

RULES
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CHINA CLASSIFICATION SOCIETY
RULES FOR SHIPS USING
NATURAL GAS FUEL
CCS RULE CHANGE NOTICE

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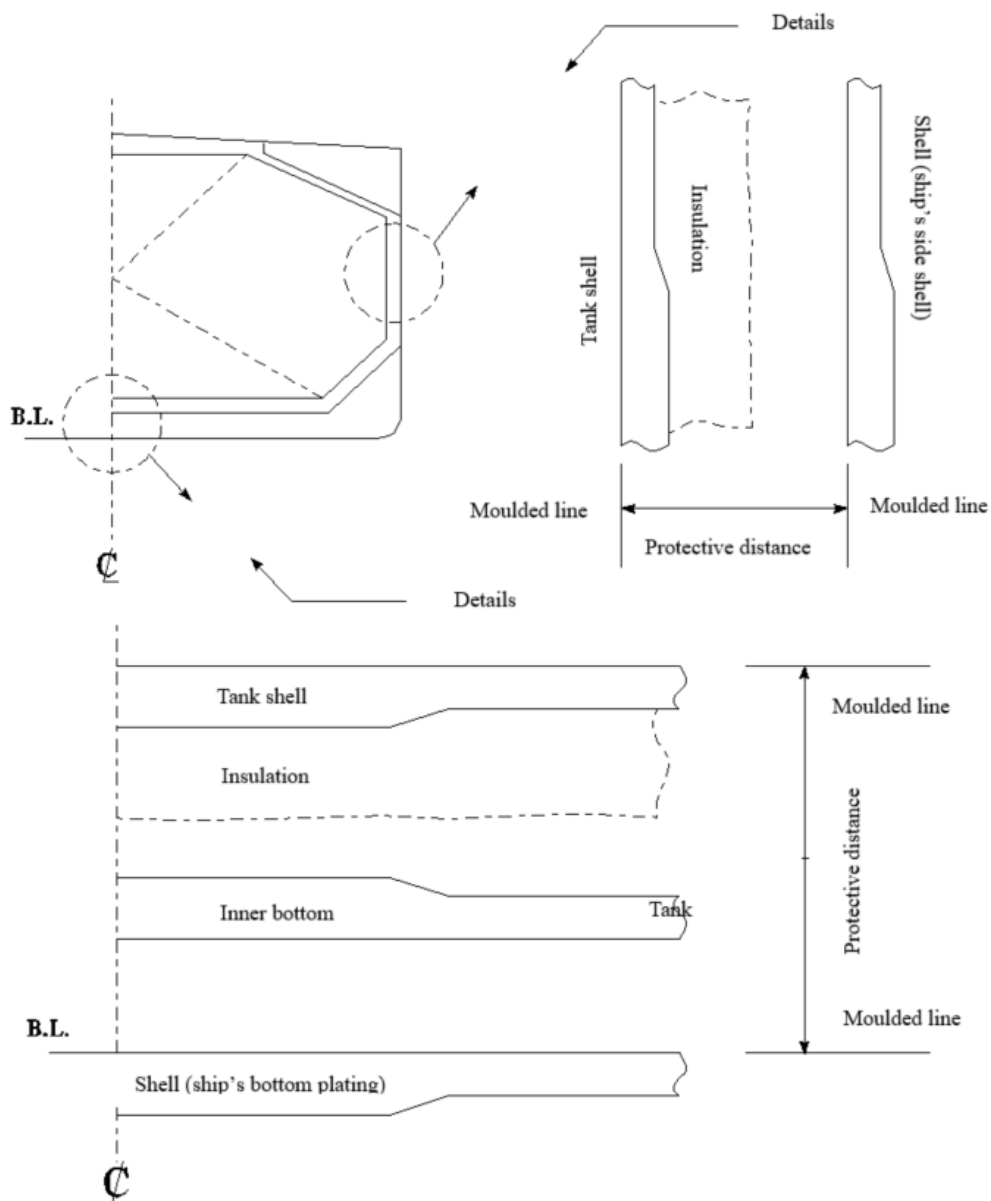
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CHAPTER 2 SHIP DESIGN AND ARRANGEMENTS

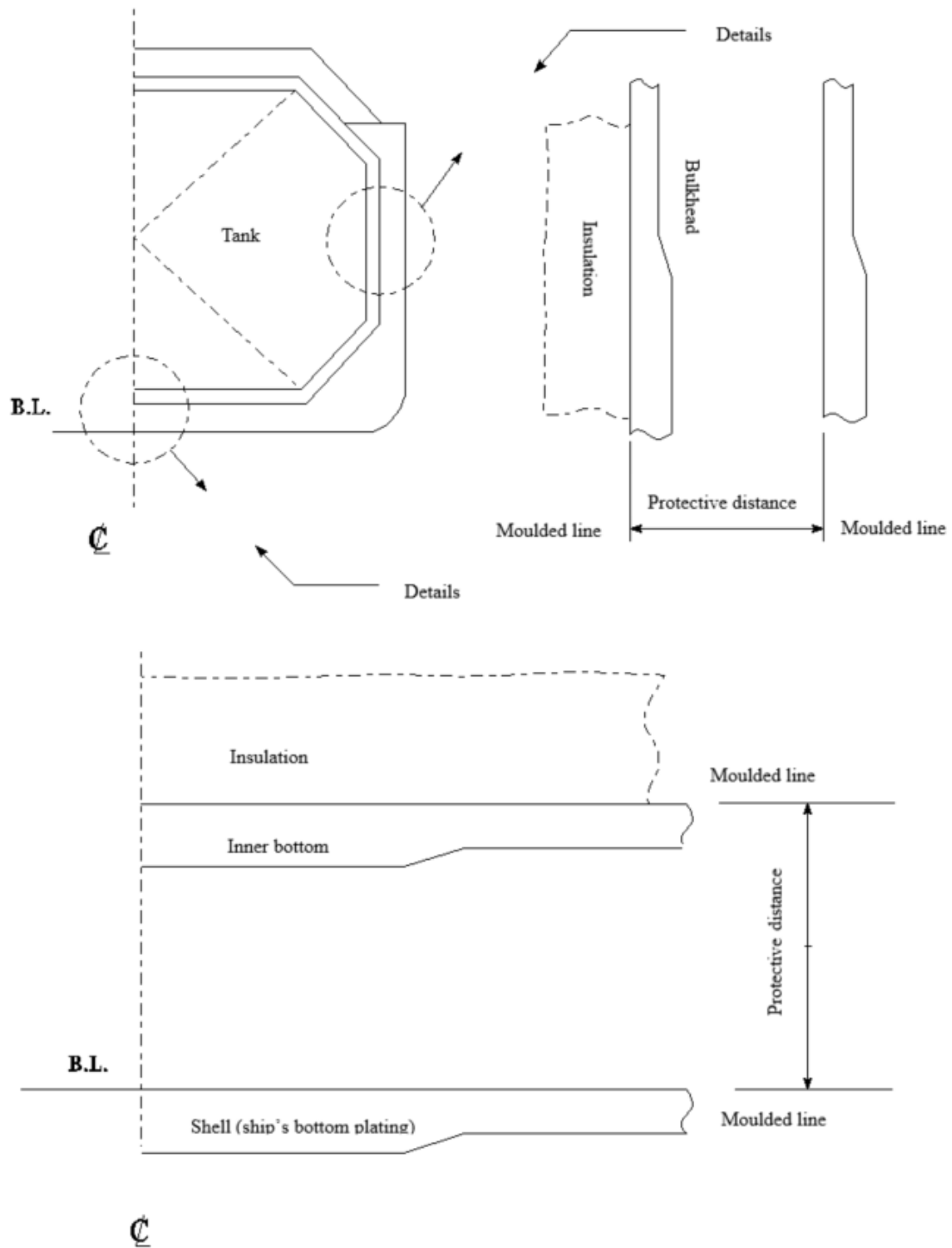
Section 2 ARRANGEMENT OF FUEL TANKS

2.2.1 General requirements

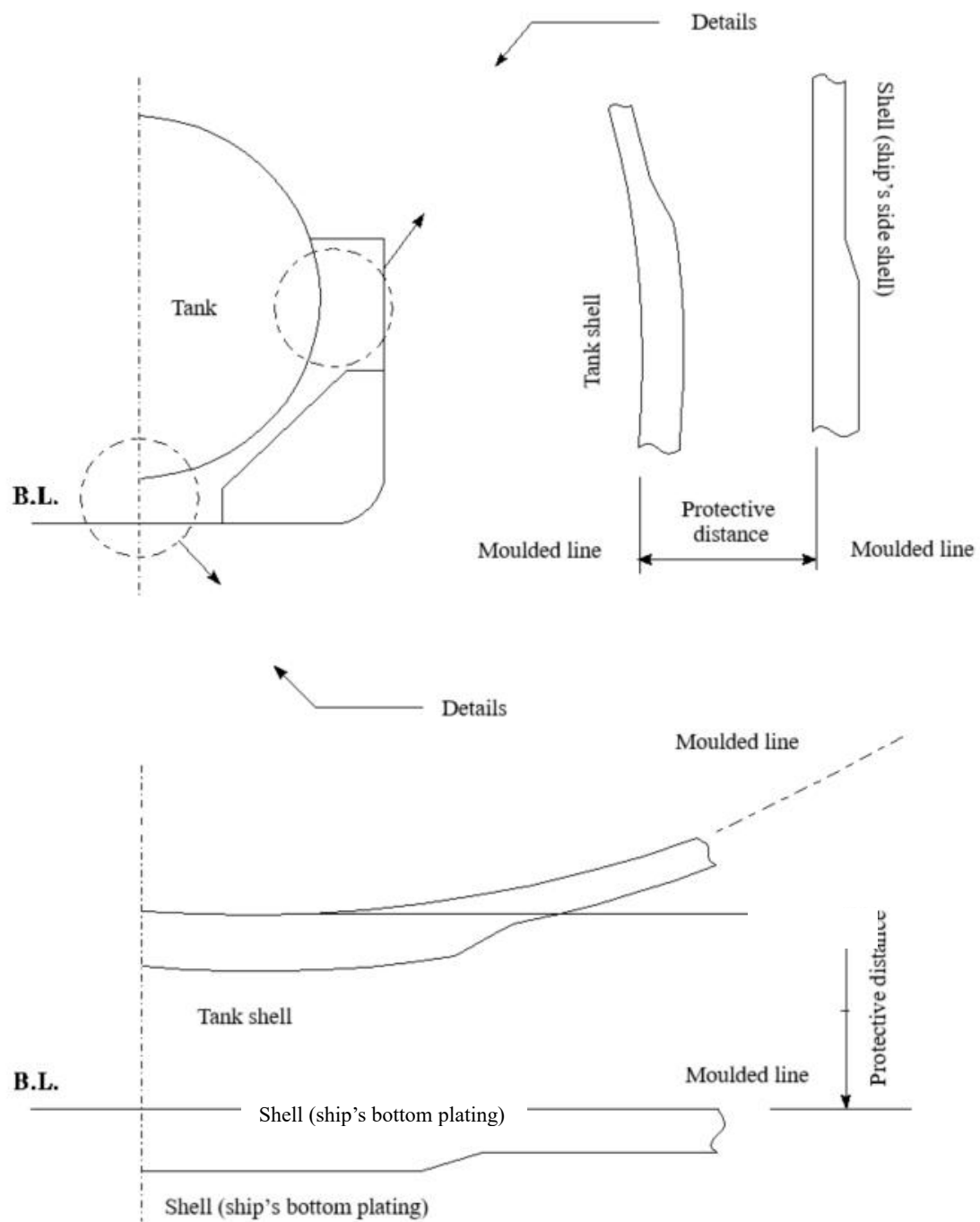
2.2.1.3 (2) For independent tanks, the protective distance is to be measured to the tank shell (the primary barrier of the ~~tank~~ fuel containment system). For membrane tanks, the distance is to be measured to the bulkheads surrounding the tank insulation. For the protective distances of different tanks, see Figure 2.2.1.3 (2);



(a) Independent Prismatic Tanks



(b) Membrane Tanks



(c) Type C Independent Tanks

Figure 2.2.1.3(2) The Protective Distances of Different Tanks

Section 3 LOCATION AND DIVISION OF SPACES

2.3.9 Airlocks

2.3.9.1 An airlock is a space enclosed by gastight bulkheads with two substantially gastight doors spaced at least 1.5 m and not more than 2.5 m apart. Unless subject to the requirements of the International Convention on Load Lines, ~~the door sill~~ the sill height of the door leading to the hazardous area is not to be less than 300 mm in height. The doors are to be self-closing without any holding back arrangements.

CHAPTER 3 MATERIAL AND PIPE DESIGN

Section 2 PIPE DESIGN

3.2.2 Wall thickness

3.2.2.1 The minimum wall thickness is to be calculated as follows:

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

where:

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

with:

P —design pressure, in MPa, refer to in 3.2.3 of this Section;

D —outside diameter, in mm;

K —allowable stress, in N/mm², referred to in 3.2.4 of this Section; and

e —efficiency factor 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, in 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:

$$b = D \cdot \frac{t_0}{2.5r}$$

with: r —mean radius of the bend, in mm;

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

a —negative manufacturing tolerance for thickness, %, i.e. where a is the manufacturing tolerance of -5%, $|a|$ is equal to 5 and shall be entered into the formula as 1- (5/100).

CHAPTER 4 FUEL CONTAINMENT SYSTEMS

Section 5 PRESSURE RELIEF SYSTEMS

4.5.3 Sizing of pressure relieving system

4.5.3.1 Sizing of pressure relief valves

(1) the pressure relief system for each liquefied gas fuel tank shall be designed so that, regardless of the state of any one PRV, the capacity of the residual PRVs meets the combined relieving capacity requirements of the system. The combined relieving capacity shall be the greater of the following, with no more than 20% rise in liquefied gas fuel tank pressure above the MARVS. The tank shall not be loaded until the full relieving capacity is restored:

Section 7 MAINTAINING OF FUEL STORAGE CONDITION

4.7.1 Control of tank pressure and temperature

4.7.1.1 With the exception of liquefied gas fuel tanks designed to withstand the full gauge vapour pressure of the fuel under conditions of the upper ambient design temperature, fuel tank pressure and temperature are to be maintained at all times within their design range by means acceptable to CCS, e.g. by one or more of the following methods:

- (1) reliquefaction of vapours;
- (2) thermal oxidation of vapours;
- (3) pressure accumulation; or
- (4) liquefied gas fuel cooling.

The method chosen is to be capable of maintaining tank pressure below the set pressure of the tank pressure relief valves for a period of 15 days assuming full tank at normal service pressure and the ship in idle condition, i.e. only power for domestic load is generated.

CHAPTER 5 GAS FUEL BUNKERING

Section 2 BUNKERING STATIONS

5.2.3 Bunkering manifolds

5.2.3.1 Bunkering manifolds are 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, arranged in order to achieve a dry-disconnect operation in one of the followings ways:~~

~~5.2.3.2 The connections at the bunkering station are to be arranged in order to achieve a dry-disconnect operation in one of the followings ways:~~

(1) Quick disconnecting couplings (QC/DC). The design, manufacture and testing of a QC/DC are to comply with the standards^① accepted by CCS; or

(2) Manual or hydraulic driving couplings. The couplings are generally fitted at the ends of loading arm for connecting the bunkering system to the pipe flange of the bunkering manifold of the receiving ship. The design, manufacture and testing of the couplings and loading arms are to comply with the standards^② accepted by CCS; or

(3) Combinations of bolted flange and flange assembly. The flange sizing is to comply with the standards^③ accepted by CCS.

5.2.3.2 In cases when the couplings mentioned in 5.2.3.1 (2) ~~and or~~ (3) above are used, an operational procedure for achieving dry disconnection is to be combined. In addition, the bunkering arrangement is to be subject to special consideration ~~within the risk assessment informed by a bunkering arrangement risk assessment^④ conducted at the design stage and considering, including~~ the effects due to dynamic loads at the bunkering connections, safety operation and other risks related to the ship during bunkering. The fuel handling manual required by 14.1.2.1(2) of the Rules shall include documentation that the bunkering arrangement risk assessment was conducted, and that special consideration was granted under this requirement.

5.2.3.3 An emergency release coupler (ERC) / Emergency Release System (ERS) or equivalent

① E.g. GB/T 39038 Ship and marine technology—Technical requirements for liquefied natural gas bunkering dry-disconnect/connect coupling and ISO 21593 Ships and marine technology —Technical requirements for dry disconnect/connect couplings for bunkering liquefied natural gas.

② E.g. HG/T 21608 Engineering technical requirements for liquid loading arm, ISO 20519 Ships and marine technology —Specification for bunkering of liquefied natural gas fueled vessels, OCIMF Design and Construction Specification for Marine Loading Arms and ISO 16904 Petroleum and natural gas industries--Design and testing of LNG marine transfer arms for conventional onshore terminals etc.

③ E.g. HG/T 20592-20635 Steel Pipe Flanges, Gaskets and Bolting, CLASS series, PN designated, D150 and above specified in ASME B16.5 Pipe Flanges & Flanged Fittings and ISO 20519 Ships and marine technology —Specification for bunkering of liquefied natural gas fueled vessels etc.

④ E.g. ISO 21593 Ships and marine technology —Technical requirements for dry disconnect/connect couplings for bunkering liquefied natural gas and CCS “Guidelines For LNG Fuel Bunkering Operation”.

means are to be provided, unless installed on the bunkering supply side of the bunkering line, and the said means is to comply with the standards^① accepted by CCS. It is to enable a quick physical disconnection "dry break-away" of the bunker system in an emergency event.

^① E.g. ISO 21593 Ships and marine technology —Technical requirements for dry disconnect/connect couplings for bunkering liquefied natural gas and CCS “Guidelines For LNG Fuel Bunkering Operation”.

CHAPTER 6 FUEL SUPPLY TO CONSUMERS

Section 1 GENERAL PROVISIONS

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) of the Rules. In particular the following apply:

(2) 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; and

For ships constructed on or after 1 July 2026, the following revised requirements are to be met:

A single common flange (ensuring ventilation flow with two sealing systems) may be accepted at the fuel connection to the gas consumers including internal combustion engines, GCUs, boilers and components, such as gas valve units provided that the technical justification is submitted to CCS:

- ① The impracticability of the installation of a double flange connection (two independent flanges, one on the gas pipe and one on the secondary enclosure), and
- ② Compliance of single common flange with the safety criterion in paragraph 6.1.2.1(2) of the Rules (i.e. no leak from the piping system into the surrounding area in case of failure of one sealing system), including at least the consideration of the rupture or loosening of bolts, depending on arrangement of components which should not result in flange failure when piping is exposed to a sudden movement (e.g. hog and sag of the ship or excessive vibration).

6.1.3 General requirements

6.1.3.1 For single fuel installations the fuel supply system shall be arranged with redundancy and segregation, so that a leakage in one system, or failure of one of the fuel supply essential auxiliaries, does not lead to an unacceptable loss of power. In the event of a leakage or failure, and in accordance with SOLAS regulation II-1/26.3, the Administration, having regard to overall safety considerations, may accept a partial reduction in propulsion capability from normal operation.

Section 2 ARRANGEMENT OF GAS SUPPLY VALVES

6.2.1 General requirements

6.2.1.6 In cases where the master gas fuel valve is automatically shut down when the safety system as required paragraph 12.1.2.1 (2) of the Rules is activated, the complete gas supply pipe between this master gas fuel valve and the double block and bleed valves and between the double block and bleed valves and the consumer shall be automatically vented.

Section 4 GAS SUPPLY SYSTEMS IN MACHINERY SPACES

6.4.1 Gas supply systems in gas-safe machinery spaces

6.4.1.1 Gas supply piping in gas safe machinery spaces is to be double wall piping fulfilling one of the following conditions:

(1) The gas piping is to be a concentric pipe made up by an inner pipe and an outer pipe with the gas fuel contained in the inner pipe. The space between the concentric pipes is to be pressurized with inert gas at a pressure greater than the gas fuel pressure. Suitable alarms are to be provided to indicate a loss of inert gas pressure between the concentric pipes. ~~When the inner pipe contains high pressure gas, the system is to be so arranged that the pipe between the master gas valve and the engine is automatically purged with inert gas when the master gas valve is closed.~~

(2) The gas fuel piping is to be installed within a ventilated duct. The air space between the gas fuel piping and the ventilated duct is to be provided equipped with mechanical underpressure ventilation having a capacity of at least 30 air changes per hour. This ventilation capacity may be reduced to 10 air changes per hour provided automatic filling of the duct with nitrogen upon detection of gas is arranged for. The fan motors are to comply with the required explosion protection in the installation area. The ventilation outlet is to be covered by a protection screen and placed in a position where no flammable gas-air mixture may be ignited.

(3) Other solutions providing an equivalent safety level may also be accepted by CCS.

6.4.1.3 The design pressure of the outer pipe or duct of fuel systems is not to be less than the maximum working pressure of the inner pipe. Alternatively, ~~for high pressure fuel piping~~ the design pressure of the ~~ducting~~ outer pipe or duct is to be taken as the higher of the following:

(1) the maximum built-up pressure: static pressure in way of the rupture resulting from the gas flowing in the annular space;

(2) local instantaneous peak pressure in way of the rupture p^* , given by the following expression:

$$p^* = p_0 \left(\frac{2}{k+1} \right)^{\frac{k}{k-1}}$$

where, p_0 —— maximum working pressure of the inner pipe;

k —— constant pressure specific heat divided by the constant volume specific heat, $k = 1.31$ for CH_4 ;

The tangential membrane stress of a straight pipe is not to exceed the tensile strength divided by $1.5(R_m/1.5)$ when subjected to the above pressures. The pressure ratings of all other piping components are to reflect the same level of strength as straight pipes. As an alternative to using the peak pressure from the above formula, the peak pressure found from representative tests can be used. Test reports are then to be submitted.

6.4.1.5 For ships constructed on or after 1 July 2026, Gas fuel vent pipes, i.e. pipes arranged for purpose of purging, venting, or bleeding fuel gas lines, which are of single-walled construction and are located within gas-safe machinery spaces may be accepted, provided that at minimum the

following conditions are to be satisfied:

(1) These pipes are to originate from a gas fuel piping system having a design pressure not greater than 1 MPa or the maximum built-up back pressure in the vent piping is to be calculated not to exceed 0.5 MPa;

(2) These pipes are to be of fully welded construction. The connection to the consumer, if not connected by welding, as well as any flexible elements, is to comply with paragraph 6.4.1.1 of the Rules;

(3) These Pipes are to be open ended;

(4) These Pipes are to not contain fuel gas or a gas fuel/air mixture, except for the sole purpose of safely purging, venting and bleeding the gas fuel and/or gas fuel/air mixture when isolating gas fuel to consumers; and

(5) The gas-safe machinery space (the spaces in which gas consumers are located) is to be permanently mechanically ventilated.

Vent piping of internal combustion engines is to be of double-walled construction unless single-walled construction is justified in the safety concept of the engine.

CHAPTER 8 FIRE SAFETY

Section 2 FIRE PROTECTION

8.2.1 General requirements

8.2.1.1 ~~Any space containing equipment for the fuel preparation, such as pumps, compressors, heat exchangers, vaporizers and pressure vessels, is~~ Fuel preparation rooms are to be regarded as a machinery space of category A/an essential machinery space for fire protection purposes. Where, fire protection refers to having structural fire protection, exclusive of means of escape.

Section 3 FIRE EXTINGUISHING

8.3.4 Dry chemical powder fire-extinguishing systems

8.3.4.4 In addition to any portable extinguishers that may be required by the Administration, at least one portable dry powder extinguisher of at least 5 kg capacity is to be located near the bunkering station and in the fuel preparation room respectively. For ships constructed before 1 January 2026, the portable dry powder extinguisher is to be provided in the fuel preparation room not later than the first survey on or after 1 January 2026.

CHAPTER 9 EXPLOSION PREVENTION

Section 2 HAZARDOUS AREA CLASSIFICATION

9.2.2 Hazardous area zones

9.2.2.1 Hazardous area zone 0

This zone 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, and interbarrier spaces as defined by paragraph 1.1.2.17(2) of the Rules.

9.2.2.2(1) Hazardous area zone 1

This zone includes, but is not limited to:

(1) tank connection spaces, fuel storage hold spaces^① ~~and interbarrier spaces~~;

① Fuel storage hold spaces for type C independent tanks are normally not considered as Zone 1. For the purposes of hazardous area classification, they are to be considered non-hazardous provided that they do not lead to any hazardous area and all potential leakage sources of type C tanks are located in the tank connection space. However, if containing potential leakage sources, e.g. tank connections, the spaces are to be considered as Zone 1. And if containing bolted hatch to tank connection space, the spaces are to be considered as Zone 2.

CHAPTER 12 CONTROL, MONITORING AND SAFETY SYSTEMS

Section 2 MONITORING AND CONTROL

12.2.1 Bunkering and fuel tanks

12.2.1.1 Level indicators for fuel tanks

(3) Fuel tank liquid level gauges may be of the following types:

- .1 indirect devices, which determine the amount of fuel by means such as weighing or in-line flow metering; or
- .2 closed devices, which do not penetrate the fuel tank, such as devices using radio-isotopes or ultrasonic devices; or
- .3 closed devices, which penetrate the fuel tank ~~(only for ships engaged on domestic voyages)~~, being part of the closed system and capable of preventing gas fuel spillage, such as float-type systems, electronic probes, magnetic probes, differential pressure sensors and bubbler tube type indicator. The device is to be considered tank connection. Where the closed device is not directly installed on the tank, a shutoff valve is to be fitted near the tank as far as practicable.

CHAPTER 13 MANUFACTURE, WORKMANSHIP AND TESTING

Section 3 WELDING OF METALLIC MATERIALS AND NON-DESTRUCTIVE TESTING FOR FUEL CONTAINMENT SYSTEMS

13.3.5 Production weld tests

13.3.5.1 For all fuel tanks and process pressure vessels except membrane tanks, production weld tests are generally to be performed for approximately each 50 m of butt-weld joints and are to be representative of each welding position. For secondary barriers, the same type production tests as required for primary ~~tanks~~ barriers are to be performed, except that the number of tests may be reduced subject to agreement with CCS. Tests other than those specified in 13.3.5.2 to 13.3.5.5 of this Chapter may be required for fuel tanks or secondary barriers.

CHAPTER 14 OPERATION

Section 2 OPERATION

14.2.3 Responsibilities

14.2.3.1 Before any bunkering operation commences, the master of the receiving ship or his representative and the representative of the bunkering source (Persons In Charge, PIC) are to:

(1) agree in writing the transfer procedure, including cooling down and if necessary, gassing up; the maximum transfer rate at all stages; minimum and maximum limiting transfer pressure and temperature; bunkering line PRVs settings; and volume to be transferred;