

# CIRCULAR

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To : All Surveyors and whom it may concern

**No : 2017-7-E**  
**Date : 2017.10.23**

<b>Subject</b>	9.105 Notice for Establishment to the KR Technical Rules (LNG Bunkering Systems)
<b>Application</b>	Immediately

- 1. Please be informed that the requirements for ships carrying liquefied gas in bulk fitted with “LNG Bunkering Systems” has been established as attachments, and you are kindly requested to apply the Guidance on the relevant works.**
- 2. Furthermore, please be informed that the amendments will be included in 2018 edition on Annex 7A-3(LNG Bunkering Systems) of Guidance for Relating to the Rules for the Classification of Steel Ships Pt 7 Ch 5 which will be published in the first half of 2018.**

Attachments: Annex 7A-3(LNG Bunkering Systems) of Guidance for Relating to the Rules for the Classification of Steel Ships Pt 7 Ch 5--- 1 copy. (The End)



Kim Chang-wook

Executive Vice President, Technical Division

**(Draft)**

**Amended Guidance Relating to the Rules for the Classification of  
Steel Ships**

**(Pt 7, Ch5 Ships Carrying Liquefied gases in Bulk)**



2017.10

## <Newly Added>

# Annex 7A-3 LNG Bunkering Systems

## Section 1 General

### 101. Application

1. This Annex applies to ships carrying liquefied gas in bulk fitted with systems for delivering LNG bunker to ships using LNG as fuel. This Annex also applies to a ship carrying liquefied gas in bulk transferring LNG cargo to another ships carrying liquefied gas in bulk.
2. This Annex provides requirements for design, construction and survey for bunkering systems and relevant safety systems installed in a bunkering vessel, and hull, machinery and cargo related requirements other than bunkering systems are to comply with **Ch 5** of the Rules and other related Rules.

### 102. Definitions

1. **Receiving ship** means is the ship that receives LNG fuel.
2. **Transfer system** means a system used to connect the bunkering ship and manifold of the receiving ship in order to deliver LNG bunker to a receiving ship. Transfer hoses or a transfer arms can be used for transfer systems.
3. **Emergency Shutdown(ESD)** means a system that safely and effectively stops equipment and operation and closes valves related with the transfer of LNG and vapor between the bunkering ship and the receiving ship in the event of an emergency.
4. **Emergency Release Coupling(ERC)** means a device to provide a means of quick release of the transfer connections by excessive force applied to the coupling when such action is required as an emergency measure
5. **Emergency Release System(ERS)** means a system that provides a positive means of quick release of transfer connections and safe isolation of bunker vessel and receiving ship gas fuel systems
6. **Quick connect disconnect coupler(QCDC)** means manual or hydraulic mechanical device used to clamp the transfer arrangement presentation flange to manifold of receiving ship without use of bolted connections.
7. **Operational envelope** means room in which the presentation flanges of bunker vessel and receiving ship can operate safely.
8. **Person in charge** means a person who is responsible for the overall management of the bunkering operation.
9. **Bunkering control station** means a space used in the control of bunker handling operations.
10. **Certified safe type** means electrical equipment that is certified safe by the relevant authorities recognized by the Society for operation in a flammable atmosphere based on a recognized stan

### 103. Class notations

1. Ships which comply with this Chapter may be assigned with the LNG Bunker notation as an additional installation notation at the request of the owner
2. Where a ship assigned the LNG Bunker notation incorporates systems for handling of excess vapor return from the receiving ship, VRS notation may be assigned in accordance with the followings.
  - (1) The capacity of vapor recovery expressed in kW is assigned next to VRS. For example, where the capacity is [X] kW, the notation will be assigned as LNG Bunker(VRS[X]).
  - (2) Requirements for the notation is to be in accordance with **505**..

## 104. Equivalence and novel features

1. The construction and equipment, etc. which are not in compliance with the requirements of the Guidance but are considered to be equivalent to those required in the Guidance will be accepted by the Society.
2. The Society may consider the classification of the construction and equipment based on or applying novel design principles or features, to which the Rules are not directly applicable, on the basis of experiments, calculations or other supporting information provided to the Society.

## 105. Codes and standards

The recognized national, international and industrial standards such as the followings may be adequately referred.

Standard No.	Standard Title
OCIMF/SIGTTO	Ship to Ship Transfer Guide(Liquefied Gases)
OCIMF/SIGTTO	Recommendations for Manifolds for Refrigerated Liquefied Gas
ISO 16904	Petroleum and natural gas industries - Design and testing of LNG marine transfer arms for conventional onshore terminals
EN 1474-2	Installation and equipment for liquefied natural gas - Design and testing of marine transfer systems - Design and testing of transfer hoses
EN 1474-3	Installation and equipment for liquefied natural gas - Design and testing of marine transfer systems - Offshore transfer systems
IACS	LNG Bunkering Guidelines
SIGTTO	ESD Arrangements & Linked Ship/ Shore Systems for Liquefied Gas Carriers
IAPH	LNG Bunkering Checklist - Ship to Ship

## Section 2 Classification Survey during Construction

### 201. Submission of plans and documents

At the Classification Survey during Construction, the following plans and documents for bunkering systems are to be submitted to the Society before the work is commenced.

- (1) Plans and documents for approval
  - (A) Power system and Control system diagram
  - (B) Plans showing hazardous area
  - (C) Electric wiring plans and a table of electrical equipment in hazardous area
  - (D) Arrangements and cause and effect diagram for emergency shutdown systems and fire and gas detection systems
  - (E) Piping diagram
  - (F) Strength analysis for supporting structures and foundations for transfer arm
  - (G) Arrangements for Bunker manifold including protection against low-temperature cargo leaks
  - (H) Bunkering operation manual
- (2) Plans and documents for reference
  - (A) Arrangements for transfers arms or hoses
  - (B) Working envelope diagram for transfer arms
  - (C) Specification for transfer arms or transfer hoses
  - (D) Cause and effect diagram for bunkering control and monitoring systems
  - (E) Gas trial procedure
  - (F) Where VRS notation is assigned, capacity calculation for vapor return systems required in 505. 7

## **202. Tests and surveys**

### **1. Tests of equipment**

- (1) Following equipment is to be type approved and tested for each production in accordance with **ISO 16904**.
  - (A) swivel
  - (B) emergency release system
  - (C) quick connect disconnect coupler
- (2) After assembly, transfer arms are to be tested in accordance with **ISO 16904**.
- (3) Transfer hoses are to be type approved and tested for each production in accordance with **EN1474-2**.
- (4) Hose cranes are to be test in accordance with **Pt 9, Ch 2** of the Rules.
- (5) Pump and valves are to be test in accordance with **Ch 5, 513**. of the Rules.

### **2. Onboard tests**

- (1) Correct operation of emergency shut down systems and emergency release systems is to be function-tested. and their sequence of operation required by **502**. and **503**. is to be confirmed.
- (2) All indicators, alarms and safety functions related to the gas fuel transfer equipment shall be tested are be function-tested.
- (3) Correct operation of gas detection system to be verified.
- (4) Transfer arms are to be tested in accordance with **ISO 16904** after installed on board.

### **2. Gas trial**

- (1) The gas trials are to be conducted in accordance with the submitted testing procedure during gas trials.
- (2) In addition to tests required in **Ch 5**, the followings are to be tested.
  - (A) Where VRS notation is assigned, capacity and performance of vapor return systems are to be tested.
  - (B) Bunkering systems, including control, alarm and safety systems are to be function-tested.

## **Section 3 Periodical Surveys**

### **301. General**

In the case of items not specified in this Section, the requirements specified in **Pt 1, Ch 2** of the Rules are to be applied.

### **302. Annual survey**

1. Emergency release systems are to be function-tested.
2. Satisfactory resistance of insulated flanges are to be examined.
3. Satisfactory operation of Emergency shutdown systems for pump, gas compressor and emergency shutdown valves used for bunkering are to be confirmed.
4. Tests and survey for transfer hoses are to be in accordance with the followings
  - (1) Confirming the satisfactory condition of hoses including end connection.
  - (2) Confirming the satisfactory condition of hose cranes and supports.
5. Transfer arms are to be in accordance with the followings
  - (1) Confirming the satisfactory function of arms.
  - (2) Visual inspection of piping and other parts of arms.

### **303. Intermediate Surveys**

At each Intermediate Survey, all the requirements of Annual Survey are to be complied with.

### **304. Special Surveys**

At the Special Survey, in addition to the requirements for Intermediate Survey, the following requirements are to be complied with.

1. Confirming the satisfactory condition of swivel and sealing, ect. of transfer arms and, if necessary, leakage test is to be performed.
2. Confirming the satisfactory condition of piping of transfer arms and, if necessary, leakage test is to be performed.
3. Transfer hoses are to be tested hydraulically to the maximum working pressure.

## **Section 4 Material**

### **401. General**

1. Selection and tests of materials used for piping, equipment and structure, etc. in contact with cryogenic liquids or gases are to be in accordance with **Ch 5, Sec 6** of the Rules taking into account the minimum design temperature.
2. Material other than those mention **Par. 1** is to be in accordance **Pt 2** of the Rules.

## **Section 5 Arrangements and Design of Bunkering Systems**

### **501. Functional requirements**

1. Bunkering systems are to be designed with suitable functionality for prevention, detection, control and mitigation of leakage of LNG and NG affecting the ship and personnel safety.
2. Systems are to be able to be drained, purged and inerted before connecting or disconnecting transfer systems.
3. Systems are to be designed to prevent from damage due to pressure increase in systems which may be isolated in a LNG full condition.
4. Substitution of systems required in this Annex with operational or procedural measures is not permitted.

### **502. Bunkering manifold area**

1. The bunkering manifold area is to be located on the open deck so that sufficient natural ventilation is provided.
2. Drip trays are to be fitted below LNG bunkering connection and where leakage may occur in accordance with the followings.
  - (1) Drip trays are to be made of suitable material for low temperatures.
  - (2) The drip tray is to be thermally insulated from the ship's structure so that the surrounding hull or deck structures are not exposed to unacceptable cooling, in case of leakage of liquid fuel.
  - (3) The tray is to be fitted with a drain valve to enable rain water to be drained over the ship's side.
  - (4) The tray is to have a sufficient capacity to ensure that the maximum amount of spill according to the risk assessment can be handled.
3. A water distribution system is to be fitted in way of the hull under the bunker connections to provide a low-pressure water curtain for additional protection of the hull steel and the ship's side structure. This system is to be operated when cargo transfer is in progress.
4. The bunker connections are to be observable from the bunker operation control position by providing permanent watch or CCTV during the transfer.

### **503. Bunkering manifold**

1. Safe working load of The bunkering manifold is to be designed to withstand the external loads during bunkering operation.
2. Information about maximum safe working load of bunkering connection is to be detailed in the operation manuals and posted at the bunker station.
3. Connections for vapor return from the receiving ship are to be provided.
4. A manually operated stop valve and a remote operated shutdown valve in series, or a combined manually operated and remote valve, are to be fitted in every bunkering line including vapor line close to the manifold connecting point. The remote valve is to be operable from the control location for bunkering operations or another safe location.
5. All pipelines or components which may be isolated in a liquid full condition are to be protected with relief valves for thermal expansion and evaporation.
6. Manifold connections not being used for bunker transfer operations are to be blanked with blind flanges suitable for the design pressure.

### **504. Cargo tank loading**

1. Cargo tanks of the bunkering ship are to be assessed for all partial loading conditions considering abortion of bunkering operation at any stage in case of emergency such that there are no operational limits on partial loading.
2. Where there are no operational limits on partial loading, such operational limits are subject to approval and are to be detailed in the operation manuals.

### **505. Vapor return systems**

1. The ship assigned with VRS notation in accordance with **103. 2** is to be provided with arrangements for handling excess vapor to protect fuel tank of receiving ship from over pressure.
2. Vapor returned from the receiving ship may be handled by one of the following methods:
  - (1) reliquefaction of vapors;
  - (2) thermal oxidation of vapors;
  - (3) pressure accumulation; or
  - (4) a combination of the above
3. The capacity of vapor return systems is to be sufficient for handling excess vapor returned from the receiving ship.
4. Reliquefaction plants and gas combustion units are to be in accordance with **Ch 5, 703. and 704.** of the Rules.
5. Vapor return process piping is to be adequately separated from other cargo process piping to avoid over pressure of cargo system on the bunkering ship.
6. Control and monitoring of the vapor return system is to be integrated into the control and monitoring system of bunkering systems and to be capable of varying LNG delivery rates in consideration of the monitored vapor return system parameters.
7. Calculations for the maximum vapor return flow rate, pressure and corresponding tank pressure management details, are to be submitted and summary information is to be detailed in the operation manuals.

### **506. Electrical insulation**

1. Inter-vessel electrical isolation between the bunkering ship and the receiving ship is to be main-

tained during transfer to reduce high-energy sparks being produced by the electrical potential difference between the hulls.

2. Each transfer connection is to have insulation flange to maintain electrical isolation. Insulation flange shall have resistance of at least 1 kohm to limit current flow but less than 100 Mohm to dissipate static charge.

## **507. Bunker transfer systems**

### **1. Transfer hoses**

- (1) Hoses are to be designed for a bursting pressure not less than five times the maximum working pressure.
- (2) Material of hoses is to be compatible with the cargo and suitable for the cargo temperature.
- (3) The overall hose length is to be sufficient to meet both storage and operation condition.
- (4) Hoses for LNG transfer are to be protected from over pressure by relief valves fitted outboard manifold valve.
- (5) In determining the size and length of the hoses to be used, the followings are to be considered
  - (A) maximum allowable bend radius of the hose
  - (B) horizontal distance between the ships
  - (C) difference in fore and after alignment(manifold offset)
  - (D) distance between the manifold and the ship's side
  - (E) vertical and horizontal ship movement
  - (F) relative change in freeboard between the ships
  - (G) allowable flow rate and pressure drop
  - (H) hose supporting and handling equipment

### **2. Hose supporting and handling equipments**

- (1) The bunkering ship is to fitted with equipment supporting hoses during the transfer and handling hoses after activation of emergency release coupling.
- (2) Hose supporting and handling equipments are to be in accordance with **Pt 9, Ch 2** of the Rules.
- (3) Hose supports or cradles are to be arranged in consideration of hose bend radius.

### **3. Transfer arms**

- (1) Transfer arms are to be designed in consideration of the followings.
  - (A) acceleration forces acting on the transfer arm
  - (B) permissible manifold loadings
  - (C) arm working envelope
  - (D) arm support arrangement in operation and storage condition
  - (E) the effect of hull vibration on the arm
  - (F) vertical and horizontal ship movement
  - (G) allowable flow rate and pressure drop
- (2) Piping is to be arranged to avoid excessive stresses due to thermal movement and from movements of the tank and hull structure.
- (3) All piping supports are to be adequately designed so that stresses in the piping and the structure are within allowable limits for all attitudes and positions.

4. Emergency release systems are to be in accordance with **603.**

## **508. Inerting systems**

1. The bunkering ship is to have onboard source of suitable inert gas for inerting, purging of bunkering lines.
2. Inert gas generators are to be in accordance with **Ch 5, 905.** of the Rules.
3. The inert gas used for purging of bunkering lines is to have dewpoint sufficiently low to eliminate risk of water condensate accumulation in the piping system.
4. Suitable arrangement to prevent back-flow of cargo vapor from cargo system into the inert gas system is to be provided in accordance with **Ch 5, 905. 4** of the Rules.



### **509. Communication systems**

1. A communication system is to be provided between the bunkering facility and the receiving ship and be provided with back-up. This may be achieved by electric, fibre-optic or pneumatic links, or a combination of these systems.
2. The components of the communication system located in hazardous area are to be of certified safe type.
3. Where portable radios are used for communication, they are to be of certified safe type for hazardous area.

### **510. Mooring equipment**

1. The bunkering ship is to be equipped with sufficient number of closed type fairleads for safe mooring to the receiving ship.
2. Reference is made to **OCIMF Mooring equipment guidelines**.

### **511. Drain**

Means are to be provided to drain residual LNG in the bunkering systems to cargo tanks.

## **Section 6 Control, Monitoring and Safety Systems**

### **601. General**

1. Control, monitoring and safety Systems are to be provided to maintain operations within preset parameters for bunkering operations
2. The bunkering control and monitoring system is to be designed so that no single control system component failure or single fault condition is to lead to loss of control of bunkering operations or result in an unsafe situation. A Failure Modes Effects Analysis (FMEA) is to be carried out and documented.
3. Control of bunkering is to be possible from a safe location in regard to bunkering operations.
4. Safety function for parameter monitored during bunkering operation is to be in accordance with **602. 2, 3** and **603. 1**.

### **602. Monitoring, alarm and control systems**

1. Visible and audible alarms are to be provide on bunkering control station.
2. Alarms are to be activated in the following cases.
  - (1) Low pressure in the supply tank
  - (2) Sudden pressure drop at the transfer pump discharge
  - (3) High level in the receiving tank
  - (4) High pressure in the receiving tank
  - (5) LNG leakage in manifold area
  - (6) Gas detection in the ducting around the bunkering lines at 30% LEL
  - (7) Gas detection in enclosed cargo machinery spaces at 30% LEL
  - (8) Manual or automatic activation of the emergency shutdown system
  - (9) Manual or automatic activation of the emergency release system
  - (10) Safe working envelope of the loading arm exceeded
  - (11) Fire detection on receiving ship or bunkering ship
  - (12) Electrical power failure

3. Where transfer arms are used as transfer systems, in addition to **Par. 2**, the followings are to be complied with.
  - (1) A system of constant monitoring of the position of arms is to be installed to provide real time information to the operator and receiving ship.
  - (2) For the hydraulic systems of the transfer arm, visible and audible alarms are to be activated in the following cases.
    - (A) low pressure in hydraulic accumulators;
    - (B) abnormal pressure in actuators chambers;
    - (C) low oil level in tank;
    - (D) low nitrogen pressure in accumulators.

### **603. Emergency shutdown systems**

1. Emergency shutdown system is to safely stop and isolate the bunker transfer between bunkering ship and receiving ship in the following cases:
  - (1) Low pressure in the supply tank
  - (2) Sudden pressure drop at the transfer pump discharge
  - (3) High level in the receiving tank
  - (4) High pressure in the receiving tank
  - (5) LNG leakage in manifold area
  - (6) Gas detection in the ducting around the bunkering lines at 60% LEL
  - (7) Gas detection in enclosed cargo machinery spaces at 60% LEL
  - (8) Manual or automatic activation of the emergency shutdown system
  - (9) Manual or automatic activation of the emergency release system
  - (10) Safe working envelope of the loading arm exceeded
  - (11) Fire detection on receiving ship or bunkering ship
  - (12) Electrical power failure
2. Activation of emergency shutdown system is to initiate the following:
  - (1) shut-down of cargo transfer pump and vapour return compressor
  - (2) closure of emergency shutdown valve; The closing time of the valve is to be considered so that the surge pressure in the transfer piping is not to be greater than allowable pressure.
3. A functional flow chart of the emergency shutdown system and related systems is to be provided at the bunkering control station and cargo control station or bridge, as applicable.
4. Activation of the emergency shutdown system is to be controllable from both bunkering ship and receiving ship.
5. Emergency shutdown systems of the bunkering ship and the receiving ship are to be linked to ensure the co-ordinated operation on both ships. This ESD link is to be fail-safe.
6. The bunkering system is not to be resumed until the transfer system and associated safety systems are returned to normal operation condition.
7. As a minimum, the emergency shutdown system is to be capable of manual operation in the followings.
  - (1) bunkering control station
  - (2) cargo control station
  - (3) navigation bridge
  - (4) at least two strategic positions around the bunker delivery area.

### **604. Emergency release systems**

1. Emergency release systems are to be capable of rapidly and automatically disconnecting the transfer system from the ship to protect the transfer system when exceeding design loads in any direction.
2. Emergency release systems are to be composed with emergency release coupling and two self-closing shutoff valves and each valve is fitted at each side of the coupling to minimize cargo leakage

when the coupling is activated.

3. Emergency release systems are to be controllable from both bunkering ship and receiving ship.
4. Emergency release systems is to be of powered type and the actuating power is to have reserve storage of energy sufficient for disconnection of all transfer lines in case the main source of actuating power becomes unavailable (e.g. in case of black-out)
5. Emergency release systems is to be capable to be activated manually on local location and at least two remote locations including bunker control station.
6. When initiation of the emergency release system is to result in the simultaneous closing of interlocking isolating valves of emergency release system, followed by the emergency release coupling separation, the followings are to be complied with to prevent hull and transfer system being damaged.
  - (1) Where transfer arms are used, the disconnected arms are to retract behind the berthing line and shall lock hydraulically.
  - (2) Where transfer hoses are used, the disconnected hoses are to be supported by cranes or other measures are to be taken to prevent hull and hose being damaged.
7. Manual or automatic activation of the emergency release system is to be inhibited without prior operation of the emergency shutdown system.

## **Section 7 Fire Protection and Fire Extinction**

### **701. General**

1. Water spray systems are to be installed at the bunkering manifold area in accordance with **Ch 5, 1103.** of the Rules.
2. Dry chemical powder fire-extinguishing systems is to be installed at the bunkering manifold area in accordance with **Ch 5, 1104.** of the Rules.

## **Section 8 Operational Requirements**

### **801. General**

1. Before any bunkering operation commences, a pre-bunkering operations meeting is to take place between the person in charge at the bunkering ship and the persons in charge at the receiving ship and they shall:
  - (1) agree in writing the transfer procedure, including cooling down and if necessary, gassing up; the maximum transfer rate at all stages and volume to be transferred;
  - (2) agree in writing action to be taken in an emergency; and
  - (3) complete and sign the bunker checklist. Form and items of bunkering checklist are to be in accordance with **IAPH 'LNG Bunkering Checklist – Ship to Ship'**.
2. Effective communications are to be maintained throughout the operation.
3. Essential cargo handling controls and alarms are to be checked and tested prior to bunkering operations.

### **802. Operation manuals**

1. The ship is to be provided with bunkering operation manuals approved by the Society.
2. The contents of bunkering operation manuals is to include:
  - (1) preparation before the bunkering
  - (2) information to be exchanged between bunkering vessel and receiving ship prior to operation
  - (3) hose or arm handling guidelines
  - (4) procedures for connection including line inerting and tightness test

- (5) preparations for start of bunkering including preparedness of fire-fighting, tightness testing, establishing communications, allocation of personnel and responsibilities
  - (6) pre-cooling of transfer connections and transfer procedures
  - (7) draining of the pipeline, purging and disconnection on completion of the transfer
  - (8) operational restrictions to prevent dangerous pressure surge effect in the pipes
  - (9) fire safety during the transfer
  - (10) procedures for raising alarms
  - (11) procedures in case of communications failure
  - (12) suspension of operation during emergencies
  - (13) procedures for authorization of ERS activation
  - (14) emergency procedures for the followings:
    - (A) gas fuel leakage
    - (B) termination of the bunkering and emergency disconnection
    - (C) response in case of unintentional disconnection of ERS
  - (15) vapor return management plan
  - (16) operational envelope of bunkering ship
- ↓