air lock is a space enclosed by gastight bulkheads with two 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 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.

5.12.4 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.

5.12.5 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.
(**NOTE**: to be moved to chapter 14)

5.12.6 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.

5.12.7 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 and general alarms systems.

5.12.8 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.
(**NOTE**: to be updated and moved to chapter 14)

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.

6.2 Functional requirements

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:

.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; and

.4 Reduction in availability of LSA.

6.2.2 The fuel containment arrangement shall be so designed that safety actions after any leakage, irrespective if in liquid or vapour phase, do not lead to an unacceptable loss of power.

6.2.3 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

6.4.1 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*bis* 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.[2] 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)

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 least [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.)~~

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

[6.3.2.4 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[3]. 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.]

[3] 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].

~~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~~

~~.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

~~6.3.4.1~~ 6.5.1 The equipment shall be capable of producing 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.~~[4]

~~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.~~]~~

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

~~(**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].~~

~~7.3.5~~ 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.~~5~~7 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.~~6~~9 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~~ 9.8.1~~Appropriate 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.[5] 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.[6]

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

6 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.[7] 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 1[8]

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;

[7] 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.

[8] 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:** Subparagraphs 4, 8 and 9 need further discussion)

12.5.3 Hazardous area zone 2[9]

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.

9 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[10] 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.

[10] 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.[11]

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

(**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)

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

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
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.

Parameter	**Alarm**	**Aut. Shut down of tank valve**	**Aut. Shutdown of methyl/ethyl alcohol bunkering valve**	**Comments**
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 AMENDMENTS TO THE IGF CODE

PART A

2 GENERAL

2.2 Definitions

1 The following new definitions are added after the existing paragraph 2.2.14:

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

2.2.14*ter* *Fuel cell installation* consists of all the components and systems required to generate electrical power for the ship from the fuel cell but does not include the storage or production of natural gas nor electrical power conditioning.

2.2.14*quater* [*Fuel reforming* is any process used to convert [fuel] [natural gas] from one form to another form on board and which is not part of the chemical conversion process in the fuel cell. Fuel reforming may include the following equipment: gas compressor, vaporiser, fuel gas cleaner, steam reformer, shift converter, selective oxidiser.]

2.2.*14quinquies Fuel Cell Power System* is fuel cell(s), fuel reforming equipment and associated hydrogen pipes.

2.2.14*sexies* *Fuel cell space* is any space containing elements of the fuel cell power system."

10 POWER GENERATION INCLUDING PROPULSION AND OTHER GAS CONSUMERS

2 The following new section 10.6 is added after the existing section 10.5:

"**10.6 Regulations for fuel cells**

10.6.1 Application

This section only applies to fuel cell installations that do not include hydrogen storage.

10.6.2 Materials

10.6.2.1 The materials within the fuel cell installation shall be suitable for the intended application and shall comply with recognized standards.

10.6.2.2 The use of combustible materials inside the fuel cell space shall be minimized.

10.6.2.3 The use of combustible materials as components of the fuel cell power system may be accepted based on the approval by the Administration.

* Available in English only.

10.6.3 Fuel Cell Specific Ship Arrangement and System Design

10.6.3.1 General

A single failure in a fuel cell installation shall not lead to an unacceptable loss of power.

10.6.3.2 Fire safety

In general, the regulations set out in chapter 11 apply. The fuel cell space shall be considered as a machinery space of category A. The fire-extinguishing system is to be suitable for use with the specific fuel cell technology proposed.

10.6.3.3 Exhaust air and residual gases

Exhaust air and residual gases of the fuel cells power systems shall not be combined with ventilation air and shall be led to the open air and [3 m] away from any entrances, ventilation inlets and other openings. Step shall be taken to ensure that no combustible mixtures will be exhausted from the system.
(**NOTE**: To be further revisited from the point of view of toxicity and inlet air)

10.6.3.4 [*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.]
(**NOTE**: To be further revisited from the point of view of safety concept)

10.6.3.5 System arrangement

10.6.3.5.1 Fuel cell power 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.

10.6.3.5.2 It shall be possible to shut down the fuel cell power system from a permanently accessible location outside the installation space.

10.6.3.5.3 Means for purging the fuel cell power system shall be provided.

10.6.3.5.4 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.

10.6.3.5.5 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.

10.6.3.6 Arrangement of fuel cell spaces

10.6.3.6.1 Fuel cell power systems shall be located in separate spaces with gas tight steel enclosures.

10.6.3.6.2 [Fuel cell spaces shall be designed to safely contain fuel leakages and be provided with suitable leakage detection systems.] [A fuel cell space shall be considered a machinery space, and shall meet the requirements of one of the two machinery space concepts specified in section 5.4.]
(**NOTE**: To be further revisited from the safety concept point of view)

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

10.6.3.6.4 [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)

10.6.3.6.5 [In general the temperature of installations in the fuel cell space shall never be above more than 30^{0}C below the auto-ignition temperature for the fuel used.] [The temperature of the external surfaces in the fuel cell space shall never be above more than 30^{0}C below the auto-ignition temperature for the fuel used.]
[Surfaces with temperatures above 220^{0}C which may be impinged as a result of a fuel system failure shall be properly insulated.]
(**NOTE**: to be further revisited from the point of view of protection of high-temperature surfaces)

10.6.3.6.6 The ventilation rate in the fuel cell space shall be sufficient to avoid gas concentration in the flammable range in all leakage scenarios.
(**NOTE**: to be further revisited from the point of view of air changes)

10.6.3.6.6*bis*[Ventilation systems for fuel cell spaces shall be independent of all other ventilation systems.]
(**NOTE**: to be discussed)

10.6.3.6.7Ventilation ducts from spaces containing hydrogen piping or release sources shall be arranged to prevent entrapped hydrogen pockets forming.

10.6.3.6.7*bis*[Permanently installed gas detectors shall be fitted in fuel cell spaces for the detection of natural gas and hydrogen.]
(**NOTE**: to be discussed)

10.6.3.6.8 Hydrogen pipes are not to be led through enclosed spaces in the ship apart from fuel cell spaces.

10.6.3.6.9 The double wall principle is not to be used for hydrogen pipes. Hydrogen pipes are as far as practicable to be fully welded. The number of connections shall be minimized.

10.6.3.7 Fuel Cell Control Monitoring and Safety System
(**NOTE**: to be further revisited regarding placement of the monitors)

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

10.6.3.7.2 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.

10.6.3.7.3 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."

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ANNEX 3

LIST OF CONSIDERATIONS FOR ASSESSING THE RISKS AND THE IMPLICATIONS OF USING LOW-FLASHPOINT OIL FUELS

1 There is a clear need to define the scope of this work.

2 The original terms of reference from MSC referred to the use of diesel fuels with a flashpoint between 52^{0}C and 60^{0}C, which are consistent with widely available automotive diesel fuels.

3 There is a consensus that such fuels will come under a new chapter in the IGF Code – much like the way in which we have incorporated natural gas.

4 There is a lack of understanding of what automotive diesel fuels or low-flashpoint oil fuels means. This has generated a large number of concerns.

5 In order to produce a new chapter of the IGF Code, a better understanding of these fuels is necessary. Without a detailed understanding of these fuels and the hazards that they bring, it would be difficult to define the goals, functional requirements and technical requirements to mitigate the hazards.

6 Therefore it is necessary to identify these fuels. It was discussed whether Member Governments or international organizations would like to present their thoughts on what low-flashpoint oil fuels may include. Such proposals might include one or more existing ISO or EN fuel definitions, or alternatively, a proposal might define a range of parameters such as flash point, auto-ignition temperature and viscosity.

7 It is suggested to start with oil fuels with a flashpoint between 52^{o}C and 60^{o}C.

8 Upon agreement for a description of these fuels it will then be possible to create the goals and functional requirements of the new chapter such that reasonable and proportional measures can be developed to mitigate the known hazards.

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