



CHINA CLASSIFICATION SOCIETY

**RULES FOR LIQUIFIED NATURAL  
GAS BUNKERING SHIPS**

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# CHAPTER 1 GENERAL

## Section 1 GENERAL PROVISIONS

### 1.1.1 General requirements

1.1.1.1 The Rules for Liquefied Natural Gas Bunkering Ships (hereinafter referred to as the Rules) apply to the ships which are provided with liquefied natural gas (LNG) containment and bunkering systems and bunker LNG for other ships as fuel.

1.1.1.2 In addition to the requirements of the Rules, sea-going LNG bunkering ships are to comply with the relevant requirements of CCS Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk, and LNG bunkering ships navigating in inland waterways are to comply with the relevant requirements of CCS Rules and Regulations for the Construction and Equipment of Inland Waterways Ships Carrying liquefied Gases in Bulk.

1.1.1.3 For ships combining the functions of bunkering oil fuel having a flashpoint more than 60°C (closed-up test) and LNG, the cargo oil areas are to comply with the relevant requirements for oil tankers of CCS rules.

1.1.1.4 The ship is to be designed according to the water environmental conditions for bunkering, and the operational constraints are to be specified in the safety operation manual.

### 1.1.2 Materials

1.1.2.1 The materials used for LNG tanks, bunkering equipment, pipes, fittings and any part which contacts with LNG or its low temperature boil-off gas are to be suitable for the temperature and pressure. In addition to the requirements of the Rules, the materials are to comply with the relevant requirements of CCS Rules for Materials and Welding and 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.

### 1.1.3 Risk analysis

1.1.3.1 Where a design and/or an arrangement not covered in the Rules are/is adopted on board ships, the ship is to be subjected to a risk analysis, and the analysis report is to be approved by CCS.

## Section 2 DEFINITIONS

1.2.1 Unless expressly specified in this Chapter, the relevant definitions of CCS Rules for Materials and Welding and Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk and Rules and Regulations for the Construction and Equipment of Inland Waterways Ships Carrying liquefied Gases in Bulk apply to the Rules.

1.2.1.1 A *bunkering ship* means a self-propelled ship which is provided with a LNG containment system and bunkering system and bunkering ships LNG for other ships as fuel.

1.2.1.2 A *receiving ship* is a ship receiving the fuel supply from a bunkering ship.

1.2.1.3 A *bunkering system* means a system consisting of transfer equipment, supercharging devices (if any), connecting equipment and related lines for bunkering LNG fuel.

1.2.1.4 *Connecting equipment* means equipment connecting a bunkering ship to a receiving ship for bunkering LNG fuel, normally including flexible connecting equipment and loading arms.

1.2.1.5 *Flexible connecting equipment* means connecting equipment normally consisting of flexible hoses, hose handling equipment (davits/brackets), bunkering joints and breakaway couplings etc.

1.2.1.6 *A loading arm* means connecting equipment generally consisting of columns, arms, rotating joints, emergency release systems, bunkering joints and rigid pipes etc.

1.2.1.7 *A business room* means a room where the procedure is dealt with for bunkering the fuel.

1.2.1.8 *ESD* means emergency shutdown.

## **Section 3 CHARACTERS OF CLASSIFICATION AND CLASS NOTATIONS**

### **1.3.1 General requirements**

1.3.1.1 The ship requesting to be classed with CCS is to comply with the provisions of the Rules and the relevant requirements of PART ONE of CCS Rules for Classification of Sea-going Steel Ships or Regulations for Classification of Sea-going Ships on Domestic Voyages or Regulations for Classification of Inland Waterways Ships.

### **1.3.2 Characters of classification**

1.3.2.1 The hull (including equipment) and machinery (including electrical installations) of a ship that are classed with CCS will be assigned appropriate characters of classification by CCS according to the relevant provisions of PART ONE of CCS Rules for Classification of Sea-going Steel Ships or Regulations for Classification of Sea-going Ships on Domestic Voyages or Regulations for Classification of Inland Waterways Ships.

### **1.3.3 Class notations**

1.3.3.1 The ship complying with the requirements of the Rules and requesting to be classed with CCS may be assigned the class notation mentioned in Table 1.3.3.1, which is to be added after its type notation “Liquefied Gas Carrier” specified by CCS.

**Table 1.3.3.1**

Class notation	Description		Technical requirements to be complied with
LNG Bunkering Ship	LNG bunkering ships	Ships having the function of bunkering LNG fuel.	Rules for Liquefied Natural Gas Bunkering Ships

## **Section 4 SURVEYS OF SHIPS**

### **1.4.1 General requirements**

1.4.1.1 The surveys of bunkering ships consist of surveys during and after construction,

and surveys after construction consist of annual, intermediate and special surveys etc.

1.4.1.2 For preservation of procedures, methods, types and intervals of surveys, conditions and preparations for surveys, inspection and test requirements, plans, documents, certificated, records and reports, those not covered in this Chapter are to comply with the relevant provisions for liquefied gas carriers of CCS Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk for sea-going bunkering ships or CCS Rules and Regulations for the Construction and Equipment of Inland Waterways Ships Carrying liquefied Gases in Bulk for inland waterways bunkering ships.

#### 1.4.2 Surveys during construction

1.4.2.1 In addition to the requirements for surveys during construction for liquefied gas carriers of the relevant rules of CCS, the following items are to be carried out:

- (1) Examination of arrangement of LNG bunkering systems and equipment;
- (2) Installation and testing (if applicable ) of LNG tanks, including saddles;
- (3) Examination of the vacuum of LNG tanks (if applicable );
- (4) Examination of the safety accessories of LNG tanks, including safety equipment, alarms and pressure relief valves etc.;
- (5) Surveys and tests for installation of ventilations systems in hazardous areas;
- (6) Surveys and tests for installation of bunkering systems, including LNG pumps, connecting equipment, valves and pipes etc.;
- (7) Surveys and tests for installation of make-up systems, including LNG pumps (if applicable), valves and pipes etc.;
- (8) Surveys and tests for installation of ESD equipment;
- (9) Examination of the location and number of gas probes and tests for gas detection and alarm systems;
- (10) Confirmation and safety check of explosion-proof or anti-ignition equipment;
- (11) Surveys and tests for installation of fire protection and extinction arrangements;
- (12) Examination of lightning protection, anti-static and stray current protection equipment;
- (13) Confirmation of carriage of flammable gas detection systems and portable gas detection equipment.

1.4.2.2 The following essential documents are to be on board ships upon verification:

- (1) Safety operation manual;
- (2) Drawings and documents related to bunkering operation;
- (3) Specifications of cryogenic protection and emergency discharge;
- (4) Personnel training record books;
- (5) Emergency response plans.

#### 1.4.3 Surveys after construction

1.4.3.1 General requirements

(1) An annual survey is normally fit to be carried out during bunkering operations, and so unless specially expressed in the Rules, gas-freeing is not required for a LNG tank or inerted hold.

(2) An intermediate survey is normally not to be carried out during loading/unloading or bunkering operation, and is to be carried out after gas freeing.

(3) A special survey is normally to be carried out at dry-docking after gas freeing.

#### 1.4.3.2 Annual surveys

(1) Examining the operation record of gas systems since the last survey to confirm the performance of the system in the past and assess whether an abnormal condition will be displayed during operation. The gas evaporation rate and inert gas consumption of the tank are needed to be considered;

(2) Examining cargo pump, compressor and control rooms;

(3) Vacuum insulated type C independent tanks (if applicable)

⊕ Examining compliance with the requirements for the color, color banding, words and their color and marking figures on the tank. Examining the clarity of writing, integrity of the contents and fastness of the tank nameplate.

⊕ Examining the good working condition of level indicators for cargo tanks and the satisfactory of high liquid level alarms and automatic shut-off systems at a high level;

⊕ Examining the maximum opening pressure setting;

⊕ Examining the satisfactory of pressure and temperature indicating devices as well as associated alarms;

⊕ Examining tank shells, external pipes and valves for denudation, corrosion, scrape, depression, deformation, weld defects, frosting or sweating etc.;

⊕ Visually inspecting the integrity of tank shells and high-stress areas (including welds);

⊕ Confirming the safety operation procedure of cargo tanks being on board, including safety control for main valves, level-volume tables, emergency isolation for pressure relief valves and precooling requirements etc.;

⊕ Examining the vacuum of cargo tanks;

⊕ Visually examining explosion-proof equipment of cargo tanks;

⊕ Examining connecting bolts between the cargo tank and its seating.

(4) Examining the satisfactory of manual emergency shutdown systems and automatic shut-off of LNG pumps;

(5) Examining the satisfactory of fixed deck foam systems (if applicable);

(6) Examining the practical operation condition of LNG pumps and appearances of their sumps (if applicable);

(7) Loading arms (if applicable)

⊕ Examining general condition of loading arms;

⊕ Visually examining the pipes of loading arms;

⊕ Checking the tightness of the pipes of loading arms;

⊕ Effectiveness tests for emergency release systems;

⊕ Examining the lubricating of slewing bearings, primary sealing of rotating joints, resistance of insulated flanges and stretching of main drive wireropes;

(8) Flexible connecting equipment (if applicable)

⊕ Examining the integrity of bunkering hoses;

⊕ Confirming the bunkering hose for damage and defects;

⊕ Pressure tests at the pressure of up to the maximum working pressure of LNG pumps or pressure relief setting;

⊕ Checking that the flanged joints of bunkering hoses are intact and the determination of insulation resistance is satisfied;

- ⊗ Checking that the breakaway couplings are intact;
  - ⊗ Checking that the end joints of hoses are intact;
  - ⊗ Checking that the davits/brackets of hoses are intact.
- (9) Examining personnel protection, safety and emergency equipment;
- (10) confirming that the technical documents, such as the safety operation manual required in 1.4.2.2 of this Chapter, are kept on board, and checking the relevant records; ;
- (11) Effectiveness tests for LNG systems, and visual examination of LNG lines and related equipment, such as bunkering pipes, LNG pumps, heat exchangers and loading arms or hoses during bunkering or refilling operations.

#### 1.4.3.3 Intermediate surveys

- (1) The survey items specified in 1.4.3.2 of the Rules;
- (2) Examination of the condition of LNG tanks and process piping as well as liquid-nitrogen (if any), ballast, stripping and ventilation piping so far as practicable. If upon examination there is any doubt as to the condition of the piping, the piping may be required to be pressure tested, thickness measured or both;
- (3) Examination of the drainage arrangements of ventilation piping;
- (4) Confirmation of safety earthing of cargo pipes and independent tanks;
- (5) Examination of the pressure-measuring systems and related alarms installed on cargo bunkering and refilling pipes and in cargo tanks;
- (6) Confirmation of the effectiveness of the circuit of liquid level alarms of cargo tanks, if applicable;
- (7) Confirmation of the effectiveness and fitness of devices measuring the content of oxygen and portable gas detection equipment;
- (8) Tests for LNG bunkering control systems to verify their shut-off for LNG pumps;
- (9) Examination of the main drive wireropes of loading arms, and renewals are to be made for any damage.

#### 1.4.3.4 Special surveys

- (1) The survey items specified in 1.4.3.e of the Rules;
- (2) Vacuum insulated type C independent tanks (if applicable)
- ⊗ Cargo tanks, together with their gas-phase and liquid-phase pipes are to be subjected to a gastightness test. Before the test, air is not to be used as the test medium unless the gas composition in the tank is examined to be qualified;
  - ⊗ Cargo tanks, together with their gas-phase and liquid-phase pipes are to be subjected to a pressure test. Where the plate or tower structures, bearings and pipe connection attachments as well as sealing devices in way of the deck penetration are in a good condition, the running of gas leakage monitoring systems is satisfied, and the operational record or survey shows no abnormal running, the pressure test may not be required at the discretion of the Surveyor;
  - ⊗ All valves and cocks directly connecting to cargo tanks are to be opened up for examination, and internal inspection is to be carried out for the cargo tank connections, if practicable;
  - ⊗ The pressure relief valves of cargo tanks are to be opened up for examination, and if applicable, their settings are to be checked.
  - ⊗ A non-destructive test is to be carried out as a supplement for the surveys of cargo

tanks, and special attention is to be given to the intact of tank shell and high-stress areas, including the welds as deemed necessary by the Surveyor. The following locations are to be deemed as high-stress locations: saddle connections to tank shell and pipe connections.

(4) Cargo pumps, gas compressors and gas boosters together with their prime movers are to be subjected to an overhaul and safety equipment are to be subjected to a performance test. An overhaul for the electric motor used as a prime mover may be dispensed with<sup>1</sup>.

(5) Heat exchangers, pressure vessels and evaporators are to be subjected to an overhaul and pressure relief valves are to be subjected to a performance test. Where an internal inspection is impossible for pressure vessels, a pressure test for pressure vessels and a performance test for pressure relief valves are to be carried out.

(6) Loading arms

⊕ Overall examination and in particular for rotating joints, if necessary, the parts or sealing are to be renewed;

⊙ Overall examination of gas-phase and liquid-phase pipes, normally including visual examination, thickness measurement, pressure tests and leakage tests.

## Section 5 INSPECTIONS OF PRODUCTS

### 1.5.1 Inspection of products and certification requirements

1.5.1.1 In addition to the provisions of this Chapter, the certification and inspections of products are to comply with the relevant requirements of PART ONE of CCS Rules for Classification of Sea-going Steel Ships or Regulations for Classification of Sea-going Ships on Domestic Voyages or Regulations for Classification of Inland Waterways Ships.

1.5.1.2 The certification of equipment, piping, valves etc. related to LNG bunkering are to comply with the certification requirements of Table 1.5.1.2.

Table 1.5.1.2

No.	Product name	Document		Approval mode				Plan approval	Remarks
		C/E	W	DA	TA-B	TA-A	WA	PA	
1	Loading arm	X	—	O	O	O	—	X	
2	Bunkering hose	X	—	—	X	O	—	X	
3	Low-temperature valve	X	—	—	X	—	—	X	
4	Breakaway coupling	X	—	—	X	—	—	X	
5	Quick connector	X	—	—	X	—	—	X	
6	Quick coupling	X	—	—	X	—	—	X	
7	Heat exchanger	X	—	—	X	—	—	X	
8	LNG pump	X	—	—	X	O	—	X	
9	LNG pump sump	X	—	—	—	—	X	X	
10	Instruments related to LNG,	—	X	—	X	—	—	X	Works Approval

<sup>1</sup> If a planned machinery maintenance system is applied, visual examination for each equipment may substitute opening up for examination.

No.	Product name	Document		Approval mode				Plan approval	Remarks
		C/E	W	DA	TA-B	TA-A	WA	PA	
	including liquid level gauging devices, temperature measuring devices, pressure gauges and pressure transmitters etc.								Certificate to be provided for W
11	Pressure, temperature and liquid level alarm systems	X	—	—	X	O	—	X	LNG tanks

Symbols:

1) C - Marine Products Certificate; E – Equivalent document; W – Manufacturer’s document; X – Applicable; O – Optional.

2) DA – Design approval; TA-B – Type approval B; TA-A – Type approval A; WA – Works approval; PA – Plan approval.

## **Section 6 PLANS AND DOCUMENTS**

### **1.6.1 Plans and documents for approval**

1.6.1.1 In addition to CCS Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk, Rules and Regulations for the Construction and Equipment of Inland Waterways Ships Carrying liquefied Gases in Bulk or other relevant rules, the plans and documents are to be submitted to CCS for approval in accordance with the requirements of this Section.

1.6.1.2 The following plans and documents are to be submitted in triplicate to CCS for approval:

(1) Arrangement showing the following locations

- ① Machinery spaces, accommodations, oil tanks, cofferdams, service spaces and control stations;
- ② Containment systems and cargo oil tanks;
- ③ Gas compressor rooms;
- ④ Gas pipes having bunkering or refilling joints;
- ⑤ Connections;
- ⑥ Hatchways, vent pipes and other openings of cargo tanks;
- ⑦ Ventilation pipes, doors and openings of gas hazardous spaces;
- ⑧ Entrances and air inlets to accommodations, service spaces and control stations;
- ⑨ Inert gas;
- ⑩ Gas hazardous areas.

(2) Following plans and technical documents of piping systems:

- ① LNG bunkering piping diagrams and instructions, including vents of safety relief valves;
- ② LNG refilling piping diagrams and instructions, including vents of safety relief valves;
- ③ Technical documents of branch pipes, return pipes, bends, expansion joints, bellows or similar devices;
- ④ Drawings and instructions of flanges, valves and other similar devices in gas piping systems;

- ⑤ Technical documents of the materials, welding, post-weld heat treatment and non-destructive testing of gas pipes;
  - ⑥ Technical documents of pressure tests (strength and tightness tests) of gas pipes;
  - ⑦ Technical documents of electrical bonding of cargo piping systems;
  - ⑧ Technical documents of the arrangements for removing residual fuel from the cargo hoses before shutoff of bunkering or refilling joints.
- (3) Control and monitoring systems as follows:
- ① Gas detection systems;
  - ② Monitoring systems of LNG tanks;
  - ③ Monitoring systems of bunkering equipment;
  - ④ Control and monitoring systems of gas compressors.
- (4) In addition, the following plans and documents are to be submitted in triplicate to CCS for approval for ships having the function of bunkering oil fuel:
- ① Cargo oil piping diagrams;
  - ② Bilge piping diagrams of cargo pump rooms and cofferdams;
  - ③ Arrangement of vent systems, including purging and gas-freeing systems;
  - ④ Closed measuring systems (if fitted);
  - ⑤ Boiler piping systems (if fitted);
  - ⑥ Heating piping systems (if fitted);
  - ⑦ Arrangement of cargo pump rooms.
- (5) Technical documents of auto-stoppers of LNG pumps;
- (6) Plans and documents of structures as follows:
- ① Seatings of loading arms/davits (if applicable);
  - ② Seatings of LNG tanks and strength calculation of their supporting structures (if applicable).
- (7) Vacuum insulated type C independent tanks
- ① Detailed structural drawings, including internal structure, insulation, pipes, valves and joints etc.;
  - ② Specifications of materials of cargo tanks and their connections;
  - ③ Technical documents of design loads and structural analysis of cargo tanks;
  - ④ Detailed information of stress analysis for cargo tanks;
  - ⑤ Calculations of discharge volumes of pressure relief valves in cargo tanks;
  - ⑥ Information of non-destructive testing and strength of cargo tank welds and of tank shell tightness tests;
  - ⑦ Welding procedure specifications of cargo tanks;
  - ⑧ Certifying documents of insulation life of cargo tanks and life of test equipment (for pressures, liquid levels and temperatures etc.) and instruments attached to cargo tanks.
- (8) LNG pumps
- ① General arrangement drawings of LNG systems;
  - ② Main component and part drawings;
  - ③ Main technical parameters;
  - ④ Component and part specifications and material checklists;
  - ⑤ Arrangement of piping systems of LNG pumps and their accessories, including sensors, safety valves (if fitted) etc.

- (9) Flexible connecting equipment
  - ① Arrangement of bunkering hoses and their supporting structure;
  - ② Specifications of materials of bunkering hoses;
  - ③ Bunkering hose instructions;
  - ④ Detailed arrangement of activated or passive release equipment, including breakaway couplings;
- (10) Breakaway couplings
  - ① Standardization or technical specifications;
  - ② General arrangement drawings;
  - ③ Main component and part drawings;
  - ④ Main technical parameters;
  - ⑤ Component and part specifications and material checklists;
  - ⑥ Strength and performance calculations;
  - ⑦ Instructions;
  - ⑧ Testing programmes.
- (11) Quick couplings
  - ① Standardization or technical specifications;
  - ② General arrangement drawings;
  - ③ Main component and part drawings;
  - ④ Main technical parameters;
  - ⑤ Component and part specifications and material checklists;
  - ⑥ Strength and performance calculations;
  - ⑦ Instructions;
  - ⑧ Testing programmes.
- (12) Information of loading arms and their design details
  - ① General arrangement and envelope diagrams;
  - ② Detailed structures, including rotating joints and their supports, emergency release systems, stray current protection equipment, electrical continuity and bonding, valves, flanges and connections etc.;
  - ③ Main component and part drawings;
  - ④ Welding procedure specifications
  - ⑤ Component and part specifications and material checklists;
  - ⑥ Information of non-destructive testing, strength and low temperature, tightness, performance tests of welds;
  - ⑦ Technical documents of design loads and structural analysis of loading arms;
  - ⑧ Hydraulic control system (if fitted) diagrams;
  - ⑨ Emergency release system diagrams;
  - ⑩ Instructions.
- (13) Quick connectors
  - ① Detailed structure;
  - ② Technical documents of design loads and structural analysis of quick connectors;
  - ③ Testing programmes.

### 1.6.2 Plans and documents for information

1.6.2.1 The following plans and documents are to be submitted in triplicate to CCS for information:

- (1) Insulation arrangement and information of low temperature piping systems;
- (2) Relevant risk analysis reports (if applicable);
- (3) Safety operation manual.

Note: The actual drawing name may be different from the drawings mentioned above, but it is to show the contents required above.

### **1.6.3 Plans and documents for other purposes**

1.6.3.1 Other plans and documents as deemed necessary by CCS.

### **1.6.4 Documentation to be kept on board**

1.6.4.1 The cargo control room is to be provided with a safety operation manual, which is to be renewed according to the equipment and procedures.

1.6.4.2 The safety operation manual is to list at least:

- (1) Operational procedures for bunkering and refilling etc. and their constraints, including operation checklists;
- (2) Inspection and maintenance programs of each LNG equipment;
- (3) Inspection methods and frequencies of equipment, and maintenance processes of equipment.

1.6.4.3 The plans and documents related to bunkering operation mainly include:

- (1) Operation processes and procedures of equipment and pipes and instrumentation diagrams, which are to cover bunkering equipment and all pipes and equipment of LNG tanks;
- (2) Bunkering diagrams, including detailed arrangement of bunkering equipment, bunkering equipment drawings, piping diagrams (including installation and insulation), vent pipes, valves, pressure relief equipment, expansion joints, ventilation, purging systems, boil-off gas control etc.;
- (3) Division of gas hazardous areas and arrangement of their entrances and ventilation;
- (4) Arrangement of electrical and mechanical equipment in bunkering areas;
- (5) Specifications of manufacturers including drawings and flowcharts, by which the safe elements are application, maintenance, inspection and calibration and maintenance for correct operation;
- (6) Specifications of safety systems, activated and passive fire protection systems and emergency shutdown systems, including the checklists of control, monitoring and alarms.

1.6.4.4 Specifications of cryogenic protection and emergency discharge.

1.6.4.5 Personnel training record books.

1.6.4.6 Emergency response plans, including risk analysis summaries for bunkering operation and necessary requirements for personnel training.

## **CHAPTER 2 THE SHIP'S ARRANGEMENT**

### **Section 1 GENERAL PROVISIONS**

#### **2.1.1 General requirements**

2.1.1.1 In addition to those stated in the Chapter, the ship's arrangement are to comply with the relevant provisions of Chapter 2 and Chapter 3 of CCS Rules for Construction and Equipment of Ships Carrying Liquefied Gas in Bulk or Chapter 2 and Chapter 3 of CCS Rules and Regulations for the Construction and Equipment of Inland Waterways Ships Carrying Liquefied Gas in Bulk.

2.1.1.2 The notation LNG Bunkering Ship is to be marked on both sides of the ship, and the marking is to be plainly visible and readily identified during the night.

### **Section 2 LOCATION AND SEPARATION OF SPACES**

#### **2.2.1 Separation of cargo areas**

2.2.1.1 For ships combining the functions of bunkering LNG and oil fuel, the LNG tank space is to be separated from the oil tank by a cofferdam or cargo pump room with a spacing of not less than 900 mm; The space of vacuum insulated type C LNG tanks may be separated by "A-60" class single gastight bulkheads of all-welded construction.

#### **2.2.2 Oil tanks**

2.2.2.1 Permanent coamings of not less than 100 mm in height are to be fitted in the deck area equipped with cargo oil piping and its operating equipment for the prevention of deck spill from flowing over board. A suitable number of drain openings and plugs are to be fitted on the coaming.

#### **2.2.3 Business rooms**

2.2.3.1 For the purpose of the Rules, the business room is to be regarded as a service space, and its arrangement is to meet the relevant requirements for service spaces.

### **Section 3 ACCESS ARRANGEMENT**

#### **2.3.1 Accesses to the receiving ship**

2.3.1.1 Where an access is provided between the bunkering ship and receiving ship for personnel to disembark in event of emergency, it is to be as far as possible away from the bunkering operation area.

#### **2.3.2 Safe accesses from the freeboard deck**

2.3.2.1 A safe access of not less than 850 mm in width is to be provided along both sides of the freeboard deck in the vicinity of the bunkering operation area, and any equipment or pipe etc. barring the passage of personnel is not to be arranged in the access, except for the temporary equipment and pipes for the purpose of operation.

## **Section 4 CONNECTING EQUIPMENT ARRANGEMENT**

### **2.4.1 General requirements**

2.4.1.1 Connecting equipment are to be reasonably arranged according to the operation and reset sizes, ship's dimensions and arrangement as well as service objects.

2.4.1.2 Connecting equipment is to have enough distance from the ship's side while meeting the bunkering needs to avoid damage during the berthing or bunkering operation.

### **2.4.2 Flexible connecting equipment**

2.4.2.1 Where flexible connecting equipment is used, a safety device is to be fitted to fix the flexible connecting equipment not in operation so as to withstand harsh climate in the design condition.

### **2.4.3 Loading arms**

2.4.3.1 Where loading arms are used, the arrangement for the loading arms in group is to be such as to ensure that when a single loading arm is working, no interference will come from another one adjacent to it. In the reset state, the net distance between the outermost projections of adjacent loading arms is at least to be 0.6 m.

2.4.3.2 The net distance between the loading arm and any other equipment or pipe etc. on board ships is at least to be 0.3 m in the operating condition.

### **2.4.4 Reinforcement to seats of connecting equipment**

2.4.4.1 The hose davit/bracket or loading arm is to be securely connected to the hull. A seat is to be provided on the hull to connect with the post of the davit/bracket or loading arm, and the structure of the seat and the strength in way of its connection to the hull structure are to be analyzed in accordance with 3.10 of the Rules for Lifting Appliances of Ships and offshore Installations.

## **Section 5 ARRANGEMENTS OF ANCHORING AND MOORING EQUIPMENT AND FENDER FACILITIES**

### **2.5.1 Anchoring equipment**

2.5.1.1 In addition to its own operation requirements, the anchoring equipment are to be provided in consideration of the current and wind force in the waters where the bunkering is

carried out and the basic situation of the receiving ship intended to receive LNG fuel..

### **2.5.2 Mooring equipment**

2.5.2.1 The design and arrangement of mooring equipment for the receiving ship is to be suitable for safety operation for various ship types.

2.5.2.2 Mooring cables of the receiving ship are to be made of synthetic fibers or other antistatic materials.

2.5.2.3 Mooring equipment of the bunkering ship are to be provided with emergency release devices

### **2.5.3 Fenders**

2.5.3.1 At least two steel fenders are to be fitted around the ship, which may be plating of increased thickness or in the shape of a semicircle, or other equivalent facilities.

2.5.3.2 The thickness of fenders in the shape of a semicircle may be the same as that of side shell plating at  $0.4L$  Amidships. Brackets and horizontal stiffeners are to be arranged inside the fenders, and have a thickness equal to that of the fenders.

2.5.3.3 Fenders are to be insulated from the ship berthed, and intercostals rubber gaskets or other equivalent measures are to be provided on the fenders to prevent sparks formed by the friction between the ships.

2.5.3.4 Vertical fenders are to be fitted between the two fenders at a spacing of not greater than 2.5 m.

2.5.3.5 Vertical fenders are to be as far as possible in line with the web frames or transverse bulkheads, and the scantlings are to be the same as those of the fenders.

2.5.3.6 A sufficient number of cushions of enough strength is to be arranged around the ship, which are to be suitable to the receiving ship. The cushions is to be capable of insulating the bunkering ship from the receiving ship.

## **Section 6 COLLISION RESISTANT DESIGN**

### **2.6.1 General requirements**

2.6.1.1 Collision resistant design is to be carried out for LNG cargo tanks by either one of the following two methods:

(1) The side shell plating is to be strengthened within the cargo area from bilge strake to side sheer strake to the thickness of not less than 1.15 times that stipulated in CCS Rules for Construction of Inland Waterways Steel Ships. For ships with hull structure of higher tensile steel, the higher tensile steel is to be converted to normal tensile hull structural steel, the thickness is to be increased based on it, and the distance from the LNG tank to side shell plating is not to be less than 1.0 m;

(2) The thicknesses of deck stringers and inner and outer side plating are to be respectively not less than 1.25 times and 1.35 times those stipulated in CCS Rules for Construction of Inland Waterways Steel Ships, and the distance from the LNG tank to side shell plating is not to be less than 0.8 m.

# CHAPTER 3 CARGO CONTAINMENT SYSTEMS

## SECTION 1 GENERAL PROVISIONS

### 3.1.1 General requirements

3.1.1.1 Unless clearly stipulated in this Chapter, the cargo containment systems of bunkering ships are to comply with the relevant provisions of CHAPTER 4 of CCS Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk.

### 3.1.2 Containment system designs

3.1.2.1 The design life of cargo containment systems is not to be less than that of the ship. The estimation of design life is to consider comprehensively matters like the life of containment system insulation, attached measuring devices and gauging. If the life of attached measuring devices and gauging don't match well with the design life of containment systems, make sure that they could be replaced.

3.1.2.2 Containment systems shall be assessed against the failure mode of plastic deformation, bending and fatigue.

3.1.2.3 The design of containment systems is to consider three main categories of design conditions:

(1) Ultimate design condition. Design is to consider the proper combination of load stated in 4.3.4.1 of CCS's Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk.

(2) Fatigue design condition. The cargo containment system structure and its structural components are not to fail under accumulative cyclic load.

(3) Accidental design condition. Cargo containment systems are to meet the following criteria:

—With regard to collision, the layout location of cargo containment systems is to conform to Chapter 2 of CCS's Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk or Chapter 2 of CCS's Rules and Regulations for the Construction and Equipment of Inland Waterways Ships Carrying Liquefied Gas in Bulk. The support components or cargo tank structure at support components shall be able to withstand the collision loads without deformation, likely to endanger the tank structure.

—With regard to fire, the containment systems shall sustain, without rupture, a 20% rise in cargo tank pressure above the maximum allowable relief valve setting(MARVS) .

—The anti-flotation arrangements is to meet its intended use and there shall be no endangering plastic deformation to the hull.

3.1.2.4 Unless clearly stipulated in this regulation, the design, manufacture and installation of vacuum insulated Type-C independent cargo tanks are to conform to the related requirement in Annex 1 of CCS's Rules for Natural Gas Fuelled Ships. Their piping, valves, , gauging and other accessories are to conform to the related requirement of CCS's Rules for the Classification and Construction of Liquefied Natural Gas Bunkering Pontoons.

3.1.2.5 With regard to vacuum insulated Type-C independent cargo tanks, if pipe connections are mounted below the highest liquid level, their outer shell is to be made of low temperature

resistant material. If the cargo tank is arranged in enclosed space, a connection space is to be installed according to the related requirement on tank connection space in CCS's Rules for Natural Gas Fuelled Ships. The connection space is to be attached to the tank to act as a protection structure against of the leakage of pipe connections (including cryogenic valves, flange, LNG pumps, etc) below the liquid surface.

### **3.1.3 Loading Limits**

3.1.3.1 The loading limits of LNG cargo tanks are to meet related requirement of Chapter 15 of CCS's Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk.

## **Section 2 Design Load**

### **3.2.1 Static Heel Load**

3.2.1.1 With regard to inland navigation vessels, loads corresponding to the most unfavorable static heel angle within the range 0° to 20° shall be considered; With regard to sea-going vessels, loads corresponding to the most unfavorable static heel angle within the range 0° to 30° shall be considered

### **3.2.2 Sloshing Load**

3.2.2.1 The sloshing load on cargo containment systems and internal structure is to be evaluated based on different water levels, it is at least to be evaluated at 20%, 40%, 60%, 80% filling ratios and limit filling ratio.

3.2.2.2 When a large load caused by sloshing is expected, specialized experiment or calculation is to be conducted, the evaluation is at least to include aforementioned different filling ratios.

### **3.2.3 Other Load**

3.2.3.1 In addition to aforementioned loads, reasonable combinations of other loads specified in CCS's Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk are also to be considered.

# CHAPTER 4 BUNKERING SYSTEMS

## Section 1 GENERAL PROVISIONS

### 4.1.1 General requirements

4.1.1.1 The Chapter applies to all bunkering equipment, pipes, valves and other annexed fittings which may come in contact with LNG or BOG.

4.1.1.2 Unless otherwise stated, the piping arrangement of bunkering systems, the thickness of pipes, desinging pressure, allowable stress, stress analysis, piping connections, heat treatment after welding, the tests of piping etc. is to meet the related requirements in chapter 5 of Rules for Construction and Equipment of Ships Carrying Liquefied Gas in Bulk or Rules for Construction and Equipment of Inland Waterways Ships Carrying Liquefied Gas in Bulk.

4.1.1.3 The following elements are to be considered when designing the bunkering system:

- (1) The compatibility of bunkering system between the bunkering ship and receiving ship, such as the tank type, the bunkering joint, etc. ;
- (2) The safety system compatibility between the bunkering ship and receiving ship, such as the ESD system, etc. ;
- (3) The influence of the ship's movement, surrounding conditions, such as the relative movement of the ships, the wind, the wave, and the currents, etc. ;
- (4) Bunkering operation procedures, such as inerting, replacement, precooling, purging and gas removal etc. ;
- (5) The beginning of bunkering, fully loading and the LNG transmission velocity of the recharging operation ;
- (6) The pressure, temperature and liquid level controlling of LNG tanks ;
- (7) The designing pressure and the designing temperature of bunkering system .

4.1.1.4 In order to prevent the hull temperature lower to the designing temperature of the hull material, the thermal insulating protection of the ship hull members adjacent the low temperature pipelines is necessary. When the liquid pipeline is expected to have a liquid leakage (such as low temperature piping joints, bunkering line and connecting equipment, supply line connecting the main connector, etc.), the lower part of the hull is to provide protecting measures of resistance to low temperature.

4.1.1.5 The piping in the operation area of the connecting equipment shall be properly protected against mechanical damage.

4.1.1.6 Unless in emergency, it is strictly prohibited to emit natural gas actively to the atmosphere on board .

## Section 2 BUNKERING PIPING

### 4.2.1 General requirements

4.2.1.1 The joints of the piping shall be as less as possible, as long as it can meet the installation and maintenance of the piping. All piping shall be properly supported.

4.2.1.2 The bunkering pipelines shall be segregated from the other pipelines where the LNG

cargo system fuel cannot be present, and shall not pass through accommodation spaces, service spaces and control station.

#### **4.2.2 Bunkering piping**

4.2.2.1 Each bunkering line and connecting equipment of the connection are to be installed a manual stop valve and an emergency stop valve, or a combination valve with a manual stop valve and an emergency stop valve.

4.2.2.2 An arrangement for purging fuel bunkering lines with inert gas shall be provided.

4.2.2.3 BOG circuit linked to the LNG storage tank of receiving ship shall be installed.

4.2.2.4 In case bunkering lines are arranged with a cross-over it shall be ensured by suitable isolation arrangements that no fuel is transferred inadvertently to the ship side not in use for bunkering.

4.2.2.5 For the evaporation gas (BOG) generated during the bunkering process, the approved method by CCS is to be adopted to utilize or to dispose of it safely, and to prevent the evaporation gas (BOG) be directly emitted to the atmosphere. "The approved method by CCS" includes but not limited to:

- (1) utilization of vapours (such as gas fuel engines);
- (2) reliquefaction of vapours;
- (3) storage of vapours ( e.g. to provide a vapour tank);
- (4) burning of evaporation gas (BOG) .

4.2.2.6 The liquid phase outlet of the LNG bunkering line and the gas phase inlet pipe line are to be provided with sufficient strengthening and supporting structure to withstand the load that may be generated during the bunkering process.

4.2.2.7 Bunkering line can also be the supply line, in this case, the bunkering line is also to meet the requirements of section 3 of this chapter

4.2.2.8 If the bunkering ship has the function of bunkering fuel oil, the refueling hose is to be equipped with a detachment device which has the same functions as the LNG connection equipment.

### **Section 3 SUPPLY PIPING SYSTEMS**

#### **4.3.1 General requirements**

4.3.1.1 The section applies to the pipelines used to transfer LNG from LNG carriers or LNG tank trucks to LNG bunkering ship.

#### **4.3.2 Supplying piping**

4.3.2.1 Adjacent the main joint of the connecting pipe for liquid phase and gas phase shall be installed a manual stop valve and an emergency stop valve in tandem, or a combination valve with a manual stop valve and an emergency stop valve.

4.3.2.2 Supply lines are to be able to inert and purging unless the consequences of non-inerting and non-purging has been assessed and approved by CCS, otherwise the idle supplying pipeline is to keep in purging state.

4.3.2.3 The main connecting pipe for liquid phase and gas phase should install sufficient strengthening and supporting structures to withstand the load that may be generated during the supplying process.

## **Section 4 BUNKERING EQUIPMENT**

### **4.4.1 General requirements**

4.4.1.1 This Section applies to bunkering equipment of bunkering ship, including LNG pump, booster equipment, connection equipment, etc.

4.4.1.2 Flexible connecting equipment shall meet the applicable requirements of 4.4.4 to 4.4.9 in this Section.

### **4.4.2 LNG Pumps**

4.4.2.1 LNG pumps shall meet the applicable requirements of chapter 3,5,6,13,and 17 of CCS 《Rules for Construction and Equipment of Ships Carrying Liquefied Gas in Bulk》 .

4.4.2.2 The structure of LNG pumps is to be able to adapt to the design pressure, design temperature and working environment (such as vibration, tilt, acceleration, etc.) .

4.4.2.3 Effective measures are to be taken to avoid the occurrence of cavitation.

4.4.2.4 LNG pumps shall be designed, manufactured, and tested according to the accepted standards<sup>2</sup>.

4.4.2.5 Monitoring devices for pressure are to be provided on the outlet pipes of LNG pumps, and the monitoring is to be capable of being carried out in the LNG control room.

4.4.2.6 To release and remove the pressure from the inlet of LNG pumps, a suitable way shall be provided. Liquid shall be discharged to the liquid hold or other suitable position.

4.4.2.7 Where LNG pump is driven by shafting passing through a bulkhead or deck, gastight seals with efficient lubrication or other means of ensuring the permanence of the gas seal are to be fitted in way of the bulkhead or deck.

4.4.2.8 Where an submerged pumps is used, and is installed in piping, it is to comply with the requirements of 4.4.2.9 to 4.4.2.12.

4.4.2.9 Submerged pumps are to be installed in the pump sump which is to be designed to meet the standards of pressure vessels.

4.4.2.10 The net height difference between the tank's bottom and the top of the pump sump is to be comply with the installation and operation requirements of submerged pumps.

4.4.2.11 The return line of pump sumps is to be connected to the gas pipe of LNG hold.

4.4.2.12 Electrical equipment of submerged pumps are to be designed in accordance with the relevant requirements of CHAPTER 7 in the Rules.

### **4.4.3 LNG Heat exchangers**

4.4.3.1 Heat exchangers are to meet the relevant requirements about the heat exchangers in CCS 《Rules for Natural Gas Fuelled Ships》 .

4.4.3.2 The fired heat exchanger is not to be permitted.

4.4.3.3 The outlet of heat exchanger is to be installed a pressure monitoring device and a temperature monitoring device.

### **4.4.4 Bunkering hoses**

4.4.4.1 Except as otherwise provided for in this section, the designing and testing of the hoses

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<sup>2</sup> e.g. ISO 24490 Low temperature vessels- pumps used in low temperature equipment

shall meet the requirements of the relevant provisions about the marine cargo hoses in CCS «Rules for Construction and Equipment of Ships Carrying Liquefied Gas in Bulk» .

4.4.4.2 Bunkering hoses are to be equipped with an emergency detaching device (including a breakaway coupling), so as to protect the hose actively or passively, preventing its breakage.

4.4.4.3 Hoses shall be regularly tested and replaced according to the actual test results.

4.4.4.4 The arrangement of the bunkering ship ,the bunkering station of the receiving ship and the operating conditions in the bunkering process (including the relative motions between the ships which the system to be adapted) should be considered in the process of designing the hoses .

4.4.4.5 The layer construction of composite hoses between the bunkering ship and the receiving ship can be made from the material with a melting point lower than 925°C .

#### **4.4.5 Bunkering davits / brackets**

4.4.5.1 Bunkering davits / brackets shall meet the relevant requirements in CCS Rules for Lifting Appliances of Ships and Offshore Installations.

4.4.5.2 Bunkering davits / brackets

All the materials contacted to LNG , the parts subjecting to low temperature, or the materials that may be affected from low temperatures, are to meet the requirements of CHAPTER 6 in CCS Rules for Construction and Equipment of Ships Carrying Liquefied Gas in Bulk.

4.4.5.3 Electrical equipment and materials for bunkering davits / brackets are to comply with the relevant requirements of CHAPTER 7 of the Rules, and meet the requirements for working environments.

#### **4.4.6 Breakaway couplings**

4.4.6.1 Breakaway couplings are to be able to achieve the function of detachment which in certain external force or driven by remote control, and the leakage of LNG is to be as less as possible after breakaway, and shall not bring cryogenic damage to the hull.

4.4.6.2 The material of breakaway coupling shall be adapted to the working pressure and working temperature, and the design pressure shall not be less than 2.0MPa.

4.4.6.3 The calculations for the maximum impact force sustained by breakaway coupling while separation are to be provided. The calculations for breaking force of the bolt are also to be provided, including the pulling forces from 3 directions (with the axial tensile 0°, 45°and 90°).

4.4.6.4 The design of breakaway coupling should avoid can't separation due to the external frost.

4.4.6.5 Prototype tests are to be carried out for each new breaking bolt type breakaway coupling. The prototype test shall be included: Hydraulic test, axial direction breakaway test, non-axial direction breakaway test, medium impact test and drop test.

(1) Hydraulic test at the ambient temperature: No obvious leakage at the pressure no less than 1.5 times of design pressure;

(2) Hydraulic test at the design temperature: No obvious leakage at the pressure no less than 1.5 times of the maximum working pressure;

(3) Axial direction breakaway test: The tensile value from zero, and gradually increase the axial tensile force until coupling detached, recording the value of separating force and the leakage.

(4) Non-axial direction breakaway test: The breakaway coupling sustained pulling force from

the direction of 45° and 90°, the tension value from zero, and gradually increase the tensile force from this direction until the coupling detached, recording the value of separating force and the leakage.

(5) Medium impact test: After the coupling separated, the medium impact test of inlet end is to be carried out in accordance with the provisions of maximum allowable flow rate in the designing calculations.

(6) Drop test: After the coupling separated, the two ends are to be dropped 4 times respectively from the height 2.5m, no obvious leakage can be found.

4.4.6.6 The breaking bolt type breakaway coupling after prototype test is no longer to be used for LNG delivery. Before each breakaway coupling put into running, the hydraulic pressure test shall be performed at the ambient temperature, the test pressure shall not be less than the specified 1.5 times of maximum working pressure. Cryogenic performance tests are to be carried out at the design temperature; the test pressure shall not be less than 0.5Mpa.

4.4.6.7 Each new breakaway coupling shall be measured and recorded the characteristics of flow rate with the drop of pressure. For the passively forced detachment breakaway coupling, the range of tensile value is to be marked on the certificate.

4.4.6.8 In addition to the breaking bolt type breakaway coupling, the other new designed breakaway coupling is to be able to provide certificates, instructions, technical standards and other documents of the successful application experience, and submitted to CCS for approval.

#### **4.4.7 Quick connecting joints**

4.4.7.1 The quick connect/disconnect coupling has the function of rapidly connecting and disconnecting with the least leakage. Both ends of the coupling have the device with automatic quick self-closing shut-off valve or other devices.

4.4.7.2 The material of quick connect/disconnect coupling is to be adapted to the working pressure and working temperature, its design pressure is not to be less than 2.0Mpa.

4.4.7.3 The design of quick connect/disconnect coupling should avoid can't separation due to the external frost.

4.4.7.4 Prototype tests are to be carried out for each new quick connect/disconnect coupling. The prototype test shall be included: Hydraulic test, operation test, medium impact test and burst test.

(1) Hydraulic test at the ambient temperature: No obvious leakage at the pressure no less than 1.5 times of design pressure;

(2) Hydraulic test at the design temperature: No obvious leakage at the pressure no less than 1.5 times of the maximum working pressure;

(3) Operation test: The leakage after the quick connect/disconnect coupling separated normally shall be measured;

(4) Medium impact test: After the quick connect/disconnect coupling separated, the medium impact test of both ends is to be carried out in accordance with the provisions of maximum allowable flow rate in the designing calculations.

(5) Burst test: No less than 5 times the maximum working pressure.

4.4.7.5 The quick connect/disconnect coupling after prototype test is no longer to be used for LNG delivery. Before each quick connect/disconnect coupling put into running, the hydraulic pressure test shall be performed at the ambient temperature, the test pressure shall not be less than

1.5 times of design pressure. Cryogenic performance tests are to be carried out at the design temperature; the test pressure shall not be less than 0.5Mpa.

4.4.7.6 Each new quick connect/disconnect coupling shall be measured and recorded the characteristics of flow rate with the drop of pressure.

4.4.7.7 The words “Only for LNG”, “Only for NG” or the similar shall be marked on the quick connect/disconnect coupling.

4.4.7.8 The specification of quick connect/disconnect coupling shall meet the technical standards accepted by CCS or generally accepted technical standards<sup>3</sup>.

#### **4.4.8 Quick connectors**

4.4.8.1 Quick connector means bunkering equipment interface flange clamped to the receiving ship’s bunkering flange by manual or hydraulic driven equipment joint other than any bolts.

4.4.8.2 A variety of flanges with different specifications shall be fitted to the quick connector, and the righting devices and the centering devices shall also be fitted.

4.4.8.3 Quick connectors are to be able to adapt to the receiving ship’s tolerance zone of the flanges. The design of the clamping device is to be able to compensate at least 5mm uneven thickness of the conventional receiving ship’s flanges.

4.4.8.4 Considering frosting, the quick connector should be able to dismantle with load from equipment .

4.4.8.5 The designing ,manufacturing and testing for the quick connectors shall meet the technical standards accepted by CCS or generally accepted technical standards<sup>4</sup>.

#### **4.4.9 Flange joints**

4.4.9.1 Specifications of the flange joints shall meet the standards accepted by CCS or generally accepted technical standards<sup>5</sup>, and shall be able to match the receiving ship’s bunkering flange.

4.4.9.2 If a flange type joint be applied, and it do not work for a long time, a blind flange si to be set to it, the flange is to have the same design pressure with the pipeline.

#### **4.4.10 Loading arms**

##### **4.4.10.1 General requirements**

(1) All the factors and working conditions are to be considered in the course of design for loading arm, including : the motion of ships, the freeboard changes, meteorology and hydrology and the characteristic of LNG etc., so it can meet the expected purposes ;

(2) The driving mode of the loading arm can be manual, pneumatic or hydraulic transmission, etc.. The control system of the loading arm shall meet the relevant provisions of CCS or the current national standards<sup>6</sup> ;

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<sup>3</sup> e.g. ISO, SIGTTO, EN etc. the relevant standards of organizations

<sup>4</sup> e.g. The chemical industry standards of China:HG/T 21608-2102 The engineering technical requirements of liquid cargo loading/unloading arms, OCIMF Rules for designing the ship’ s loading/unloading arms and EN1474-1 Designing and testing for marine conveying system etc..

<sup>5</sup> e.g. The chemical industry standards of China: PN series or class series in Steel flange, washer, fastener HG/T 20592-20635—2009

<sup>6</sup> e.g.GB/T 7932-1987 General technical conditions of pneumatic system; GB/T 3766-2001 General technical conditions of hydraulic system; GB/T 7935-2005 General technical conditions of hydraulic components; ISO

(3) The working scope of the loading arm is generally divided into the docking zone, the working zone, the alarm zone and the emergency detach zone;

(4) The loading arm shall be provided with an active protection device (such as an emergency detach device) to prevent damage. After separation from the device, the end of the loading arm is to moved up, let the receiving ship leaving safely, and can be moved above horizontal position;

(5) The three-dimensional rotating joint of the loading arm is to be maintained balance in all attitude so that the interface flange is maintained within a vertical plane of 3°, so it is easy to be docked with the flange of the LNG pipe line;

(6) The loading arm shall be counterweight balanced in the empty condition. The loading arm is to be fixed securely while in idle.

(7) For the bunkering ship and receiving ship be electrical insulated, the loading arm shall be fitted with an insulating flange.

(8) The end the loading arm may be flange, quick connecting joint, or quick connector.

#### 4.4.10.2 Design Load

(1) In general, the weight of loading arm is to include frosting layer (take the density as 800kg/m<sup>3</sup>), Frosting layer shall not be an accumulative total.

In cold season, take the frosting layer as 6mm on all parts;

Liquefied natural gas: take the frosting layer as 25mm on LNG conveying parts;

If the bunkering ship is located at extremely cold area, the frosting layer should be calculated according to the Local climate conditions.

(2) In general, the design wind speed passing through the loading arm shall be:

at working conditions : ≤20m/s;

at reset state: =55m/s.

The calculations of wind load shall be carried out according to the maximum area which the loading arm subjected, and meet the relevant requirements in CCS 《Rules for lifting appliance of ships and offshore installations》 ;

(3) While designing the loading arm, the load resulted from the inclining and the motion of ship should be considered, this load shall meet the relevant provisions in CCS 《Rules for lifting appliance of ships and offshore installations 》 ;

(4) While designing the loading arm, the thermal load resulted from difference in temperature of material shall be considered;

(5) The other loads may be arised in the process of operation shall also be considered;

(6) 《The stress analysis report of the loads combination of the loading arm in all the working attitudes》 shall be submitted by the loading arm manufacturers.

(7) The basic design allowable stress  $[\sigma]$  of the structure components of the loading arm shall be taken from the smaller one of the following two:

$$R_{eh}/1.5 \text{ Or } R_m/2.35$$

There into:  $R_{eh}$  is the yielding stress of the material;  $R_m$  is the tensile strength of the material;  $R_{eh}$  and  $R_m$  should be the specified value at the designing temperature in CCS Rules for

Materials and Welding or other generally accepted technical standards<sup>7</sup>.

(8) The transmission wire rope of the loading arm shall be in accordance with the current Chinese standard, and the wire rope and fasteners shall have at least 5 times the safety factor of the fracture strength.

#### 4.4.10.3 Emergency release systems (ERSs)

(1) Emergency release system is usually composed of two interlock shut-off valves and an emergency release coupler between these 2 valves, the leakage should be as less as possible while releasing.

(2) Emergency release device should be fitted at the vertical segment of 3D revolving joint.

(3) Emergency release device should be able to sustain the design pressure of loading arm, the maximum load of it at the design temperature.

(4) Emergency release device should be able to accurately and safely shut off the valve at the condition of 25mm frosting layer, the loading arm and the receiving ship should be separated after the coupler detached.

(5) While receiving the detaching signal, the emergency release device should be actuated rapidly. The detaching time should be at 5~30s.

(6) Loading arm shall be fitted with mechanical or hydraulic interlock to prevent the actuating of the emergency release coupler before the shut-off valve completely shut down.

(7) The emergency release device should not have leakage, deformation and failure under 2 times of the maximum external load.

(8) The valve and the hydraulic pipe of the emergency release device shall meet the requirements of generally accepted technical standards<sup>8</sup> about fire prevention.

(9) The release mechanism of the emergency detachment device shall be combined with the characteristics of the accumulator to ensure the effective detachment and break through the possible ice formation.

(10) In cold conditions an emergency detachment device shall be capable of being removed from or installed to the ship.

(11) The leakage status and result of the emergency detachment device of the loading arm shall be recognized by the surveyor.

(12) From emergency release device to emergency release zone of loading arm should be able to detach automatically; manual starting should have the protective function of misoperation.

#### 4.4.10.4 Revolving joint

(1) The revolving joint shall meet the test with load at design temperature and the design pressure, it shall be revolved flexibly. The permanent deformation shall not be permitted, and the leakage rate should not be larger than 10.0cm<sup>3</sup>/min at the pressure of 0.6Mpa.

(2) The seal of the revolving joint shall meet the design temperature, design pressure, and the purpose for conveying LNG. The seal of the revolving joint should be able to prevent the moisture and the impurities from entering into it.

(3) The rotating joint shall be able to withstand the transient vacuum state of the 0.05MPa pressure and be well sealed.

(4) The revolving joint shall have a suitable lubricating system to ensure good revolving performance in the bunkering operations.

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<sup>7</sup> e.g. ASME B31.3 or ASME IID etc.

<sup>8</sup> e.g. SY/T 6960-2013 valve test fire test requirements or ISO 10497-2010 valve test fire test requirements etc..

#### 4.4.10.5 Alarm and Monitoring System

(1) The loading arm shall be equipped with a two-level alarm system for the swing and revolving of the loading arm to monitor the excessive drifting of the receiving ship.

(2) The action of the first level alarm should be able to turn off the bunkering operation, should be able to automatically close the bunkering pump, the booster equipment of LNG liquid cargo tank and return gas pipeline.

(3) The second level alarm should be able to automatically close the shut-off valve of the emergency release device, and start the emergency release device.

(4) If the loading arm is provided with an additional warning besides the first level and the second level alarm, the warning should not start any function unless there is a manual intervention.

(5) The alarm limit of detection (except for the alarm of the automatic shutdown system) should trigger the sound and light signal at the control station of the receiving ship.

(6) The malfunction of hydraulic, electrical and other functions of the loading arm should not result in incorrect activation of the emergency release device.

4.4.10.6 After the completion of the loading arm in the production plant assembly and the installation, all the relevant tests shall be carried out, including the arm strength test, the pressure test, the tightness test, the low temperature rotating joint test, the quick connector test, the low temperature emergency detachment device test, and the complete machine performance test . All the tests shall meet the requirements of relevant provisions of CCS rules and 《 Engineering technical requirements for liquid cargo loading/unloading arms 》 (HG/T 21608-2012) .

## **CHAPTER 5    POWER SYSTEMS**

### **SECTION 1    GENERAL PROVISIONS**

#### **5.1.1    General requirements**

5.1.1.1    Unless clearly stipulated in this Chapter, power systems fuelled by LNG are to meet the relevant requirements in CHAPTER 16 of CCS Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk.

5.1.1.2    Dedicated LNG fuel tank (if fitted) is to be arranged inside cargo area. If there really are difficulties for arrangement, LNG fuel tank could be arranged outside cargo area with CCS's approval, but they should still meet arrangement requirement for gas tanks of CCS Rules for Natural Gas Fuelled Ships.

5.1.1.3    Every liquid pipeline from LNG cargo tanks to LNG fuel tanks is to be arranged one manual stop valve and one emergency stop valve connected in series, or a combined valve of manual stop valve and emergency stop valve. The handle of the manual stop valve or the combined valve is to be operated from a position easy to reach. This pipeline should be able to be purged and inerted.

5.1.1.4    The design, manufacture, installation and experiment of gas fuelled engines(if fit) are to meet the related requirements in Chapter 11, Annex 2 and Annex 3 of CCS Rules for Natural Gas Fuelled Ships.

5.1.1.5    A breakdown in gas fuel supply systems from LNG fuel tanks to gas equipment will not result in unacceptable power loss.

5.1.1.6    For single gas fuel power system, the follows are applied:

(1) at least two completely independent gas fuel supply systems are arranged;

(2) If gas fuel only comes from dedicated LNG fuel tanks, then:

-Two or more LNG fuel tanks in similar sizes are arranged in different space; or

-One Type-C LNG fuel tank are arranged with two completely independent cold box.

# **CHAPTER 6      MONITORING, ALARM AND SAFETY SYSTEMS**

## **Section 1      GENERAL PROVISIONS**

### **6.1.1      General requirements**

6.1.1.1      Appropriate segregation shall be maintained between monitoring/alarm and safety functions to limit the effect of single failures. This shall be taken to include all parts of the automation systems that are required to provide specified functions, including connecting equipment and power supplies.

6.1.1.2      In addition to the requirement in Section 2 of this Chapter, monitoring, alarm and safety systems are to meet the relevant requirements concerning instrumentations and automation systems of 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 Gas in Bulk.

6.1.1.3      In addition to the requirement expressly provided in Section 2 of this Chapter, monitoring, alarm and safety systems are to contain other abnormality and fault points of LNG supply, storage, bunkering and gas supply system in all possible working conditions.

6.1.1.4      In addition to be remotely controlled in the cargo control room, the LNG pump is also to be locally controlled.

6.1.1.5      Unless other provided, the alarm of LNG storage and bunkering systems is to be arranged in cargo control room and machinery space; the alarm of gas fuel supply system is to be arranged in wheelhouse or manned location of engine room.

6.1.1.6      The purpose of emergency shutdown (ESD) system in this Chapter is to stop cargo flow or leakage in the event of an emergency when cargo liquid or vapour transfer is in progress. The ESD system is intended to return the cargo system to a safe static condition so that any remedial action can be taken. The ESD system is a part of safety system.

## **Section 2      ADDITIONAL FUNCTION REQUIREMENTS FOR BUNKERING SYSTEMS AND GAS SUPPLY SYSTEMS**

### **6.2.1      Function requirements**

6.2.1.1      LNG cargo tanks are to be provided with pressure monitoring, and the signal is to be sent to cargo control room for a centralized display.

6.2.1.2      LNG cargo tanks are to be provided with high pressure alarm, when tank pressure exceeds 90% the setting value of pressure relief valve, then a high pressure alarm is to be triggered.

6.2.1.3      LNG cargo tanks are to be provided with level monitoring, and the signal is to be sent to cargo control room for a centralized display.

6.2.1.4      LNG cargo tanks are to be provided with high level and low level alarms.

6.2.1.5 LNG cargo tanks are to be provided with temperature monitoring, and the signal is to be sent to cargo control room for a centralized display.

6.2.1.6 BOG tanks (if fitted) are to be provided with pressure monitoring, and the signal is to be sent to cargo control room for a centralized display.

6.2.1.7 LNG heat exchangers are to be provided with outlet pressure and temperature abnormal alarms, and the LNG transfer pump(if fitted) and associated valves are to be shut off automatically.

6.2.1.8 Outlet pipelines of LNG pumps are to be provided with high pressure alarm, and the LNG pumps are to be stopped automatically.

6.2.1.9 LNG submersible pumps are to be provided with low level and low discharge pressure alarms.

6.2.1.10 The motors of LNG pumps are to be provided with overload and short circuit protection, and the alarm signal is to be sent to cargo control room to display.

6.2.1.11 Pressure gauges are to be provided between the shut-off valves on LNG bunkering pipelines and connecting joints for bunkering equipment and receiving ships.

6.2.1.12 Bunkering equipment are to be provided with abnormal alarm, and the emergency shut-off valves on bunkering pipelines and corresponding LNG transfer pumps are to be automatically closed.

6.2.1.13 When the pressure of fuel tanks is high during transferring LNG from cargo tanks to fuel tanks, the alarm is to be provided, meanwhile, the emergency shut-off valves on transferring pipelines and LNG transfer pumps are to be automatically closed.

### **Section 3 EMERGENCY SHUTDOWN SYSTEMS**

#### **6.3.1 General requirements**

6.3.1.1 An emergency shutdown (ESD) system is to be fitted to stop LNG transfer operations and segregate ships (if applicable) rapidly and safely during supplying and bunkering.

6.3.1.2 In addition to the requirement expressly provided in this Section otherwise, the ESD system is to meet the relevant requirements of 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 Gas in Bulk.

6.3.1.3 An ESD system is to be provided with the manual and automatic mode of operation.

6.3.1.4 An ESD system is to be capable of manual operation in at least two locations, one of which is bunkering control room or equivalent location, the other is the location in escape passage generally easy to observe and operate, meanwhile, easy to reach and evacuate as far as possible, the arrangement of which is to prevent from being touched by accident. The manual operation of ESD is not to be replaced by other shutdown system.

6.3.1.5 The emergency shut-off valves on bunkering/supplying pipelines are to be shut off and LNG transfer pumps are to be closed when ESD system operates, the emergency shut-off valves on each bunkering pipeline are to be operated independently.

6.3.1.6 The bunkering equipment (if applicable) are to be shut off and disengaged when ESD system operates.

6.3.1.7 In addition to the requirement expressly provided in 6.3.1.5 and 6.3.1.6 , ESD operations should also shut off and shut down any other necessary equipment when an emergency (during supplying and bunkering) occurs to fulfill the overall function objective in 6.3.1.1, such as the equipment for cargo vapour return and pipeline clearing.

6.3.1.8 An audible and visual alarm shall be given at the bunkering operation location and cargo control room when ESD system operates.

6.3.1.9 The ESD system shall be automatically activated on detection of a fire on the weather decks of the cargo area and/or spaces where LNG compressors, pumps, cargo processing units are located. As a minimum, the method of detection used on the open decks shall cover the liquid and vapour domes of the cargo tanks, the bunkering/supplying manifolds and areas where liquid piping is dismantled regularly. Detection may be by means of fusible elements<sup>2</sup> designed to melt at temperatures between 98°C and 104°C, or by area fire detection methods.

6.3.1.10 The information displayed on ESD system includes, but not be limited to:

- (1) ESD status;
- (2) History of ESD events, record of abnormalities and failures;
- (3) Alarm items.

### **6.3.2 Function requirements for ESD systems during bunkering operation**

6.3.2.1 Requirements of this Section apply to ESD systems of sea-going bunkering ships.

6.3.2.2 ESD system is to communicate with the receiving ship by transferring ESD message with a hard-wired data link, as a minimum, the communication is to cover synthesized automatic alarm and manual alarm for significant failures and abnormalities of liquid cargo or fuel systems on both ships.

6.3.2.3 If it is truly difficult to carry out to the requirements of 6.3.2.2, the operating personnel on receiving ships are to be provided with ESD communication equipment from bunkering ships for local manual operation, the ESD communication equipment are to be connected with ESD systems of bunkering ships by wired connection.

6.3.2.4 ESD system is to carry out the operations prescribed in the items 6.3.1.5 to 6.3.1.8 automatically in the situations include, but not be limited to, the following:

- (1) Manual trigger;
- (2) A fire in the areas or spaces prescribed in 6.3.1.9;
- (3) Power supply failure <sup>3</sup>;
- (4) ESD system failure;
- (5) Pressure failure of remote control system for LNG valve;
- (6) ESD signal from a receiving ship is to be accepted, the signal may be the alarm signal prescribed in 6.3.2.2.

### **6.3.3 Function requirements for ESD systems during supplying operation**

6.3.3.1 This Section applies to ESD systems supplying on shore.

6.3.3.2 ESD systems may incorporate a ship-shore link in accordance with recognized

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<sup>2</sup>If the temperature fuses or similar electronic elements are adopted for fire detection, two temperature fuses are to be fitted at each location, one of which is used for trigger operation of ESD system, and the other for indicator of fire position.

<sup>3</sup> LNG pumps and other power equipment are to be designed as that when the power supply is restored, they are not to restart automatically.

standards<sup>4</sup>.

6.3.3.3 A suitable communication system is to be fitted on bunkering ship to shore station, for transferring data, ESD signal, ERS signal and speech.

6.3.3.4 An ESD system is to carry out the operations prescribed in the items 6.3.1.5 to 6.3.1.8 automatically in the situations include, but not be limited to, the following:

- (1) Situations prescribed in 6.3.2.4 (1) to (5);
- (2) High-level alarm <sup>5</sup> of overcharge level in LNG cargo tank;
- (3) ESD signal from shore station is to be accepted.

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<sup>4</sup>As ISO 28460:2010 Petroleum and natural gas industries – Installation and equipment for liquefied natural gas – Ship-to-shore interface and port operations.

<sup>5</sup>High liquid level alarm is to be independent of liquid level gauging system of LNG cargo tank.

# CHAPTER 7 ELECTRIC EQUIPMENT

## Section 1 ELECTRIC EQUIPMENT

### 7.1.1 General requirements

7.1.1.1 In addition to comply with the requirements of this Chapter, the electric equipment shall also comply with the relevant requirements of CCS Rules for Classification of Sea-going Steel Ships or CCS Rules for Construction of Sea-going Ships Engaged on Domestic Voyages or CCS Rules for the Construction of Inland Waterways Steel Ships.

7.1.1.2 Electrical installations shall be such as to minimize the risk of fire and explosion from flammable products.

### 7.1.2 Distribution systems

7.1.2.1 The LNG bunkering ships can adopt the following distribution systems:

- (1) DC(direct-current) two-wire insulation system;
- (2) AC (alternating current)single-phase two-wire insulation system;
- (3) AC (alternating current)three-phase three-wire insulation systems.

7.1.2.2 It is proposed the installation of device which can set an alarm when the insulation resistance of continuous monitoring system is abnormally low. The monitoring scope of the device is to include access to the electrical equipment installed in dangerous spaces or all circuits passing the dangerous spaces (except for intrinsically safe circuits).

7.1.2.3 LNG pumps and the other bunkering power equipment shall be directly supplied by the main distribution board, except for the total discrimination.

### 7.1.3 Power

7.1.3.1 The main power source apparatus are to enable the power supply for all the necessary electrical equipment which is to keep the bunkering ships in normal operating states and meeting the conditions required for normal operations.

7.1.3.2 The main power is to be composed of at least two independent generators sets.

7.1.3.3 The bunkering ships are to be provided with emergency power, which is to adopt the separate accumulator battery or emergency generator sets.

7.1.3.4 In addition to comply with the requirements of other relevant CCS Rules , it is also required the emergency power supply for the following equipment:

- (1) Gas detection system;
- (2) Video surveillance system;
- (3) Equipment required for emergency operation of bunkering operations (such as emergency release device);
- (4)Bunkering facilities, fuel supply and monitoring and alarm systems of LNG cargo tanks.

7.1.3.5 In addition to comply with the requirements of other relevant CCS Rules, it is required the emergency lighting for the following spaces:

(1) local operating positions of cargo control rooms, business rooms and bunkering equipment;

- (2) personnel accesses between the bunkering ship and receiving ship (if appropriate);
- (3) the connection between bunkering equipment and receiving ships;
- (4) the area provided with bunkering equipment and its accesses.

7.1.3.6 The supply time of the emergency power are to comply with Rules for Classification of Sea-going Steel Ships, Rules for Construction of Sea-going Ships Engaged on Domestic Voyages or the relevant requirements specified in CHAPTER 4 of PART 3 of Rules for the Construction of Inland Waterways Steel Ships.

**7.1.4 Lighting**

7.1.4.1 The main lighting system is to provide adequate lighting for all premises and spaces which are easy to reach and use for the whole ship personnel, and be supplied by the main power supply.

7.1.4.2 The areas between bunkering ships and receiving ships are to have a good lighting.

7.1.4.3 The necessary facilities and operation locations are to have lightings as the bunkering operation is carried out.

7.1.4.4 The main lighting illumination of bunkering operation is not to be less than the requirements specified in Table 7.1.4.4.

The main lighting illumination requirements Table 7.1.4.4

Spaces	Reference plane and its height	Standard values of Illumination (lx)
LNG related equipment(such as pumps, compressors, valves, bunkering equipment, etc.)	The height of operating position	100
Instrument display location, such as indicating instrument, Liquid indicator, etc.	The height of control point	150
open deck LNG relevant equipment	Top	75
Personnel access	Ground	30

7.1.4.5 The bunkering ships are to be provided with emergency lighting, the range of emergency lighting is to be conformed to the provisions specified in 7.1.3.5.

7.1.4.6 Unless otherwise specified, the luminance value of emergency lighting is not to be less than 10% of the general lighting illumination value, and the lighting illumination value of the channel for evacuation purpose is not to be less than 0.5lx.

7.1.4.7 The lighting or photo luminescent strip display signs contained in the standards accepted by CCS, are to be fitted at the point where the height from the escape route across the board (including turnings and forks) which is from the business room to freeboard deck lifesaving appliance embarkation to the deck does not exceed 0.3m. The display mark is to enable passengers to identify the exits of the entire escape route.

As using the lighting, it is to be supplied by emergency lighting.

7.1.4.8 Red warning lights with automatic and manual control are to be fitted in bunkering operation areas liable for observation, warning lights shall be automatically activate at the beginning of the bunkering operation with the flash rate of 50~70 times per minute.

**7.1.5 Video surveillance systems**

7.1.5.1 The bunkering ships are to be equipped with video surveillance system, the range

of video surveillance is to cover at least fuel tanks on the open deck, the areas arranged with bunkering equipment, and is to be centralized for display in the control room or staffed locations.

#### **7.1.6 Lightning protection**

7.1.6.1 For protection against lightning damage, the lightning protection device can be used.

7.1.6.2 For LNG cargo tanks arranged on the open deck, when its outer shell is made of non-metallic or steel materials with a thickness of less than 4mm, then the direct lightning protection device is to be provided. The distance of direct lightning protection device away from the outer shell of cargo tanks is not to be less than 3m.

7.1.6.3 For LNG cargo tanks arranged on the open deck, when its outer shell is made of steel material with a thickness of not less than 4mm, then the lightning arrester is not required to be provided.(if necessary, it is proposed to set lightning-protection network or 1 lightning-protection line, but not the lightning arrester), but the outer shell of cargo tanks is to be well grounded, and the grounding points are not to be less than two, the cross-sectional area of the grounding conductor is to meet the requirements for downlead of lightning current (copper: cross-sectional area of not less than 70mm<sup>2</sup> ; steel: cross-sectional area of not less than 100mm<sup>2</sup>; aluminum: cross-sectional area of not less than 84mm<sup>2</sup>).

7.1.6.4 The combustible gas vent pipe is to be installed with lightning arrester for protection and to be provided within the range protected by the lightning arrester, the lightning arrester is to be above the pipe orifice 2m, the horizontal distance of the lightning arrester from the pipe orifice is not to be less than 3m. But when there are measures to ensure or prove that the flame cannot spread down along the vent pipe, the lightning arrester is not required to be provided.

#### **7.1.7 Anti-static and anti-stray currents**

7.1.7.1 To prevent electrostatic discharge damage, LNG cargo tanks and its processing units and piping, in addition to directly or fixedly mounted on the hull by the welding of supporting elements, it is to be added with a dedicated grounding strap; each pipe section between the fuel pipes using flange joints, diaphragm valves using a non-conductive material (Such as polytetrafluoroethylene) gasket or seal are also to be added with strap connection, and maintain a good electrical connection with the hull structure. The straps are to be made of copper or corrosion-resistant materials having a good conductivity, and its cross-sectional area is not to be less than 10mm.

7.1.7.2 The grounding device which can eliminate the human body electrostatic is to be provided near the personnel entrance of the receiving ships and Wharf towards to the bunkering ships.

7.1.7.3 There is not to be any ungrounded floating objects in LNG cargo tanks.

7.1.7.4 Before loading into LNG cargo tanks, the metal equipment must be safely and effectively bridged with the hull structure, and must remain grounded until it is removed.

7.1.7.5 The fenders facilities of bunkering ships are to be insulated from the berthing receiving ships.

7.1.7.6 The channel between the bunkering ships and receiving ships (if any) is not to become an electric road access between the two.

7.1.7.7 It is proper to install an insulating flange or a separate section non-conductive hose

on the flexible connecting equipment and loading arms for bunkering ships.

7.1.7.8 The insulating flange or single section non-conductive hose, is not to form a short circuit due to the contacting with external metals.

7.1.7.9 The insulating flange and non-conductive hoses is to be tested regularly, the resistance value of the insulating flange of bunkering hoses or non-conductive hoses is not to be less than 1000Ω.

7.1.7.10 When the loading arm is unloaded, the resistance value of the insulating flange is not to be less than the following value;

Before the hydrostatic test: when voltage > 1000V,  $\geq 10000\Omega$

After the hydrostatic test or operation state: when voltage is 20V,  $\geq 1000\Omega$

7.1.7.11 It is not proper to use disconnect cathodic protection system in place of the insulating flange or non-conductive hoses.

7.1.7.12 It is not proper to use jumper cables to connect the bunkering ships and receiving ships.

### **7.1.8 Communications and Public Address (Broadcast) System**

7.1.8.1 The sound-powered telephone or battery- powered telephone are to be provided as communication tools in the important spaces, such as operating location of bunkering equipment, cargo control room, wheelhouse, operating room (as appropriate).

7.1.8.2 At least three qualified explosion-proof wireless transceivers are to be equipped to satisfy the requirements of the operation.

7.1.8.3 The broadcasting system are to be provided, the loudspeakers in broadcasting system are to be set at least in cabins for staff to live and spaces with people working in general, and enable to transmit one-way message to receiving ships.

7.1.8.4 The remote control devices of broadcasting system are to be installed in cargo control room or wheelhouse.

## **Section 2 DIVISION OF HAZARDOUS AREAS**

### **7.2.1 Division of hazardous area and the equipment**

7.2.1.1 The division of hazardous area and the setting of equipment shall comply with the relevant requirements specified in PART 3 of Rules for Construction and Equipment of Ships Carrying Liquefied Gases in Bulk or the relevant requirements specified in PART 10 of Rules and Regulations for the Construction and Equipment of Inland Waterways Ships Carrying Liquefied Gas in Bulk.

7.2.1.2 Explosion-proof categories, grades and temperature groups of electrical Equipment are to be selected based on the gas classification, grading and ignition temperature of any gas(mixture) or vapour (mixture) that may occur around the electrical devices. Explosion-proof categories, grades and temperature groups of explosion-proof equipment which suitable for dangerous areas where may exist natural gas are not to be less than II A, T2, explosion-proof categories, grades and temperature groups of explosion-proof equipment in battery room are not to be less than II C, T1.

7.2.1.3 Equipment arrangement of bunkering ships is to be considered for the interaction between the bunkering ships and receiving ships or shore station, a explosion-proof electrical

device is to be arranged at gunwale.

7.2.1.4 In case the monitoring instrument equipment related to bunkering operation are to be equipped in operating room, the instrument equipment of which are to be adopted with indirect readout system, and the instrument equipment are to be designed to prevent flammable gas from leakage to operating room in any case.

### **Section 3     **ADDITIONAL REQUIREMENTS FOR ELECTRIC PROPULSION****

#### **7.3.1     General requirements**

7.3.1.1 The electric propulsion system shall be designed to ensure the redundancy of the maneuverability of the ships so that a single failure in the electrical system not disables the propulsion permanently, except for fire and flooding of the engine room.

7.3.1.2 The power management system shall be arranged, upon failure of the power management system, there is no change in the available electric power, the failure of the power management system is to be alarmed by indication.

7.3.1.3 The electric propulsion system shall be equipped with means for local control, these means shall be understood as a method of controlling the equipment that independent of the remote control system

7.3.1.4 The electric propulsion system shall include the means for limiting the power level, the electric propulsion system may automatically limit the propulsion level when there is not adequate available power in public power station.

7.3.1.5 The propeller revolutions shall not be increased substantially in case of a signal failure or a data loss of the electric propulsion control system.

7.3.1.6 Means for emergency stop of propulsion motors shall be arranged at all control locations. The emergency stops shall be independent of the normal stop, and separate for each propulsion line.

# CHAPTER 8 FIRE SAFETY

## Section 1 GENERAL PROVISIONS

### 8.1.1 General requirements

8.1.1.1 Unless expressly provided otherwise, the fire of bunkering ships is to meet the relevant requirements of 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 Gas in Bulk.

8.1.1.2 The gas outlet pipe of bunkering ships' engine shall be fitted with spark arresters.

## Section 2 FIRE PROTECTION AND EXTINCTION

### 8.2.1 Fire mains and hydrants

8.2.1.1 The fire mains and hydrants of bunkering ships are to meet the relevant requirements of 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 Gas in Bulk.

### 8.2.2 Water-spray systems

8.2.2.1 A water-spray system, for cooling, fire prevention and crew protection shall be installed on the bunkering ship to cover the areas required in 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 Gas in Bulk, as well as the areas on deck where bunkering equipment are arranged, such as the area fitted with bunkering pipes, connecting equipment and relevant valves.

8.2.2.2 If the water-spray system of a bunkering ship is divided into two or more sections, the areas where bunkering equipment are arranged may be served by an independent section.

8.2.2.3 The capacity of water supply pump in water-spray system is to supply all the water needed during spraying water to every parts simultaneously, or, if the system has been divided into several sections, the arrangement and capacity of water supply pump is to supply all the water needed during spraying water to any section, areas fitted with bunkering equipment and coverage prescribed in 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 Gas in Bulk simultaneously.

### 8.2.3 Dry chemical powder fire-extinguishing systems

8.2.3.1 Bunkering ships are to be fitted with fixed dry chemical powder fire-extinguishing systems prescribed in 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 Gas in Bulk.

8.2.3.2 Bunkering ships are to be fitted with corresponding number of portable dry powder fire-extinguishers in following positions:

(1) One portable dry powder fire-extinguisher of no less than 5kg capacity is to be fitted near areas where bunkering equipment are arranged.

(2) At least one portable dry powder fire-extinguisher of no less than 5kg capacity is to be fitted separately near the gas fuelled engine and in the entrance of machinery space where the engine placed.

#### 8.2.4 Fixed deck foam fire-extinguishing systems

8.2.4.1 The bunkering ships with function of bunkering both LNG fuel and fuel oil are to be fitted with fixed deck foam fire-extinguishing systems.

8.2.4.2 Fixed deck foam fire-extinguishing systems are to meet the following functions:

(1) The unit supplying foam is to be capable of delivering foam to the whole deck area of oil tank and to any cargo oil tank with broken deck.

8.2.4.3 (2) The operation of deck foam system is to be easy and rapid. The main control station of the system is to be situated in suitable space outside the oil tank area, adjacent to the accommodation, and in an easily accessible and readily operable position in the event of fire in the protected areas.

8.2.4.4 Fixed deck foam fire-extinguishing systems are to be fitted according to oil tank capacity which meets the relevant requirements of CCS rules concerning oil tankers having a flashpoint of no more than 60°C, for bunkering ships with fuel oil load less than 4000t in oil tank area, foam applicators are to be fitted, foam monitors may be not.

8.2.4.5 One kind of foam solution is to be provided, 补充 general protein foam is not to be used. The general protein foam may be allowed by the Society if it can be proved that the dry powder extinguishing agent on ship is compatible with the general protein foam.

#### 8.2.5 Water curtain systems

8.2.5.1 Water curtain systems are to be fitted in broadside near LNG bunkering areas to protect them in the event of fire. The coverage of water curtain systems are to be extended to 5m beyond both sides of bunkering area.

8.2.5.2 The height of water curtain formed by water curtain system is to be enough to protect the operation personnel and bunkering equipment.

8.2.5.3 The installation of water curtain nozzle is not to affect the mooring and fuel bunkering.

8.2.5.4 The control device of water curtain system is to be situated in suitable position far away from connecting equipment.

#### 8.2.6 Firemen's outfits

8.2.6.1 Firemen's outfits are to meet the relevant requirements of 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 Gas in Bulk.