GUIDANCE NOTES GD16-2022

CHINA CLASSIFICATION SOCIETY

GUIDELINES FOR SHIPS USING METHANOL/ETHANOL FUEL

2022

Effective from 1, July 2022

Beijing

FOREWORD

For To facilitate the rapid development of ships using methanol and/or ethanol as fuel, China Classification Society (CCS) developed the *Guidelines for Ships Using Methanol/Ethanol as Fuel， 2022*(hereinafter referred to as the Guidelines) based on the *Interim Guidelines for the Safety of Ships Using Methyl/Ethyl Alcohol as Fuel* adopted by the IMO circular (MSC.1/Circ.1621) and research results in recent year as well as the current status of the Industry.

In the Guidelines, the original paragraphs of MSC.1/Circ.162 are in Times New Roman and CCS' requirements in italics to differentiate them.

After entry into force, the Guidelines will replace PART 1 Methyl/Ethyl Alcohol of the *Guidelines for Ships Using Alternative Fuels, 2017* of CCS.

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CHAPTER 1 GENERAL

Section 1 GENERAL PROVISIONS

1.1.1 Application

1.1.1.1 *The Guidelines For Ships Using Methanol/Ethanol Fuel (hereinafter referred to as the Guidelines) apply to ships of 20 m in length and above, constructed by steel or equivalent metallic material and using methanol/ethanol fuel or ready for a methanol/ethanol fuel system (hereinafter referred to as methanol/ethanol fueled ships) . Where methanol/ethanol fuel is used on ships of less than 20m in length and constructed by steel or equivalent metallic materials, a risk assessment is to be conducted, and the Guidelines may be referred to at the discretion of China Classification Society (CCS). A ship carrying methanol/ethanol in bulk fueled by its own cargo could refer to applicable parts of the Guidelines.*

1.1.1.2 *In addition to the Guidelines, ships using methanol/ethanol fuel are to comply with the relevant requirements of CCS Rules for Classification of Sea-going Steel Ships, Rules for the Construction of Sea-going Ships Engaged on Domestic Voyages or Rules for the Construction of Inland Waterways Steel Ships (hereinafter referred to as CCS Rules). These ships are also to comply with the related provisions (if any) of the Administration of the flag State. In addition to the above requirements, ships using methanol/ethanol fuel cells are to comply with CCS Guidelines for Ships Using Fuel Cell Power Installations.*

1.1.1.3 *A ship applying for assignment of the class notations of methanol/ethanol fuel power system ready is to comply with Chapter 15 of the Guidelines.*

1.1.2 Definitions

Unless expressly provided in this Section,, the relevant definitions in the CCS Rules for Natural Gas Fuels for Marine Applications apply for the Guidelines.

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

1.1.2.2 ***Bunkering station*** *means a location or place where a fuel bunkering system is installed, including bunkering connections, gas return connections (if any), related valves and control systems.*

1.1.2.3 ***Qualified safe type*** *means electrical equipment that is certified safe by the relevant authorities recognized by CCS for operation in a flammable atmosphere based on a standard accepted① by CCS.*

1.1.2.4 **Fuel** means methanol/ethanol fuels, containing allowable additives or impurities, which is appropriate for safe application on board and can satisfy the requirements for the operation of engines, fuel cells and so on.

1.1.2.5 **Fuel containment system** is an integral, independent or portable arrangement for the storage of fuel including tank connections used for storage of fuel, including tank connections. The spaces around the fuel tank are defined as follows:

(1) **Fuel storage hold space** is the space enclosed by the ship's structure in which an independent fuel tank is situated. If tank connections are located in the fuel storage hold space, it will also be a tank connection space. Integral fuel tanks do not have a fuel storage hold space;

(2) **Cofferdam** is a structural space surrounding a fuel tank which provides an added protection of gas and liquid tightness against a fire and toxic and flammable vapours outside of the fuel tank;

(3) **Tank connection space** is a space surrounding all tank connections and tank valves.

1.1.2.6 **Integral tanks** are tanks that form a structural part of the hull and are influenced in the same manner by the loads that stress the the adjacent hull structure. Integral tanks are normally essential to the structural integrity of the hull.

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① E.g. IEC 60079 series, Explosive atmospheres and IEC 60092-502:1999 Electrical Installations in Ships–Tankers–Special Features, or GB 3836 Explosive atmospheres.

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

1.1.2.8 **Portable tank** are independent tanks being able to be:

(1) easily connected and disconnected from ship systems;

(2) easily removed from ship or installed on board ship;

(3) only moved outboard for fuel bunkering.

1.1.2.9 **Fuel preparation room** means any space containing pumps, heat exchangers, filters and so on for fuel preparation purpose.

1.1.2.10 ***Fuel supply system*** *means a piping system transferring fuel from a fuel tank to a fuel consumer, including fuel pipes, associated equipment (pumps, compressors and heat exchangers etc.), valves, instruments and control systems.*

1.1.2.11 ***Fuel valve unit space*** *means a gastight and watertight space or a valve box inside which valves are fitted for controlling or adjusting the gas supply to the engine.*

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

(1) 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;

(2) replacing the diluted inert atmosphere with air.

1.1.2.13 **Single fuel engine** means an engine capable of operating on a fuel as defined n 1.1.2.4 only.

1.1.2.14 ***Dual fuel engine*** *means an engine that employs both a fuel as defined in 1.1.2.4 and oil fuel (with pilot oil or an ignition plug) ,and is capable of operating only on oil fuel.*

1.1.2.15 ***Methanol/ethanol fuel engine*** *means a dual fuel engine or a single fuel engine.*

1.1.2.16 ***Double wall pipe*** *means pipes mainly used for supplying fuel to engines and constructed with an inner pipe and an outer pipe, which is gastight and liquid tight to the surrounding space.*

1.1.2.17 ***Bunker master valve*** *means a remote stop valve located in the gas supply line to each tank and as close to the tank outlet as possible. The tan master valve is to be of the fail-closed type (closed on loss of power).*

1.1.2.18 ***Hazardous area*** *means an area in which an explosive gas atmosphere is or may be expected to be present, in quantities such as to require special precautions for the construction, installation and use of equipment.*

Hazardous areas are divided into:

(1) Hazardous area zone 0 is an area in which an explosive gas atmosphere is present continuously or is present for a long periods;

(2) Hazardous area zone 1 is an area in which an explosive gas atmosphere is likely to occur in normal operation;

(3) Hazardous area zone 2 is an area in which an explosive gas atmosphere is not likely to occur in normal operation and,if it does occur, is likely to do so only infrequently and will exist for a short period only.

1.1.2.19 ***Non-hazardous zone*** *means an area in which an explosive gas atmosphere is not expected to be present in quantities such as to require special precautions for the construction, installation and use of equipment.*

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

1.1.2.21 ***Source of release*** *means a portion or a location which may release liquid fuel or fuel vapour, such as valves on pipeline, detachable pipe joints, pipe gaskets or pump seals.*

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

For sea-going ships engaged on domestic voyages and inland waterways ships, the unacceptable loss of power means a loss of power exceeding 60% of the total power essential to the propulsion and normal power supply.

1.1.2.23 ***Lower explosive limit(LEL)*** *means the lowest concentration of a mixture with air of flammable substances in the form of gas, vapour or mist, below which the air of flammable gas or vapour will not form an explosion.*

1.1.2.24 ***Loading limit*** *(LL) means the maximum allowable liquid volume relative to the tank volume to which the tank may be loaded.*

1.1.3 Goals and functional requirements

1.1.3.1 *The goal of the Guidelines is to provide a standard for arrangement, installation, control and monitoring of the machinery, equipment and systems on board ships using methanol/ethanol fuel and to minimize the risk to the ship, persons on board and the environment.*

1.1.3.2 The design and construction of a methanol/ethanol fueled ship are to comply with the following functional requirements for the above goal:

(1) The safety, reliability and dependability of the systems are to be equivalent to that achieved with new and comparable conventional oil-fueled main and auxiliary machinery;

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

(3) The design philosophy is to ensure that risk-reducing measures and safety actions for the methanol/ethanol fuel installation do not lead to an unacceptable loss of power;

(4) Hazardous areas are to be restricted, as far as practicable, to minimize the potential risks that might affect the safety of the ship, persons on board, and equipment;

(5) Equipment installed in hazardous areas is to be minimized to that required for operational purposes and to be suitably and appropriately approved by CCS;

(6) Unintended accumulation of explosive, flammable or toxic vapour and liquid concentrations are to be prevented;

(7) System components are to be protected against external damage;

(8) Sources of ignition in hazardous areas are to be minimized to reduce the probability of fire and explosions;

(9) Safe and suitable fuel supply, storage and bunkering arrangements are to be provided, capable of receiving and containing the fuel in the required state without leakage;

(10) Piping systems, containment and overpressure relief arrangements that are of suitable design, material, construction and installation for their intended application are to be provided;

(11) Machinery, systems and components are to be designed, constructed, installed, operated, maintained and protected to ensure safe and reliable operation;

(12) Suitable control, alarm, monitoring and shutdown systems are to be provided to ensure safe and reliable operation;

(13) Fixed vapour and/or leakage detection suitable for all spaces and areas concerned is to be arranged;

(14) Fire protection, detection and extinction measures appropriate to the hazards concerned are to be provided;

(15) Commissioning, trials and maintenance of fuel systems and fuel utilization machinery are to satisfy the goal in terms of safety, availability and reliability;

(16) The technical documentation is to permit an assessment of the compliance of the system and its components with follows:

① the applicable rules, guidelines and design standards;

② the principles related to safety, availability, maintainability and reliability.

(17) A single failure in a technical system or component is to not lead to an unsafe or unreliable situation.

(18) Appropriate personnel protection equipment is to be provided on board to protect crew engaged in fuel handling.

1.1.3.3 An explosion in any space containing any potential sources of release[①] and potential ignition sources is not to:

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

(2) damage the ship in such a way that flooding of water below the main deck and any progressive flooding occur;

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

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

(5) damage life-saving equipment or associated launching arrangements;

(6) disrupt the proper functioning of fire-fighting equipment located outside the explosion-damaged space;

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

(8) prevent persons' access to life-saving appliances (LSA) or impede escape routes.

1.1.4 Class notations

1.1.4.1 *For ships using methanol/ethanol fuel, the class notation Methanol/Ethanol Fuel may be assigned upon the application of the the ship-owner or shipyard/designer and upon the plan approval and survey by CCS to confirm that the relevant provisions in Chapters 1 to 14 of the Guidelines are complied with. The meaning of the class notation is detailed as follows:*

(1) Methanol/Ethanol Fuel: the ships of which the main propulsion systems use methanol/ethanol fuel.

1.1.4.2 *For ships having a methanol/ethanol fuel ready system, the class notation M/E FR*[②] *may be assigned upon the application of the the ship-owner or shipyard/designer and upon the plan approval and survey by CCS to confirm that the relevant provisions in Chapter 15 of the Guidelines are complied with. The meaning of the class notation is detailed as follows:*

(1) M/E FR: the ships have methanol/ethanol fuel ready system.

(2) According to the different preset degree of ship in different construction stages, the corresponding suffixes are to be given after the notation of M/E FR, namely, M/E FR (X_1,..., X_N). See Table 1.1.4.2 for the meaning of the symbol X_N.

① Double wall fuel pipes are not considered as potential sources of release.
② The class notation M/E FR is an acronym for Methanol/Ethanol Fuel Ready.

The Corresponding Suffixes of Methanol/Ethanol Fuel Ready System

Table 1.1.4.2

X_N	*Intention*	*Remark*	*Requirement*
S	*Indicating that the hull structures have been strengthened in accordance with the relevant requirements*	*Optional*	*15.2.2*
T	*Indicating that the methanol/ethanol fuel containment system and its supporting members have been installed*	*Optional*	*15.2.3*
F	*Indicating that the methanol/ethanol fuel bunkering stations and bunkering systems have been installed*	*Optional*	*15.2.4*
P	*Indicating that the methanol/ethanol fuel piping and related systems have been installed, or the design and arrangement requirements of methanol/ethanol fuel piping for future remodeling have been fully considered*	*Optional*	*15.2.5*
M	*Indicating that the main engine installed during construction of the ship is a dual fuel engine*	*Required, alternative*	*15.2.6*
m	*Indicating that the main engine installed during construction of the ship may be converted/replaced to a methanol/ethanol fuel engine in future*		*15.2.7*
A	*Indicating that the auxiliary engine installed during construction of the ship is a dual fuel engine*	*Optional, alternative*	*15.2.8*
a	*Indicating that the auxiliary engine installed in ship's construction may be converted to/replaced by a methanol/ethanol fuel engine in future*		*15.2.9*
B	*Indicating that the boiler installed during construction of the ship is a dual fuel boiler*	*Optional, alternative*	*15.2.10*
b	*Indicating that the boiler installed during construction of the ship may be converted to/replaced by a methanol/ethanol fuel boiler in future*		*15.2.11*
FC	*Indicating that the ship was constructed with due consideration to the requirements for future arrangement and installation of methanol/ethanol fuel cell systems during reconstruction of the ship*	*Optional*	*15.2.12*
E	*Indicating that the power distribution system for methanol/ethanol fuel power system related equipment has been reserved during construction of the ship*	*Optional*	*15.2.13*
D	*Indicating that the hazardous area has been considered during construction of the ship*	*Optional*	*15.2.14*
C	*Indicating that the methanol/ethanol fuel control, monitoring and safety systems have been considered during construction of the ship*	*Optional*	*15.2.15*

1.1.4.3 *After the addition of corresponding class notations, if the ship is reconstructed before the installation and modification of methanol/ethanol fuel power system on board, the relevant revised drawings are to be submitted to CCS for review.*

1.1.4.4 *After the installation and transformation of methanol/ethanol fuel power system is completed and verified by CCS according to the Guidelines, it can be granted "Use Methanol/Ethanol Fuel" corresponding notation Methanol/Ethanol Fuel, and the ready corresponding notations will be withdrawn.*

1.1.5 Alternative design

1.1.5.1 *Where the Guidelines require that a particular fitting, material, appliance, apparatus, item of equipment or type thereof is to be fitted or carried in a ship, or that any particular provision is to be made, or any procedure or arrangement is to be complied with, CCS may allow any other fitting, material, appliance, apparatus, item of equipment or type thereof to be fitted or carried, or any other provision,*

procedure or arrangement to be made in that ship, if it is satisfied by trial thereof or otherwise that such fitting, material, appliance, apparatus, item of equipment or type thereof or that any particular provision, procedure or arrangement is at least as effective as that required by the Guidelines.

1.1.5.2 *The equivalence of alternative designs is to be proved in accordance with the CCS Guidelines for the Application of Alternative Ship Designs and Arrangements and approved by CCS.*

1.1.5.3 *However CCS does not allow operational methods or procedures to be made an alternative to particular fitting, material, appliance, apparatus, and item of equipment, or type thereof which is prescribed by the Guidelines.*

1.1.6 Risk assessment

1.1.6.1 A risk assessment is to be conducted to ensure that risks involved 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.

1.1.6.2 *Risk assessments need only be conducted where explicitly required by the Guidelines.*

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

Section 2 PLANS AND DOCUMENTS

1.2.1 Plans and documents for approval

1.2.1.1 For methanol/ethanol fueled ships, in addition to the plans and documents specified in CCS Rules, the follows are to be submitted to CCS for approval:

(1) Ship arrangements

① machinery spaces and boiler rooms, accommodation spaces, service spaces and control stations;

② fuel tanks/fuel storage hold spaces;

③ fuel preparation space, if any;

④ fuel bunkering system, including bunkering connections;

⑤ accesses, vent pipes and other openings of fuel storage hold spaces and tank connection spaces;

⑥ ventilation pipes, doors and openings in hazardous areas;

⑦ entrances, air inlets and openings into accommodation and service spaces and control stations;

⑧ locations and structures of air locks, if fitted;

⑨ penetrations in gastight bulkheads, if any;

⑩ instruction of coamings, drip trays or other protection means;

⑪ hazardous area classification.

(2) Piping systems

① details or instruction of gas fuel piping, including pressure relief valves and vent pipes;

② technical documents of branch pipes, return pipes, bends, bellows or similar devices;

③ *plans and instruction of the flanges, valves and other devices;*

④ *technical documents of the materials, welding, post-weld heat treatment and non-destructive testing of fuel piping;*

⑤ *technical documents of pressure testing (strength and tightness test) of fuel piping;*

⑥ *functional test guidelines for all piping, including valves, fittings and equipment relating to fuel (liquid or vapour) operation;*

⑦ *technical documents of electrical bonding of piping;*

⑧ *technical documents of the arrangements for removing fuel from fuel tubes before the bunkering joint is cut off;*

⑨ *cooling water systems or hot water systems relating to fuel systems, if any;*

⑩ *arrangement and instruction of gas freeing and inert gas purging systems;*

⑪ *arrangement of bilge and drainage systems for the fuel preparation room and tank connection space, if any;*

⑫ *displacement calculation of pressure relief valves on the pipes.*

(3) Ventilation systems

① *arrangement and instruction of mechanical ventilation systems in hazardous areas, including the capacity and arrangement of fans and their motors, plans of the moving parts and covers of fans and material document;*

② *arrangement of double wall pipes (air ducts).*

(4) Fire-fighting appliances and systems

① *arrangement and instruction (e.g. capacity calculation, etc.) of water spray systems, including pipes, valves, nozzles and fittings;*

② *arrangement of fire detection systems;*

③ *structural fire protection arrangement of fuel tanks / fuel storage hold spaces and their vent pipes, bunkering stations (if applicable);*

④ *arrangement of foam fire-fighting arrangements.*

(5) Electrical systems

① *arrangement of all electrical installations within hazardous areas;*

② *single line diagram of intrinsically safe circuits;*

③ *list of certified explosion-proof equipment.*

(6) Control, monitoring and safety systems

① *arrangement and specifications of gas detection and alarm systems, including probes, alarm arrangements and alarm set points;*

② *arrangement and specifications of tank monitoring and control systems, including sensors and alarm set points;*

③ *arrangement and specifications of fuel pump control and monitoring systems, if any;*

④ *arrangement and specifications of methanol/ethanol engine control and monitoring systems;*

⑤ *electrical schematic diagram and monitoring lists of the fuel bunkering and supply system.*

(7) Independent tanks

① tank details, including internal structures, thermal insulations (if any), pipes, valves and joints;

② supporting and fixed structure for independent tanks/ securing and installation for portable tanks;

③ material specifications of tank and connections;

④ technical documents of tank design load and structure analysis;

⑤ complete information of the stress analysis of tank;

⑥ displacement calculations of tank pressure relief valves;

⑦ documents of non-destructive testing and strength of tank welds and tank tightness test;

⑧ tank welding procedure specifications.

(8) Methanol/ethanol engines

① plans and documents for diesel engines required to be submitted in CCS Rules;

② diagram of fuel injection system, instruction of explosion prevention and leakage prevention measures, valves and their driving and sealing systems;

③ arrangement and specifications of crankcase explosion prevention;

④ arrangement and calculations of exhaust system explosion prevention;

⑤ diagram of methanol/ethanol engine control system, including monitoring, alarm and safety protection devices;

⑥ test procedure and test report for methanol/ethanol engines;

⑦ arrangement and calculations (if applicable) of gas-intake system explosion prevention;

⑧ other plans and documents as deemed necessary by CCS.

(9) Documented testing or procedures

① mooring and sea trials procedure relating to fuel, e.g. functional tests for all fuel piping and their valves, fittings and relevant equipment.

1.2.2 Plans and documents for information

1.2.2.1 *In addition to the plans and documents specified in* CCS Rules, *the related risk analysis reports, e.g. risk analysis of methanol/ethanol engine (e.g. FMEA report) are to be submitted to CCS for information.*

1.2.3 Plans and documents kept on board

1.2.3.1 *In addition to the plans and documents required for diesel engines in CCS Rules, the following is to be kept on board:*

(1) a safe operation procedure of fuel tank;

(2) an operation manual of fuel supply system;

(3) an operation manual of fuel supply system.

Section 3 PRODUCTS SURVEYS

1.3.1 General requirements

1.3.1.1 *In addition to meeting the requirements of the Guidelines, products surveys are to comply with the relevant requirements of CCS Rules and product inspection guidelines.*

1.3.1.2 *The equipment (e.g. methanol/ethanol engine, independent fuel tanks and fuel pumps), pipes and valves related to methanol/ethanol fuel are to be approved by CCS and obtain the product certificate issued by CCS before they can be used on board.*

Section 4 SHIP SURVEYS

1.4.1 General requirements

1.4.1.1 *All survey programs, survey methods, types of survey, intervals between the surveys, survey conditions, preparations before survey, survey and testing requirements and preservation of the drawings and documentation, certificates, records and reports etc., are to be in compliance with CCS Rules for Classification of Sea-going Steel Ships, or in compliance with CCS Regulations for Classification of Inland Waterways Ships for inland waterways ships.*

1.4.2 Surveys during construction

1.4.2.1 *In addition to following the applicable requirements of CCS rules, the following survey items are to be carried out in surveys during construction:*

(1) Installation and testing of methanol/ethanol engine;

(2) Installation and testing of fuel tank;

(3) Installation and testing of fuel bunkering system;

(4) Installation and testing of fuel supply systems;

(5) Installation and testing of the ventilation system of the machinery space containing methanol/ethanol engine(s), double walled pipes, tank connection space and fuel preparation room (if any);

(6) Installation and testing of remote closing appliance for methanol/ethanol engine;

(7) The location and quantity of gas detectors, and tests for gas detection and alarm systems;

(8) Verification and safety inspection of explosion-proof or anti-ignition equipment;

(9) Function tests of ventilation equipment located in the space of which the hazardous class depends on mechanical ventilation; the ventilation is to be adequate, and the alarm for the fault of ventilation systems is to be correct;

(10) Verification of installation of equipment and cables of intrinsically safe circuits;

(11) Verification and safety checking of protected spaces by positive pressure ventilation;

(12) Installation and test of means of the fire detection and extinction;

(13) Checking of the operation manual of fuel supply system.

1.4.3 Surveys after construction

1.4.3.1 *Annual surveys: in addition to following the applicable requirements of CCS rules, the following survey items are to be carried out:*

(1) Independent tanks

- *① verifying that the tank nameplate (if any) is clear, solid and complete in content;*
- *② examining whether the tank level indicators are in working condition and the high level alarms and high level self-closing systems are in normal working condition;*

③ *calibrating the maximum opening pressure setting of tank pressure relief valves;*

④ *inspecting whether the pressure and temperature indicators (if any) and associated alarms are in order;*

⑤ *inspecting any erosion, corrosion, scratch, indent, and deformation of the shell of tanks;*

⑥ *examining the connections of tanks for weld cracks;*

⑦ *confirming that the safe operation procedure of fuel tank is kept on board.*

(2) Integral tanks are to be surveyed according to the applicable requirements in CCS Rules for the annual surveys of integral liquid tanks;

(3) Examining whether the sealing devices of tank connection spaces and fuel preparation rooms are in order;

(4) Examining whether the doors, side scuttles and windows of the end bulkheads of the superstructure and deckhouse facing the hazardous area are in good conditions;

(5) Examining whether the shutdown devices and other means (if any) used to close any specially enclosed space to protect the crew in case of fuel leakage are in normal working condition;

(6) examining whether the portable ventilation (if any) used in the space which is not frequently entered are in normal working condition;

(7) examining whether the drip trays (if any) are in order;

(8) examining whether the ventilation system and air lock (if any) of working spaces and the ventilation shutdown device of accommodation spaces are in order;

(9) Inspecting whether the manual ESD system is in normal working condition;

(10) Examining the vent pipe system, including vent masts and protective screening;

(11) examining whether the electrical installations in hazardous areas are in order, and checking the maintenance repair records;

(12) Examining and testing the gas detection systems to confirm that they are in normal working condition, and if necessary, checking them with the gas sample;

(13) Examining the fire detection and extinction systems;

(14) Examining whether the water-spraying fire-extinguishing system is satisfactory;

(15) Checking the operation procedure and the maintenance manual of methanol/ethanol engine.

1.4.3.2 *Intermediate surveys: in addition to following the applicable requirements of CCS Rules and the requirements of 1.4.3.1, the following survey items are to be carried out:*

(1) Confirming safety earthing of pipes and tanks to the hull;

(2) Confirming that the fans used for mechanical ventilation of hazardous spaces have been provided with spare parts;

(3) Examining visually the pressure, temperature and liquid level instruments of the fuel system by contrast; A simulation test may be accepted to the inaccessible sensors, including alarm tests and safety functional tests;

(4) electrical equipment: ground protection (checking of earthing contact), integrity of flame-proof enclosures, damage of cable jackets, functional tests of pressurized apparatuses and the related alarm devices for the electrical equipment within hazardous areas as far as possible, testing of shutoff the power supply for non-certificated explosion-proof electrical equipment in the spaces protected by air locks (if any), and measurement of insulation resistance;

1.4.3.3 *Special surveys:* i*n addition to following the applicable requirements of CCS Rules and the*

requirements of 1.4.3.2, the following survey items are to be carried out:

(1) Independent tanks

① *gas-tightness test for the tank together with its pipes (including fuel piping and vent piping), and the test medium is to be dry and clean nitrogen or air. Air is not permitted to use as test medium unless gas composition in the tank is qualified before the gas-tightness test;*

② *hydraulic test for the tank together with its pipes (including fuel piping and vent piping);*

③ *all valves and cocks directly connecting to the tank are to be opened upon for examination, and where practicable the internal examination is to be carried out for connecting pipes;*

④ *the tank's pressure relief valves / vacuum relief valves are to be opened out for examination, and the valve settings are to be calibrated, if applicable.*

(2) The surveys for integral tanks are to comply with the applicable requirements in CCS Rules for the special surveys of integral liquid tanks;

(3) Checking of the settings of pressure relief valve (if any) on the fuel supply system;

(4) Checking of valves of gas pipes, and the valves may be dismantled for setting with air or other applicable gas;

(5) Heat exchangers are to be opened up for examination and tested for performance;

(6) Examining the inert gas generator to confirm that the generated inert gas is compliance with the technical specifications and the generator is in order;

(7) A general examination of inert gas distributing valves and pipes, an internal and external examination of pressure vessels for storage of inert gas and a special survey are to be carried out, and the satisfactory condition of pressure relief valves confirmed;

(8) Removing the shaft seal on the gastight bulkhead and examining the sealing device;

(9) Examination of the pipes covered with insulation material by removing sufficient insulation material to confirm the situation of the pipe. A special inspection is to be carried out on the sealing condition;

(10) *Methanol/ethanol engines are subject to, in addition to the special survey items specified in CCS Rules, the following items: general inspection of the ducts or housing of gas pipes, inspection of discharge or inerting equipment for pipes, and running testing of methanol/ethanol engines in operating condition*.

CHAPTER 2 SHIP ARRANGEMENT

Section 1 GENERAL PROVISIONS

2.1.1 Goal

2.1.1.1 The goal of this Chapter is to provide the technical requirements for safe location, space arrangements and mechanical protection of power generation equipment, fuel containment systems, fuel supply equipment and fuel bunkering systems.

2.1.2 Functional requirements

2.1.2.1 This Chapter is related to functional requirements 1.1.3.2 (1) to (7), (12) to (14) and (16). In particular, the following applies:

(1) the fuel tank(s) is to be located in such a way that the probability of the tank(s) being damaged following a collision or grounding is reduced to a minimum;

(2) Fuel containment systems, fuel piping and other fuel release sources are to be located and arranged such that released fuel vapour is led to safe locations in the open air;

(3) The access or other openings to spaces containing fuel sources of fuel release are to be arranged such that flammable, asphyxiating or toxic vapours cannot escape to spaces that are not designed for the presence of such substances;

(4) Fuel piping is to be protected against mechanical damage;

(5) The propulsion and fuel supply system is to be designed such that safety actions after any fuel leakage do not lead to an unacceptable loss of power;

(6) The probability of a fire or explosion in a machinery space as a result of a fuel release is to be minimized in the design.

Section 2 ARRANGEMENT OF TANKS

2.2.1 General requirements

2.2.1.1 Tanks containing fuel is not to be located within accommodation spaces or machinery spaces of category A (for sea-going ships) / essential machinery spaces (for inland waterways ships).

2.2.1.2 Fuel tanks and their cofferdams are to be abaft of the collision bulkhead and forward of the aft peak bulkhead.

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

2.2.1.4 Fuel tanks on open decks are to be surrounded by coamings and spills are to be collected in a dedicated holding tank.

2.2.2 Integral tanks

2.2.2.1 Integral 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 methanol/ethanol, or fuel preparation space.

2.2.2.2 *For inland waterways ships, in no case should the tank be located less than 760 mm from shell plating.*

2.2.3 Independent fuel tanks

2.2.3.1 Independent fuel tanks may be accepted on open decks or in an enclosed space.

2.2.3.2 Independent fuel tanks are to be fitted with:

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

(2) if located on an open deck, drip tray arrangements for leak containment and water spray systems for emergency cooling;

(3) if located in an enclosed space, the space is to meet the provisions of Chapters 8 and 12 of the Guidelines.

2.2.3.3 Independent fuel tanks are to be secured to the ship's structure. The arrangement for supporting and fixing the tanks is to be designed for the maximum expected static, dynamic inclinations and acceleration, taking into account the ship characteristics and the position of the tanks.

2.2.3.4 *For inland waterways ships, in no case should the tank be located less than 760 mm from shell plating.*

2.2.4 Portable fuel tanks

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

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

(2) if located on an open deck, drip tray arrangements for leak containment and water spray systems for emergency cooling;

(3) if located in an enclosed space, the space is to meet the provisions of Chapter 8 and Chapter 12 of the Guidelines.

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

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

2.2.4.4 Connections to the ship's fuel piping systems are to be made by means of approved flexible hoses suitable for methanol/ethanol or other suitable means designed to provide sufficient flexibility.

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

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

2.2.4.7 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.

2.2.4.8 Safe accesses to tank connections for the purpose of inspection and maintenance are to be ensured.

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

(1) with the exception of the pressure relief system in 2.2.4.6, each portable tank is to be capable of being isolated at any time;

(2) isolation of any one tank is not to impair the availability of the remaining portable tanks;

(3) the tank is not to exceed its loading limits.

Section 3 LOCATION AND DIVISION OF SPACES

2.3.1 Machinery spaces

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

2.3.1.2 All fuel piping within machinery space boundaries is to comply with the requirements of 6.2.1.

2.3.2 Arrangement of fuel piping

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

2.3.2.2 Fuel piping is not to be led directly through accommodation spaces, service spaces, electrical equipment rooms or control station.

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

2.3.2.4 Fuel piping that passes through enclosed spaces in the ship is to be set as double walled. Such double walled piping is not required in cofferdams surrounding fuel tanks, fuel preparation spaces or fuel storage hold spaces.

2.3.2.5 All fuel pipes are to be self-draining to suitable fuel or collecting tanks in normal condition of trim and list of the ship. Alternative arrangements for draining the piping are to be subject to approval by CCS.

2.3.3 Fuel preparation spaces

2.3.3.1 Fuel preparation spaces are to be located outside machinery spaces of category A (for sea-going ships) / essential machinery spaces (for inland waterways ships).

2.3.4 Bilge systems

2.3.4.1 Bilge systems installed in areas where fuel can be present are to be segregated from the bilge system of spaces where fuel cannot be present.

2.3.4.2 One or more holding tanks for collecting drainage and any possible leakage of fuel from fuel pumps, valves or from double walled inner pipes are to be provided. These tanks are to comply with the relevant requirements for fuel tank arrangement. A means is to be provided for safely transferring contaminated liquids to onshore reception facilities.

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

2.3.5 Drip trays

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

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

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

2.3.5.4 *Each tray is to be fitted with a drain valve to enable rain water to be drained over the ship's side.*

2.3.5.5 *The holding tank mentioned in 2.3.5.3 is to be equipped with a level indicator and alarm.*

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

2.3.6 Tank connection spaces

2.3.6.1 *For ships on domestic voyages, tank connections, flanges and valves, if not located on an open deck, are to be enclosed in a tank connection space. This space is to be capable of covering the potential leakage form the tank connections.*

2.3.7 Entrances and accesses in enclosed spaces

2.3.7.1 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 2.3.8 is to be provided.

2.3.7.2 Fuel preparation spaces below open deck are to have independent access direct from open deck. Where a separate access from open deck is not practicable, an airlock complying with 2.3.8 is to be provided. Fuel tanks and surrounding cofferdams are to have suitable direct access from the open deck, where practicable, for gas freeing, cleaning, maintenance and inspection.

2.3.7.3 Without direct access to open deck, an entry space to fuel tanks or surrounding cofferdams is to be provided and comply with the following:

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

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

(3) not be an accommodation space, service space, control station or machinery space of category A (sea-going ships) / essential machinery spaces (inland waterways ships);

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

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

2.3.7.5 For ships of 500 gross tonnage and above, horizontal hatches or openings to or within fuel tanks or surrounding cofferdams are to have a minimum clear opening of 600 mm × 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 is not to be less than 600 mm × 800 mm at a height of not more than 600 mm from bottom plating unless gratings or footholds are provided. Smaller openings may be accepted provided evacuation of an injured person from the bottom of the tank/cofferdam can be demonstrated.

2.3.7.6 *For ships of less than 500 gross tonnage, smaller openings may be accepted in a special case after approval of CCS, and in no case should the opening be less than 400 mm × 600 mm or 450 mm × 550 mm.*

2.3.8 Airlocks

2.3.8.1 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. 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.

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

2.3.8.3 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.

2.3.8.4 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.

2.3.8.5 For non-hazardous spaces with access from hazardous spaces below deck where the access is protected by an airlock, upon loss of underpressure 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.

2.3.8.6 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, gas detection, public address and general alarms systems.

2.3.8.7 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.

CHAPTER 3 MATERIALS AND PIPE DESIGN

Section 1 GENERAL PROVISIONS

3.1.1 Goal

3.1.1.1 The goal of this Chapter is to ensure the safe handling of methanol/ethanol fuel, under all operating conditions, to minimize the risk to the ship, personnel and to the environment, having regard to the nature of the products involved.

3.1.2 Functional requirements

3.1.2.1 This Chapter relates to functional requirements 1.1.3.2 (1), (6), (8), (9) and (10). In particular, all materials used are to be suitable for the fuel under the maximum working pressure and temperature.

Section 2 PIPE DESIGN

3.2.1 General requirements

3.2.1.1 Fuel pipes and all the other piping are to be colour marked in accordance with a standard① accepted by CCS.

3.2.1.2 All fuel piping and independent fuel tanks are to be electrically bonded to the ship's hull. Electrical conductivity is to be maintained across all joints and fittings. Electrical resistance between piping and the hull is to be maximum1 MΩ.

3.2.1.3 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.

3.2.1.4 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.

3.2.1.5 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.

3.2.2 Wall thickness

3.2.2.1 The wall thickness of pipes made of steel is not to be less than:

$$t = \frac{t_0 + b + c}{1 - \frac{a}{100}} \text{ mm}$$

where:

t_0—— theoretical thickness, mm, $t_0 = \frac{PD}{2.0Ke + P}$;

P——system design pressure, MPa , but not less than the design pressure given in 3.2.1.5；

D—— outside pipe diameter， mm；

K—— allowable stress, N/mm^2 (see 3.2.3);

① Refer to GB3033: Ships and marine technology – Identification colours for the content of piping systems, ISO 14726 Ships and marine technology – Identification colours for the content of piping systems.

e—— efficiency factory equal to 1.0 for seamless pipes and for longitudinally or spirally welded pipes, delivered by approved manufacturers of welded pipes, that 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 of less than 1.0, in accordance with recognized standards, may be required depending on the manufacturing process;

b—— allowance for bending(mm). The value of *b* is to 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* is to be: $b = D \cdot \frac{t_0}{2.5r}$,where: r——radius of the bend(mm);

c—— corrosion allowance (mm). If corrosion or erosion is expected, the wall thickness of piping is to be increased over that required by the other design provisions. This allowance is to be consistent with the expected life of the piping;

a—— negative manufacturing tolerance for thickness (%).

3.2.3 Allowable stress

3.2.3.1 For pipes made of steel the allowable stress K to be considered in the formula for t_0 in 3.2.2.1 is the lower of the following values:

$$\frac{R_m}{A} \text{ or } \frac{R_e}{B}$$

where:

R_m—— specified minimum tensile strength at room temperature (N/mm²);

R_e—— specified minimum yield stress at room 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 are to be at least A = 2.7 and B = 1.8.

3.2.3.2 Where necessary for mechanical strength to prevent damage, collapse, excessive sag or buckling of pipes due to superimposed loads, the wall thickness is to be increased over that required by 3.2.2.1 or, if this is impracticable or would cause excessive local stresses, these loads are to 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 (if applicable) or otherwise.

3.2.3.3 For pipes made of materials other than steel, the allowable stress is to be considered by CCS.

3.2.3.4 High pressure fuel piping systems① are to have sufficient constructive strength. This is to be confirmed by carrying out stress analysis and taking into account:

(1) stresses due to the weight of the piping system;

(2) acceleration loads when significant;

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

3.2.4 Flexibility of piping

3.2.4.1 The arrangement and installation of fuel piping are 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.

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① Whether a fuel system is to be considered as a high-pressure system for the purpose of the Guidelines depends on the design and arrangement of the specific system. Accordingly, the stress analysis is to be waived or done to the satisfaction of CCS.

3.2.5 Piping fabrication and joining details

3.2.5.1 Piping fabrication and joining details are to comply with the following:

(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:

① during the use of the fuel piping, all doors, ports and other openings on the corresponding superstructure or deckhouse side are to normally be kept closed;

② 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) Piping for fuel is to be joined by welding except:

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

② for other exceptional cases specifically approved by CCS.

(3) The following direct connections of pipe length without flanges may be considered:

① butt-welded joints with complete penetrations at the root;

② slip-on welded joints with sleeves are to only be used in pipes having an external diameter of 50 mm or less; the possibility for corrosion is to be considered;

③ screwed connections are to only be used for piping with an external diameter of 25 mm or less.

(4) Where flanges are used, they are to be of the welded-neck or slip-on type. For those with nominal size greater than 50mm, flange of insert-weld type is not to be used

(5) Other connections: Piping connections are to be joined in accordance with 3.2.5.1 (2), but for other exceptional cases CCS may consider alternative arrangements.

3.2.5.2 Welding, post-weld heat treatment, pressure testing, leakage testing and non-destructive testing are to be performed in accordance with the CCS Rules for Materials and Welding or other standards accepted by CCS. 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).

Section 3 MATERIALS

3.3.1 General requirements

3.3.1.1 Due consideration is to be taken with respect to the corrosive and swelling nature of fuel when selecting materials of the compartments and piping directly contacting with fuel. In addition to this Chapter, the materials are to comply with the CCS Rules for Materials and Welding and CCS Rules for Construction and Equipment of Ships Carrying Dangerous Chemicals in Bulk.

3.3.1.2 *The coating and hatch sealing materials of fuel tank are to be resistant to fuel, fuel vapour and inert gas.*

3.3.2 Metallic materials

3.3.2.1 *Materials sensitive to methyl alcohol, such as aluminum alloy, galvanized steel and lead alloy, are not to be used in systems containing methanol fuel.*

3.3.2.2 *Materials sensitive to ethyl alcohol, such as zinc, aluminum, brass, lead and lead-base alloy, are not to be used in systems containing ethyl alcohol fuel.*

3.3.2.3 *Metallic materials used for fuel tanks or piping systems include but not be limited to:*

(1) austenitic stainless steel;

(2) duplex stainless steel.

3.3.2.4 *Where new steel, e.g. austenitic manganese steel, is intended to be used, the material compatibility information is to be submitted and approved by CCS.*

3.3.3 Non-metallic material

3.3.3.1 *Materials sensitive to methyl alcohol, such as nitrile butadiene rubber and butyl rubber, are not to be used in methanol fuel systems.*

3.3.3.2 *Teflon, EPDM (ethylene propylene diene monomer) and chloroprene rubber may be allowed for methanol fuel systems.*

3.3.3.3 *Materials sensitive to ethyl alcohol, such as natural rubber, PU (polyurethane), polyvinyl chloride, polyamide, MMA denture base and polyester-bonded glass fiber laminate, are not to be used in ethyl alcohol fuel systems.*

3.3.3.4 *Nitrile butadiene rubber, chloroprene rubber, fluorinated rubber, polypropylene and thermosetting reinforced glass fiber may be allowed for ethyl alcohol fuel systems.*

CHAPTER 4 FUEL CONTAINMENT SYSTEMS

Section 1 GENERAL PROVISIONS

4.1.1 Goal

4.1.1.1 The goal of this Chapter is to ensure a rational design for a fuel containment system where the risk to the ship, personnel its crew and to the environment is minimized to a level that is equivalent to a conventional oil-fueled ship.

4.1.2 Functional requirements

4.1.2.1 This Chapter is related to functional requirements in 1.1.3.2 (1), (2), (5) and (8) to (16). In particular the following is to apply:

(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:

① flammable fuels spreading to locations with ignition sources;

② toxicity potential and risk of oxygen deficiency or other negative impacts on crew health due to fuels and inert gases;

③ restriction of access to muster stations, escape routes or LSAs;

④ reduction in availability of LSA.

4.1.2.2 The fuel containment system and the fuel supply system are 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.

4.1.2.3 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.

4.1.3 General requirements

4.1.3.1 *A fuel containment system located below deck is to be gas tight towards adjacent spaces.*

4.1.3.2 *For single fuel installations, the fuel storage is to be divided between two or more tanks providing that the fuel tanks are located in enclosed spaces. The tanks are to be located in separate compartments. For independent tank constructed according to pressure vessel standards, one tank may be accepted if two completely separate tank connection spaces are installed for the one tank.*

4.1.3.3 *The scantlings of integral tanks are to comply with the applicable requirements for deep tanks specified in the CCS Rules for Classification of Sea-going Steel Ships or Rules for the Construction of Inland Waterways Steel Ships.*

4.1.3.4 *The scantlings of independent tanks may be designed by referring to the Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk or Rules and Regulations for the Construction and Equipment of Inland Waterways Ships Carrying Liquefied Gases in Bulk, or may be designed according to the provisions for pressure vessels.*

Section 2 VENTING AND GAS-FREED SYSTEMS

4.2.1 General requirements

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

4.2.1.2 The fuel gas venting system is to be independent of those and air pipes of accommodation, service and control spaces, or other non-hazardous spaces.

4.2.1.3 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.

4.2.1.4 The formation of gas pockets during the gas freeing operation is to be avoided by considering the arrangement of internal tank structure and location of gas freeing inlets and outlets.

4.2.1.5 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 are 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 standards① accepted by CCS. 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 standards② accepted by CCS.

4.2.1.6 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 4.2.1.7 of the Guidelines.

4.2.1.7 The fuel tank-controlled venting system is to be designed with redundancy for the relief of full flow overpressure and/or vacuum. Pressure sensors fitted in each fuel tank, and connected to an alarm system, may be accepted in lieu of the secondary redundancy requirement for pressure relief. The opening pressure of the PRVs is not to be lower than 0.007 MPa below atmospheric pressure.

4.2.1.8 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.

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

4.2.1.10 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.

Section 3 INERTING AND ATMOSPHERIC CONTROL

4.3.1 General requirements

4.3.1.1 All fuel tanks are to be inerted at all times during normal operation.

4.3.1.2 Cofferdams are to be arranged either for purging or filling with water through a non-permanent connection. Emptying the cofferdams is to be done by a separate drainage system, e.g. bilge ejector.

4.3.1.3 The system is to be designed to eliminate the possibility of a flammable mixture atmosphere existing in the fuel tank during any part of the atmosphere change operation, gas freeing or inerting by utilizing an inerting medium.

4.3.1.4 To prevent the return of flammable liquid and vapour to the inert gas system, the inert gas 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.

4.3.1.5 Where the connections to the inert gas piping systems are non-permanent, two non-return valves may substitute the valves required in 4.3.1.4.

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

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① Refer to MSC/Circular.677 - Revised Standards for the Design, Testing and Locating of Devices to Prevent the Passage of Flame into Cargo Tanks in Tankers.

② Refer to MSC/Circular.677 - Revised Standards for the Design, Testing and Locating of Devices to Prevent the Passage of Flame into Cargo Tanks in Tankers.

via removable spool piece.

4.3.1.7 Fuel tank vent outlets are to be situated normally not less than 3 m above the deck or gangway if located within 4 m from such gangways. The vent outlets are also to be arranged at a distance of at least 10 m from the nearest air intake or opening to accommodation and service spaces and ignition sources. The vapour discharge is to be directed upwards in the form of unimpeded jets.

4.3.1.8 Vapour outlets from fuel tanks are to be provided with devices tested and type approved to prevent the passage of flame into the tank. Due attention is to 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 is to be arranged.

4.3.1.9 The arrangements for gas freeing and ventilation of fuel tanks are to be such as to minimize the hazards due to the dispersal of flammable vapours to the atmosphere and to flammable gas mixture in the tanks. The ventilation system for fuel tanks is to be exclusively for ventilating and gas freeing purposes. Connection between fuel tank and fuel preparation space ventilation will not be accepted.

4.3.1.10 Gas freeing operations are to be carried out such that vapour is initially discharged in one of the following ways:

(1) 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;

(2) 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;

(3) through outlets underwater.

4.3.1.11 In designing a gas freeing system in conformity with 4.2.1.3 due consideration is to be given to the following:

(1) materials of construction of system;

(2) time to gas free;

(3) flow characteristics of fans to be used;

(4) the pressure losses created by ducting, piping, fuel tank inlets and outlets;

(5) the pressure achievable in the fan driving medium (e.g. water or compressed air);

(6) the densities of the fuel vapour/air mixture.

Section 4 INERT GAS AVAILABILITY ON BOARD

4.4.1 General requirements

4.4.1.1 Inert gas ise to 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 2 weeks in harbour with minimum port consumption.

4.4.1.2 A production plant and adequate storage capacities might be used to achieve the availability target defined in 4.4.1.1.

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

4.4.1.4 The production plant 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.

4.4.1.5 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.

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

4.4.1.7 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 below 19.5% 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.

4.4.1.8 Nitrogen pipes are to only be led through well ventilated spaces. Nitrogen pipes in enclosed spaces are to:

(1) have only a minimum of flange connections as needed for fitting of valves and be fully welded;

(2) be as short as possible.

4.4.1.9 Notwithstanding the provisions of this Section, inert gas utilized for gas freeing of tanks may be provided externally to the ship.

CHAPTER 5 FUEL BUNKERING

Section 1 GENERAL PROVISIONS

5.1.1 Goal

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

5.1.2 Functional requirements

5.1.2.1 This Chapter relates to functional requirements in 1.1.3.2 (1) to (16) of the Guidelines. In particular the following is to apply:

(1) The piping system for transfer of fuel to the fuel tank is to be designed such that any leakage from the piping system cannot cause danger to the persons on board, the environment or the ship.

Section 2 BUNKERING STATIONS

5.2.1 General requirements

5.2.1.1 The bunkering station is to be located on open deck so that sufficient natural ventilation is provided. Enclosed or semi-enclosed bunkering stations are to be subject to the risk assessment, and the relevant report is to be approved by CCS.

T*he special consideration is as a minimum to include, but not be restricted to, the following design features:*

(1) segregation towards other areas on the ship;

(2) arrangement of hazardous areas on board the ship;

(3) requirements for forced ventilation;

(4) requirements for leakage monitoring;

(5) safety actions related to leakage detection;

(6) access to bunkering station from non-hazardous areas through airlocks;

(7) monitoring of bunkering station by direct line of sight or by a closed circuit television (CCTV).

5.2.1.2 Entrances, air inlets and openings to accommodation, service and machinery spaces and control stations are to not face the bunkering station. *They are to be located on the end bulkhead not facing the bunkering station or on the outboard side of the superstructure or deckhouse at a distance of at least 4% of the length of the ship, but not less than 3 m from the end of the superstructure or deckhouse facing the bunkering station. This distance need not exceed 5 m. No doors are to be fitted in the limits mentioned above, but access doors may be permitted within the limits to cargo control stations and store-rooms and similar spaces provided they do not give access to any accommodation, control station or service space. Where such doors are provided, the boundary of such a space is to be insulated to "A-60" class standard.*

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

5.2.1.4 Bunkering lines are not to be led through accommodation, control stations or service spaces. Bunkering lines passing through non-hazardous areas in enclosed spaces are to be double walled or located in gastight ducts.

5.2.1.5 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.

5.2.1.6 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.

5.2.1.7 *All doors, windows and other openings and air inlets in the sides of the corresponding superstructures or deckhouses are to be kept closed during the bunkering operation.*

Section 3 SHIP'S BUNKER HOSES

5.3.1 General requirements

5.3.1.1 Bunker hoses carried on board are to be suitable for methanol/ethanol. 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.

5.3.1.2 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.

5.3.1.3 A means is to be provided for draining any fuel from the bunkering hoses upon completion of operation.

5.3.1.4 Where fuel hoses are carried on board, arrangements are to be made for safe storage of the hoses, taking into consideration the potential leakage from the hose joints. 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.

Section 4 BUNKERING MANIFOLDS

5.4.1 General requirements

5.4.1.1 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.

Section 5 BUNKERING SYSTEMS

5.5.1 General requirements

5.5.1.1 In any case the tank loading limit is not to be greater than 98%.

5.5.1.2 A means is to be provided for draining any fuel from the bunkering lines upon completion of operation.

5.5.1.3 Bunkering lines are to be arranged for inerting and gas freeing. When not engaged in bunkering, the bunkering lines are to be free of gas, unless the consequences of not gas freeing is evaluated and approved by CCS.

5.5.1.4 A ship-shore link (SSL) or an equivalent means for automatic and manual ESD communication to the bunkering source is to be fitted. This system can be fitted on board the receiving ship and also can be operated by the bunkering source. The ESD system is to be capable of rapidly and safely cutting off the fuel

supply without any leakage.

5.5.1.5 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 location and / or other safe locations.

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

CHAPTER 6 SUPPLY TO CONSUMERS

Section 1 GENERAL PROVISIONS

6.1.1 Goal

6.1.1.1 The goal of this Chapter is to ensure safe and reliable distribution of fuel to the consumers.

6.1.2 Functional requirements

6.1.2.1 This Chapter is related to functional requirements in 1.1.3.2 (1) to (6), (8) to (11) and (13) to (17).

6.1.3 General requirements

6.1.3.1 The fuel piping system is to be separate from all other piping systems.

6.1.3.2 The fuel supply system is to 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 are to be subject to special consideration within the risk assessment in 1.1.6.

6.1.3.3 The piping system for fuel transfer to the consumers is to 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.

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

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

Section 2 FUEL DISTRIBUTION

6.2.1 General requirements

6.2.1.1 The outer pipe or duct is to be gas and liquid tight.

6.2.1.2 The annular space between inner and outer pipe is to have mechanical ventilation of underpressure type with a capacity of minimum 30 air changes per hour and be ventilated to open air. An appropriate means for detecting leakage into the annular space is 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.

6.2.1.3 Inerting of the annular space might be accepted as an alternative to ventilation. An appropriate means of detecting leakage into the annular space is to be provided. Suitable alarms are to be provided to indicate a loss of inert gas pressure between the pipes.

6.2.1.4 The outer pipe in the double walled fuel pipes is to be dimensioned for a design pressure not less than the maximum working pressure of the fuel pipes. As an alternative the calculated maximum built-up pressure in the duct in the case of an inner pipe rupture may be used for dimensioning of the duct.

Section 3 SAFETY FUNCTIONS

6.3.1 General requirements

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

6.3.1.2 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.

6.3.1.3 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 methanol/ethanol-fueled consumer(s). The master fuel valve(s) is to automatically shut off the fuel supply in accordance with Table 11.4.1.

6.3.1.4 A means of manual emergency shutdown of fuel supply to the consumers or set of consumers is 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.

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

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

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

6.3.1.8 When pipes penetrate the fuel tank below the top of the tank a remotely operated shut-off valve is to be fitted to the fuel tank bulkhead. When the fuel tank is adjacent to a fuel preparation space, the valve may be fitted on the tank bulkhead on the fuel preparation space side.

Section 4 FUEL PREPARATION ROOMS

6.4.1 General requirements

6.4.1.1 Any fuel preparation space is not to be located within machinery spaces of category A (for sea-going ships) / essential machinery spaces (for inland waterways ships), is to be gas and liquid tight to surrounding enclosed spaces and vented to open air.

6.4.1.2 *Fuel preparation spaces are to be provided with detectors for fuel leakage and be negative pressure mechanically ventilated.*

6.4.1.3 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 methanol/ethanol. The double barrier is to be arranged for detection and drainage of eventual methanol/ethanol leakage.

6.4.1.4 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 fuel 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 5 FUEL VALVE UNITS

6.5.1 General requirements

6.5.1.1 *The valves and couplings on the fuel piping within the machinery space, if not provided with double barriers, are to be located in a fuel valve unit.*

6.5.1.2 *Fuel valve units are to be gas and liquid tight.*

6.5.1.3 *The fuel valve unit is to have mechanical ventilation of underpressure type with a capacity of minimum 30 air changes per hour and be ventilated to open air.*

6.5.1.4 *An appropriate means of detecting leakage into the annular space is to be provided in a fuel valve unit, and is to be connected to a suitable draining tank allowing the collection and detection of any possible leakage.*

CHAPTER 7 METHANOL/ETHANOL ENGINES

Section 1 GENERAL PROVISIONS

7.1.1 Goal

7.1.1.1 The goal of this Chapter is to provide safe and reliable delivery of mechanical, electrical or thermal energy.

7.1.2 Functional requirements

7.1.2.1 This Chapter relates to functional requirements in 1.1.3.2 (1), (11) and (13) to (17) . In particular the following is to apply:

(1) the exhaust system are to be designed to prevent any accumulation of unburnt fuel;

(2) each methanol/ethanol engine are to have a separate exhaust system.

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

7.1.3 General requirements

7.1.3.1 This Chapter is applicable to main propulsion methanol/ethanol engine, methanol/ethanol engine for driving generators and important auxiliary equipment.

7.1.3.2 In addition to this Chapter and Chapter 11 of the Guidelines, the engines are to be designed, manufactured, installed and tested according to the appropriate requirements for diesel engine certification in CCS Rules, and are to have a Marine Products Certificate.

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

7.1.3.4 Engine components through which methanol/ethanol fuel may flow are to be effectively sealed to prevent leakage of fuel into the machinery space.

7.1.3.5 Risk analysis is to be conducted on all possible faults affecting operation safety of gas fuel engine. Required engine monitoring items are to be determined based on the risk analysis results, and the report is to be submitted to CCS for information.

7.1.4 Safety protection

7.1.4.1 *Where air intakes are located inside the engine room, they are to be situated as far apart as practicable from the fuel supply pipe such that the risk of the leakage gas entering the intake is minimized. Air intakes located outside the engine room are to be lead from a non-hazardous area at least 1.5m from the boundaries of any hazardous area.*

7.1.4.2 *Where fuel is supplied into the cylinder through the air inlet manifold, an explosion relief valve or other explosion-proof facilities is to be fitted on the air inlet manifold, except documentation demonstrating that the system has sufficient strength to contain the worst-case explosion.*

7.1.4.3 *For engines where the space below the piston is in direct communication with the crankcase, the crankcase is to be provided with appropriate breathing apparatus. The vents are to lead to a safe location in the open area, and their ends are to be fitted with flame arresters or other equivalent devices. The fuel collected by the breathing apparatus is to be stored in a suitable collecting tank. The crankcases are to be provided with interfaces or other equivalent devices for inerting to readily maintain.*

7.1.4.4 *For engines where the space below the piston is in direct communication with the crankcase, a detailed evaluation regarding the hazard potential of fuel gas accumulation in the crankcase is to be carried out.*

Where it cannot be demonstrated that gas detection in the crankcase does not exceed LEL in any case, the following requirements are to comply with:

(1) The crankcase is to be provided with oil mist detectors or equivalent devices, such as install temperature detector for each bearing;

(2) Electrical installation and instruments fitted inside the crankcase, including oil mist detectors, are to be of the certified safe type.

7.1.4.5 *The exhaust pipes are to be equipped with relief valves sufficiently dimensioned to prevent excessive explosion pressures in the event of ignition failure of one cylinder followed by ignition of the unburned gas in the pipes, except that it can be demonstrated that the system can accommodate the pressure from the explosion.*

7.1.4.6 *The exhaust pipe is to be automatically purged to discharge the combustible gas that may be present in the event a starting failure of the methanol/ethanol engine or the engine stops during the methanol/ethanol fuel mode.*

7.1.4.7 *Where gas can leak directly into the auxiliary system medium (lubricating oil, cooling water), an appropriate means is to be fitted after the engine outlet to extract gas in order to prevent gas dispersion. The gas extracted from auxiliary systems media are to be vented to a safe location in the atmosphere or stored in a suitable collecting tank.*

7.1.4.8 A means is to be provided to monitor and detect poor combustion or misfiring in the engine. 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.

Section 2 DUAL FUEL ENGINES

7.2.1 General requirements

7.2.1.1 In case of shut-off of the methanol/ethanol supply, the engines are to be capable of continuous operation by oil fuel only without interruption.

7.2.1.2 An automatic system is to be fitted to change over *from oil fuel operation to methanol/ethanol fuel operation or from methanol/ethanol 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 abnormal operation on engines when methanol/ethanol firing, the engine is to automatically change to oil fuel mode. There is also to be the possibility for manual changeover in any case.

7.2.1.3 *The fuel and air mixture in the cylinder can be ignited by compression ignition. The volume of pilot fuel is to be sufficient to ensure reliable ignition of the mixture.*

7.2.1.4 In case of an emergency stop or a normal stop, the methanol/ethanol 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.

7.2.1.5 *The engine is to be started in oil fuel mode. The fuel injection device is to be started up at the minimum starting speed in methanol/ethanol fuel mode.*

Section 3 SINGLE FUEL ENGINES

7.3.1 General requirements

7.3.1.1 *The starting sequence is to be such that fuel gas is not admitted to the cylinders until ignition is activated and the engine has reached an engine and application specific minimum rotational speed.*

7.3.1.2 *If combustion has not been detected by the engine monitoring system within an engine specific time after the opening of the fuel supply unit, the fuel supply unit is to be automatically shut off, and a means is to be provided to purge any unburnt fuel mixture away from the exhaust system.*

7.3.1.3 In case of a normal stop or an emergency shutdown, the methanol/ethanol 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.

CHAPTER 8 FIRE SAFETY

Section 1 GENERAL PROVISIONS

8.1.1 Goal

8.1.1.1 The goal of this Chapter is to provide for fire protection, detection and fighting for all system components related to the storage, conditioning, transfer and use of methanol/ethanol as ship fuel.

8.1.2 Functional requirements

8.1.2.1 This Chapter relates to functional requirements in 1.1.3.2 (1), (2), (4), (5), (12), (14) and (16).

Section 2 FIRE PROTECTION

8.2.1 General requirements

8.2.1.1 For the purposes of fire protection, a fuel preparation space is to be regarded as machinery space of category A (for sea-going ships) / essential machinery spaces (for inland waterways ships). Where the space have boundaries towards other machinery spaces of category A (for sea-going ships) / essential machinery spaces (for inland waterways ships) or other rooms with high fire risk, accommodation, control station or cargo areas, these boundaries are not to be less than A-60.

8.2.1.2 Any boundary of accommodation spaces, service spaces, control stations, escape routes and machinery spaces, facing fuel tanks on open deck, is to have A-60 fire integrity. These class divisions are to extend up to the underside of the deck of the navigation bridge or up to the true height of the bulkhead.

8.2.1.3 The fuel tank boundaries are to be separated from machinery spaces of category A (for sea-going ships) /essential machinery spaces (for inland waterways ships) and other rooms with high fire risks by a cofferdam of at least 600mm, with insulation of not less than A-60 class.

8.2.1.4 *In determining the insulation of the fuel tank or the fuel storage hold space from other spaces with lower fire risks, the fuel tank or the fuel storage hold space is to be regarded as a machinery spaces of category A (for sea-going ships) /essential machinery spaces (for inland waterways ships) . The boundary between fuel storage hold spaces is to be A-60 class division.*

8.2.1.5 *The fire protection of fuel pipes led through ro-ro spaces is to be subject to special consideration by CCS depending on the use and expected pressure in the pipes. Special consideration is to be paid to, but not be restricted to:*

(1) arrangement of the pipes as far as possible in the position where the vehicle is not easy to collide in order to prevent them from being damaged by vehicle collision. If this is impracticable, effective measures resistant to collision are to be provided, such as protective railings or covers of sufficient strength;

(2) increasing of the pipe's design pressure to prevent a sudden change in the expected pressure in the pipe;

(3) fire insulation wrapping for the pipes to prevent being affected by a fire in the space;

(4) effective ventilation arrangements to prevent against accumulation of flammable gas after a pipe rapture;

(5) detectors and alarms for flammable gas fitted near the pipes to prevent a fire or explosion in the space;

(6) providing a water spray system if necessary.

8.2.1.6 The bunkering station is to be separated by A-60 class divisions towards machinery spaces of category A(for sea-going ships) /essential machinery spaces (for inland waterways ships), accommodation, 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. The A-60 class divisions are to extend up to the underside of the deck of the navigation bridge or the actual height of the bulkhead.

Section 3 FIRE EXTINCTION

8.3.1 Fire main

8.3.1.1 When the fire main passes through the fuel tank area on the open deck, isolating valves are to be fitted in the fire main in order to isolate damaged sections of the fire main. Isolation of a section of fire main is not to deprive the fire line ahead of the isolated section from the supply of water.

8.3.2 Water spray systems

8.3.2.1 Where fuel tanks are located on open deck, there is to be a fixed water spray system set out for dilution, cooling and fire prevention. The water spray system is to cover all exposed areas of the fuel tank above the deck.

8.3.2.2 *In addition, the water spray system is to provide coverage for boundaries of the superstructures, fuel preparation rooms, cargo control rooms, bunkering control stations, bunkering stations and any other normally occupied deck houses that face the fuel tank on open decks unless the tank is located 10 m (5 m for inland waterways ships) or more from the boundaries.*

8.3.2.3 *The system is to be designed to cover all areas as specified above with an application rate of 10 l/min · m^2 for the largest horizontal projected surfaces and 4 l/min · m^2 for vertical surfaces.*

8.3.2.4 *Stop valves are to be fitted in the water spray application main supply line(s), at intervals not exceeding 40 m, for the purpose of isolating damaged sections. Alternatively, the system may be divided into two or more sections that may be operated independently, provided the necessary controls are located together in a readily accessible position not likely to be inaccessible in case of fire in the areas protected.*

8.3.2.5 *The pumps for a water spray system are to be capable of delivering for fire-fighting purposes the quantity of water required to all protected areas.*

8.3.2.6 *A stop valve is to be fitted in the upstream of the pipe connected to the fire main of the ship.*

8.3.2.7 *Pump starting and valve operation of the water spray system are to be located in a readily accessible position which is not likely be blocked by a fire in the protected area.*

8.3.2.8 *The nozzles are to be of an approved full bore type and they are to be arranged to ensure an effective distribution of water throughout the space being protected.*

8.3.3 Fixed fire-extinguishing systems

8.3.3.1 Where fuel tanks were located on open deck, there is to be a fixed fire-fighting system of alcohol-resistant foam type (AR-AFFF), as set out in Chapter 17 of the IBC Code and, where appropriate, chapter 14 of the FSS Code. The operation and control of the system are to ensure a safe operation in the case of a fire in the protected area.

8.3.3.2 The alcohol-resistant foam type fire-fighting system is to cover the maximum area on the deck where a spill of fuel could be expected to spread.

8.3.3.3 *Machinery space and fuel preparation space where methanol/ethanol-fueled engines or fuel pumps are arranged are to be protected by an approved fixed fire-extinguishing system in accordance with the Technical Regulations for Statutory Surveys of Sea-going Ships on Domestic Voyage or the Technical Regulations for Statutory Surveys of Inland Waterways Ships and the FSS Code. In addition, the fire-extinguishing medium used is to be suitable for the extinguishing of methanol/ethanol fires.*

8.3.3.4 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 (for sea-going ships) / essential machinery space (for inland waterways ships) and fuel preparation space containing methanol/ethanol.

8.3.3.5 *Only a fire-fighting system mentioned in 8.3.3.4 is to be fitted providing that it meets the requirements for a fixed fire-fighting system in 8.3.3.3.*

8.3.3.6 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 at the entrance of or near the bunkering station.

8.3.3.7 *Where the tank is located on the open deck, at least two portable dry powder extinguishers of at least 5 kg capacity are to be located near the tank.*

8.3.3.8 *At least one portable dry powder extinguisher of at least 5 kg capacity is to be fitted near the methanol/ethanol fueled engine and the entrance of the machinery space where it is located.*

Section 4 FIRE DETECTION AND FIRE ALARM SYSTEMS

8.4.1 Fire detection

8.4.1.1 A fixed fire detection and fire alarm system complying with Fire Safety System Code is to be provided for all compartments containing the methanol/ethanol fuel system.

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

8.4.1.3 A means to ease detection and recognition of methanol/ethanol fires in machinery spaces is to be provided for fire patrols and for fire-fighting purposes, such as portable heat-detection devices.

8.4.1.4 *If the fire detection system cannot identify each detector, each detector is to be set up to be a single loop.*

8.4.2 Alarm and measures for safety

8.4.2.1 *On detection of fire mentioned above, safety measures specified in Table 11.4.1 of Chapter 11 of the Guidelines are to be adopted.*

CHAPTER 9 EXPLOSION PROOF

Section 1 GENERAL PROVISIONS

9.1.1 Goal

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

9.1.2 Functional requirements

9.1.2.1 This Chapter is related to functional requirements in 1.1.3.2 (1) to (6), (8) and (11) to (17). In particular the following apply:

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

(1) reducing number of sources of ignition;

(2) reducing the probability of formation of ignitable mixtures;

(3) using certified safe type electrical equipment suitable for the hazardous zone where the use of electrical equipment in hazardous areas is unavoidable.

9.1.3 General requirements

9.1.3.1 Hazardous areas on open deck and other spaces not addressed in this section are to be analyzed and classified based on a standard① accepted by CCS. The electrical equipment fitted within hazardous areas is to be according to the same standard.

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

9.1.3.3 The explosion group and temperature class of explosion proof equipment used for an explosive gas atmosphere which may contain methyl or ethyl alcohols are not to be lower than II A T2.

Section 2 HAZARDOUS AREAS CLASSIFICATION

9.2.1 Area classification

9.2.1.1 Area classification is a method of analyzing 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.

9.2.1.2 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 2②. In cases where the prescriptive provisions in 9.2.2 are deemed to be inappropriate, area classification according to a standard③ accepted by CCS may be permitted.

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

9.2.2 Hazardous area zones

9.2.2.1 Hazardous area zone 0

Zone 0 includes, but is not limited to the interiors of fuel tanks, any pipework for pressure-relief or other venting systems for fuel tanks, pipes and equipment containing fuel.

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① Refer to IEC standard 60092-502: Tankers carrying flammable liquefied gases as applicable.

② Refer to standards IEC 60079-10-1: Explosive atmospheres part 10-1: Classification of areas – Explosive gas atmospheres and guidance and informative examples given in IEC 60092-502:60092, Electrical Installations in Ships – Tankers – Special Features for tankers.

③ Refer to IEC 60079-10-1: Explosive atmospheres part 10-1: Classification of areas – Explosive gas atmospheres.

9.2.2.2 Hazardous area zone 1

Zone 1 includes, but is not limited to:

(1) cofferdams and other protective spaces surrounding the fuel tanks;

(2) fuel preparation spaces;

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

(4) 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 centered upon the center of the outlet and within a hemisphere of 6 m radius below the outlet;

(5) 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;

(6) 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;

(7) 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;

(8) a space protected by an airlock is considered as a 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.

9.2.2.3 Hazardous area zone 2

Zone 2 includes, but is not limited to:

(1) areas within 1.5 m surrounding other open or semi-enclosed spaces of zone 1 defined in 9.2.2.2;

(2) areas 4 m beyond the sphere defined in 9.2.2.2 (4);

(3) airlocks.

CHAPTER 10 ELECTRICAL INSTALLATIONS

Section 1 GENERAL PROVISIONS

10.1.1 Goal

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

10.1.2 Functional requirements

10.1.2.1 This Chapter is related to functional requirements in 1.1.3.2 (1), (2), (3), (5), (8), (11), (13), (15), (16) and (17).

10.1.3 General requirements

10.1.3.1 Electrical equipment is to comply with a standard① at least equivalent to those acceptable to CCS.

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

10.1.3.3 Where electrical equipment is installed in hazardous areas as provided in 9.2.2, it is to be selected, installed and maintained in accordance with the standards② at least equivalent to those acceptable to CCS.

10.1.3.4 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.

10.1.3.5 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.

10.1.3.6 *Electrical equipment for propulsion, power generation, maneuvering, anchoring and mooring, as well as emergency fire pumps, that are located in spaces protected by airlocks, is to be of a certified safe type.*

10.1.3.7 *An alarm is to be given at the low liquid level in the tank and automatic shutdown of motor is to be done at the low-low liquid level. Automatic shutdown can be achieved by detecting a low discharge pressure, a low motor current or a low liquid level. This shutdown is to give an audible and visual alarm on the navigation bridge, continuously manned central control station or onboard safety centre.*

10.1.3.8 *The methanol/ethanol fueled engine control, fuel control and fuel safety systems are to be from a duplicated power supply, of which one is main sources of electrical power, and the other is storage batteries or uninterruptible power systems (UPS), off-line UPS excluded. They are to be capable of automatically converting to the storage battery or UPS in the event of failure of the main source of electrical power, and showing an alarm both locally and on the bridge. The period of power supply of the storage batteries is to be a minimum of 30 min. When only storage batteries are used as the main power, two separate power supplies are required for the systems mentioned above.*

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① Refer to IEC 60092 series standards, as applicable.

② Refer to IEC 60092-502: Electrical Installations in Ships–Tankers–Special Features and IEC 60079-10-1: Explosive atmosphere-Part 10-1: Classification of areas-Explosive gas atmospheres.

CHAPTER 11 CONTROL, MONITORING AND SAFETY SYSTEMS

Section 1 GENERAL PROVISIONS

11.1.1 Goal

11.1.1.1 The goal of this Chapter is to provide for the arrangement of control, monitoring and safety systems that support an efficient and safe operation of the gas-fueled installation as covered in the other chapters of the Guidelines.

11.1.2 Functional requirements

11.1.2.1 This Chapter is related to functional requirements in 1.1.3.2 (1), (2), (3), (9), (10), (11), (13), (14) and (17). In particular the following is to apply:

(1) the control, monitoring and safety systems of the fuel installations are to be arranged such that there is not an unacceptable loss of power in the event of a single failure.

(2) a fuel safety system is to be arranged to close down the fuel supply system automatically, upon failure in systems as described in Table 11.4.1 and upon other fault conditions which may develop too fast for manual intervention.

(3) the safety functions are to be arranged in a dedicated fuel safety system that is independent of the fuel control system in order to avoid possible common cause failures; this includes power supplies and input and output signals.

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

(5) where two fuel supply systems are required to meet the provisions, each system is to be fitted with its own set of independent fuel control and safety systems.

11.1.3 General requirements

11.1.3.1 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.

11.1.3.2 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, in fuel tank joints and in other enclosed spaces containing single walled fuel piping or other fuel equipment.

11.1.3.3 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 table 11.4.1.

11.1.3.4 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 table 11.4.1.

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

Section 2 MONITORING AND CONTROL

11.2.1 Fuel tanks

11.2.1.1 Level indicators for fuel tanks

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

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

11.2.1.2 Overflow control

(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) 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. This sensor is to give an audible and visual alarm at its action.

(3) The high and high-high-level alarm for the fuel tanks is to be visual and audible at the location at which gas freeing by water filling of the fuel tanks is controlled, given that water filling is the preferred method for gas freeing.

11.2.1.3 Fuel tanks are to be provided with overpressure/underpressure protection devices complying with 4.2.1.6. *Where a pressure sensor required in 4.2.1.7 is fitted, an alarm is to be given at overpressure/underpressure.*

11.2.2 Bunkering

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

(1) tank level is to be capable of being monitored;

(2) the remote-control valves required by 5.5.1.5 are to be capable of being operated from this location;

(3) closing of the bunkering shutdown valve is to be possible from the control location for bunkering and from another safe location;

(4) overfill alarms and automatic shutdown are to also be indicated at this location.

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

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

11.2.3 Engines

11.2.3.1 In addition to the diesel engine monitoring provided in accordance with Part C of SOLAS Chapter II-1 and CCS Rules for Classification of Sea-going Steel Ships (in case of ships engaged on international voyages) or CCS Rules for Classification of Sea-going Steel Ships and CCS Rules for the Construction of Inland Waterways Steel Ships (in case of ships engaged on domestic voyages), as applicable, indicators are to be fitted on the navigation bridge, the engine control room and the manoeuvring platform for indicating:

(1) operation of methanol/ethanol fuel engines in the case of single fuel engines;

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

Section 3 GAS, FIRE AND VENTILATION DETECTION

11.3.1 Gas detection

11.3.1.1 Permanently installed gas detectors are to be fitted in:

(1) annular spaces of the double walled fuel pipes;

(2) machinery spaces containing fuel equipment or consumers;

(3) fuel preparation spaces;

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

(5) other enclosed or semi-enclosed spaces where fuel vapour may accumulate;

(6) cofferdams and fuel storage hold spaces surrounding fuel tanks;

(7) airlocks;

(8) ventilation inlets to accommodation and machinery spaces, if required, based on the risk assessment required in 1.1.6.

11.3.1.2 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.

11.3.1.3 Gas detection equipment is to be designed, installed and tested in accordance with a standard① accepted by CCS.

11.3.1.4 An audible and visible alarm is to be activated at a fuel vapour concentration of 20% of LEL. The safety system 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.

11.3.1.5 For annular spaces (ventilated ducts) around fuel pipes in the machinery spaces containing methanol/ethanol-fueled 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.

11.3.1.6 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, onboard safety center and at the control location for bunkering as well as locally.

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

11.3.2 Fire detection

11.3.2.1 Fire detection in machinery space containing methanol/ethanol 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 onboard safety center as well as locally.

11.3.3 Ventilation detection

11.3.3.1 Any loss of the required ventilating capacity is to give an audible and visual alarm on the navigation bridge, and in a continuously manned central control station or onboard safety center as well as locally.

Section 4 SAFETY FUNCTIONS OF FUEL SUPPLY SYSTEMS

11.4.1 General requirements

11.4.1.1 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.

11.4.1.2 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

① Refer to IEC 60079-29-1 – Explosive atmospheres – Gas detectors – Performance requirements of detectors for flammable detectors.

the machinery space.

11.4.1.3 A caution placard or signboard is to be permanently fitted in the machinery space containing methyl/ethyl-fueled 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.

11.4.1.4 Compressors, pumps and fuel supply are to be arranged for manual remote emergency stop from the following locations as applicable:

(1) navigation bridge;

(2) cargo control room;

(3) onboard safety center;

(4) engine control room;

(5) fire control station;

(6) adjacent to the exit of fuel preparation spaces.

Monitoring of methanol/ethanol supply system to engines

Table 11.4.1

Parameter	Alarm	Automatic shutdown of tank valve (Valve(s) referred to in 6.3.1.2)	Shutdown of master fuel valve (Valve(s) referred to in 6.3.1.3)	Automatic shutdown of stop valve of bunkering manifold	Comments
High-level fuel tank	×			×	See 11.2.1.2 (1)
High-high-level fuel tank	×			×	See 11.2.1.2(2) and 11.2.2.1
Loss of ventilation of in the annular space in the bunkering line	×			×	See 11.2.2.2.
Gas detection in the annular space in the bunkering line	×			×	See 11.2.2.3
Loss of ventilation in ventilated areas	×				See 11.3.3
Manual shutdown				×	See 11.2.2.1
Liquid methanol/ethanol detection in the annular space of the double walled bunkering line	×			×	See 11.2.2.3
Gas detection in ducts around fuel pipes	×				See 11.3.1.1 (1)
Gas detection in cofferdams surrounding fuel tanks. One detector giving 20% of LEL	×				See 11.3.1.4
Gas detection in airlocks	×				See 11.3.1.1 (7)
Gas detection in cofferdams surrounding fuel tanks. Two detectors giving 40% of LEL	×	×		×	See 11.3.1.1 (6)
Gas detection in ducts around double walled pipes, 20% of LEL	×				See 11.3.1.5
Gas detection in ducts around double walled pipes, 40% of LEL	×	×	×		See 11.3.1.5

Liquid leak detection in annular space of double walled pipes	×	×	×		See 11.1.3.3
Liquid leak detection in engine-room	×	×			See 11.1.3.2
Liquid leak detection in fuel preparation space	×	×			See 11.1.3.2
Liquid leakage detection in protective cofferdams surrounding fuel tanks	×				See 11.1.3.2

CHAPTER 12 MECHANICAL VENTILATION

Section 1 GENERAL PROVISIONS

12.1.1 Goal

12.1.1.1 The goal of this Chapter is to provide for the ventilation required for safe working conditions for personnel and the safe operation of machinery and equipment.

12.1.2 Functional requirements

12.1.2.1 This Chapter relates to functional requirements in 1.1.3.2 (1), (2), (4), (6), (11) to (17).

12.1.3 General requirements

12.1.3.1 Ventilation inlets and outlets for spaces required to be fitted with mechanical ventilation are to be located and closing appliances are to be provided according to the provisions of load lines in the SOLAS Convention or the CCS Technical Regulations for Statutory Surveys of Sea-going Ships on Domestic Voyage or Technical Regulations for Statutory Surveys of Inland Waterways Ships.

12.1.3.2 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 function at all temperatures and environmental conditions the ship will be operating in.

12.1.3.3 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.

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

(1) 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:

① impellers or housings of non-metallic material, due regard being paid to the elimination of static electricity;

② impellers and housings of non-ferrous metals;

③ impellers and housings of austenitic stainless steel;

④ impellers of aluminum 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;

⑤ any combination of ferrous (including austenitic stainless steel) impellers and housings with not less than 13 mm tip design clearance.

(2) 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;

(3) any combination of an aluminum or magnesium alloy fixed or rotating component and a ferrous fixed or rotating component, regardless of tip clearance, is considered a sparking hazard and is not to be used in these places.

12.1.3.5 Unless otherwise specified in the Guidelines, ventilation systems required to avoid any vapour accumulation are to consist of independent fans, each of sufficient capacity. The ventilation system is to be of a mechanical exhaust type, with extraction inlets located such as to avoid accumulation of vapour from leaked methanol/ethanol in the space.

12.1.3.6 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.

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

12.1.3.8 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.

12.1.3.9 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.

12.1.3.10 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:

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

① proceed with purging (at least five air changes) or confirm by measurements that the space is non-hazardous;

② pressurize the space.

(2) operation of the overpressure ventilation is to be monitored and in the event of failure of the overpressure ventilation:

① an audible and visual alarm is to be given at a manned location;

② if overpressure cannot be immediately restored, automatic or programmed, disconnection of electrical installations according to a standard[①] accepted by CCS is to be required.

12.1.3.11 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:

(1) an audible and visual alarm is to be given at a manned location;

(2) if underpressure cannot be immediately restored, automatic or programmed, disconnection of electrical installations according to recognized standards[②] in the non-hazardous space is to be required.

12.1.3.12 Double bottoms, cofferdams, 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.

12.1.3.13 *The ventilation system is to ensure a good air circulation in the spaces served, and in particular ensure that any formation of air-pockets in the room is avoided.*

12.1.3.14 *Any ducting used for the ventilation of hazardous spaces is not to be through accommodation space, service space or other similar space.*

12.1.3.15 *Mobile ventilation plants are to be provided in hazardous spaces where crew do not enter often, such as empty places or similar places. Ventilation is to be provided before entrance into such places with the notice board of ventilation. The explosion-proof degree of a mobile ventilation plant is to be matched with the level of the gas hazardous area and hold a marine products certificate.*

12.1.3.16 *Ventilation fans associated with the hazardous space are to be fitted with substitutes in the absence of standby fans or without any redundancy. The name, type and number of the substitutes are to be*

① Refer to IEC 60092-502: Electrical Installations in Ships–Special Features-Tankers, or GB/T 22189: Electrical Installations in Ships–Special Features-Tankers.

② Refer to IEC 60092-502: Electrical Installations in Ships–Special Features-Tankers ,or GB/T 22189: Electrical Installations in Ships–Special Features-Tankers.

determined according to the number, type and capacity of the ventilation fans.

12.1.3.17 *The shell of the fan is to be earthed.*

12.1.3.18 *Suitable protective screens of not more than 13 mm square mesh are to be fitted on vent outlets.*

12.1.3.19 *An audible and visual alarm is to be given at a manned location in case of failure of the ventilation system.*

12.1.3.20 *A suitable means is to be provided to prevent ventilation circuits formed by the pipes where the fan is located and the pipes where other pipes are located in case of failure of a fan or a group of fans.*

12.1.3.21 *For mechanical ventilation systems of the extraction type within hazardous spaces, inlets of each air duct are to be carried out according to the area where combustible gas may be accumulated and its height.*

Section 2 FUEL PREPARATION SPACES

12.2.1 General requirements

12.2.1.1 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 at least 30 air changes per hour.

12.2.1.2 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.

12.2.1.3 Ventilation systems for fuel preparation spaces and other fuel handling spaces are to be in operation when pumps or other fuel treatment equipment are working.

12.2.1.4 *Measures are to be taken to ensure that the ventilation system of the fuel preparation space is activated at least 10 minutes prior to entry into the fuel preparation space and prior to operation of pumps and other fuel treatment equipment. In addition, a notice board of ventilation is to be provided for such spaces. Except for emergency lighting, lighting in the fuel preparation space is to be interlocked with ventilation, and a failure of the ventilation system is not to affect the normal lighting.*

12.2.1.5 *The number of the fan motors required in 12.2.1.1 to 12.2.1.4 is not to be less than 2 and in the case of a failure of any one motor, the remained motors and the ventilation system are to be run continuously. As an alternative, standby fans which have a capacity not less than 100% of that required in 12.2.1.1 may be provided.*

Section 3 BUNKERING STATIONS

12.3.1 General requirements

12.3.1.1 Bunkering stations that are located in enclosed or semi-enclosed spaces 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.

Section 4 DOUBLE WALL PIPES

12.4.1 General requirements

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

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

12.4.1.3 The ventilation inlet for the double wall piping or duct is always to 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.

12.4.1.4 *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.*

12.4.1.5 *Double piping and gas valve unit spaces in gas safe engine-rooms are to be considered an integral part of the fuel supply systems and, therefore, their ventilation system does not need to be independent of other fuel supply ventilation systems provided such fuel supply systems contain only gaseous fuel.*

Section 5 FUEL VALVE UNIT SPACES

12.5.1 General requirements

12.5.1.1 The ventilation system for gas valve unit spaces is to comply with the requirements for ventilation systems of double wall pipe specified in 12.4.1.

Section 6 TANK CONNECTION SPACES

12.6.1 General requirements

12.6.1.1 The ventilation system for tank connection spaces is to comply with the requirements for ventilation systems of double wall pipe specified in 12.4.1.

CHAPTER 13 OPERATIONS

Section 1 GENERAL PROVISIONS

13.1.1 Goal

13.1.1.1 The goal of this Chapter is to ensure that operational procedures for the loading, storage, operation, maintenance, and inspection of systems for methanol/ethanol fuels minimize the risk to personnel, the ship and the environment and that are consistent with practices for a conventional oil-fueled ship.

13.1.2 Functional requirements

13.1.2.1 This Chapter is related to functional requirements in 1.1.3.2. In particular the following is to apply:

(1) Provisional Regulations for Technology and Survey of Ships Using Methanol/Ethyl Alcohol as Fuels or a copy of the Regulations are to be kept on board the ship;

(2) maintenance procedures and information for methanol/ethanol related installations are to be available on board;

(3) the ship is to be provided with operational procedures including a suitably detailed fuel handling manual, such that trained personnel can safely operate the fuel bunkering, storage and transfer systems;

(4) the ship is to be provided with suitable emergency procedures.

Section 2 MAINTENANCE

13.2.1 General requirements

13.2.1.1 Maintenance and repair procedures are to include considerations with respect to the fuel containment system and adjacent spaces. Special consideration is to be given to the toxicity of fuel.

13.2.1.2 The procedures and information are to include maintenance of electrical equipment that is installed in hazardous areas. The inspection and maintenance of electrical installations in hazardous areas are to be performed in accordance with the standards① accepted by CCS.

Section 3 BUNKERING OPERATIONS

13.3.1 Responsibilities

13.3.1.1 Before any bunkering operation commences, the master of the receiving ship or their representative and the representative of the bunkering source (persons in charge (PIC)) are to:

(1) agree in writing the transfer procedure including the maximum transfer rate at all stages and volume to be transferred;

(2) agree in writing action to be taken in an emergency;

(3) complete and sign the bunker safety checklist.

13.3.1.2 Upon completion of bunkering operations, the ship PIC is to receive and sign documentation containing a description of the product and the quantity delivered.

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① See IEC60079-17 explosive Atmospheres - Part 17: Inspection and maintenance of electrical installations.

13.3.2 Control, automation and safety systems

13.3.2.1 The fuel handling manual required by 13.1.2.1(3) is to include but not limited to:

(1) overall operation of the ship from dry dock to dry dock, including procedures for bunker loading and, where appropriate, discharging, sampling, inerting and gas freeing;

(2) operation of inert gas systems;

(3) fire-fighting and emergency procedures:

(4) operation and maintenance of fire-fighting systems and use of extinguishing agents;

(5) specific fuel properties and special equipment needed for the safe handling of the particular fuel;

(6) fixed and portable gas detection operation and maintenance of equipment;

(7) emergency shutdown systems;

(8) a description of the procedural actions to take in an emergency situation, such as leakage, fire or poisoning.

13.3.2.2 A fuel system schematic/piping and instrumentation diagram (P&ID) are to be reproduced and permanently displayed in the ship's bunker station.

13.3.3 Pre-bunkering verification

13.3.3.1 Prior to conducting bunkering operations, pre-bunkering verification including, but not limited to, the following is to be carried out and documented in the bunker safety checklist:

(1) all communications methods, including ship shore link (SSL), if fitted;

(2) operation of fixed fire detection equipment;

(3) operation of portable gas detection equipment;

(4) readiness of fixed and portable fire-fighting systems and appliances;

(5) operation of remote-controlled valves;

(6) inspection of hoses and couplings.

13.3.3.2 Documentation of successful verification is to be indicated by the mutually agreed and executed bunkering safety checklist signed by both PICs.

13.3.4 Ship bunkering source communications

13.3.4.1 Communications are to be maintained between the ship PIC and the bunkering source PIC at all times during the bunkering operation. In the event that communications cannot be maintained, bunkering is to stop and not resume until communications are restored.

13.3.4.2 Communication devices used in bunkering are to comply with recognized standards.

13.3.4.3 PICs are to have direct and immediate communication with all personnel involved in the bunkering operation.

13.3.4.4 The SSL or equivalent means to a bunkering source provided for automatic ESD communications is to be compatible with the receiving ship and the delivering facility ESD system①.

13.3.5 Electrical connection

13.3.5.1 Consideration is to be given to the electrical insulation between ship and shore.

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① Refer to ISO 28460: Petroleum and natural gas industries - Installation and equipment for liquefied natural gas - Ship-to-shore interface and port operations.

CHAPTER 14 PERSONNEL PROTECTION

Section 1 GENERAL PROVISIONS

14.1.1 Goal

14.1.1.1 *The goal of this chapter is to ensure the personal safety of crew members engaged in methanol/ethanol fuel operations.*

14.1.2 Functional requirements

14.1.2.1 *This Chapter is related to functional requirements in 1.1.3.2(18).*

14.1.3 Protective equipment

14.1.3.1 *The ship is to have on board suitable protective equipment consisting of large aprons, special gloves with long sleeves, suitable footwear, coveralls of methanol/ethanol-resistant material, and tight-fitting goggles or face shields or both. The protective clothing and equipment are to cover all skin so that no part of the body is unprotected.*

14.1.3.2 *The ship is to have at least two sets of protective equipment for persons engaged in dangerous operation.*

14.1.3.3 *Protective equipment is to be used in any operation which may entail danger to personnel.*

14.1.3.4 *Work clothes and protective equipment are to be kept in easily accessible places and in special lockers. Such equipment is not to be kept within accommodation spaces, with the exception of new, unused equipment and equipment which has not been used since undergoing a thorough cleaning process. CCS may, however, approve storage rooms for such equipment within accommodation spaces if adequately segregated from living spaces such as cabins, passageways, dining rooms, bathrooms, etc.*

14.1.4 Emergency equipment

14.1.4.1 *The ship is to be provided with suitable respiratory and eye protection sufficient for every person on board for emergency escape purposes, subject to the following:*

(1) filter-type respiratory protection is unacceptable;

(2) self-contained breathing apparatus is to have at least a duration of service of 15 min;

(3) emergency escape respiratory protection is not to be used for fire-fighting or cargo-handling purposes and is to be marked to that effect.

14.1.4.2 *The ship is to have on board medical first-aid equipment based on the physical and chemical properties of methanol/ethanol.*

14.1.4.3 *A stretcher is to be placed in a readily accessible location.*

14.1.4.4 *Suitably marked decontamination showers and an eyewash are to be available on deck.*

CHAPTER 15 REQUIREMENTS OF METHANOL/ETHANOL FUEL READY SYSTEM

Section 1 GENERAL PROVISIONS

15.1.1 Application

15.1.1.1 *This chapter applies to ships that adopt methanol/ethanol fuel ready system and plan to install and modify methanol/ethanol fuel system in the future. Such ships are to meet the relevant requirements of the competent authority of the flag State (if any).*

15.1.1.2 *This Chapter specifies the requirements of methanol/ethanol fuel system installation and its design, arrangement, structural strengthening, space reservation and surveys when the ship adopts methanol/ethanol fuel ready system.*

15.1.1.3 *Conventional ship systems and/or equipment shared with methanol/ethanol fuel systems are to meet the requirements of relevant conventions, regulations and CCS's rules.*

15.1.2 Goal and Functional Requirements

15.1.2.1 *The goal of this chapter is to clarify the requirements of methanol/ethanol fuel ready system, providing technical guidance for the subsequent conversion of ships to use methanol/ethanol fuel as power.*

15.1.2.2 *The methanol/ethanol fuel ready system is to meet following functional requirements:*

(1) The probability and consequences of methanol/ethanol fuel-related hazards are to be limited to a minimum through arrangement and system design of methanol/ethanol fuel ready system;

(2) In the event of methanol/ethanol fuel leakage or failure of risk reduction measures, the necessary safety measures are to be considered as well as the risk reducing measures and safety actions for the methanol/ethanol fuel installation do not lead to an unacceptable loss of power;

(3) The arrangement of methanol/ethanol fuel ready system is to consider restricting the hazardous areas, as far as practicable, to minimize the potential risks that might affect the safety of the ship, persons on board, and equipment;

(4) The arrangement and location of the fuel containment systems and methanol/ethanol fuel system are to be considered to ensure that a fire or explosion in either of them would not result in unacceptable power loss or inoperable equipment in other compartments.

Section 2 READY REQUIREMENTS

15.2.1 General Requirements

15.2.1.1 *For ships use methanol/ethanol fuel ready systems, the ship's stability, structural strength, arrangement and requirements of related systems and equipment under the following three possible conditions are to be taken into consideration.*

(1) Single fuel powered system is provided when the methanol/ethanol fuel ready ship is delivered;

(2) Methanol/ethanol fuel powered system is added when the methanol/ethanol fuel ready ship is converted , and the original fuel powered system is kept;

(3) Methanol/ethanol fuel powered system is added when the methanol/ethanol fuel ready ship is converted, but the original fuel powered system has been changed.

15.2.2 Hull Structure (S)

15.2.2.1 *The hull girder strength and cargo hold structure strength after arranging fuel tanks of methanol/ethanol fuel ready ship in potential three operation conditions as described in 15.2.1.1 are to*

meet the relevant requirements of hull structures in CCS Rules.

15.2.3 Fuel Containment System (T)

15.2.3.1 *The arrangement and design of methanol/ethanol fuel ready containment system are to be in compliance with the relevant requirements of Chapter 4 of the Guidelines.*

15.2.3.2 *The related strength requirement of methanol/ethanol fuel ready containment system, including local supporting structure strengthening, structure strengthening in special zones and etc. are to meet the relevant requirements of Chapter 4, Section 1 of the Guidelines.*

15.2.4 Fuel Bunkering System (F)

15.2.4.1 *The bunkering station and its bunkering system of methanol/ethanol fuel ready ship are to be in compliance with the relevant requirements of Chapter 5 of the Guidelines.*

15.2.5 Fuel Piping System (P)

15.2.5.1 *The fuel piping system of methanol/ethanol fuel ready ship is to be in compliance with the relevant requirements of Chapter 3 in the Guidelines.*

15.2.5.2 *In the design and construction of the methanol/ethanol fuel ready ships, the future modification and arrangement of methanol/ethanol fuel piping system are to be considered, allowing sufficient space. In particular, consideration is to be given to the design and arrangement of double-walled pipes in such areas or premises like bunkering stations, fuel tank joints, machinery space, fuel preparation space, etc.*

15.2.6 Dual-Fuel Main Engine (M)

15.2.6.1 *In addition to the relevant requirements of diesel engines in Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships, or in Chapter 6, PART TWO of CCS Rules for the Construction of Inland Waterways Steel Ships, the dual fuel main engine is to meet the relevant requirements of Chapter 7 of the Guidelines.*

15.2.7 Converted/replaced to Methanol/ethanol Fuel Main Engine (m)

15.2.7.1 *Prior to the conversion, the main engine is to meet the relevant requirements of Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships, or in Chapter 6, PART TWO of CCS Rules for the Construction of Inland Waterways Steel Ships, and the relevant documents showing that it can be converted to methanol/ethanol fuel engine are to be submitted.*

15.2.7.2 *If a methanol/ethanol engine is replaced, the replacement engine is to meet the relevant requirements of Chapter 7 of the Guidelines.*

15.2.7.3 *The converted/replaced main engine is to be capable of matching with the original propulsion system.*

15.2.8 Dual-Fuel Auxiliary Engine (A)

15.2.8.1 *In addition to the relevant requirements for diesel engines in Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships, or in Chapter 6, PART TWO of CCS Rules for the Construction of Inland Waterways Steel Ships, the dual fuel auxiliary engine (prime mover for generator set) is to meet the relevant requirements of Chapter 7 of the Guidelines.*

15.2.9 Converted/replaced to Methanol/ethanol Fuel Auxiliary Engine (a)

15.2.9.1 *Prior to the conversion, the auxiliary engine is to meet the relevant requirements of Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships, or in Chapter 6, PART TWO of CCS Rules for the Construction of Inland Waterways Steel Ships, and the relevant documents showing that it can be converted to methanol/ethanol fuel engine are to be submitted.*

15.2.9.2 *If a methanol/ethanol engine is replaced, the replacement engine is to meet the relevant requirements of Chapter 7 of the Guidelines.*

15.2.9.3 *The power of auxiliary engine after conversion/replacement is to meet the demands for capacity of power station onboard ship.*

15.2.10 Dual-Fuel Boiler (B)

15.2.10.1 *In addition to the applicable boiler requirements in Chapter 6, PART THEE of CCS Rules for Classification of Sea-going Steel Ships, or in Chapter 5, PART TWO of CCS Rules for the Construction of Inland Waterways Steel Ships, and in Regulation 10 of International Code of Safety for Ships Using Gases or Other Low-flashpoint Fuels (IGF Code), the methanol/ethanol duel fuel boiler is to meet the relevant requirements on methanol/ethanol fuel usage provided by the manufacturer.*

15.2.11 Converted/replaced to Methanol/ethanol Fuel Boiler (b)

15.2.11.1 *Prior to the conversion, the auxiliary engine is to meet the applicable requirements for boilers of Chapter 9, PART THREE of CCS Rules for Classification of Sea-going Steel Ships, or in Chapter 5, PART TWO of CCS Rules for the Construction of Inland Waterways Steel Ships, and the relevant documents showing that it can be converted to methanol/ethanol fuel boiler are to be submitted.*

15.2.11.2 *If a methanol/ethanol fuel boiler is replaced, in addition to the applicable boiler requirements in Regulation 10 of International Code of Safety for Ships Using Gases or Other Low-flashpoint Fuels (IGF Code), the methanol/ethanol fuel boiler is to meet the relevant requirements on methanol/ethanol fuel usage provided by the manufacturer.*

15.2.12 Fuel Cell Systems (FC)

15.2.12.1 *The fuel cell systems of a methanol/ethanol fuel ready ship are to be in compliance with the relevant requirements of Chapter 11 in the Guidelines for Ships Using Fuel Cell Power Installations.*

15.2.13 Power Distribution System (E)

15.2.13.1 *In the design and construction of the methanol/ethanol fuel ready ships, the relevant electrical equipment, such as compressor, inert gas system, etc. of natural gas supply system is to be fully considered to reserve adequate capacity of the power station onboard the ships, so that it is unnecessary to increase the number or capacity of generators after such equipment has been installed, meanwhile, spaces for power supply switches for such equipment are to be reserved in the switchboard or power distribution box.*

15.2.14 Hazardous area (D)

15.2.14.1 *The hazardous areas classification and electrical installations in the areas are to meet the applicable requirements of Chapter 9 in the Guidelines.*

15.2.15 Control, Monitoring and Safety Systems (C)

15.2.15.1 *Control, monitoring and safety systems are to meet the applicable requirements of Chapter 11 in the Guidelines.*

Section 3 PLANS AND DOCUMENTS

15.3.1 Plans and Documents for applying for M/E FR Class Notations

15.3.1.1 *For the ships intended to apply for M/E FR class notations, in addition to the plans and documents specified in CCS Rules, at least the following plans and documents are to be submitted:*

(1) General arrangement and capacity plans;

(2) Arrangement of engine room;

(3) Loading manuals and damage stability calculations for the required three potential operation conditions (if applicable);

(4) Equipment number calculations (if applicable);

(5) Fire control plan.

15.3.1.2 *For the ships intended to apply for M/E FR class notations, in addition to the plans and documents specified in CCS Rules, at least the following plans and documents are to be submitted for information:*

(1) Tonnage calculations;

(2) Hull specifications;

(3) Machinery specifications;

(4) The design and arrangement specifications of methanol/ethanol fuel ready system;

(5) Mechanical equipment calculations.

15.3.2 Plans and Documents for applying for M/E FR(X_1,…,X_N) Class Notations

15.3.2.1 *For the ships intended to apply for M/E FR(X_1,…,X_N) class notations, in addition to the plans and documents required in 15.3.1.1 and CCS Rules, at least the following plans and documents are to be submitted:*

(1) Hull Structure(S)

① Girder strength calculations under the required three potential operation conditions;

② Cargo hold structure strength calculations after arranging methanol/ethanol fuel tanks.

(2) Fuel Containment System(T)

① Fuel tank and fuel storage hold space arrangement plans;

② Structure details of fittings and supporting members for fuel tanks and the strength evaluation report.

(3) Fuel Bunkering System(F)

① Bunkering station and bunkering system arrangement plans(including bunkering joints);

② Schematic plans of bunkering system.

(4) Fuel Piping System(P)

① Detailed plans and specifications for fuel piping, including joints, valves, breathability, etc.

② Detailed plans of fuel preparation space arrangement and internal fuel piping system (if any);

③ Technical documents for materials, welding, post-welding heat treatment and nondestructive testing of fuel piping system (if any);

④ Technical documents for pressure and tightness test of fuel piping system (if any);

⑤ Ventilation system arrangement plans;

⑥ Arrangement plans and instructions of degassing and inert gas purging system.

(5) Dual-Fuel Main Engine and Auxiliary Engine (M and A)

① Engine space arrangement plans;

② Arrangement plans and instructions of engine control and monitoring system;

③ Engine operating procedure and maintenance manual.

(6) Converted/replaced to Methanol/ethanol Fuel Main Engine or Auxiliary Engine (m and a)

① *Documentation or explanatory materials showing that the engine can be converted or replaced.*

(7) Dual-Fuel Boiler(B)

① *Boiler space arrangement plans;*

② *Boiler fuel supply piping system plans;*

③ *condensate and dead steam piping system plans;*

④ *Boiler feed piping system and discharge piping system plans;*

⑤ *Boiler space ventilation piping arrangement plans.*

(8) Converted/replaced to Methanol/ethanol Fuel Boiler(b)

① *Documentation or explanatory materials showing that the boiler can be converted or replaced.*

(9) Fuel Cell Systems(FC)

① *The fuel cell power system arrangement plans, indicating the position of each component equipment in the fuel cell power system;*

② *Classification of Hazardous zones;*

③ *Plans of control, monitoring and safety systems associated with fuel cell systems.*

(10) Power Distribution System (E)

① *Electric power system plan and single line plan (including parameters of power supply switches of related electrical equipment, type of cables, sectional areas, etc. for natural gas fuel supply system);*

② *Electric power load calculations (including rated power, operating condition of related electrical equipment for natural gas fuel supply system, etc.).*

(11) Hazardous area(D)

① *Classification of hazardous zones;*

② *Arrangement of mechanical ventilation for hazardous zones.*

(12) Control, Monitoring and Safety Systems(C)

① *Plans and arrangement for fuel gas detection and alarm system;*

② *Plans and arrangement for monitoring system of fuel tanks;*

③ *Fuel pump control and monitoring system plans(if applicable) and arrangement;*

④ *Plans and arrangement for methanol/ethanol fuel engine control and monitoring system;*

⑤ *Electrical system plans and a list of monitoring details of fuel supply system and bunkering system.*

Section 4 SURVEYS

15.4.1 General Requirements

15.4.1.1 *All survey procedures, methods, types, intervals, conditions, preparations before survey, inspection and test requirements as well as ship's plans, information, certificates, records, and reports, etc. of methanol/ethanol fuel ready ships are to be maintained in compliance with the relevant requirements of CCS Rules.*

15.4.2 Special Requirements

15.4.2.1 *The surveys during and after construction of the methanol/ethanol fuel ready ships are to meet the applicable requirements of Section 4 in Chapter 1 of the Guidelines as appropriate.*

15.4.2.2 *Equipment related to methanol/ethanol fuel systems installed in the ship's ready stage is to hold product certificates, and the Guidelines are to be included in the "survey basis" indicated in the certificate.*