RULES
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**CHINA CLASSIFICATION SOCIETY**

# RULES FOR CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING LIQUEFIED GASES IN BULK

AMENDMENTS

## 2026

Effective from 1 February 2026

**Beijing**

# CONTENTS

# PART ONE GENERAL

## Chapter A1 GENERAL PROVISIONS

A1.2 In addition to general requirements, ~~applicable chapters or indications for different cargo tanks, cargo containment systems and liquefied carbon dioxide carriers are as follows~~the application or indication of appendices of PART TWO of the Rules is as follows:

(1) Appendix 1 to PART TWO of the Rules — Additional Requirements for Type A and Type B Prismatic Independent Tank Liquefied Gas Carriers;

(2) Appendix 2 to PART TWO of the Rules — Additional Requirements for Type C Independent Tank Liquefied Gas Carriers;

(3) Appendix 3 to PART TWO of the Rules — Additional Requirements for Independent Tank Liquefied Gas Carriers with regard to fatigue strength of the hull structures, cargo tanks and their support structures;

(4) Appendix 4 to PART TWO of the Rules —Applicable Requirements for Ships Dedicated to Carry Liquefied Carbon Dioxide in Bulk;

(5) Appendix 5 to PART TWO of the Rules — Applicable Requirements for reliquefication systems;

(6) Appendix 6 to PART TWO of the Rules — Applicable Requirements for gas combustion units;

(7) Appendix 7 to PART TWO of the Rules — Applicable Requirements for integrated automation systems;

(8) Appendix 8 to PART TWO of the Rules — Applicable Requirements for use of ammonia cargo as fuel;

~~(5)~~(9) For relevant requirements for hull structures and pump towers of membrane tank ~~LNG~~ liquefied gas carriers, see CCS Rules for Classification of Sea-going Steel Ships, PART TWO, Chapter 20 “Membrane Tank ~~LNG~~ Liquefied Gas Carriers”.

# PART TWO CLASSIFICATION SURVEY AND ADDITIONAL REQUIREMENTS FOR HULL STRUCTURE

# Appendix 1 ADDITIONAL REQUIREMENTS FOR CARRIERS WITH INDEPENDENT TYPE A AND TYPE B PRISMATIC TANKS

## Section 3 STRUCTURAL SCANTLING OF INDEPENDENT PRISMATIC TANKS

3.2.8 Where the watertight bulkhead may be subjected to internal hydrostatic pressure $P_{eq}$ on only one side, the bulkhead plating and stiffening and primary supporting members are to comply with requirements of 3.2.1 to 3.2.6. If not affected by the above mentioned loads, thickness of plating is not to be less than the considered height and spacing of frames as required by the boundary of the corresponding tank, and another 0.5 mm is then to be reduced. Section modules of stiffeners and transverse web frames are to comply with requirements of 3.2.3 to 3.2.6 respectively, but the value of $P_{eq}$~~$P_{eg}$~~ need not to exceed that obtained from the following formula:

~~$max\left\{(P_1+\frac{\rho h}{10^5}),0.1(\frac{t-1.0}{126.5s\sqrt{K}})^2\right\}$~~ $max\left\{(P_1+\frac{\rho h}{10^2}),0.1(\frac{t-1.0}{12.65s\sqrt{K}})^2\right\}$ MPa

where: $P_1$ — setting value of vacuum relief valves. in MPa;

$\rho$ — density of liquid, in t/m$^3$;

$h$ — considered height of tank, in m;

$t$ — obtained in accordance with 3.2.1, in mm;

$s$ — spacing of stiffeners, primary supporting members or transverse web frames, in m.

3.2.9 For tank dome structure, where the minimum thickness of 7.5 mm is taken for tank periphery by dome skin plate, the stiffeners and transverse web frames are to comply with requirements of 3.2.3 to 3.2.8, however, the value of $P_{eq}$ is not to be less than the value of the pressure according to the obtained minimum thickness, i.e.:

~~$P_{eq\_min}=\left(\frac{6.5}{126.5\,s\sqrt{K}}\right)^2$~~ $P_{eq\_min}=0.1\left(\frac{6.5}{12.65\,s\sqrt{K}}\right)^2$ MPa

for symbols in the formula, see 3.2.8.

The strength of plating and stiffeners of cargo tank dome structure is also to be able to withstand the greater pressure obtained according to the following provisions:

pressure of port pressure relief valves, or air pressure when cargo tank is to be subject to hydrostatic pressure pneumatic compartment test.

# Appendix 2 ADDITIONAL REQUIREMENTS FOR CARRIERS WITH TYPE C INDEPENDENT TANK

## Section 4 DIRECT CALCULATION OF STRUCTURAL STRENGTH OF TYPE C INDEPENDENT TANK AND SUPPORTING STRUCTURES OF SADDLE

**Load Conditions** **Table 4.7.1**

| Load item / Load Condition | Cargo load | | | Structural self weight | Seawater pressure | Additional load for equilibrium | 1/2 (tank + cargo)forward collision force; longitudinal inertial force | 1/4 (tank + cargo)backward collision force; ~~vertical~~longitudinal inertial force/component force | Static heeling angle of 30o; transverse inertial force/component force | Load in pressure testing |
|---|---|---|---|---|---|---|---|---|---|---|
| | $a_x$ | $a_y$ | $a_z$ | | | | | | | |
| Ultimate Limit State (ULS): Pitch＋Heave | 1.0 | / | 1.0 | 1.0g | 1.0 | 1.0 | / | / | / | / |
| Ultimate Limit State (ULS): Roll＋Heave | / | 1.0 | 1.0 | 1.0g | 1.0 | 1.0 | / | / | / | / |
| Ultimate Limit State (ULS): Pitch＋Roll＋Heave | 0.8 | 0.8 | 0.9 | 1.0g | 1.0 | 1.0 | / | / | / | / |
| Accident Limit State (ALS): Independent condition (1) | / | / | / | 1.0g | / | / | 0.5g | / | / | / |
| Accident Limit State (ALS): Independent condition (2) | / | / | / | 1.0g | / | / | / | -0.25g | / | / |
| Ultimate Limit State (ULS): Independent condition (3) | / | / | / | 0.87g | / | / | / | / | 0.5g | / |
| Accident Limit State (ALS): Independent condition (4) | / | / | / | 1.0g | / | / | / | / | / | 1.0 |

Notes: ① $a_x$, $a_y$, $a_z$ — the respective components of acceleration due to ship motions obtained according to 4.28.2 in Chapter 4 of PART THREE of the Rules and taken as the inertial acceleration of cargo tanks and cargos for simplification.

② The values in the Table are the coefficients of the load combinations (self-weight and inertial force have been considered in gravity acceleration).

# Section 5 DIRECT STRENGTH CALCULATIONS FOR TYPE C INDEPENDENT TANK AND CONNECTED SUPPORTING STRUCTURES

## 5.1 General requirements

5.1.3 As an alternative to this Appendix, finite element yielding strength assessment of type C independent tanks may also be carried out in accordance with CCS Guidelines for Yielding Strength Assessment of Type C Independent Tanks based on LRFD Criteria, and notation 'LRFD' may be assigned when satisfied.

# Appendix 6 APPLICABLE REQUIREMENTS FOR GAS COMBUSTION UNITS

## Section 11 FIRE EXTINGUISHING SYSTEM

11.1 The compartment described in 2.3.1(2) of this Appendix is to comply with requirements for machinery space of category A in ~~be provided with a fixed fire extinguishing system complying with~~ SOLAS regulation II-2/10 ~~Chapter II-2, PART SIX of CCS Rules for the Classification of Sea-going Steel Ships and Chapter 11, PART THREE of the Rules~~.

# Appendix 7 APPLICABLE REQUIREMENTS FOR INTEGRATED AUTOMATION SYSTEMS

## Section 1 GENERAL PROVISIONS

### 1.1 General requirements

1.1.1 This Appendix applies to the design, manufacture, plan approval, and survey of integrated automation systems (IAS) on liquefied natural gas (LNG) carriers.

1.1.2 When LNG carriers are fitted with the IAS, the relevant requirements specified in 13.8 to 13.9 , Chapter 13 of PART THREE of the Rules are to be satisfied.

1.1.3 The IAS are at least to satisfy the relevant cyber security requirements for SL0 in Chapter 2 of CCS Guidelines for Ship Cyber Security.

1.1.4 The IAS are to be provided with an uninterruptible power supply (UPS) as a backup power supply. In case of failure of the power supply of the IAS, audible and visual alarms are to be given.

1.1.5 The IAS may be assigned the "IAS(c)" notation subject to compliance with the requirements of this Appendix.

1.1.6 Other types of liquefied gas carriers, e.g. liquefied petroleum gas carriers, ethane carriers, and ethylene carriers, may refer to the requirements of this Appendix for implementation. The "IAS(c)" notation may be assigned subject to assessment by CCS.

### 1.2 Objectives and functional requirements

1.2.1 The IAS is to support the control of onboard cargo transfer systems, ship-to-ship cargo transfer systems, ship loading and unloading operations, and emergency shutdown functions.

1.2.2 The IAS is to safely perform intended functions.

1.2.3 The IAS is to display the operational status of the system and send alarms to watchkeeping personnel when operating conditions or performance deviate from expected parameters.

1.2.4 In the event of an emergency or failure of remote control functions, alternative measures are to be provided to ensure safe operation of the system.

1.2.5 The IAS is to provide safety and operability equivalent to local control.

1.2.6 The IAS is to be designed in accordance with the fail-safe principle. In the event of a fault that might endanger personnel, equipment on board, or the environment, the IAS is capable of automatically placing controlled equipment into a safe protective state.

1.2.7 Subsystems of the IAS may operate independently to perform different functions, and a single failure in one subsystem is not to cause failure of other subsystems.

1.2.8 The IAS is to be fitted with a sound human-machine interface, so as to avoid inadvertent operation caused by improper arrangement of equipment.

1.2.9 In order to achieve the above objectives, the design, manufacture, and maintenance of the IAS are to comply with the following functional requirements:

(1) All control systems, manual emergency control systems, and safety systems are to be designed according to the fail-safe principle to prevent subsequent hazards arising from a single failure.

(2) In the event of a failure of any module, device, or subsystem within the IAS, an alarm signal is

to be output, and functions other than those directly dependent on the failed part are not to be affected.

(3) Redundant and interchangeable computer system hardware is to be provided onboard to prevent loss of monitoring and control capabilities of the IAS.

(4) Independent alternative control methods are to be provided to prevent the loss of critical functions of the IAS.

(5) Operation records such as equipment operation and parameter adjustment, as well as data records of equipment parameters, are to be provided.

### 1.3 Drawings and data to be submitted

1.3.1 For product approval and survey, the necessary drawings and information are to be submitted to CCS in accordance with the certification requirements for the IAS specified in Appendix 1D of Chapter 3, PART ONE of CCS Rules for Classification of Sea-going Steel Ships, and relevant CCS requirements for product approval of the IAS.

1.3.2 Drawings and information to be submitted for review during the onboard installation, testing and survey phases:

1.3.2.1 Drawings for approval

(1) General arrangement of the IAS;

(2) Wiring diagram of the IAS (including power supply);

(3) Onboard testing program (on-site approval);

(4) List of control, monitoring and alarms (including safety system);

(5) Other drawings and information deemed necessary by CCS.

1.3.2.2 Drawings for information

(1) System instructions (including system composition, logic control (display, alarm, and control), system functions);

(2) Risk assessment report;

(3) Operation and maintenance instructions (to be kept onboard).

## Section 2 CONTROL, MONITORING AND ALARM

### 2.1 Control

2.1.1 The IAS is to be capable of maintaining cargo tank pressure and temperature within the limits specified by the containment system design and/or cargo carriage requirements by controlling relevant systems and equipment. The requirements for cargo pressure and temperature control are to be in accordance with Chapter 7 of PART THREE of the Rules.

2.1.2 When cargo loading and unloading operations are performed by the IAS via remotely controlled valves and pumps, all control devices and indicators related to the cargo tanks are to be fitted at one control location.

2.1.3 Overflow control of the IAS is to comply with 13.3.1 to 13.3.4 and 13.3.7 of Chapter 13 of PART THREE of the Rules.

2.1.4 When a gas combustion unit or reliquefication system is fitted, the IAS is to have the capability to control these systems.

### 2.2 Monitoring and alarm

2.2.1 The IAS is to be capable of displaying cargo liquid level, pressure, and temperature, and it may display signals from pressure gauges and temperature indicators fitted on liquid and vapor piping systems as well as on cargo refrigeration units (if any).

2.2.2 Instruments of the IAS are to comply with the requirements of 13.1.3, 13.2.1, 13.2.3, 13.3.1, 13.3.5, 13.4.2 to 13.4.7, 13.5.1 to 13.5.3, 13.6.1 to 13.6.4, 13.6.7, 13.6.9 to 13.6.18, and 13.7.1 to 13.7.2 of Chapter 13 of PART THREE of the Rules, and acquire the corresponding indication or alarm signals.

## Section 3 EMERGENCY SHUTDOWN

### 3.1 Cargo emergency shutdown function

3.1.1 The IAS is to have the function of cargo emergency shutdown and comply with relevant requirements of 18.10 of PART THREE of the Rules.

## Section 4 SURVEYS

### 4.1 General Requirements

4.1.1 This Section specifies the requirements for the survey of the IAS during its manufacturing process at the manufacturer, as well as the requirements for installation, testing and survey on board.

### 4.2 Testing and survey at the manufacturer

4.2.1 When conducting surveys at the manufacturer, the CCS surveyor is to:

(1) Confirm that the factory producing, manufacturing or repairing the IAS or its major components has and effectively implements a quality control program covering design, procurement, manufacturing and testing (if applicable), and that this program complies with recognized standards applicable to its products (for type approval);

(2) Review material certificates/documentation, such as verifying compliance with the relevant requirements of PART SEVEN of CCS Rules for Classification of Sea-going Steel Ships;

(3) Verify that all certified safety systems, automation systems, control consoles, instruments and control panels comply with the approved drawings.

4.2.2 Prior to delivery of the IAS, the following test items are to be carried out to satisfy design requirements:

(1) Checking human-machine interface (HMI) display;

(2) Checking system functions;

(3) Checking interlocks;

(4) Communication tests with all subsystems (if any);

(5) Checking and testing system performance(including system fault recovery, hardware

redundancy, alarm processing and acknowledgment, etc.);

(6) Checking the content of the test items (including document review, hardware and software inventory checks, etc.);

(7) Pressure test and insulation test (if applicable).

## 4.3 Onboard survey

4.3.1 During onboard installation and testing, CCS surveyor is to carry out the following surveys to the IAS and associated systems:

(1) Confirming that external electrical wiring and connections comply with CCS rules;

(2) Functional tests;

(3) Survey of system self-check and alarms;

(4) Survey of communication between system I/O signals;

(5) Checking that the operation and maintenance manual is provided on board.

# Appendix 8 APPLICABLE REQUIREMENTS FOR USE OF AMMONIA CARGO AS FUEL

## Section 1 GENERAL PROVISIONS

1.1 This Appendix applies to gas carriers as defined in SOLAS regulation VII/11.2 using ammonia cargo as fuel and complying with PART THREE of the Rules, which is a supplement to the existing provisions of chapter 16 of PART THREE of the Rules.

1.2 For the purposes of this Appendix and application of chapter 16 of PART THREE of the Rules, ammonia fuel consists of anhydrous ammonia as listed in chapter 19 of PART THREE of the Rules. It can be in either a liquefied or gaseous state. Ammonia in the liquefied state is referred to as ammonia liquid, and ammonia in the gaseous state is referred to as ammonia vapour. References to "gas" in the requirements in chapter 16 of PART THREE of the Rules are to be taken as referring to ammonia, in liquid or gaseous state.

1.3 The ammonia fuel storage and distribution systems design and arrangements should be in accordance with the requirements of Chapter 1, PART THREE of the Rules and the special requirements for ammonia as given in 17.12 of chapter 17. The requirements of 14.4, 17.2.1 and 17.12 of the Rules, indicated as required for carriage of anhydrous ammonia by chapter 19 of PART THREE of the Rules, should also be applicable for the carriage, containment, distribution and use of ammonia as fuel.

1.4 An ammonia fuel consumer is any unit within the ship using cargo ammonia vapour or liquid as a fuel.

1.5 An ammonia fuel preparation room means any space containing pumps, compressors, treatment systems or vaporizers for ammonia fuel preparation purposes and should be considered as a cargo machinery space in accordance with 1.2.10 of PART THREE of the Rules.

1.6 An ammonia release mitigation system is a system that processes ammonia released from the fuel supply system.

## Section 2 GOAL

2.1 The goal of this Appendix is to ensure safe and reliable operation of fuel supply systems and consumers for use of ammonia cargo as fuel.

## Section 3 FUNCTIONAL PROVISIONS

3.1 All ammonia fuel storage and processing equipment should be located within the cargo area as defined in 1.2.7 of chapter 1 of PART THREE of the Rules.

3.2 A single failure in the ammonia fuel system(s) should not lead to a release of ammonia

outside the cargo area.

3.3 Ammonia fuel preparation rooms may be combined with cargo machinery spaces subject to a risk assessment taking into account any high-pressure fuel preparation equipment leakage.

3.4 Effectiveness of the ventilation and detection for ammonia leakage should be ensured taking into account the characteristics and physical properties of ammonia.

3.5 The ammonia fuel characteristics and physical properties should be suitable for operation of the fuel consumer.

3.6 Fuel supply systems should be designed to prevent fuel from unintended phase changes in the processing of the fuel supply to consumers, considering temperature and pressure at the design conditions.

3.7 The uncontrolled and direct release of ammonia may only occur in emergency situations in accordance with 7.1.3 of chapter 7 of PART THREE of the Rules.

*CCS 3.7 Emergency situations mean:*

*(1) Situations necessary for safeguarding ship safety or safety of life at sea; or*

*(2) Situations resulting from damage to the ship or its equipment;*

*(3) Situations where special pollution incidents are dealt with to minimize pollution damage, as approved by the Administration.*

3.8 Fire detection, protection and extinction measures appropriate to the hazards concerned should be provided.

## Section 4 SUPPLEMENTARY GUIDANCE TO THE PROVISIONS OF CHAPTER 16 OF PART THREE

4.1 In addition to the requirements of 18.7 of chapter 18 of PART THREE of the Rules, the crew should receive appropriate ship- and equipment-specific familiarization.

4.2 In accordance with the principles of 16.9 of chapter 16 of PART THREE of the Rules, [①] ammonia cargoes may be consumed in machinery spaces of category A. In these spaces, it may be consumed only in boilers, internal combustion engines, gas combustion units, gas turbines or other devices designed to consume ammonia as fuel.

4.3 The ammonia fuel supply systems and ammonia fuel consumers should be designed for operation considering the characteristics and physical properties of all possible specified compositions of the ammonia. Information about the range of acceptable specifications for ammonia fuel should be available on board.

4.4 The exposed exterior surfaces of ammonia fuel supply piping including double-wall piping should be identified in accordance with recognized standards.

4.5 Each ammonia fuel consumer should have a separate exhaust system and exhibit no external visible flame.

4.6 The supply piping and, if applicable, return piping of each consumer should be provided with an isolation valve in accordance with 16.4.5 of chapter 16 of PART THREE of the Rules. With regard to valves:

[①] Refer to MSC.1/Circ.1681 on Voluntary early implementation of the amendments to chapter 16 of the IGC Code, adopted by resolution MSC.566(109).

(1) the function of one of the shut-off valves in series and the bleed valve can be incorporated into one valve body, so arranged that the flow to the consumer will be blocked and the ventilation opened; and

(2) the two valves should be of the fail-to-close type, while the bleed valve should be fail-to-open.

4.7 The ammonia fuel consumers should be designed to prevent the unintended accumulation of ammonia. A design assessment of the ammonia fuel consumer should be carried out by using Failure Mode and Effects Analysis (FMEA) or equivalent engineering method.

# Section 5 ADDITIONAL PROVISIONS

## 5.1 Risk assessment

5.1.1 A risk assessment should be conducted for the entire ammonia fuel system design and arrangements to document that the same level of safety as natural gas is achieved. The risk assessment should also cover the ammonia fuel arrangements installed in the cargo area to document the same level of safety as when utilizing ammonia as cargo. Consideration should be given to the hazards associated with the arrangement, operation and maintenance of the fuel system, considering all reasonably foreseeable failures.

5.1.2 The risk assessment should address the consequences of fuel leakage, considering the properties of ammonia, taking into account ammonia toxicity and corrosivity and its accumulation or escape into adjacent areas and spaces. The risk assessment should specifically consider the ammonia fuel system integrity with focus on its ability to prevent and isolate leakages and also evaluate potential toxicity hazards, ignition mechanisms and consequences of ignition. Special consideration should be given, but not limited to, the following specific ammonia-related hazards and topics:

(1) toxic ammonia releases, leakages or spills from a single failure of the ammonia fuel supply system or operation of the ammonia release mitigation system and their consequences including, but not limited to, dispersion of emergency toxic releases to the atmosphere, the accumulation of ammonia vapours and their spreading throughout the ship's spaces via openings, access to life-saving appliances, muster stations and access to escape routes or the formation of alkaline solutions when contacted with water;

(2) gas detector locations, sample points and suitability for detecting required toxicity levels;

(3) ventilation arrangements, particularly the relative density and dispersion of any potential ammonia releases;

(4) the location of double wall fuel piping ventilation inlets and outlets;

(5) risks associated with any ammonia fuel storage tank locations, such as the open deck;

(6) the impact of reactions of ammonia with water and mitigation provided by water spray systems;

(7) risks associated with drip trays, bilge systems or holding tanks for ammonia-contaminated water;

(8) the location for leak detection in the ammonia fuel system is to be assessed by means of a gas dispersion analysis where gas could be present outside the cargo area. The gas dispersion analysis should consider the implications for both toxicity and flammability;

(9) fuel supply system vent arrangements, including the possibility of two-phase release from any pressure relief system and the requirement for blowdown vessels;

(10) arrangements for closed fuel return and vent systems, together with associated arrangements for ammonia capture and treatment;

(11) arrangements for purging and inerting, including proposed alternatives to nitrogen as the inerting media;

(12) control, monitoring and safety system failure modes and conditions, considering criticality and safety requirements;

(13) fail-safe positions of all remotely operated valves in the ammonia fuel system;

(14) risks associated with the chosen exhaust gas abatement technology and piping between the consumers and such equipment; and

(15) risk of mechanical damage to the fuel piping and fuel supply system in accordance with 16.4.1.1, Chapter 16 of PART THREE of the Rules.

5.1.3 Risks which cannot be eliminated should be mitigated as necessary. Details of risks, and the means by which they are mitigated, should be documented.

## 5.2 Arrangements of spaces containing ammonia fuel consumers

5.2.1 Machinery spaces with ammonia-fuelled machinery should be gas-safe machinery spaces.

*CCS 5.2.1 Gas-safe machinery space means a machinery space so arranged that the space is considered gas-safe under all circumstances (including both normal and abnormal circumstances), i.e., inherently gas-safe. A single failure of a gas-safe machinery space should not lead to the leakage of gas fuel into the space.*

5.2.2 A single failure of fuel systems in the machinery space should not lead to a gas release in the machinery space.

5.2.3 Fuel piping should be of double wall design or ducted and the outer boundary should be continuous and gas tight in the space. Non-continuous double barriers should not be used in the machinery space.

5.2.4 In accordance with 3.2 of chapter 3 of PART THREE of the Rules, direct access from a space containing ammonia fuel consumers to an ammonia fuel supply system space or ammonia fuel preparation room should not be permitted.

## 5.3 Ammonia fuel supply

5.3.1 Where fuel supply systems supply ammonia liquid, the venting and purging systems should drain to dedicated tanks, gas-liquid separator or similar device. Heating arrangements for the gas-liquid separator may be required when ship is operating in cold areas.

5.3.2 The use of expansion joints and bellows should be kept to a minimum outside the cargo area. Engine mounted expansion joints may be accepted based upon evaluation as reflected in the safety concept of the engine.

5.3.3 Where gaseous ammonia fuel is supplied to an ammonia fuel consumer, provisions should be made to prevent ammonia condensate from entering the consumer.

5.3.4 Except in an emergency, the release of ammonia directly to the atmosphere from the ammonia fuel supply system should be avoided.

5.3.5 The fuel supply system should include ammonia release mitigation system capable of collecting and handling ammonia releases, including but not limited to:

(1) bleed from double block and bleed valves; and

(2) releases from purging and draining operations of fuel pipes.

5.3.6 Where dedicated ammonia fuel tanks or service tanks are installed, the pressure and temperature of ammonia should be maintained within the tank design range at all times in accordance with chapter 7 of PART THREE of the Rules. Venting of fuel vapour for control of the tank pressure should not be acceptable except in emergency situations.

5.3.7 In application of 16.4.3 of chapter 16 of PART THREE of the Rules, the ventilation inlets for the double-wall piping or ducts should be in a safe location outside the engine-room. Ventilation outlets for the double-wall piping or ducts should be in a safe location in the cargo area. Inerting of the annular space may be accepted as an alternative to ventilation.

*CCS 5.3.7 Safe location means non-hazardous area defined in 1.2.25, Chapter 1, PART THREE of the Rules.*

5.3.8 The ammonia fuel treatment or ammonia release mitigation system should be arranged to be independent of any other water treatment or bilge systems and arranged to collect residues or ammonia-contaminated water in appropriate holding tanks for further processing.

5.3.9 Ammonia release mitigation system should be capable of reducing the ammonia vapour concentrations below 110 ppm, unless otherwise provided by the Administration. The capacity and operating conditions should be established as part of the risk assessment, considering the operating profile of the ship.

## 5.4 Fuel plant ventilation and liquid/gas detection

5.4.1 The ammonia fuel preparation room should, as far as practicable, have an independent access direct from the open deck. Where a separate access from the deck is not practicable, an airlock which complies with 3.6 of chapter 3 of PART THREE of the Rules should be provided.

5.4.2 The access or other openings to spaces containing fuel sources of release should be arranged so that flammable, asphyxiating and/or toxic gas cannot escape into spaces that are not appropriately zoned.

5.4.3 In addition to the requirements of 16.3.1 and 16.5.1 of chapter 16 of PART THREE of the Rules, special consideration should be given to the density, toxicity, corrosivity and lower explosion limit (LEL) of ammonia vapour. Ventilation capacity, including the ventilation inlet and outlet locations, should be supported by numerical calculations, such as a computational fluid dynamics (CFD) analysis. Ammonia fuel preparation rooms should be fitted with ventilation arrangements ensuring that the space can withstand any pressure or vacuum caused by vapourization of the liquefied fuel.

5.4.4 For ammonia fuel preparation room(s), the requirements of 12.1.8 of chapter 12 of PART THREE of the Rules should apply.

5.4.5 The arrangements and ventilation of ammonia fuel preparation rooms should be designed to minimize the accumulation of gases or formation of gas pockets.

5.4.6 A fixed ammonia gas detection system should be installed at the locations specified in 13.6.2 of chapter 13 of PART THREE of the Rules. In addition, fixed ammonia gas detection should be provided in the following locations:

(1) enclosed spaces containing fuel piping or other fuel handling equipment;

(2) ventilation inlets to accommodation and machinery spaces based on a risk assessment required by 5.1.2 of this Appendix; and

(3) ventilated annular spaces of double-wall piping identified in 5.2.3 of this Appendix.

5.4.7 Portable detection equipment, permitted by 13.6.5 of chapter 13 of PART THREE of the Rules, should not be used as an alternative to a permanently installed system.

5.4.8 In addition to the requirements of 14.4.3 of chapter 14 of PART THREE of the Rules, decontamination showers and eyewash stations should be available in the following locations:

(1) near the exits from ammonia fuel preparation rooms; and

(2) in machinery spaces containing ammonia fuel consumers.

5.4.9 The ammonia fuel preparation room should be provided with bilge wells incorporating a high-level alarm. The bilge system should be segregated from other bilge systems.

*CCS 5.4.9 The bilge system fitted in areas where cargo ammonia may be present should be segregated from areas free of cargo ammonia.*

**5.5 Alarms and shutdowns**

5.5.1 Remote stops should be provided in accordance with 16.5.2 of chapter 16 of PART THREE of the Rules. In addition, remote stops should be provided adjacent to ammonia fuel preparation rooms.

5.5.2 For enclosed spaces containing ammonia fuel equipment, where personnel can be present, fixed gas detection shall be continuous.. An audible and visual alarm should be provided in the space, in accordance with 13.6.13 of chapter 13 of PART THREE of the Rules, to indicate the presence of ammonia vapour. The alarm setpoint should be 25 ppm, unless otherwise provided by the Administration, and stated in the document required by 18.2 of chapter 18 of PART THREE of the Rules.

*CCS 5.2 Ammonia fuel equipment means fuel piping or equipment involved in transfer, handling and use of ammonia fuel.*

5.5.3 The leak detection system required by 16.4.2 of chapter 16 of PART THREE of the Rules should be described in a safety concept and enable continuous monitoring of the fuel piping system to provide suitable information to the crew.

5.5.4 The alarm and shut down required by 16.4.8 of chapter 16 of PART THREE of the Rules should be determined by a risk assessment which includes the health and safety of the crew. The setpoint for alarm and shut down should comply with the applicable requirements of Table 1 of MSC.1/Circ1687, unless otherwise provided by the Administration.

**5.6 Combustion equipment**

5.6.1 A safety concept should be developed for all ammonia fuel consumers and approved by CCS.

5.6.2 The ammonia concentration of fuel consumers exhaust gases released to atmosphere should not present a health hazard at the point of release. The explosion venting of ammonia fuel consumers should be led away from where persons may normally be present.

5.6.3 In addition to demonstrating that the potential explosion hazards have been considered, the safety concepts for the ammonia fuel consumers should also take account of the toxic injury potential and should document the arrangements to prevent toxic injury.

5.6.4 The ammonia fuel supply system to each consumer, downstream of the master gas fuel valve, should be purged automatically outside the cargo area when the master gas fuel valve is shut by a safety action. The purged gas should be led to the ammonia release mitigation system.

5.6.5 For the purpose of maintenance of the ammonia consumers or ammonia fuel supply systems, a suitable purging system should be provided to ensure that they are purged to a level that does not present a health hazard. Compatibility of the purging medium with ammonia should be demonstrated. Arrangements for fuel purging and venting should be in accordance with 3.6, 4.6 and 5.3.1 of this Appendix.

5.6.6 Gas turbines should be fitted within a gastight enclosure unless fuel supply piping meets the requirements of 16.4.3 of chapter 16 of PART THREE of the Rules and with the additional requirements indicated in this Appendix. The consequences of gas leakage should be evaluated based on the risk assessment in 5.1 of this Appendix.

# PART THREE THE INTERNATIONAL CODE FOR THE CONSTRUCTION AND EQUIPMENT OF SHIPS CARRYING LIQUEFIED GASES IN BULK

# CHAPTER 11 FIRE PROTECTION AND EXTINCTION

### 11.4 Dry chemical powder fire-extinguishing systems

11.4.4 The capacity of a monitor shall be not less than 10 kg/s. Hand hose lines shall be non-kinkable and be fitted with a nozzle capable of on/off operation and discharge at a rate not less than 3.5 kg/s. The maximum discharge rate shall allow operation by one man. The length of a hand hose line shall not exceed 33 m. Where fixed piping is provided between the powder container and a hand hose line or monitor, the length of piping shall not exceed that length which is capable of maintaining the powder in a fluidized state during sustained or intermittent use, and which can be purged of powder when the system is shut down. Hand hose lines and nozzles shall be of weather-resistant construction or stored in weather resistant housing or covers and be readily accessible.

# CHAPTER 12 ARTIFICIAL VENTILATION IN THE CARGO AREA

## 12.1 Spaces required to be entered during normal cargo handling operations

12.1.7 Electric motors' driving fans shall be placed outside the ventilation ducts that may contain flammable vapours. Ventilation fans shall not produce a source of ignition in either the ventilated space or the ventilation system associated with the space. For hazardous areas, ventilation fans and ducts, adjacent to the fans, shall be of non-sparking construction, as defined below:

.1 impellers or housing of non-metallic construction, with due regard being paid to the elimination of static electricity;

.2 impellers and housing of non-ferrous materials;

.3 impellers and housing of austenitic stainless steel; and

.4 ferrous impellers and housing with design tip clearance of not less than 13 mm.

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

# CHAPTER 16 USE OF CARGO AS FUEL

## 16.9 Alternative fuels and technologies

16.9.2 ~~The use of cargoes identified as toxic products shall not be permitted.~~ The use of cargoes requiring carriage in type 1G ships, as identified in column "c" in the table of chapter 19, shall not be permitted. If acceptable to the Administration, cargoes identified as toxic products in column "f" which are required to be carried in type 2G/2PG ships in column "c" in the table of chapter 19 may be used as fuel, provided that the same level of safety as natural gas (methane) is ensured in accordance with the relevant provisions of this Code, including those in 1.3, and taking into account the guidelines developed by the Organization[①], after special consideration has been given by the Administration.

[①] Refer to the guidelines to be developed by IMO.