BUREAU VERITAS MARINE & OFFSHORE
RULE NOTE

METHANOL AND ETHANOL-FUELLED SHIPS

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These rules are provided within the scope of the Bureau Veritas Marine & Offshore General Conditions, enclosed at the end of Part A of NR467, Rules for the Classification of Steel Ships. The latest version of these General Conditions is available on the Bureau Veritas Marine & Offshore website.

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Rule note
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Section 1 General

1 General

1.1 Application

1.1.1 This Rule Note applies to ships using or prepared to use methyl/ethyl alcohol as fuel.

1.1.2 This Rule Note provides requirements 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.

1.1.3 Ships using methyl/ethyl alcohol as fuel and falling within the scope of SOLAS Convention are to comply with the requirements of IMO IGF Code Part A and Flag Administration rules as applicable.

1.1.4 In accordance with NR467, Pt A, Ch 1 Sec 2, [6], this Rule Note provides a set of design and installation requirements for the assignment of:

- the additional class notation **methanolfuel** or **ethanolfuel**, defined in [1.2.1], for ships using methyl/ethyl alcohol as fuel
- the additional class notation **METHANOLFUEL-PREPARED** or **ETHANOLFUEL-PREPARED**, defined in [1.2.3], for ships prepared to use methyl/ethyl alcohol as fuel.

1.2 Classification notations

1.2.1 Methanol or ethanol-fuelled ships

Ships designed and built in accordance with the requirements of Sec 2 to Sec 13 are to be assigned the additional class notation **methanolfuel** or **ethanolfuel** as defined in NR467, Pt A, Ch 1, Sec 2, [6.17.9].

In addition to the requirements of Sec 1 to Sec 13, ships assigned the service notation **chemical tanker**, and designed to use methyl/ethyl alcohol cargo as fuel, are to comply with the requirements of Sec 14.

The additional class notation **methanolfuel** or **ethanolfuel** is completed by:

- the notation **singlefuel** when the engine uses only methyl/ethyl alcohol as fuel
- the notation **dualfuel** when the engine uses methyl/ethyl alcohol fuel and oil fuel.

The additional class notation e.g. **methanolfuel dualfuel** or **ethanolfuel singlefuel** may be completed by:

- the notation **-prop** when methyl/ethyl alcohol fuel is only used for propulsion systems
- the notation **-aux** when methyl/ethyl alcohol fuel is only used for auxiliary systems.

For methyl/ethyl alcohol-fuelled ship fitted with fuel cells the additional requirements of [1.2.2] are to be considered.

1.2.2 Methanol and ethanol-fuelled ships fitted with fuel cells

In addition to the requirements of [1.2.1], for ships fitted with fuel cells using methyl/ethyl alcohol as fuel and complying with the requirements of NR547, the additional class notation **fuelcell** is to be assigned to complete the additional class notation **methanolfuel** or **ethanolfuel**.

1.2.3 Methanol or ethanol fuel prepared ships

New ships that are designed to accommodate future installation of a methyl/ethyl alcohol fuel system at a later stage and complying with the requirements of Sec 15 may be assigned the additional class notation **METHANOLFUEL-PREPARED** or **ETHANOLFUEL-PREPARED** completed, as applicable, by the notations **S**, **T**, **H**, **P**, **A**, **ME-DF**, **AE**, **B**, as defined in NR467 Pt A, Ch 1, Sec 2 [6.17.14].

When the ship is effectively converted to operate on methyl/ethyl alcohol fuel, the additional class notation **METHANOLFUEL-PREPARED** or **ETHANOLFUEL-PREPARED** may be replaced by the additional class notation **methanolfuel dualfuel** or **ethanolfuel dualfuel** provided that the requirements of Sec 15, [1.1.3] are fulfilled.

1.3 Reference documents

1.3.1 Statutory documents

This Rule Note incorporates requirements from IMO MSC.1/Circ.1621 "Interim guidelines for the safety of ships using methyl/ethyl alcohol as fuel", which are applicable for Classification purposes.

1.3.2 References to Society's Rules for Classification and Rule Notes

The following references to BV Rules and Rule Notes are used in this Rule Note:

- NR467 Rules for the classification of steel ships
- NR445 Rules for the classification of offshore units
- NR216 Rules on materials and welding for the classification of marine units
- NR480 Approval of the manufacturing process of metallic materials
- NR529 Gas-fuelled ships
- NR547 Ships using fuel cells
- NR566 Hull arrangement, stability and systems for ships less than 500 GT
- NR598 Implementation of safe return to port and orderly evacuation.

1.4 Documents to be submitted

1.4.1 The documents listed in Tab 1 are to be submitted for ships to be assigned the additional class notation **methanolfuel** or **ethanolfuel**.

For ships to be assigned the additional class notation **METHANOLFUEL-PREPARED** or **ETHANOLFUEL-PREPARED**, reference is made to Sec 15.

Table 1 : Documents to be submitted for additional class notations methanolfuel or ethanolfuel

No.	I/A **(1)**	Documents	Particulars
1	A	Methyl/ethyl alcohol fuel installation general arrangement	General arrangement showing the location of the bunkering stations, fuel tanks, TCS, fuel preparation rooms, header, etc
2	A	General arrangement of the machinery spaces	Including the fuel utilization units (engines, turbines, boilers)
3	I	General specifications of methanol/ethanol fuel installations	
4	I	Operating manuals documents	Indicating the installation particulars, including at least operating and maintenance instructions of fuel tanks, supply system and methyl/ethyl fuelled engines
5	I	Bunkering operational procedures and maintenance instruction manuals	
6	I	Testing and trial procedure	Including sea trials and testing of safety shutdowns in accordance with the cause and effect diagram
7	I	Arrangement of fuel tanks and/or fuel containment systems	
8	I	Arrangement of fuel preparation spaces	
9	I	Arrangement of fuel bunkering systems	Including the bunkering connections
10	A	Arrangement of doors and openings within hazardous areas	
11	A	Arrangement of entrances and air inlets leading to accommodation spaces, service spaces and control station spaces	
12	A	Location and structure of airlocks	
13	A	Pipe, cable and duct penetrations in bulkheads and decks	
14	A	Calculation of the hull temperature and associated distribution of quality and steel grades	
15	A	Scantlings, material and arrangement of the fuel containment system	Including the secondary barrier, if any
16	A	Sloshing calculation	Where relevant
17	A	Details of tank domes and deck sealings	
18	A	Fuel containment system testing and inspection procedures	
19	A	Header detailed drawing	
20	A	Description of coamings, drip trays and other protective measures	
21	A	Plan of hazardous areas	
22	I	Risk analysis and follow-up report of the recommendations	As per Sec 2, [1]
23	A	Details or instruction of fuel piping	Including pressure relief valves and vent pipes for each fuel utilization unit
24	A	Technical documents for branches, return pipes, elbows, expansion joints and similar devices	

No.	I/A **(1)**	Documents	Particulars
25	A	Drawing and instruction of flanges vent lines for pressure/ vacuum relief valves or similar piping and ducts for fuel pipes	
26	A	Technical documents for the material, welding, post-weld heat treatment and non-destructive testing of fuel pipes	
27	I	Functional test guidelines for all piping	Including valves, fittings and equipment relating to fuel (liquid or vapour) operation
28	A	Technical documents for electrical ground system of fuel pipes	
29	I	Technical documents for the measures to remove the fuel from the fuel bunkering pipes before shutoff the bunkering connections	
30	A	Fuel heating or cooling system	
31	A	Diagram of the inert gas piping system	
32	I	Fuel containment system gas freeing procedure	Including emptying, inerting and aerating
33	A	Arrangement of bilge and drainage systems for fuel pump rooms and fuel tank connection spaces	
34	I	Calculation for the discharge volume of pressure relief valves of pipes	
35	A	Exhaust gas system	Including arrangement of explosion relief
36	A	Interbarrier space drainage, inerting and pressurisation systems if fitted	
37	A	Diagram of the fuel oil system including pilot fuel supply	
38	A	Stress analysis of the high pressure piping systems	
39	A	Arrangement and instruction of mechanical ventilation systems in hazardous areas and adjacent zones	Including the capacity and arrangement of fans and their motors
40	A	Arrangement of the double piping or duct system	
41	I	Fire Safety operational documentation including methyl/ ethyl alcohol safety / emergency procedures	
42	A	Arrangement of fixed fire-extinguishing systems	The following details are to be included: • service pressures, capacity and head of the pumps • materials and dimensions of piping and associated fittings • surface areas of protected zones • capacity of extinguishing medium storage • type, number and location of nozzles.
43	A	Fire protection arrangement of fuel tanks and/or fuel storage hold spaces and their vent pipes, bunkering stations	
44	A	Structural fire protection plan	
45	A	External surface protection water spraying system	
46	A	Bunkering station fire extinguishing system	
47	A	Single line diagram of intrinsically safe circuits	
48	A	List of certified explosion-proof equipment	
49	A	Arrangement of electrical installation in hazardous areas	Including lighting system
50	I	Safety certificates for electrical equipment located in hazardous spaces or zones	Where applicable
51	A	Arrangement and instruction of fuel vapour detection and alarm systems	Including probes, alarm arrangements and alarm set points
52	A	Arrangement and instruction of fuel tanks monitoring and control systems	Including sensors and alarm set points
53	A	Arrangement and instruction of fuel pumps monitoring and control systems	
54	A	Arrangement and instruction of methyl/ethyl alcohol fuelled engines monitoring and control systems	
55	A	Arrangement and instruction of fire detection and alarm system	

No.	I/A **(1)**	Documents	Particulars
56	I	Type testing of the engine with electronic controls or a proposed test plan with the electronic controls operational	
57	A	Arrangement and instruction of liquid leakage detection and alarm system	
58	A	Emergency shutdown system	
59	A	Tank hatches, pipes and any openings to tanks	
60	A	Details of tanks coating	
61	A	Detailed drawings of fuel tanks, materials	Including internal structure, heat insulation (if any), piping, valves and connections
62	A	Detailed drawings of fuel tanks supporting	
63	A	Pressure analysis of fuel tanks	
64	I	Specification and type-approval reference of the fuel utilization units	
65	A	Fabrication details of fuel tanks including building tolerances, NDT plan and welding procedures (WPS)	
66	I	Procedure for maintenance of the fuel utilization units and other fuel-related equipment	Including the steps to be taken prior to servicing the units
67	A	Diagram of the engine lubricating oil system	
68	A	Diagram of the engine cooling system	
69	A	Diagram of the engine crankcase venting systems	
70	A	Drawings of the boilers, including burners	
71	A	Fuel injection valves and drive and sealing system	
72	A	Protection of engines against crankcase explosions	
73	A	Explosive protection and calculation of exhaust system	
74	A	Schematic diagram of engine control system related to methyl/ethyl alcohol fuel	Including monitoring, alarm and safety protection devices
75	A	Schedule of testing at engine builders and commissioning prior to sea trials	Including any testing required to verify the safeguards determined in the risk-assessment
(1) A: To be submitted for approval ; I: To be submitted for information			

1.5 Definitions

1.5.1 For the purpose of this Rule Note, the terms used have the meanings defined in the following paragraphs. Terms not defined are to have the same meaning as in NR467, NR566 and NR529.

1.5.2 Bunkering

Bunkering means the transfer of fuel from land-based or floating facilities into ships' permanent tanks or connection of portable tanks to the fuel supply system.

1.5.3 Fuel

Fuel means methyl/ethyl alcohol fuels, containing allowable additives or impurities. Physical and chemical properties considered for the application of the present Rule Note are those of the products identified under CAS 67-56-1, UN 1230 or EC 00-659-6 for methyl alcohol and CAS 64-17-5, UN 1170, or EC 200-578-6 for ethyl alcohol.

1.5.4 Fuel preparation space

Fuel preparation space means any space containing equipment for fuel preparation purposes, such as fuel pumps, fuel valve train, heat exchangers and filters.

1.5.5 Fuel tank

Fuel tank is any integral, independent or portable tank used for storage of fuel. The spaces around the fuel tank are defined as follows:

- fuel storage hold space is the space enclosed by the ship's structure in which an independent fuel tank is located. If tank connections are located in the fuel storage hold space, a fuel storage hold space also is to be considered as tank connection space. Integral fuel tanks do not have a fuel storage hold space
- cofferdam is a structural space surrounding a fuel tank which provides an added layer of gas and liquid tightness protection against external fire and toxic and flammable vapours between the fuel tank and other areas of the ship
- tank connection space is a space surrounding all tank connections and tank valves that is required for tanks with such connections in enclosed spaces.

1.5.6 Gas freeing

Gas freeing is the process carried out to achieve a safe tank atmosphere. It includes two distinct operations:

- purging the hazardous tank atmosphere with an inert gas or other suitable medium (e.g. water) to dilute the hazardous vapour to a level where air can be safely introduced
- replacing the diluted inert atmosphere with air.

1.5.7 High fire risk spaces

It includes as a minimum, but is not to be restricted to:

a) cargo spaces except cargo tanks for liquids with flashpoint above 60°C and except cargo spaces exempted in accordance with SOLAS regulations II-2/10.7.1.2 or II-2/10.7.1.4

b) vehicle, ro-ro and special category spaces

c) service spaces (high risk): galleys, pantries containing cooking appliances, saunas, paint lockers and store-rooms having areas of 4 m^2 or more, spaces for the storage of flammable liquids and workshops other than those forming part of the machinery space, as provided in SOLAS regulations II-2/9.2.2.4, II-2/9.2.3.3 and II-2/9.2.4, and

d) accommodation spaces of greater fire risk: saunas, sale shops, barber shops, beauty parlours and public spaces containing furniture and furnishing of other than restricted fire risk and having deck area of 50 m^2 or more, as provided in SOLAS regulation II-2/9.2.2.3.

1.5.8 Independent fuel tank

Independent tanks are self-supporting, do not form part of the ship's hull and are not essential to the hull strength.

1.5.9 Integral fuel tank

Integral tank means a fuel-containment envelope tank 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 strength of the ship's hull.

1.5.10 Methanol or ethanol convertible

Methanol or ethanol convertible applies to engines and boilers that are designed and approved for oil fuel operation, and are capable of being subsequently converted to methanol fuel, respectively ethanol fuel, operation, and for which a conversion method has been approved by the Society.

1.5.11 Methanol / ethanol fuel preparation system

Methanol / ethanol fuel preparation system means the equipment necessary for treatment, pumping, heating or cooling the methanol or ethanol fuel.

1.5.12 Methanol or ethanol related spaces

Methanol or ethanol related spaces means a space identified by the risk analysis in which a possible source of leakage exists.

1.5.13 Methanol or ethanol venting system

Methanol or ethanol venting system is a venting system to which fuel tank pressure relief valves are connected and which complies with Sec 4, [3.1].

1.5.14 Portable fuel tank

Portable tank means an independent tank being able to be:

- easily connected and disconnected from ship systems and
- easily removed from ship and installed on board ship.

1.5.15 Single failure

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

1.5.16 Single fuel engine

Single fuel engine means an engine capable of operating on a fuel as defined in [1.5.3].

1.5.17 Working pressure

- low pressure means a maximum working pressure lower than or equal to 1,0 MPa
- high pressure means a maximum working pressure greater than 1,0 MPa but lower than or equal to 2,0 MPa
- very high pressure means a maximum working pressure greater than 2,0 MPa.

Section 2 Risk-Based Studies

1 Risk assessment

1.1 Scope of the risk assessment

1.1.1 A risk assessment is to 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 is to be given to the hazards associated with physical layout, operation and maintenance, following any reasonably foreseeable failure.

1.1.2 In addition to the requirements of this Section, risk-based studies for ships assigned the service notation **chemical tanker**, and designed to use methyl/ethyl alcohol cargo as fuel, are to comply with the provisions of Sec 14, [1.2].

1.2 Methodology

1.2.1 The risks are to be analysed using acceptable and recognized risk analysis techniques. Loss of function, component damage, fire, explosion, toxicity and electric shock are to, be considered, as a minimum. The analysis is to ensure that risks are eliminated wherever possible. Risks which cannot be eliminated are to be mitigated as necessary.

1.2.2 The assessment is to be carried out in accordance with acceptable and recognized techniques described in the current version of, for example, ISO 31010 (Risk management - Risk assessment techniques), ISO 17776 (Petroleum and natural gas industries - Major accident hazard management during the design of new installations), ISO 16901 (Guidance on performing risk assessment in the design of onshore LNG installations including the ship/shore interface), NORSOK Z-013 (Risk and emergency preparedness assessment standard) or CPR 12E. (Methods for determining and processing probabilities).

1.2.3 An HAZID study is to be carried out for each methyl/ethyl alcohol fuelled ship. It should cover at least the following spaces, zones and systems:

- tank connection space (TCS)
- enclosed and semi-enclosed fuel preparation rooms
- enclosed and semi-enclosed bunkering stations
- spaces containing very high pressure fuel piping
- spaces where fuel enclosure units are installed
- zones where vent lines and safety valve discharge lines are led, except where ventilation inlets to accommodation and machinery spaces are provided with vapour detection arrangements (see Sec 12, [4.1.1]).

The risks identified by the HAZID study may be mitigated by operational procedures (e.g. stopping ship spaces ventilation during bunkering operations to prevent vapour from entering those spaces through openings).

Where the requirements of this Rule Note for the arrangement of vents outlets cannot be satisfied due to size limits, vapour dispersion analysis will be required to assess the risk associated with gas venting or pressure relief.

1.2.4 A FMECA analysis is to be carried out for the very high pressure equipment, including:

- pumps
- compressors
- diesel engines
- electrical generation and distribution systems as settled in IEC 60812.

1.2.5 An HAZOP study is to be carried out for the very high pressure fuel installation.

1.2.6 For any risk assessment carried out in the scope of the present Rule Note, a detailed follow-up report of actions and mitigation measures taken in response to any analysis findings is to be submitted to the Society.

2 Limitation of explosion consequences

2.1 Principle

2.1.1 An explosion in any space containing any potential sources of release and potential ignition sources may be not to:

a) cause damage to or disrupt the proper functioning of equipment/systems located in any space other than that in which the incident occurs
b) damage the ship in such a way that flooding of water below the main deck or any progressive flooding occur
c) damage work areas or accommodation in such a way that persons who stay in such areas under normal operating conditions are injured
d) disrupt the proper functioning of control stations and switchboard rooms necessary for power distribution
e) damage life-saving equipment or associated launching arrangements
f) disrupt the proper functioning of fire-fighting equipment located outside the explosion-damaged space
g) affect other areas of the vessel in such a way that chain reactions involving, inter alia, cargo, gas and bunker oil may arise
h) prevent persons' access to life-saving appliances (LSA) or impede escape routes.

Note 1: Double wall fuel pipes are not considered as potential sources of release.

2.2 Additional requirements for explosion analysis

2.2.1 An explosion analysis may be required for hazardous spaces, as a result of the risk assessment.

2.2.2 Explosion analyses are to demonstrate that, for the worst case scenario, the maximum pressure built-up in case of explosion does not exceed the design pressure of the space, taking into account the venting arrangement and the explosion pressure relief devices, where provided.

2.2.3 The worst case scenario is to assume a complete rupture of a fuel pipe and to take into account the following parameters:

- maximum expected time between the pipe rupture and the leakage detection
- time between the leakage detection and the fuel supply shutoff
- ventilation flow rate.

2.2.4 Where necessary, explosion pressure relief devices are to be provided.

Section 3 Ship Design and Arrangement

1 General

1.1 Ship arrangement

1.1.1 Application

Unless otherwise specified, design and arrangement of ships assigned the additional class notation **methanolfuel** or **ethanolfuel** are to comply with the requirements of this Section.

In addition to the requirements of this Section, ships assigned the service notation **chemical tanker**, and designed to use methyl/ethyl alcohol cargo as fuel, are to comply with the provisions of Sec 14, [1.3].

1.1.2 In case of methanol or ethanol leakage, cofferdams surrounding fuel tanks are to be arranged either:

- for purging with inert gas, or
- for filling with water through a non-permanent connection. In this case, emptying the cofferdams is to be done by a separate drainage system, e.g. bilge ejector.

1.1.3 Cofferdams surrounding integral fuel storage tanks that may be filled with water are to be:

- designed according to the requirements for ballast tanks given in NR467, Part B, Chapter 7. The corrosion addition may however be reduced to the standard corrosion addition for cofferdams not normally filled with water
- served by a piping system separate from the general ballast system.

1.1.4 Escape routes are to not pass through hazardous areas.

1.2 Design and arrangement of methyl/ethyl alcohol tanks

1.2.1 Tanks containing fuel are not to be located within accommodation spaces or machinery spaces of category A. Integral methyl/ethyl alcohol tanks may be placed between the aftmost and foremost boundaries of the machinery spaces of Category A, provided that a cofferdam of at least 600mm width with A60 insulation is fitted between the tank and the machinery space.

1.2.2 Integral fuel tanks are to be surrounded by protective cofferdams, except on those surfaces bound by shell plating below the lowest possible waterline, other fuel tanks containing methyl/ethyl alcohol, or fuel preparation space. Attention is to be paid to the fire integrity requirements of Sec 9, [1.2] for the fuel preparation space.

Exemption for the arrangement of cofferdams between the fuel tank and an area on open deck may be permitted, provided the arrangement has been considered by the risk assessment as per Sec 2, [1] taking into account the use of the area, fire, toxicity, and possible additional construction and survey requirements.

1.2.3 All protective cofferdams are to be in accordance with Sec 12, [1.1.4].

1.2.4 The fuel containment system is to be abaft of the collision bulkhead and forward of the aft peak bulkhead.

1.2.5 Fuel tanks located on open decks are to be protected against mechanical damage.

1.2.6 Fuel tanks on open decks are to be surrounded by coamings and spills are to be collected in a dedicated holding tank complying with the requirements of [1.7.5].

1.2.7 For dual fuel installations, engine is to be capable to switch to the other fuel in case of failure.

1.2.8 For single fuel installations, the fuel storage is to be divided between two or more tanks so that, in the event of any one tank becoming unavailable, the remaining tank(s) will provide sufficient fuel to enable the ship to operate within its service at least 8 hours at maximum continuous rating of the propulsion plant and normal operating load at sea of the generator plant. These tanks are to be located in separate spaces. If those spaces are adjacent, the insulation between both spaces is to be at least A-60.

1.3 Independent fuel tanks

1.3.1 Independent tanks may be accepted on open decks or in a fuel storage hold space.

1.3.2 Independent tanks are to be fitted with:

- mechanical protection of the tanks depending on location and cargo operations
- if located on an open deck, drip tray arrangements for leak containment and water spray systems for emergency cooling as indicated in Sec 9.

1.4 Portable tanks

1.4.1 Portable fuel tanks are to be located in dedicated areas fitted with:

- mechanical protection of the tanks depending on location and cargo operations
- if located on an open deck, drip tray arrangements for leak containment and water spray systems for emergency cooling as indicated in Sec 9.

1.4.2 Portable fuel tanks are to be secured to the deck or hold space while connected to the ship systems. The arrangement for supporting and fixing the tanks are to be designed for the maximum expected static and dynamic inclinations according to NR467, Pt C, Ch 1, Sec 1, Tab 1 and NR467, Pt C, Ch 2, Sec 2, Tab 4, as well as the accelerations according to NR467, Pt B, Ch 5, Sec 3 taking into account the ship's characteristics and the position of the tanks.

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

1.4.4 Connections to the ship's fuel piping systems are to be made by means of flexible hoses of a type approved by the Society according to the requirements of NR467 Pt C, Ch 1, Sec 10 and suitable for methyl/ethyl alcohol or other suitable means designed to provide sufficient flexibility.

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

1.4.6 The pressure relief system of portable tanks is to be connected to a fixed venting system.

1.4.7 Control and monitoring systems for portable fuel tanks are to be integrated in the ship's control and monitoring system. A safety system for portable fuel tanks is to be integrated in the ship's safety system (e.g. shutdown systems for tank valves, leak/vapour detection systems).

1.4.8 Safe access to tank connections for the purpose of inspection and maintenance is to be ensured.

1.4.9 When connected to the ship's fuel piping system:

- each portable tank is to be capable of being isolated at any time
- isolation of one tank is not to impair the availability of the remaining portable tanks
- the tank is not to exceed its filling limits.

1.5 Machinery space

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

1.5.2 All fuel piping within machinery space boundaries are to be enclosed in gas and liquid tight enclosures in accordance with [1.6.4].

1.6 Location and protection of fuel piping

1.6.1 Fuel pipes are not to be located less than 800 mm from the ship's side.

1.6.2 Fuel piping are not to be led directly through accommodation spaces, service spaces, electrical equipment rooms or control stations.

1.6.3 Fuel pipes led through ro-ro spaces, special category spaces and on open decks are to be protected against mechanical damage.

1.6.4 Fuel piping that passes through enclosed spaces in the ship is to be enclosed in a pipe or duct that is gas and liquid tight towards the surrounding spaces with the fuel contained in the inner pipe. Such double walled piping is not required in cofferdams surrounding fuel tanks, fuel preparation spaces or spaces containing independent fuel tanks as the boundaries for these spaces will serve as a second barrier.

1.6.5 The annular space between inner and outer pipe is to have mechanical ventilation of under pressure type with a capacity of minimum 30 air changes per hour and be ventilated to open air. Appropriate means for detecting leakage into the annular space are to 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.

1.6.6 Inerting of the annular space may be accepted as an alternative to ventilation. Appropriate means of detecting leakage into the annular space are to be provided. Suitable alarms are to be provided to indicate a loss of inert gas pressure between the pipes.

1.6.7 The annular space is to be in accordance with Sec 11, [1.4] and Sec 12, [1.1.5].

1.6.8 The outer pipe in the double walled fuel pipes is to be designed for a design pressure not less than the maximum working pressure of the fuel pipes.

1.6.9 All fuel pipes are to be self-draining to suitable fuel or collecting tanks in normal condition of trim and list of the ship.

1.6.10 For maintenance, all fuel sections are to be capable of being:

a) Safely isolated, and

b) Safely drained and purged of fuel.

1.7 Drip trays

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

1.7.2 Each tray is to have a sufficient capacity to ensure that the maximum amount of spill according to the risk assessment can be handled.

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

1.7.4 Drip trays for leakage of less than 10 litres may be provided with means for manual emptying.

1.7.5 The leakage holding tank is to be equipped with a level indicator and alarm and is to be inerted at all times during normal operation.

2 Enclosed spaces design

2.1 Bilge systems

2.1.1 Bilge systems installed in areas where methyl/ethyl alcohol can be present are to be segregated from the bilge system of spaces where methyl alcohol or ethyl alcohol cannot be present.

2.1.2 One or more bilge 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 are to be provided. Means are to be provided for safely transferring contaminated liquids to onshore reception facilities.

2.1.3 Bilge holding tanks must be sized to accumulate the maximum estimated leakage of fuel identified by the risk assessment.

2.1.4 The bilge system serving the fuel preparation space is to be operable from outside the fuel preparation space.

2.2 Arrangement of entrances and other openings in enclosed spaces

2.2.1 Direct access is not to be permitted from a non-hazardous area to a hazardous area. Where such openings are necessary for operational reasons, an airlock which complies with the provisions of [2.3] is to be provided.

2.2.2 Fuel preparation spaces are to have independent access direct from open deck. Where a separate access from open deck is not practicable, an airlock complying with [2.3] is to be provided.

2.2.3 Fuel tanks and surrounding cofferdams are to have access from the open deck, where practicable, for gas freeing, cleaning, maintenance and inspection.

2.2.4 Where direct access from the open deck is not practicable an entry space to fuel tanks or surrounding cofferdams is to be provided and is to comply with the following:

a) be fitted with an independent mechanical extraction ventilation system, providing a minimum of six air changes per hour; a low oxygen alarm and a vapour detection alarm are to be fitted

b) have sufficient open area around the fuel tank hatch for efficient evacuation and rescue operation

c) not be an accommodation space, service space, control station or machinery space of category A and

d) a cargo space may be accepted as an entry space, depending upon the type of cargo, if the area is cleared of cargo and no cargo operation is undertaken during entry to the space.

2.2.5 Where the surveyor requires to pass between the surface to be inspected, flat or curved, and structural elements such as deck beams, stiffeners, frames, girders etc., the distance between that surface and the free edge of the structural elements is to be at least 380 mm. The distance between the surface to be inspected and the surface to which the above structural elements are fitted, e.g. deck, bulkhead or shell, is to be at least 450 mm in case of a curved tank surface or 600 mm in case of a flat tank surface.

2.2.6 For safe access, horizontal hatches or openings to or within fuel tanks or surrounding cofferdams are to have a minimum clear opening of 600 mm 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 are not to be less than 600 mm 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 is demonstrated.

2.3 Airlocks

2.3.1 An airlock 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 Lines, the door sill is not to be less than 300 mm in height. The doors are to be self-closing without any hold-back arrangements.

2.3.2 Airlocks are to be mechanically ventilated at an overpressure relative to the adjacent hazardous area or space.

2.3.3 Airlocks are to have a simple geometrical form. They are to provide for free and easy passage, and are to have a deck area not less than 1,5 m^2. Airlocks are not to be used for other purposes, for instance as storerooms.

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

2.3.5 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 are to be given at a manned location to indicate both loss of pressure and opening of the airlock doors when pressure is lost.

2.3.6 Airlocks are to be in accordance with Sec 10, [1.6].

3 Safe return to port (SRtP)

3.1 Systems required to remain operational

3.1.1 On ships to be assigned the additional service feature **SRTP**, the following systems are to remain operational after any flooding or fire casualty not exceeding the thresholds defined in SOLAS II-2/21.3 and SOLAS II-1/8-1.2:

- propulsion, where the propulsion relies only on methanol or ethanol as fuel, and
- safety systems supporting the methanol or ethanol installation.

3.1.2 The exact list of the safety systems supporting the methanol or ethanol installation is to be defined based on the general philosophy adopted to keep the methanol or ethanol system safe during the SRtP voyage, taking into account the foreseen status of the methanol or ethanol installation during the SRtP voyage and whether the SRtP voyage is intended to be performed using conventional fuel or methanol or ethanol as fuel. The safety systems supporting the methanol or ethanol installation are expected to include, at least:

- vapour detection in hazardous areas
- ESD functions as necessary
- methanol or ethanol containment system and associated systems (e.g. inert gas system or water purging for the cofferdams).

3.2 SRtP analysis

3.2.1 On ships to be assigned the additional service feature **SRTP**, SRtP scenarios are to be analyzed taking into account the requirements of NR598.

Section 4 Fuel Containment System

1 Fuel containment system

1.1 Requirements

1.1.1 The fuel tanks are to be designed such that a leakage from the fuel tank or its connections does not endanger the ship, persons on board or the environment. Potential dangers to be avoided include:

- flammable fuels spreading to locations with ignition sources
- toxicity potential and risk of oxygen deficiency or other negative impacts on crew health due to fuels and inert gases
- restriction of access to muster stations, escape routes or life-saving appliances (LSAs)
- reduction in availability of LSAs.

1.1.2 The fuel containment system and the fuel supply system is to be designed such that safety actions after any leakage, irrespective of in liquid or vapour phase, do not lead to an unacceptable loss of power.

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

2 Scantlings of methyl/ethyl alcohol fuel tanks and supports

2.1 Integral fuel tanks

2.1.1 The tanks are to be designed according to the applicable requirements of NR467, Part B for tanks carrying liquid.

2.2 Independent fuel tanks

2.2.1 The structure of independent fuel tanks is to comply with the applicable provisions of NR467 Pt D, Ch 7, Sec 3, [6] for independent cargo tanks.

In the case of pressurized tanks, the scantlings are to comply with NR467 Pt C, Ch 1, Sec 3, or with a recognized pressure vessel Code accepted by the Society, and the internal design pressure is to take into account the design vapour pressure and the dynamic liquid pressure resulting from ship movements.

2.3 Supports

2.3.1 The scantlings of the supports of independent fuel tanks are to comply with the applicable provisions of NR467 Pt D, Ch 7, Sec 3, [7] for supports of independent cargo tanks.

2.3.2 Contacts of tanks to supporting blocks are to be checked on board.

3 Fuel tanks venting and gas freeing system

3.1 Fuel tanks venting and gas freeing system

3.1.1 The fuel tanks are to be fitted with a controlled tank venting system.

3.1.2 Fuel tank venting system is to be independent of ventilation systems serving accommodation spaces, service spaces, control stations or other non-hazardous areas, and of air pipes from other tanks and piping systems.

3.1.3 A fixed piping system is to be arranged to enable each fuel tank to be safely gas freed, and to be safely filled with fuel from a gas-free condition. In this regard, the following information is to be provided for verification:

- materials of construction of system
- time to gas free
- vapour concentration inside the tank
- flow characteristics of fans to be used
- the pressure losses created by ducting, piping, fuel tank inlets and outlets
- the pressure achievable in the fan driving medium (e.g. water or compressed air)
- the densities of the fuel vapour / air mixture.

3.1.4 The arrangement of internal tank structure and location of gas freeing inlets and outlets are to be such as to avoid the formation of vapour pockets during the gas freeing operation.

3.1.5 Pressure and vacuum relief valves are to be fitted to each fuel tank to limit the pressure or vacuum in the fuel tank. The tank 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. Design and arrangement is to prevent flame propagation into the fuel containment system. If pressure relief valves (PRVs) of the high velocity type are fitted to the end of the vent pipes, they are to be certified for endurance burning in accordance with MSC/Circ.677. If PRVs are fitted in the vent line, the vent outlet is to be fitted with a flame arrestor certified for endurance burning in accordance with MSC/Circ.677.

3.1.6 Fuel tank vent outlets are normally to 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 is to be directed upwards in the form of unimpeded jets. The vent outlets are to be arranged to minimize the possibility of water or snow entering the vent system.

3.1.7 The fuel tank vent system is to be sized to permit bunkering at a design loading rate without over-pressurizing the fuel tank.

3.1.8 The opening pressure of the PRVs is not to be lower than 0,007 MPa below atmospheric pressure.

3.1.9 Shut-off valves are not to be arranged either upstream or downstream of the PRVs. Bypass valves may be provided. For temporary tank segregation purposes (maintenance) shut-off valves in common vent lines may be accepted if a secondary independent over/underpressure protection is provided to all tanks as per [3.1.15].

3.1.10 The mentioned venting system includes the individual vents and the methanol or ethanol venting system.

3.1.11 Very high pressure vent systems and other vent systems are to be separate up to the methanol or ethanol venting system outlet.

3.1.12 Vapour outlets from fuel tanks should be provided with devices tested and type approved to prevent the passage of flame into the tank. Due attention should be paid in the design and position of the PRVs with respect to blocking and due to ice during adverse weather conditions. Provision for inspection and cleaning should be arranged.

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

- through outlets at least 3 m above the deck level with a vertical efflux velocity of at least 30 m/s maintained during the gas freeing operation
- through outlets at least 3 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
- through outlets underwater.

3.1.14 In designing a gas freeing system in conformity with [3.1.3] due consideration should be given to the following:

- materials of construction of system
- time to gas free
- flow characteristics of fans to be used
- the pressure losses created by ducting, piping, fuel tank inlets and outlets
- the pressure achievable in the fan driving medium (e.g. water or compressed air)
- the densities of the fuel vapour/air mixture.

3.1.15 PRVs are to vent to a safe location on open deck and are to be of a type which allows the functioning of the valve to be easily checked.

3.1.16 The fuel tank vent system is to be connected to the highest point of each tank and vent lines are to be self draining under all normal operating conditions.

4 Inerting and atmospheric control within the fuel storage system

4.1 General

4.1.1 The inerting and atmospheric control systems are to be sized to be able to keep the tanks inerted during normal operation, gas freeing or inerting by utilizing an inerting medium.

4.1.2 To prevent the return of flammable liquid and vapour to the inert gas system, the inert gas main supply line is to 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 is to be installed between the double block and bleed arrangement and the fuel system. These valves are to be located inside hazardous spaces.

4.1.3 Where the connections to the inert gas piping systems are non-permanent, two non-return valves may substitute the valves required in [4.1.2].

4.1.4 Blanking arrangements are to be fitted in the inert gas supply line to individual tanks. The position of the blanking arrangements are to be immediately obvious to personnel entering the tank. Blanking is to be via removable spool piece.

5 Inert gas availability on board

5.1 General

5.1.1 Inert gas should be available permanently on board in order to achieve at least one trip from port to port considering maximum consumption of fuel expected and maximum length of trip expected and to keep tanks inerted during two weeks in harbour with minimum port consumption.

5.1.2 A production plant and/or adequate storage capacities might be used to achieve availability target defined in [5.1.1].

5.1.3 Fluid used for inerting is not to modify the characteristics of the fuel.

5.1.4 The production plant, if fitted, is to be capable of producing inert gas with oxygen content at no time greater than 5% by volume. A continuous-reading oxygen content meter is to be fitted to the inert gas supply from the equipment and is to be fitted with an alarm set at a maximum of 5% oxygen content by volume. The system is to be designed to ensure that if the oxygen content exceeds 5% by volume, the inert gas is to be automatically vented to atmosphere.

5.1.5 The system is to be able to maintain an atmosphere with an oxygen content not exceeding 8% by volume in any part of any fuel tank.

5.1.6 An inert gas system is to have pressure controls and monitoring arrangements appropriate to the fuel containment system.

5.1.7 Where a nitrogen generator or nitrogen storage facilities are installed in a separate compartment outside of the engine-room, the separate compartment is to be fitted with an independent mechanical extraction ventilation system, providing a minimum of six air changes per hour. If the oxygen content is equal or below 19% in the separate compartment, an alarm is to be given. A minimum of two oxygen sensors are to be provided in each space. Visual and audible alarms are to be placed at each entrance to the inert gas room.

5.1.8 Inert gas piping system is not to pass through accommodation, service or control spaces.

5.1.9 When inert gas pipes led through enclosed spaces piping system is to:
- have only a minimum of flange connections as needed for fitting of valves and be fully welded
- be as short as possible
- valves on the inert gas system are to be provided with nameplates indicating the tank, cofferdam or other space they serve.

5.1.10 Notwithstanding the provisions of Article [5], inert gas utilized for gas freeing of tanks may be provided externally to the ship.

Section 5 Material and General Pipe Design

1 General

1.1 Classes of fuel piping systems

1.1.1 Piping systems are subdivided into three classes, denoted as class I, class II and class III, for the purpose of acceptance of materials, selection of joints, heat treatment, welding, pressure testing and the certification of fittings.

1.1.2 Piping classes I, II and III are to be determined in accordance with the provisions of Tab 1 for fuel pipes and in accordance with the provisions of Tab 2 for all vent pipes and open ended lines, including:.

- discharge lines from tank pressure relief valves
- venting lines from "bleed" valves
- purging lines from engines and other fuel consumers
- vent line from tank connection space.

1.1.3 Fuel pressure vessels including surge tanks, heat exchangers and accumulators are to be considered as class I pressure vessels, in accordance with NR467, Pt C, Ch 1, Sec 3, [1.4].

Table 1 : Classes of liquid fuel piping

Design conditions		Class of the piping		
Design pressure	Design temperature	Single wall arrangement	Double wall arrangement	
			inner pipe	outer pipe **(1)**
all	all	class I	class I	class II

(1) The design pressure of the outer pipe or duct of fuel systems is to comply with Sec 3, [1.6.8]

Table 2 : Classes of vent pipes and bleed lines

Design conditions		Class of the piping		
Design pressure	Design temperature	Single wall arrangement	Double wall arrangement	
			inner pipe	outer pipe **(1)**
p =5 bar **(2)**	all	class III	class III	class III
p > 5 bar and p ≤ 10 bar **(3)**	all	class II	class III	class III
p > 10 bar **(3)**	all	class I	class II	class III

(1) The design pressure of the outer pipe or duct of vent pipes or open ended lines is to comply with Sec 3, [1.6.8]
(2) The design pressure of vent pipes or open ended lines is not to be taken less than 5 bar
(3) The design pressure of vent pipes or open ended lines is not to be less than the maximum expected pressure, which is to be justified.

2 General pipe design

2.1 General

2.1.1 All materials used are to be suitable for the fuel under the maximum working pressure and temperature.

2.1.2 The design pressure for any section of the fuel piping system 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.

2.1.3 The wall thickness t, in mm, of pipes made of steel should not be less than:

$$t = \frac{(t_0 + b + c)}{\left(1 - \frac{a}{100}\right)}$$

where:

t_0 : Theoretical thickness, in mm

$$t_0 = \frac{PD}{(2Ke + P)}$$

P : System design pressure, in MPa, but not less than the design pressure given in [2.1.2]

D : Outside pipe diameter, in mm

K : Allowable stress, in N/mm² (see [2.1.4])

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, in mm. The value for b should 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 should not be less than:

$$b = Dt_0 / (2{,}5\ r)$$

r : Mean radius of the bend, in mm

c : Corrosion allowance, in mm. If corrosion or erosion is expected, the wall thickness of piping should be increased over that required by the other design provisions

a : Negative manufacturing tolerance for thickness, in %.

2.1.4 For pipes made of steel the allowable stress K to be considered in the formula for t_0 in [2.1.3] is the lower of the following values:

R_m / A or R_e / B

where:

R_m : Specified minimum tensile strength at ambient temperature (N/mm²)

R_e : 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

The values of A and B should be at least:

A = 2,7 and B = 1,8.

2.1.5 Where necessary for mechanical strength to prevent damage, collapse, excessive sag or buckling of pipes due to superimposed loads, the wall thickness should be increased over that required by [2.1.3] or, if this is impracticable or would cause excessive local stresses, these loads should 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.

2.1.6 For pipes made of materials other than steel, the allowable stress should be considered by the Society.

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

- stresses due to the weight of the piping system
- acceleration loads when significant and
- internal pressure and loads induced by hog and sag of the ship.

2.1.8 Fuel pipes and all the other piping needed for safe and reliable operation and maintenance should be colour marked in accordance with a standard at least equivalent to those acceptable to the Society.

Note 1: Refer to EN ISO 14726:2008 Ships and marine technology – Identification colours for the content of piping systems.

2.1.9 All fuel piping and independent fuel tanks are to be electrically bonded to the ship's hull. Electrical conductivity are to be maintained across all joints and fittings. Electrical resistance between piping and the hull is to be maximum 10^6 Ohm.

2.1.10 Piping other than fuel supply piping and cabling may be arranged in the double wall piping or duct provided that it does not create a source of ignition or compromise the integrity of the double pipe or duct. The double wall piping or duct is to only contain piping or cabling necessary for operational purposes.

2.1.11 Filling lines to fuel tanks are to be arranged to minimize the possibility for static electricity, e.g. by reducing the free fall into the fuel tank to a minimum.

2.1.12 The arrangement and installation of fuel piping is to provide the necessary flexibility to maintain the integrity of the piping system in the actual service situations, taking potential for fatigue into account. Expansion bellows are not to be used.

2.2 Piping fabrication and joining details

2.2.1 The inner piping, where a protective duct is required, is to be full penetration butt-welded, and fully radiographed. Flange connections in this piping are to only be permitted within the tank connection space and fuel preparation space or similar when:

- during the use of the fuel piping, all doors, ports and other openings on the corresponding superstructure or deckhouse side are to be kept closed and clearly indicated that this position is to be preserved during the operation; and
- the annular space in the double walled fuel piping is to be segregated at the engine-room bulkhead; this implies that there is to be no common ducting between the engine-room and other spaces.

2.2.2 Piping for fuel is to be joined by welding except:
- for approved connections to shut-off valve and expansion joints, if fitted
- for other exceptional cases specifically approved by the Society.

2.2.3 The following direct connections of pipe length without flanges may be considered:
- butt-welded joints with complete penetrations at the root
- slip-on welded joints with sleeves and related welding having dimensions in accordance with recognized standards is only to be used in pipes having an external diameter of 50 mm or less; the possibility for corrosion is to be considered
- screwed connections, in accordance with recognized standards, is only to be used for piping with an external diameter of 25 mm or less.

2.2.4 Welding, post-weld heat treatment, radiographic testing, dye penetrating testing, pressure testing, leakage testing and non-destructive testing are to be performed in accordance with recognized standards. Butt welding is to be subject to 100% non-destructive testing, while sleeve welds are to be subject to at least 10% liquid penetrant testing (PT) or magnetic particle testing (MT).

2.2.5 Where flanges are used, they are to be of the welded-neck or slip-on type. Socket welds are not to be used in nominal sizes above 50 mm.

2.2.6 Expansion of piping is normally to be allowed for by the provision of expansion loops or bends in the fuel piping system. Use of expansion joints used in high pressure fuel systems are to be approved by the Society. Slip joints are not to be used.

2.2.7 Piping connections are to be joined in accordance with [2.2.2], for other exceptional cases the Society may consider alternative arrangements.

2.3 Materials

2.3.1 Due consideration is to be taken with respect to the corrosive nature of fuel when selecting materials with special attention to the corrosive nature of methyl/ethyl alcohol when contaminated with water.

2.3.2 In general, requirements for materials are to be in accordance with NR216 Rules on materials and welding.

2.3.3 Materials for integral tanks and independent tanks are to be selected in accordance with normal practice as given in NR467, Pt B, Ch 4, Sec 1 and Sec 4.

2.3.4 Materials, for tank coatings and tank access hatch sealing are to be resistant to:
- methyl/ethyl alcohol liquid
- methyl/ethyl alcohol where it may contain water
- methyl/ethyl alcohol vapour
- nitrogen gas used for inerting.

2.3.5 Fluorinated materials such as Teflon may be used as equipment components in methyl alcohol service. Rubbers such as EPDM and neoprene are considered suitable for methyl alcohol service. Nitrile and butyl rubbers are not to be used in systems containing methyl alcohol fuel. The rubber hoses are to have an internal coil wire for strength and electrical continuity and are to be compatible with methyl alcohol service.

2.3.6 Galvanised steel is to be avoided for equipment and piping systems in contact with methanol or ethanol.

Section 6 Bunkering Equipment

1 Bunkering station

1.1 General provisions

1.1.1 The bunkering station should be located on open deck so that sufficient natural ventilation is provided.

1.1.2 Closed and semi-enclosed bunkering stations are to be protected from the effects of the sea.

1.1.3 Closed and semi-enclosed bunkering stations are to be in accordance with Sec 11, [1.3].

1.1.4 Closed or semi-enclosed bunkering stations are to be subject to special consideration within the risk assessment, which is to include but not be restricted to the following design features:

- segregation towards other areas on the ship
- hazardous area plans for the ship
- requirements for mechanical ventilation
- requirements for leakage detection (e.g. vapour detection)
- safety actions related to leakage detection (e.g. vapour detection)
- requirements for fire detection (e.g. flame detection)
- safety actions related to fire detection (e.g. flame detection)
- access to bunkering station from non-hazardous areas through airlocks
- monitoring of bunkering station by direct line of sight or by CCTV.

1.1.5 Entrances, air inlets and openings to accommodation, service and machinery spaces and control stations are not to face the bunkering station.

1.1.6 Closed or semi-enclosed bunkering stations are to be surrounded by gas and liquid-tight boundaries against enclosed spaces.

1.1.7 Bunkering lines are not to be led directly through accommodation, control stations or service spaces. Bunkering lines passing through non-hazardous areas in enclosed spaces are to be in compliance with Sec 11, [1.4].

1.1.8 Arrangements are to be made for safe management of fuel spills. Coamings and/or drip trays are to be provided below the bunkering connections together with a means of safely collecting and storing spills, such as a drain to a dedicated holding tank equipped with a level indicator and alarm or other arrangements agreed by the Society. Where coamings or drip trays are subject to rainwater, provisions are to be made to drain rainwater overboard.

1.1.9 Showers and eye wash stations for emergency usage are to be located in close proximity to areas where the possibility for accidental contact with fuel exists. The emergency showers and eye wash stations are to be operable under all ambient conditions.

1.1.10 Bunkering stations are not to be used for any other purpose than bunkering methyl/ethyl alcohol fuel.

1.2 Ships' bunker hoses

1.2.1 Bunker hoses carried on board are to be suitable for methyl/ethyl alcohol. Each type of bunker hose, complete with end-fittings, is to be prototype-tested at a normal ambient temperature, with 200 pressure cycles from zero to at least twice the specified maximum working pressure. After this cycle pressure test has been carried out, the prototype test is to demonstrate a bursting pressure of at least 5 times its specified maximum working pressure at the upper and lower extreme service temperature. Hoses used for prototype testing are not to be used for bunker service.

1.2.2 Before being placed in service, each new length of bunker hose produced is to be hydrostatically tested at ambient temperature to a pressure not less than 1,5 times its specified maximum working pressure, but not more than two fifths of its bursting pressure. The hose is to be stencilled, or otherwise marked, with the date of testing, its specified maximum working pressure and, if used in services other than ambient temperature services, its maximum and minimum service temperature, as applicable. The specified maximum working pressure is not to be less than 1 MPa gauge.

1.2.3 Means are to be provided for draining any fuel from the bunkering hoses upon completion of operation.

1.2.4 Where fuel hoses are carried on board, arrangements are to be made for safe storage of the hoses. Hoses are to be stored on the open deck or in a storage room with an independent mechanical extraction ventilation system, providing a minimum of six air changes per hour.

1.2.5 All bunker hoses are to be clearly labelled indicating their use only for methyl/ethyl alcohol. Hose ends are to be capped or protected by other suitable means to avoid contamination during storage.

2 Manifold

2.1 General

2.1.1 The bunkering manifold is to be designed to withstand the external loads during bunkering. The connections at the bunkering station are to be of dry-disconnect type equipped with additional safety dry break-away coupling/self-sealing quick release. The couplings are to be of a standard type.

3 Bunkering system

3.1 General

3.1.1 Means are to be provided for draining any fuel from the bunkering lines upon completion of operation.

3.1.2 Bunkering lines are to be arranged for inerting and gas freeing.

3.1.3 To ensure a rapid and safe shutdown of the bunker supply system without any release of liquid or vapour, a ship-shore link (SSL) or an equivalent means for automatic and manual ESD communication to the bunkering source operable from the bunker supply facility and the ship control station is to be provided.

3.1.4 The bunkering emergency release system is to be of a type approved by the Society.

3.1.5 In the bunkering line, as close to the connection point as possible, there is to be a manually operated stop valve and a remotely operated shutdown valve arranged in series. Alternatively, a combined manually operated and remote shutdown valve may be provided. It is to be possible to operate this remotely operated valve from the bunkering control station.

3.1.6 Where bunkering lines are arranged with a crossover, suitable isolation arrangements are to be provided to ensure that fuel cannot be transferred inadvertently to the ship side not in use for bunkering.

Section 7 Fuel Supply to Consumers

1 General

1.1 Fuel supply system

1.1.1 The fuel piping system should be separate from all other piping systems.

1.1.2 The fuel supply system should be arranged such that the consequences of any release of fuel will be minimized, while providing safe access for operation and inspection. The causes and consequences of release of fuel should be subject to special consideration within the risk assessment in Sec 2, [1.2].

1.1.3 The piping system for fuel transfer to the consumers should 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.

1.1.4 Fuel lines should be installed and protected so as to minimize the risk of injury to persons on board in case of leakage.

1.2 Redundancy of fuel supply

1.2.1 Propulsion and power generation arrangements, are to be arranged so that a failure in fuel supply does not lead to an unacceptable loss of power

1.2.2 For single fuel installations the fuel supply system is to be arranged with full redundancy and segregation all the way from the fuel tanks to the consumer, so that a leakage in one system does not lead to an unacceptable loss of power.

1.3 Safety functions of the fuel supply system

1.3.1 All fuel piping system is to be arranged for gas freeing and inerting.

1.3.2 Fuel tank inlet and outlet valves are to 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, are to be remotely operated if not easily accessible.

1.3.3 The main fuel supply line to each consumer or set of consumers is to be equipped with an automatically operated master fuel valve. The master fuel valve(s) is to be situated in the part of the piping that is outside the machinery space containing methyl/ethyl alcohol-fuelled consumer(s). The master fuel valve(s) is to automatically shut off the fuel supply in accordance with Sec 12, [5.1.1] and Sec 12, Tab 1.

1.3.4 Means of manual emergency shutdown of fuel supply to the consumers or set of consumers are to be provided on the primary and secondary escape routes from the consumer compartment, at a location outside consumer space, outside the fuel preparation space and at the bridge. The activation device is to be arranged as a physical button, duly marked and protected against inadvertent operation and operable under emergency lighting.

1.3.5 The fuel supply line to each consumer is to be provided with a remotely operated shut-off valve.

1.3.6 All automatic and remotely operated valves are to clearly indicate whether they are in open or closed position where they are installed and where the valves are remotely operated.

1.3.7 There is to be one manually operated shutdown valve in the fuel line to each consumer to ensure safe isolation during maintenance.

1.3.8 Valves are to be of the fail-safe type.

1.3.9 When pipes penetrate the fuel tank below the top of the tank a remotely operated shut-off valve are to be fitted to the fuel tank bulkhead.

1.4 Fuel preparation spaces and pumps

1.4.1 Any fuel preparation space is not to be located within a machinery space of category A, is to be gas and liquid tight to surrounding enclosed spaces and hold an independent ventilation system.

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

1.4.3 All pumps in the fuel system are to be protected against running dry (i.e. protected against operation in the absence of fuel or service fluid). All pumps which are capable of developing a pressure exceeding the design pressure of the system are to be provided with relief valves. Each relief valve is to be in closed circuit, i.e. arranged to discharge back to the piping upstream of the suction side of the pump and to effectively limit the pump discharge pressure to the design pressure of the system.

Section 8 Power Generation including Propulsion and other Energy Converters

1 General

1.1 Internal combustion engines

1.1.1 One single failure in the fuel system is not to lead to an unacceptable loss of power.

1.1.2 Methyl/ethyl alcohol engines are to be type approved on the basis of the following general and specific provisions for dual-fuel and single-fuel engines, in addition to those required in NR467, Pt C, Ch 1, Sec 2, for standard diesel engines.

1.1.3 All engine components and engine-related systems are to be designed in such a way that fire and explosion risks are minimized.

1.1.4 Engine components containing methyl/ethyl alcohol fuel are to be effectively sealed to prevent leakage of fuel into the machinery space.

1.1.5 Fuel piping system is to be double walled. The efficiency of the inerting or ventilation arrangement of the double walled space is to be verified.

1.1.6 A means are to be provided to monitor and detect poor combustion or misfiring. In the event that it is detected, continued operation may be allowed, provided that the fuel supply to the concerned cylinder is shut off and provided that the operation of the engine with one cylinder cut-off is acceptable with respect to torsional vibrations.

1.1.7 The capability of engines driving generators to accept sudden load variations is to be verified.

1.1.8 A risk assessment of the engine is to be carried out using an HAZID analysis or other acceptable methods and reflected in the safety concept of the engine. The risk assessment is to cover at least the following hazards:

- presence and possible accumulation of methyl/ethyl alcohol vapour in the charge air system or in the crankcase
- leakage of high pressure liquid methyl/ethyl alcohol
- presence of unburnt methyl/ethyl alcohol vapours in the exhaust system
- failure of a methyl/ethyl alcohol admission valve or injection valve
- failure of the ignition system (sparking plug or pilot injection)
- failure of the oil system (cooling and sealing)
- failure of the purging system.

The possible variations of the methyl/ethyl alcohol characteristics associated with its composition (density, flashpoint, heat value, flammability range) are to be considered.

1.2 Provision for dual-fuel engines

1.2.1 The lowest specified speed is to be verified in diesel mode and methyl/ethyl alcohol mode.

1.2.2 In case of shut-off of the methyl/ethyl alcohol supply, the engines are to be capable of continuous operation by oil fuel only without interruption.

1.2.3 An automatic system is to be fitted to change over from methyl/ethyl alcohol fuel operation to oil fuel operation with minimum fluctuation of the engine power. Acceptable reliability is to be demonstrated through testing. In the case of unstable operation on engines when methyl/ethyl alcohol firing, the engine is to automatically change to oil fuel mode. There is to also be the possibility for manual changeover.

1.2.4 In case of an emergency stop or a normal stop, the methyl/ethyl alcohol fuel is to be automatically shut off not later than the pilot oil fuel. It is not to be possible to shut off the pilot oil fuel without first or simultaneously closing the fuel supply to each cylinder or to the complete engine.

1.3 Provision for single fuel engines

1.3.1 In case of a normal stop or an emergency shutdown, the methyl/ethyl alcohol fuel supply is to be shut off not later than the ignition source. It is not to be possible to shut off the ignition source without first or simultaneously closing the fuel supply to each cylinder or to the complete engine.

1.4 Methyl/ethyl alcohol-fuelled boilers

1.4.1 Boiler arrangements and burner systems are to be in accordance with the requirements of NR467, Pt C, Ch 1, Sec 3 and NR467, Pt C, Ch 1, Sec 10, or NR566 as applicable.

1.4.2 The entire boiler casing is to be gastight and each boiler is to have a dedicated uptake.

1.4.3 Unless it is incorporated in the burner, on the fuel pipe of each burner a shut-off valve and a flame arrestor is to be fitted.

1.4.4 Combustion chambers and uptakes are to be designed to prevent any accumulation of fuel vapour.

1.4.5 Each boiler is to be provided with a dedicated forced draught system.

1.4.6 In the event of a satisfactory ignition cannot be established or maintained, arrangements are to be provided to ensure that fuel flow to the burner is automatically cut off with a visual and audible alarm.

1.4.7 Arrangements are to be provided for automatically and manually purging the fuel supply piping to the burners, after the extinguishing of these burners. Safety devices are to be fitted to ensure that purging can be carried out only when the burner fuel supply is shut off.

1.4.8 On main/propulsion dual fuel boilers an automatic system is to be provided to change from methyl/ethyl alcohol fuel operation to oil fuel operation without interruption of boiler firing with the minimum impact to the flame.

1.4.9 The automatic fuel changeover system required by [1.4.8] is to be monitored with alarms to ensure continuous availability.

1.4.10 A low water condition is to automatically shut off the fuel supply to the burners with a visual and audible alarm as required in NR467, Pt C, Ch 1, Sec 3, [5.1.8] when boilers are operating on methyl/ethyl alcohol.

1.4.11 Arrangements are to be provided to enable the boilers purging sequence to be manually activated.

1.5 Provisions for Fuel Cells

1.5.1 Fuel cell systems using methyl/ethyl alcohol are to comply with the relevant requirements given in NR547.

1.6 Exhaust systems

1.6.1 The exhaust system is to be designed to prevent any accumulation of unburnt fuel.

1.6.2 The exhaust system is to be designed to withstand combustion of any fuel-air leak mixture by means of:

a) explosion relief venting to prevent excessive pressure build-up. Where explosion relief venting is installed, the combustion products are to be vented to a safe location, or
b) having sufficient strength to contain a worst-case explosion, in which case, evidences are to be submitted, or
c) arrangements to prevent the exhaust system exceeding the auto-ignition temperature of the methyl/ethyl alcohol in addition to eliminating sources of ignition.

1.6.3 Each fuel consumer is to have a separate exhaust system.

Section 9 Fire Safety

1 General

1.1 Application

1.1.1 Unless otherwise specified, design and arrangement of ships assigned the additional class notation **methanolfuel** or **ethanolfuel** are to comply with the requirements of this Section.

In addition to the requirements of this Section, ships assigned the service notation **chemical tanker**, and designed to use methyl/ethyl alcohol cargo as fuel, are to comply with the provisions of Sec 14, [1.4].

1.2 Provision for fire protection

1.2.1 For the purposes of structural fire protection as addressed in NR467, Pt C, Ch 4, Sec 5, fuel preparation spaces are to be regarded as machinery spaces of category A. In addition, boundaries of the fuel preparation space towards other machinery spaces of category A, accommodation spaces, control stations or cargo areas are to have fire integrity not less than A-60. Any boundary of accommodation spaces, service spaces, control stations, escape routes and machinery spaces, facing fuel tanks on open deck, is to be shielded by A-60 class divisions. The A-60 class divisions are to extend up to the underside of the deck of the navigation bridge.

1.2.2 For fire integrity, the fuel tank boundaries are to be separated from the machinery spaces of category A and other rooms with high fire risks by a cofferdam of at least 600 mm, with insulation of not less than A-60 class. As an alternative to a 600 mm-cofferdam with A-60 insulation between fuel preparation room and methanol or ethanol fuel tank:

- H-60 class divisions, as defined in NR445 Pt C, Ch 4, Sec 1, may be accepted
- other arrangements may be accepted, provided that an equivalent insulation capacity is demonstrated in case of a fire in the fuel preparation space. For the purpose of demonstrating such equivalence, a comparative analysis between the submitted arrangement and the 600 mm-cofferdam with A-60 insulation configuration is to be carried out and the report is to be submitted to the Society. The analysis is to demonstrate that the vapour phase temperature in the tank and at the boundary of the vapour phase remain lower for the alternative arrangement than for the reference configuration at any time between the starting of the fire in the fuel preparation room and opening of the tank PV valve. The thermal transient phase in the cofferdam is to be modelled to the satisfaction of the Society or tested.

1.2.3 The bunkering station should be separated by A-60 class divisions from machinery spaces of category A, accommodation spaces, control stations and high fire risk spaces, except for spaces such as tanks, voids, auxiliary machinery spaces of little or no fire risk, sanitary and similar spaces where the insulation standard may be reduced to class A-0.

2 Fire detection

2.1 General

2.1.1 A fixed fire detection and fire alarm system complying with NR467, Pt C, Ch 4, Sec 15, [8] is to be provided in the fuel preparation room, enclosed and semi enclosed bunkering stations, tank connection spaces and all compartments containing the methyl/ethyl alcohol fuel system.

2.1.2 Suitable detectors are to be selected based on the fire characteristics of the fuel. Smoke detectors are to be used in combination with detectors (e.g. flame detector with triple IR technology) which can more effectively detect methyl/ethyl alcohol fires.

2.1.3 Means to ease detection and recognition of methyl/ethyl alcohol fires in machinery spaces are to be provided for fire patrols and for fire-fighting purposes, such as portable heat-detection devices.

2.1.4 Fire detection in machinery space containing methyl/ethyl alcohol engines and fuel storage hold spaces is to give audible and visual alarms on the navigation bridge and in a continuously manned central control station or safety centre as well as locally.

3 Provision for fire main

3.1 General

3.1.1 When the fuel storage tank is located on the open deck, isolating valves are to be fitted in the fire main (on each side, aft and fore) in order to isolate sections damaged of the fire main in case of fire of the fuel storage tank. Isolation of a section of fire main is not to deprive the fire line ahead of the isolated section from the supply of water.

4 Fire fighting

4.1 General

4.1.1 Where fuel tanks are located on open deck, there is to be a fixed fire-fighting system of alcohol-resistant foam type, as set out in Chapter 17 of the IBC Code and, where appropriate, NR467, Pt D, Ch 7, Sec 6, [3]. The system is to be operable from a safe position.

4.1.2 The alcohol-resistant foam type fire-fighting system is to cover the area below the fuel tank where a spill of fuel could be expected to spread.

4.1.3 Foam from the fixed foam system is to be supplied by means of monitors and foam applicators. The capacity of any monitor shall be at least 10 l/min of foam solution per square metre of deck area protected by that monitor, such area being entirely forward of the monitor.

4.1.4 The bunker station is to have a fixed fire-extinguishing system of alcohol resistant foam type and a portable dry chemical powder extinguisher or an equivalent extinguisher, located near the access of the bunkering station.

4.1.5 Each powder or carbon dioxide extinguisher shall have a capacity of at least 5 kg and each foam extinguisher shall have a capacity of at least 9 l and be in accordance with NR467, Pt C, Ch 4, Sec 15, [3.2.1] or NR566 as applicable.

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

5 Provision for fire extinguishing of engine-room and fuel preparation space

5.1 General

5.1.1 Machinery space and fuel preparation space where methyl/ethyl alcohol-fuelled engines or fuel pumps are arranged are to be protected by an approved fixed fire-extinguishing system in accordance with NR467, Pt C, Ch 4, Sec 6 and NR467, Pt C, Ch 4, Sec 15. In addition, the fire-extinguishing medium used is to be suitable for the extinguishing of methyl/ethyl alcohol fires.

5.1.2 Where CO_2 fire extinguishing system are used as fixed gas fire-extinguishing system for machinery space or fuel preparation space, the quantity of CO_2 carried is to be sufficient to give a minimum volume of free gas equal to 50% of the gross volume of the largest space protected, including the machinery space casing.

As an alternative, aspects, such as, but not limited to, the inventory of methanol and the expected duration of a potential methanol fire in the space considered, may be considered in the risk assessment to confirm the suitability of the fire-extinguishing arrangements in machinery space, including both the fixed gas fire-extinguishing system (required by NR467, Pt C, Ch 4, Sec 4 [4.3]) and the fixed local application fire-extinguishing system (required by NR467, Pt C, Ch 4, Sec 4 [4.7]). Such alternative may be subject to approval by the Administration.

5.1.3 An approved alcohol-resistant foam system covering the tank top and bilge area under the floor plates is to be arranged for machinery space category A and fuel preparation space containing methyl/ethyl alcohol.

Section 10 Explosion Prevention and Area Classification

1 General

1.1 Means of reducing the probability of explosion

1.1.1 The probability of explosions is to be reduced to a minimum by:

- reducing the number of sources of ignition
- reducing the probability of formation of ignitable mixtures
- using certified safe type electrical equipment suitable for the hazardous zone where the use of electrical equipment in hazardous areas is unavoidable.

1.2 General provisions for hazardous areas

1.2.1 Hazardous areas on open deck and other spaces not addressed in this section are to be analysed and classified based on a recognized standard (Note 1). The electrical equipment fitted within hazardous areas are to be according to the same standard.

Note 1: Refer to IEC standard 60092-502:1999, part 4.4: Tankers carrying flammable liquefied gases, as applicable.

1.2.2 All hazardous areas are to be inaccessible to passengers and unauthorized crew at all times.

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

1.2.4 Ventilation of hazardous areas are to be in accordance Sec 11, [1.1].

1.3 Area classification

1.3.1 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.

1.3.2 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, according to [1.4]. In cases where the prescriptive provisions in [1.4] are deemed to be inappropriate, area classification according to IEC 60079-10-1:2015 is to be applied with special consideration by The Society.

1.3.3 Ventilation ducts are to have the same area classification as the ventilated space.

1.4 Hazardous area zones

1.4.1 Hazardous area zone 0

This zone includes, but is not limited to:

a) the interiors of methyl/ethyl fuel tanks

b) any pipework for pressure-relief or other venting systems for fuel tanks

c) pipes and equipment containing methyl/ethyl fuel.

Instrumentation and electrical apparatus installed within these areas are to be of an intrinsically safe type (Ex ia) suitable for zone 0.

1.4.2 Hazardous area zone 1

This zone includes, but is not limited to:

a) cofferdams and other protective spaces surrounding the fuel tanks

b) fuel preparation spaces

c) areas on open deck, or semi-enclosed spaces on deck, within 3 m of any methyl/ethyl fuel tank outlet, vapour outlet, bunker manifold valve, other methyl/ethyl fuel valve, methyl/ethyl fuel pipe flange, methyl/ethyl fuel preparation space ventilation outlets

d) areas on open deck or semi-enclosed spaces on deck in the vicinity of 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

e) areas on open deck or semi-enclosed spaces on deck, within 1.5 m of fuel preparation space entrances, fuel preparation space ventilation inlets and other openings into zone 1 spaces

f) 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

g) 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

h) a space protected by an airlock is considered as non-hazardous area during normal operation, but will require equipment to operate following loss of differential pressure between the protected space and the hazardous area to be certified as suitable for zone 1

i) airlocks not protected by over pressure relative to the surrounding area but artificially ventilated, between hazardous area zone 1 and hazardous area zone 2.

Instrumentation and electrical apparatus installed within these areas are to be of a type suitable for zone 1.

1.4.3 Hazardous area zone 2

This zone includes, but is not limited to:

a) areas 4 m beyond the cylinder and 4 m beyond the sphere defined in [1.4.2], item d).

b) areas within 1.5 m surrounding other open or semi-enclosed spaces of zone 1 defined in [1.4.2]

c) airlocks protected by over pressure relative to the surrounding area, between hazardous area zone 1 and non-hazardous area

d) airlocks not protected by over pressure relative to the surrounding area but artificially ventilated, between hazardous area zone 2 and non-hazardous area.

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

1.5 Electrical installations

1.5.1 Electrical installations are to comply with IEC 60092 series standards.

1.5.2 Electrical equipment or wiring are not to be installed in hazardous areas unless essential for operational purposes or safety enhancement.

1.5.3 Where electrical equipment is installed in hazardous areas as provided in [1.5.2], it is to be selected, installed and maintained in accordance with IEC standards. The types of electrical equipment admitted, depending on the zone where they are installed, are specified in NR467, Pt C, Ch 2, Sec 3, [10].

1.5.4 The lighting system in hazardous areas is to be divided between at least two branch circuits. All switches and protective devices are to interrupt all poles or phases and are to be located in a non-hazardous area.

1.5.5 The onboard installation of the electrical equipment units is to be such as to ensure the safe bonding to the hull of the units themselves.

1.5.6 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 are not to be located in spaces to be protected by airlocks.

1.6 Accesses between hazardous and non-hazardous space

1.6.1 Non-hazardous spaces with entry openings to a hazardous area are to be arranged with an airlock and be maintained at overpressure relative to the external hazardous area. The overpressure ventilation is to be arranged according to the following:

a) 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 is to be required to:
   - proceed with purging (at least five air changes) or confirm by measurements that the space is non-hazardous; and
   - pressurize the space

b) operation of the overpressure ventilation is to be monitored and in the event of failure of the overpressure ventilation:
   - an audible and visual alarm is to be given at a manned location
   - if overpressure cannot be immediately restored, automatic or programmed, disconnection of electrical installations according to a recognized standard is to be required.

Note 1: Refer to IEC 60092-502:1999 Electrical Installations in Ships – Tankers – Special Features, table 5.

1.6.2 Non-hazardous spaces with entry openings to a hazardous enclosed space are to be arranged with an airlock and the hazardous space is to be maintained at underpressure relative to the non-hazardous space. Operation of the extraction ventilation in the hazardous space is to be monitored and in the event of failure of the extraction ventilation:

- an audible and visual alarm is to be given at a manned location; and
- if underpressure cannot be immediately restored, automatic or programmed, disconnection of electrical installations according to recognized standards in the non-hazardous space is to be required.

Section 11 Ventilation

1 General

1.1 Ventilation of hazardous areas

1.1.1 Enclosed spaces classified hazardous areas and not containing a source of release are to be provided with mechanical ventilation capable to provide at least 6 air changes per hour. Higher ventilation rate may be required for enclosed spaces classified hazardous areas and containing a source of release, based on the outcome of the risk assessment.

1.1.2 Ventilation inlets and outlets for spaces to be equipped with mechanical ventilation are to be located in such a way that, according to NR467, Pt B, Ch 11, Sec 12, [9.1.2], they are not required to have closing devices.

1.1.3 Any ducting used for the ventilation of hazardous spaces is to be separate from that used for the ventilation of non-hazardous spaces. The ventilation is to be designed to work at all temperatures and environmental conditions the ship will be operating in.

1.1.4 Electric motors for ventilation fans are not to be located in ventilation ducts for hazardous spaces unless the motors are certified for the same hazard zone as the space served.

1.1.5 Design of ventilation fans serving spaces where vapours from fuels may be present is to fulfill the following:

a) Ventilation fans are not to 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, are to be of non-sparking construction defined as:
   - impellers or housings of non-metallic material, due regard being paid to the elimination of static electricity
   - impellers and housings of non-ferrous metals
   - impellers and housings of austenitic stainless steel
   - 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
   - any combination of ferrous (including austenitic stainless steel) impellers and housings with not less than 13 mm tip design clearance.

b) In no case, the radial air gap between the impeller and the casing is to 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

c) 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 are not to be used in these places.

1.1.6 Ventilation systems required to avoid any vapour accumulation are to consist of independent fans, each of sufficient capacity, unless otherwise specified in this Rule Note. The ventilation system is to be of a mechanical exhaust type, with extraction inlets located such as to avoid accumulation of vapour from leaked methyl/ethyl alcohol in the space.

1.1.7 Air inlets for hazardous enclosed spaces are to be taken from areas that, in the absence of the considered inlet, would be non-hazardous. Air inlets for non-hazardous enclosed spaces are to 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 is to be gastight and have over-pressure relative to this space.

1.1.8 Air outlets from non-hazardous spaces are to be located outside hazardous areas.

1.1.9 Air outlets from hazardous enclosed spaces are to 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.

1.1.10 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.

1.1.11 Double bottoms, cofferdams, duct keels, pipe tunnels, hold spaces and other spaces where methyl/ethyl fuel may accumulate are to be capable of being ventilated to ensure a safe environment when entry into the spaces is necessary.

1.1.12 Any loss of required ventilation capacity in a hazardous area is to give an audible and visual alarm on the navigation bridge and in a continuously manned central control station or safety center as well as locally.

1.1.13 An approved type fail-safe automatic closing fire damper is to be fitted in each ventilation trunk serving tank connection spaces.

1.2 Fuel preparation spaces

1.2.1 Fuel preparation spaces are to be provided with an effective mechanical forced ventilation system of extraction type. During normal operation the ventilation is to be capable of provide at least 30 air changes per hour.

1.2.2 The number and power of the ventilation fans are to be such that the capacity is not reduced by more than 50% if a fan with a separate circuit from the main switchboard or emergency switchboard or a group of fans with common circuit from the main switchboard or emergency switchboard is inoperable.

1.2.3 Ventilation systems for fuel preparation spaces and other fuel handling spaces are to be interlocked with pumps or other fuel treatment equipment so as to prevent inadvertent operation if the ventilation is not operational.

1.3 Bunkering station

1.3.1 Bunkering stations that are not located on open deck are to be suitably ventilated to ensure that any vapour being released during bunkering operations will be removed outside. If the natural ventilation is not sufficient, the bunkering stations are to be subject to special consideration with respect to provisions for mechanical ventilation. The Society may require special risk assessment.

1.4 Ducts and double wall pipes

1.4.1 Ducts and double wall pipes containing fuel piping fitted with a mechanical ventilation system of the extraction type are to be provided with a ventilation capacity of at least 30 air changes per hour.

1.4.2 The ventilation system for double wall piping and ducts is to be independent of all other ventilation systems.

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

Section 12 Control and Monitoring

1 General

1.1 General requirements

1.1.1 The requirements given in the following paragraphs may be adapted on the basis of the risk analysis required in Sec 2, [1].

In particular, monitoring and control options are to be defined for systems not covered in the following paragraphs but for which the risk analysis would show significant risks.

The required monitoring and alarms functions to be provided are listed in Tab 1 but additional alarms may be required for unconventional or complex installations.

1.1.2 The control, monitoring and safety systems of the methyl/ethyl alcohol installations are to be arranged such that there is not an unacceptable loss of power in the event of a single failure.

1.1.3 Suitable instrumentation devices are to be fitted to allow a local and a remote reading of essential parameters to ensure safe management of the whole fuel equipment including bunkering.

1.1.4 Liquid leakage detection is to be installed in the protective cofferdams surrounding the fuel tanks, in all ducts around fuel pipes, in fuel preparation spaces, and in other enclosed spaces containing single walled fuel piping or other fuel equipment.

1.1.5 The annular space in a double walled piping system is to be monitored for leakages and the monitoring system is to be connected to an alarm system. Any leakage detected is to lead to shutdown of the affected fuel supply line in accordance with Tab 1.

1.1.6 At least one bilge well with a level indicator is to be provided for each enclosed space, where an independent storage tank without a protective cofferdam is located. A high-level bilge alarm is to be provided. The leakage detection system is to trigger an alarm and the safety functions in accordance with Tab 1.

1.1.7 For tanks not permanently installed in the vessel, a monitoring system equivalent to that provided for permanent installed tanks is to be provided.

2 Bunkering and fuel tank monitoring

2.1 Level indicators for fuel tanks

2.1.1 Each fuel tank is to be fitted with closed level gauging devices, arranged to ensure a level reading is always obtainable.

2.1.2 Unless any necessary maintenance can be carried out while the fuel tank is in service, two devices are to be installed.

2.2 Overflow control

2.2.1 Each fuel tank is to be fitted with a visual and audible high-level alarm. This is to be able to be function tested from the outside of the tank and can be common with the level gauging system (configured as an alarm on the gauging transmitter), but is to be independent of the high-high-level alarm.

2.2.2 An additional sensor (high-high-level) operating independently of the high liquid level alarm is to automatically actuate a shut-off valve to avoid excessive liquid pressure in the bunkering line and prevent the tank from becoming liquid full.

2.2.3 When water filling is the method for gas freeing the high and high-high-level alarm for the fuel tanks are to be visual and audible at the location at which gas freeing by water filling of the fuel tanks is controlled.

2.3 Bunkering control

2.3.1 Bunkering control is to be from a safe remote location. At this safe remote location:

- tank level is to be capable of being monitored
- the remote control valves required by Sec 6, [3.1.3] are to be capable of being operated from this location; closing of the bunkering shutdown valve is to be possible from the control location for bunkering and from another safe location
- overfill alarms and automatic shutdown are to also be indicated at this location.

2.3.2 If the ventilation in the ducting enclosure or annular spaces of the double walled bunkering lines stops, an audible and visual alarm is to be activated at the bunkering control location.

2.3.3 If fuel leakage is detected in ducting enclosure or the annular spaces of the double walled bunkering lines, an audible and visual alarm and emergency shutdown of the bunkering valve is to automatically be activated.

3 Engine monitoring

3.1

3.1.1 In addition to the instrumentation provided in accordance with NR467, Part C, Chapter 1 indicators are to be fitted on the navigation bridge, the engine control room and the manoeuvring platform for:

- operation of methyl/ethyl alcohol fuel engines
- operation and mode of operation of the engine in the case of dual fuel engines.

Table 1 : Monitoring of methyl/ethyl alcohol supply system to engines

Parameter	Alarm	Automatic shutdown of			Comments
		Tank valve (valve(s) referred to Sec 7, [1.3.2])	Master fuel valve (valve(s) referred to Sec 7, [1.3.3])	Bunkering valve	
VAPOUR DETECTION					
Vapour detection in the annular space in the bunkering line	X			X	see [2.3.3]
Vapour detection in cofferdams surrounding fuel tanks. One detector giving 20% of LEL	X				see [4.1.5]
Vapour detection in cofferdams surrounding fuel tanks. Two detectors giving 40% of LEL	X	X	X		see [4.1.1], item f)
Vapour detection in ventilated ducts or annular spaces, 20% of LEL	X				see [4.1.5]
Vapour detection in ventilated ducts or annular spaces, 40% of LEL. Two vapour detectors to give min. 40% of LEL before shutdown	X	X	X		see [4.1.5]
Vapour detection in airlocks	X				see [4.1.1], item g)
Vapour detection in engine room	X				see [4.1.1], item b)
LIQUID DETECTION					
Liquid methyl/ethyl alcohol detection in the annular space of the double walled bunkering line	X			X	see [2.3.3]
Liquid leakage detection in protective cofferdams surrounding fuel tanks	X				see [1.1.3]
Liquid leak detection in fuel preparation space	X	X			see [1.1.3]
Liquid leak detection in annular space of double walled pipes	X	X	X		see [1.1.4]
VENTILATION					
Loss of ventilation in the annular space in the bunkering line	X			X	see [2.3.2]
Loss of ventilation in ventilated areas	X				see Sec 11, [1.1.12]
INERTING					
Oxygen detection in inert gas supply, giving 5% oxygen content by volume when inerted	X				see Sec 4, [5.1.4]
Oxygen detection in the fuel tank, giving 8% oxygen content by volume when inerted	X	X			see Sec 4, [5.1.5]
Loss of pressure in annular spaces, when inerted	X				see [4.1.6]
OTHER					
High-level fuel tank	X				see [2.2.1]
High-high-level fuel tank	X			X	see [2.2.2] and [2.2.3]
Manual shutdown	X			X	see [2.3.1]

4 Vapour detection

4.1

4.1.1 Permanently installed vapour detectors are to be fitted in:

a) all ventilated annular spaces of the double walled fuel pipes

b) machinery spaces containing fuel equipment or consumers

c) fuel preparation spaces

d) other enclosed spaces containing fuel piping or other fuel equipment without ducting

e) other enclosed or semi-enclosed spaces where fuel vapours may accumulate

f) cofferdams and fuel storage hold spaces surrounding fuel tanks

g) airlocks

h) ventilation inlets to accommodation and machinery spaces if required based on the risk assessment required in Sec 2, [1.2.2].

4.1.2 The number and placement of detectors in each space are to be considered taking into account the size, layout and ventilation of the space. Gas dispersal analysis or a physical smoke test is to be used to find the best arrangement.

4.1.3 Fuel vapour detection equipment is to be designed, installed and tested in accordance with a recognized standard.

Note 1: Refer to IEC 60079-29-1:2016 - Explosive atmospheres - Gas detectors - Performance requirements of detectors for flammable gases.

4.1.4 An audible and visible alarm is to be activated at a fuel vapour concentration of 20% of the lower explosion limit (LEL). The safety system, if any, is to be activated at 40% of LEL at two detectors. Special consideration is to be given to toxicity in the design process of the detection system. If the gas detector is of self-monitoring type the installation of a single gas detector can be permitted.

4.1.5 For ventilated ducts and annular spaces around fuel pipes in the machinery spaces containing methyl/ethyl alcohol-fuelled engines, the alarm limit is to be set to 20% of LEL. The safety system is to be activated at 40% of LEL at two detectors.

4.1.6 When the double pipe are inerted, an audible and visible alarm is to be activated at gas pressure less than 100 mm water gauge.

4.1.7 Audible and visible alarms from the fuel vapour detection equipment are to be located on the navigation bridge, in the continuously manned central control station, safety centre and at the control location for bunkering as well as locally.

4.1.8 Fuel vapour detection required by this section is to be continuous without delay.

5 Safety functions of fuel supply systems

5.1

5.1.1 A fuel safety system is to be arranged to close down the fuel supply system automatically, upon failure in systems as described in Tab 1 and upon other fault conditions which may develop too fast for manual intervention.

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

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

5.1.4 A caution placard or signboard is to be permanently fitted in the machinery space containing methyl/ethyl alcohol fuelled engines stating that heavy lifting, implying danger of damage to the fuel pipes, is not to be done when the engine(s) is running on methyl/ethyl.

5.1.5 Pumps and fuel supply are to be arranged for manual remote emergency stop from the following locations as applicable:

- navigation bridge
- cargo control room
- onboard safety centre
- engine control room
- fire control station; and
- adjacent to the exit of fuel preparation spaces.

Section 13 Survey at work and Certification

1 General

1.1 Principles

1.1.1 The manufacture, testing, and survey is to be in accordance with the applicable Rules for Classification, recognized standards accepted by the Society and the specific recommendations given in this Rule Note.

1.2 Certification

1.2.1 Equipment is to be certified as listed in Tab 1.

Symbols used in the table have the following meaning:

TA : Indicates that Type Approval is required.

DA : Indicates that Design assessment / Appraisal of the product is required; this one may be carried out as applicable either for a specific unit or using the Type Approval procedure.

C : Indicates that a BV product certificate is required with invitation of the Surveyor to attend the tests unless otherwise agreed, in addition to the manufacturer's document stating the results of the tests performed and/or compliance with the approved type as applicable.

W : Indicates that a manufacturer's document is required, stating the results of the tests performed and/or stating compliance with the approved type (as applicable).

X : Indicates that examinations and tests are required.

Where fitted, each additional index (h, ndt) indicates a specific type of test:

h : Hydraulic pressure test (or equivalent).

ndt : Non-destructive tests as per Rules.

Table 1 : Certification requirements for methyl/ethyl alcohol-related equipment

No.	Item	Product certification				Remarks
		Design assessment / Approval	Raw material certificate	Examination and testing	Product certificate	
1	Methyl/ethyl alcohol bunkering hoses (1)	TA	C	X h ndt	C	(1) See Sec 6
2	Emergency release system (1)		(2)			(1) See Sec 6 (2) All materials are to be compatible with each other and with the fluid conveyed (methyl/ethyl alcohol and vapours) (3) Performance test / Pressure and leak test (4) Power system and PERC
	1- QCDC (Quick Connect Disconnect Coupler) (including DDCC)	TA	C	X h (3)	C	
	2- ERC (Emergency Release Coupling)		C	X h (3)	C	
	3- PERC (Powered Emergency Release Coupling)	TA (4)	C	X h (3)	C	
3	Plates and profiles for methyl/ethyl alcohol fuel tanks	(1)	C (1)	X	C	(1) As per provisions of Sec 5
4	Independent methyl/ethyl alcohol tank supporting materials	TA (1)	C (1)	X	C	(1) As per provisions of Sec 4 and relevant provisions of NR216 and NR480
5	Pressure relief valves for tank	TA (1)	C	X h ndt (2) (3)	C	(1) The approval includes capacity testing (2) Checking of the setting including tightness test (3) When the valves have welded elements, the welding procedures are to be examined
6	Single or double wall flexible hoses assembly (1) (2)	TA	W (3)	W h (4)	C	(1) See Sec 3, [1.4] and NR467 Pt C, Ch 1, Sec 10 (2) Short length of metallic hose with end fittings ready for installation (3) All materials are to be compatible with each other and with methyl/ethyl alcohol (4) Inner and outer pipes are to be tested. Bursting test to be performed at minimum 5 times the maximum working pressure. Hydraulic test for the inner pipe is to be carried out at 1,5 time the maximum service pressure without pressure in the outer pipe. Pressure test for the outer pipe is to be carried out at 1,5 time the design pressure.
7	Fuel pipes for liquid methyl/ethyl alcohol					(1) As per provisions of Sec 5 and NR467, Pt C, Ch 1, Sec 10 (2) W for Seamless steel, C for longitudinally welded steel pipes
	1- nominal diameter ND ≥ 50mm		W	X h ndt (1)	C	
	2- nominal diameter ND < 50mm		W	X h ndt (1)	W/C (2)	
8	Outer pipe of double wall fuel pipes (1), including elbows, reducers and flanges					(1) As per provisions of Sec 5 and NR467, Pt C, Ch 1, Sec 10 (2) Pressure test is at the maximum working pressure of the inner pipe (3) W for Seamless steel, C for longitudinally welded steel pipes
	1- nominal diameter ND ≥ 100mm		W	X h ndt (2)	C	
	2- nominal diameter ND < 100mm		W	X h ndt (2)	W/C (3)	
9	Methyl/ethyl alcohol fuel valves (1)					(1) Class of piping as per provisions of Sec 5 (2) In case of welded construction. When the valves have welded elements, the welding procedures are to be examined
	1- nominal diameter ND ≥ 50mm	TA	C	X h ndt (2)	C	
	2- nominal diameter ND < 50mm	TA	W	X h ndt (2)	C	

No.	Item	Product certification				Remarks
		Design assessment / Approval	Raw material certificate	Examination and testing	Product certificate	
10	Methyl/ethyl alcohol fuel pipe fittings (1)	DA (2)	W	X h ndt (3)	C	(1) Such as elbows, reducers, flanges: same remarks as for item 7, as appropriate (2) If not already addressed within the scope of the system approval (3) When the fittings are of welded type, the welding procedures are to be examined
11	Methyl/ethyl alcohol fuel process and containment sensors, transmitters, flow meters, PT100 and PLC, Circuit breakers, Electric cables	TA (1)		X	C/W (2)	(1) For some equipment, DA is applicable on a case-by-case basis; refer to general rules for approval (2) As per conditions set in the Type Approval
12	Methyl/ethyl alcohol fuel pumps and their prime movers					(1) As per provisions of Sec 7 (2) See relevant provisions of general rules for approval
	1- Methyl/ethyl alcohol fuel pumps	TA or DA (1)	C (1)	X h	C	
	2- Prime movers	(2)	(2)	(2)	C	
13	Pressure relief valves for piping	TA or DA (1)	C	X h ndt (2) (3)	C	(1) TA, or case-by-case DA (2) Checking of the setting (3) When the valves have welded elements, the welding procedures are to be examined
14	Vent lines (1)	DA	W	X h ndt (2)	C	(1) The design pressure of the vent pipe is to be in accordance with Sec 5, Tab 2 (2) In case of welded construction. When the vent lines have welded elements, the welding procedures are to be examined
15	Fire fighting system (1)					(1) See Sec 9, [4]
16	Fire and vapour detection system	TA (1)		X	C	(1) Automation systems: see relevant provisions of general rules for approval
17	Inert gas generation system	DA	C	X h ndt	C	
18	Flame arresting devices	TA(1)		X	C	(1) See Sec 4, [3.1.5]
19	Fans for hazardous enclosed spaces, and their prime movers					(1) For anti-sparking fans (2) As per conditions set in the Type Approval (3) For electrical motors, refer to general rules for approval
	1- Fans	TA (1)		X	C/W (2)	
	2- Prime movers	(3)	(3)	X (3)	C	
20	Engines using methyl/ethyl alcohol as fuel (1)	TA (2)	C/W	X	C	(1) See Sec 8 (2) The provisions of main and auxiliary diesel engines regarding survey of engine components and evaluation of test results are to be complied with, as far as applicable

Section 14 Additional Provisions for Chemical Tankers

1 Chemical tankers using methyl/ethyl alcohol cargo as fuel

1.1 General

1.1.1 Ships assigned the service notation **chemical tanker**, and designed to use methyl/ethyl alcohol cargo as fuel, are to comply with Sec 2 to Sec 14, as relevant, and with the requirements of [1.2] to [1.5].

1.2 Risk assessment

1.2.1 The following risks are to be considered in the risk assessment:

- the risk of fire or explosion in the cargo area that extends to the fuel supply system
- the risk of unforeseen transfer of contaminating or incompatible cargo to the fuel system
- when a cargo tank is dedicated as a fuel storage tank the risk of fire or explosion related to higher frequency of use of piping systems for transfer of fuel from service tank to engine room and transfer from a cargo tank to service tank.

1.3 Ship arrangement

1.3.1 A dedicated fuel service tank is to be provided. Except for the fuel transfer pipes from tanks for fuel storage, the piping system serving this tank is to be separated from cargo handling piping systems.

1.3.2 Both fuel pump room and fuel service tank are be located in the cargo area.

1.4 Fire protection and fire extinction

1.4.1 Fuel tanks are to be covered by the cargo deck fire extinguishing system and additional foam monitors or sprinklers are to be fitted where necessary.

1.4.2 Boundaries of fuel pump room and fuel service tank are to be protected by a water spray system for fire prevention and cooling. The system with a uniformly distributed water application rate of at least 10 litre/m^2/min for the largest projected horizontal surfaces and 4 litre/m^2/min for vertical surfaces.

1.4.3 The capacity of the water spray pump is to be sufficient to deliver the required amount of water to the hydraulically most demanding area as specified in [1.4.2] in the areas protected.

1.4.4 If the water spray system is not part of the fire main system, a connection to the ships fire main through a stop valve is to be provided.

1.5 Cargo segregation

1.5.1 When a cargo tank located within the cargo area is used as fuel storage tank, this cargo tank is to be dedicated as fuel tank when ship is operating on methyl/ethyl alcohol as fuel.

1.5.2 Methyl/ethyl alcohol fuel tanks in cargo area of chemical tankers are not required to be surrounded by protective cofferdams, except if the cargo in the adjacent cargo tanks is not compatible with methyl/ethyl alcohol.

1.5.3 All cargo pipes dedicated to fuel use are to be separated from other cargo piping serving other tanks.

1.5.4 The venting system for a dedicated fuel cargo tank is to be separated from other cargo venting systems.

1.5.5 When the ship is arranged to operate only with methyl/ethyl alcohol as fuel, if the fuel service tank is located within the cargo area, the ship is to be provided with an alternative power supply system to ensure all essential services onboard.

Section 15 Methanol and Ethanol Fuel Prepared Ships

1 General

1.1 Application

1.1.1 The additional class notation **METHANOLFUEL-PREPARED**, respectively **ETHANOLFUEL-PREPARED**, is assigned to new ships that are designed to accommodate future installation of a methanol, respectively ethanol, fuel system, in accordance with the requirements of this Section.

1.1.2 When specific systems or arrangements compatible with the use of methyl/ethyl alcohol are effectively installed on board at new construction stage, the additional class notation may be completed between brackets with one or a combination of the following notations **S, T, H, P, A, ME-DF, AE, B**:

- **S** when the ship structure is designed and built with specific arrangements at new construction stage with the aim of preventing the need for specific structural modifications at a later stage (see Article [3])
- **T** when at least one original fuel storage tank can be used with methyl/ethyl alcohol fuel, possibly with modifications of the operational conditions of the tank at a later stage (see Article [4])
- **H** when the original fuel handling equipment can be used with methyl/ethyl alcohol (see Article [5])
- **P** when the original piping system can be used with methyl/ethyl alcohol (see Article [6])
- **A** when specific arrangements for ventilation and access to methyl/ethyl alcohol related spaces are already on board (see Article [7])
- **ME-DF** when the main engine(s) is (are) of the dual fuel type approved for methyl/ethyl alcohol (see [8.1]])
- **AE** when the auxiliary engines either are of a dual fuel type approved for methyl/ethyl alcohol, or designed for future conversion to dual fuel operation (see [8.2])
- **B** when the oil-fired boilers are either of a dual fuel type approved for methyl/ethyl alcohol, or designed for future conversion to dual fuel operation (see [8.3]).

Examples:

METHANOLFUEL-PREPARED,

METHANOLFUEL-PREPARED (T),

METHANOLFUEL-PREPARED (S,T,H).

1.1.3 When the ship is effectively modified to operate on methyl/ethyl alcohol fuel, the additional class notation **METHANOLFUEL-PREPARED** or **ETHANOLFUEL-PREPARED** is to be replaced by the additional class notation **methanolfuel** or **ethanolfuel**, provided that all the applicable requirements of Sec 1 to Sec 14 are complied with.

1.2 Documents to be submitted

1.2.1 The documents listed in Tab 1 are to be submitted for ships to be assigned the additional class notation **METHANOLFUEL-PREPARED** or **ETHANOLFUEL-PREPARED**.

In addition, the documents to be submitted for the notations **S**, **T**, **H**, **P**, **A**, **ME-DF**, **AE** and **B** are listed in the corresponding Tab 1 to Tab 9.

The list of documents requested is intended as a guidance for the complete set of information to be submitted, rather than an actual list of titles.

The Society reserves the right to request the submission of additional documents in the case of non-conventional design or if it is deemed necessary for the evaluation of the systems, equipment or components.

Table 1 : Documents to be submitted for additional class notation METHANOLFUEL-PREPARED and ETHANOLFUEL-PREPARED

No.	A/I **(1)**	Documents	Particulars
1	A	General arrangement drawing of the ship showing the areas and methyl/ethyl alcohol related spaces and the associated installations, either at the new construction stage or in view of a future modification	In particular: • the methyl/ethyl alcohol bunkering station(s) • the methyl/ethyl alcohol tank(s) • the methyl/ethyl alcohol fuel handling and supply system • the methyl/ethyl alcohol leakage treatment and recovery systems • the bilge system in methyl/ethyl alcohol related spaces • the methyl/ethyl alcohol venting system • the inert gas system
2	I	General specification of the contemplated methyl/ethyl alcohol fuel installation	Including: • type and capacity of the methyl/ethyl alcohol storage tanks, range of pressure and temperature anticipated under operational conditions • bunkering method (from terminal, bunker ship or barge, truck).
3	A	Drawing showing the hazardous areas and their classification, assuming that all methyl/ethyl alcohol installations are fitted on board	
4	A	Drawing showing the methyl/ethyl alcohol related spaces	
5	A	Drawing showing the foreseen structural fire protection and cofferdams to be provided in connection with methyl/ethyl alcohol installations	
6	A	Preliminary loading manual and loading conditions assuming the methyl/ethyl alcohol installation in ready-for-use conditions	
7	A	Tank and Capacity Plan taking into account the methyl/ethyl alcohol installation in ready-for-use condition	
8	A	Intact stability calculations taking into account the methyl/ethyl alcohol installation in ready-for-use condition	
9	A	Foreseen arrangements of accesses to the methyl/ethyl alcohol related spaces, assuming the methyl/ethyl alcohol installation in ready-for-use condition	
10	A	Arrangement of the ventilation systems serving the methyl/ethyl alcohol related spaces	
11	I	Report of HAZID analysis (see [2.1.5])	
12	A	Electrical power balance anticipated with the use of methyl/ethyl alcohol as fuel	
13	I	Main engine of methyl/ethyl alcohol convertible type documents	Including: • details of the methyl/ethyl alcohol conversion • list of the components that need to be replaced (e.g. cylinder heads) • list of new components (e.g. methyl/ethyl alcohol injection valve, pilot injection system) • reference of approval for the engine running on methyl/ethyl alcohol
14	A	Damage Control Plan as applicable and taking into account the methyl/ethyl alcohol installation in ready-for-use condition	For ships assigned the additional class notation **SDS**
15	A	Damage Stability Booklet as applicable and taking into account the methyl/ethyl alcohol installation in ready-for-use condition	For ships assigned the additional class notation **SDS**
16	A	Damage Stability Calculations as applicable and taking into account the methyl/ethyl alcohol installation in ready-for-use condition	For ships assigned the additional class notation **SDS**

(1) A: To be submitted for approval ; I: To be submitted for information

Table 2 : Additional documents to be submitted for notation S

No.	A/I **(1)**	Documents	Particulars
1	A	Structural drawings for the methyl/ethyl alcohol related spaces	• methyl/ethyl alcohol bunkering station • methyl/ethyl alcohol tank or methyl/ethyl alcohol tank hold space in case of independent tank • methyl/ethyl alcohol fuel handling room • methyl/ethyl alcohol fuel valve train unit room (where fitted)
2	A	Details of structural modifications and local reinforcements in way of machinery, piping components associated with the use of methyl/ethyl alcohol as fuel	
3	A	Holes and penetration drawings	
4	A	Structural drawings for cofferdams surrounding methyl/ethyl alcohol tanks	
(1) A: To be submitted for approval ; I: To be submitted for information			

Table 3 : Additional documents to be submitted for notation T

No.	A/I **(1)**	Documents	Particulars
1	I	Manufacturer's document describing the methyl/ethyl alcohol readiness of the original tank and the modifications foreseen at a later stage	
2	A	Tank material specification	
3	A	Methyl/ethyl alcohol tank structural drawings and details of structural modifications and local reinforcements in way of the methyl/ethyl alcohol tank	Including tank supports structural drawings in the case of an independent tank
(1) A: To be submitted for approval ; I: To be submitted for information			

Table 4 : Additional documents to be submitted for notation H

No.	A/I **(1)**	Documents
1	I	Manufacturer's document describing the methyl/ethyl alcohol readiness of the original fuel handling system and the modifications foreseen at a later stage
2	A	Justifications regarding the suitability of the concerned equipment (pumps, heat exchangers) for use with methyl/ethyl alcohol, in particular with respect to operating characteristics (density, pressure, temperature, viscosity and head loss in the pipeline), capacity and materials
(1) A: To be submitted for approval ; I: To be submitted for information		

Table 5 : Additional documents to be submitted for notation P

No.	A/I **(1)**	Documents	Particulars
1	I	Manufacturer's document describing the methyl/ethyl alcohol readiness of the original fuel piping system and the modifications foreseen at a later stage	
2	A	Schematic diagram and arrangement of the methyl/ethyl alcohol piping systems	Including venting systems
3	A	Arrangement of the methyl/ethyl alcohol venting system	
(1) A: To be submitted for approval ; I: To be submitted for information			

Table 6 : Additional documents to be submitted for notation A

No.	A/I **(1)**	Documents	Particulars
1	A	Arrangement and instruction of mechanical ventilation systems in hazardous areas and adjacent zones	Including the capacity and arrangement of fans and their motors
2	A	Arrangements of accesses to the methyl/ethyl alcohol related spaces	
(1) A: To be submitted for approval ; I: To be submitted for information			

Table 7 : Additional documents to be submitted for notation ME-DF

No.	A/I **(1)**	Documents
1	I	Reference of type approval for the dual fuel main engine
(1) A: To be submitted for approval ; I: To be submitted for information		

Table 8 : Additional documents to be submitted for notation AE

No.	A/I **(1)**	Documents	Particulars
1	I	Auxiliary engines of methyl/ ethyl alcohol convertible type documents	Including: • details of the methyl/ethyl alcohol conversion • list of the components that need to be replaced (e.g. cylinder heads) • list of new components (e.g. methyl/ethyl alcohol injection valve, pilot injection system) • reference of approval for the auxiliary engine running on methyl/ethyl alcohol
2	I	For dual fuel auxiliary engines, reference of type approval	
(1) A: To be submitted for approval ; I: To be submitted for information			

Table 9 : Additional documents to be submitted for notation B

No.	A/I **(1)**	Documents	Particulars
1	I	Boilers of methyl/ethyl alcohol convertible type documents	Including: • details of the methyl/ethyl alcohol conversion • list of the components that need to be replaced • list of new components • reference of approval for the boiler running on methyl/ethyl alcohol
(1) A: To be submitted for approval ; I: To be submitted for information			

2 General requirements for the additional class notation METHANOLFUEL-PREPARED or ETHANOLFUEL-PREPARED

2.1 Design principles

2.1.1 The initial design of the ship is to take into account the specific characteristics of methyl/ethyl alcohol.

2.1.2 The design of spaces intended to accommodate the methyl/ethyl alcohol storage tanks is to take into account the required fuel capacity to cover the operating range of the ship.

2.1.3 The electrical power balance is to take into consideration all the main and auxiliary equipment that will form part of the methyl/ethyl alcohol installation.

2.1.4 All parts of the ship expected to be in contact with methyl/ethyl alcohol once the retrofit is performed are to be made of materials compatible with methyl/ethyl alcohol.

2.1.5 An HAZID analysis is to be conducted to ensure that the risks arising from the use of methyl/ethyl alcohol fuel are addressed, in particular the risks related to its explosivity, flammability and toxicity. Loss of function, system damage, spillage of liquid methyl/ethyl alcohol or release of methyl/ethyl alcohol vapours, fire and explosion are, as a minimum, to be considered. The results of the HAZID are to be implemented in the design of the methyl/ethyl alcohol systems.

2.2 General arrangement

2.2.1 The initial design of the ship is to take into account the necessary spaces or zones to accommodate the future installation of the following installations, taking into account the requirements of Sec 3, Sec 9 and Sec 11, especially regarding access to, and ventilation of, methyl/ethyl alcohol related spaces:

a) methyl/ethyl alcohol fuel bunkering station

b) methyl/ethyl alcohol fuel storage tanks

c) cofferdams

d) methyl/ethyl alcohol fuel handling and supply systems

e) methyl/ethyl alcohol leakage drainage tank

f) ventilation systems (independent systems)

g) methyl/ethyl alcohol venting system and gas freeing system

h) inert gas system.

2.2.2 The hazardous / non-hazardous area classification of the methyl/ethyl alcohol related spaces is to be defined in accordance with the provisions of Sec 10 of this Rule Note.

2.3 Ship structure and stability

2.3.1 The ship stability is to be assessed for preliminary loading conditions, assuming the methyl/ethyl alcohol installation in ready-for-use condition, and to comply with the relevant provisions of the Rules. The relevant loads are to be stated.

2.4 Machinery

2.4.1 Main engines are to be of dual fuel methyl/ethyl alcohol approved type or methyl/ethyl alcohol convertible type. When engines are of the dual fuel type for methyl/ethyl alcohol, the additional class notation can be completed with the **ME-DF** notation as per [8.1.1].

2.4.2 All installations and equipment necessary for the ship to operate on methyl/ethyl alcohol and that are fitted on the ship at the new construction stage are to comply with the relevant provisions of this Rule Note.

3 Additional requirements for notation S

3.1 General

3.1.1 The structural arrangements and reinforcements in way of machinery and piping components associated with the use of methyl/ethyl alcohol as fuel are to be implemented at the new construction stage with the aim of preventing the need for specific structural modifications at a later stage.

3.1.2 Methyl/ethyl alcohol tanks are to be surrounded by cofferdams as indicated in Sec 3, [1.2] and Sec 9, [1.2].

4 Additional requirements for notation T

4.1 General

4.1.1 In addition to complying with the provisions of Article [2], ships having the notation **T** are to be provided with tanks also suitable for methyl/ethyl alcohol, as per [4.2].

The operational conditions of the tank (e.g. maximum filling level) may however be modified at a later stage.

Note 1: Upon request, an Approval in Principle may be issued by the Society upon satisfactory completion of the procedure.

4.1.2 In the case of independent tanks, the ship structure in way of the tanks is to take into account the density of methyl/ethyl alcohol.

4.2 Design of the methyl/ethyl alcohol storage tank

4.2.1 Material compatibility

When it is foreseen to use the original tanks to store methyl/ethyl alcohol as fuel, the provisions of Sec 5, [2.3] are to be taken into account.

4.2.2 Scantling

The scantling of the original tank is to take into account the static and dynamic load on the tank structure due to the density of liquid methyl/ethyl alcohol, and where applicable, the sloshing loads for the full range of intended filling levels.

4.2.3 Pressure/Vacuum valves

The scantling of the original tank is to take into account the setting of the future PV valves.

4.2.4 Tank connections

The size of the tank connections is to be sufficient to allow the required flow rates, taking into account the energy density of methyl/ethyl alcohol and the permissible velocity.

The tank is to be fitted, at the new construction stage, with all the connections necessary for operation with methyl/ethyl alcohol.

4.2.5 Instrumentation

The tank is to be fitted, at the new construction stage, with all the necessary penetrations for the instrumentation relevant to methyl/ethyl alcohol operation.

5 Additional requirements for notation H

5.1 General

5.1.1 In addition to complying with the provisions of Article [2], ships having the notation **H** are to be provided with a fuel handling system (pumps, filters, heat exchangers) also suitable for use with methyl/ethyl alcohol, as per [5.2].

Note 1: Upon request, an Approval in Principle may be issued by the Society upon satisfactory completion of the procedure

5.2 Design of the methyl/ethyl alcohol fuel handling system

5.2.1 Design parameters

The fuel handling system intended for methyl/ethyl alcohol is to be designed for the pressure and temperature conditions and the flow rate required at the engine inlet.

The capacity of the methyl/ethyl alcohol fuel handling system is to take into account the characteristics of methyl/ethyl alcohol, in particular its volumetric energy density.

5.2.2 Material compatibility

The components of the methyl/ethyl alcohol fuel handling system are to comply with the provisions of Sec 5, [2.2] and Sec 5, [2.3].

5.2.3 All pumps in the fuel system are to comply with the provisions of Sec 7, [1.4].

6 Additional requirements for notation P

6.1 General

6.1.1 In addition to complying with the provisions of Article [2], ships having the notation **P** are to be provided with a fuel piping system also suitable for use with methyl/ethyl alcohol, as per [6.2].

6.1.2 The piping system intended for methyl/ethyl alcohol is to comply with the provisions of Sec 4, [3.1].

6.2 Design of the methyl/ethyl alcohol piping system

6.2.1 The piping system intended for methyl/ethyl alcohol is to be designed for the pressure and temperature conditions expected in the different parts of the system.

6.2.2 Pipe diameters are to be suitable for the maximum expected flow rates, taking into account the energy density of methyl/ethyl alcohol and the maximum allowable velocity defined by the designer.

6.2.3 Materials used for pipes (including the enclosing duct or pipe), valves and fittings are to comply with the provisions of Sec 5, [2.2]. This also applies to gaskets.

6.2.4 Fuel system design is to be in accordance with Sec 3, [1.6].

7 Additional requirements for notation A

7.1 General

7.1.1 The arrangement and location of methyl/ethyl alcohol related spaces are to comply with the provisions of Sec 4, Sec 5 and Sec 6.

7.1.2 The access to methyl/ethyl alcohol related spaces is to comply with the provisions of Sec 3. Where required, airlocks are to be provided.

7.1.3 The ship's ventilation is to be arranged in accordance with the provisions of Sec 11, in particular as regards the separation between the ventilation systems serving methyl/ethyl alcohol related spaces and those serving other spaces.

7.1.4 Ventilation systems are to be fitted with all necessary locations sized for ventilators compatible with the requirements of Sec 11. Such ventilators need not be installed at new construction stage.

8 Additional requirements for notations ME-DF, AE and B

8.1 Notation ME-DF

8.1.1 To obtain the notation **ME-DF**, main engine is to be provided with a dual fuel approved type certificate.

8.2 Notation AE

8.2.1 The auxiliary engines are to be of methyl/ethyl alcohol fuel approved type or methanol or ethanol convertible type, as defined in Sec 1, [1.5.10].

8.3 Notation B

8.3.1 The boilers are to be of methyl/ethyl alcohol fuel approved type or methanol or ethanol convertible type, as defined in Sec 1, [1.5.10].

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