

RULES

FOR THE CLASSIFICATION AND CONSTRUCTION OF SHIPS CARRYING LIQUEFIED GASES IN BULK

PART I CLASSIFICATION

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RULES FOR THE CLASSIFICATION AND CONSTRUCTION OF SHIPS CARRYING LIQUEFIED GASES IN BULK

Rules for the Classification and Construction of Ships Carrying Liquefied Gases in Bulk of Russian Maritime Register of Shipping (RS, the Register) have been approved in accordance with the established approval procedure and come into force on 1 January 2023.

The present edition of the Rules is based on the 2022 edition taking into account the amendments developed immediately before publication.

The Rules establish requirements, which are specific for ships carrying liquefied gases in bulk, and supplement the Rules for the Classification and Construction of Sea-Going Ships and Rules for the Equipment of Sea-Going Ships of Russian Maritime Register of Shipping.

The Rules are published in the following parts:

Part I "Classification";

Part II "Ship Arrangement";

Part III "Stability. Subdivision. Freeboard";

Part IV "Cargo Containment";

Part V "Fire Protection";

Part VI "Systems and Piping";

Part VII "Electrical Equipment";

Part VIII "Instrumentation and Automation Systems";

Part IX "Materials and Welding";

Part X "Special Requirements".

The Annexes to the Rules are published separately.

REVISION HISTORY

(purely editorial amendments are not included in the Revision History)

For this version, there are no amendments to be included in the Revision History.

1 GENERAL

1.1 Application.

1.1.1 Rules for the Classification and Construction of Ships Carrying Liquefied Gases in Bulk¹ apply to specially built or converted ships, regardless of their gross tonnage and power plant output, intended for the carriage of liquefied gases in bulk having a vapour pressure exceeding 280 kPa absolute at a temperature of 37,8 °C, and other substances listed in the Table of Technical Requirements (refer to Annex 1).

Ships carrying liquefied gases in bulk² are in full measure covered by the requirements of the Rules for the Equipment of Sea-Going Ships, Rules for the Cargo Handling Gear of Sea-Going Ships, Load Line Rules for Sea-Going Ships, Rules for the Classification and Construction of Sea-Going Ships³ apply to LG carriers to the extent stipulated in the text of the LG Rules.

1.2 Definitions and explanations.

1.2.1 The following definitions are used in the LG Rules.

Upper flammable limit means the concentration of a hydrocarbon gas in air above which there is insufficient air to support and propagate combustion.

Secondary barrier is the liquid-resisting outer element of a cargo containment system designed to afford temporary containment of any envisaged leakage of liquid cargo through the primary barrier and to prevent the lowering of the temperature of the ship's structure to an unsafe level.

Gas-safe space is a space other than a gas-dangerous space.

LG carrier is a ship designed for the carriage of liquefied gases and other products in bulk listed in the Table of Technical Requirements (refer to Annex 1).

LG-dangerous space (including hazardous space) is:

a space in the cargo area which is not arranged or equipped in an approved manner to ensure that its atmosphere is at all times maintained in a gas-safe condition;

an enclosed space outside the cargo area through which any piping containing liquid or gaseous product passes, or within which such piping terminates, unless approved arrangements are installed to prevent any escape of product vapour into the atmosphere of that space;

a cargo containment system and cargo piping;

a hold space where cargo is carried in a cargo containment system not requiring a secondary barrier;

a space separated from a hold space, in which a cargo containment system requiring a secondary barrier is arranged, by a single gastight steel boundary;

a cargo pump room and cargo compressor room;

a zone on the open deck, or semi-enclosed space on the open deck, within 3 m of any cargo tank outlet, gas or vapour outlet, cargo pipe flange or cargo valve or of entrances and ventilation openings to cargo pump rooms and cargo compressor rooms;

the open deck over the cargo area and 3 m forward and aft of the cargo area on the open deck up to a height of 2,4 m above the weather deck;

a zone within 2,4 m of the outer surface of a cargo containment system where such surface is exposed to the weather;

¹ Hereinafter referred to as "the LG Rules".

² Hereinafter referred to as "the LG carriers".

³ Hereinafter referred to as "the Rules for the Classification".

an enclosed or semi-enclosed space in which pipes containing products are located. (A space which contains gas detection equipment specified in 6.3, Part VIII "Instrumentation and Automation Systems" and a space utilizing boil-off gas as fuel and complying with the requirements of Part VI "Systems and Piping" are not considered as gas-dangerous spaces);

a compartment for cargo hoses;

an enclosed or semi-enclosed space having a direct opening into any gas-dangerous space or zone.

Cargo tank is the liquid-tight shell designed to be the primary container of the cargo and includes all such containers whether or not associated with insulation or secondary barriers or both.

Cargo area is that part of the ship which contains the cargo containment system and cargo pump and compressor rooms and includes deck areas over the full length and breadth of the part of the ship over the above-mentioned spaces. Where fitted, the cofferdams, ballast or void spaces at the after end of the aftermost hold space or at the forward end of the forward most hold space are excluded from the cargo area.

Loading arm is an articulated transfer system used for loading and/or unloading liquefied gas to or from LG carrier and capable of withstanding various external aspects of cargo handling operations such as ship's motions, ship's freeboard, changes in water depth (tides).

Loading hose is a part of cargo system used for loading and/or unloading liquefied gas to or from LG carrier and composed of flexible pipes and relevant fitting.

Cargo machinery spaces are the spaces where cargo compressors or pumps, cargo processing units, are located, including those supplying gas fuel to the engine-room.

Cargo service spaces are spaces within the cargo area used for workshops, lockers and store-rooms of more than 2 m² in area.

Cargo containment system is the arrangement for containment of cargo including, where fitted, a primary and secondary barrier, associated insulation and any intervening spaces, and adjacent structure if necessary for the support of these elements.

Cargoes are products listed in the Table of Technical Requirements (Annex 1) and carried in bulk by ships, which meet the LG Rules requirements.

Vapour pressure is the equilibrium pressure of the saturated vapour above the liquid expressed in kilopascals absolute at a specified temperature.

Accommodation spaces — refer to 1.5.2 of Part VI "Fire Protection" of the Rules for the Classification.

Tank cover is the protective structure intended to protect the cargo containment system against damage where it protrudes through the weather deck or to ensure the continuity and integrity of the deck structure.

Closed loop sampling is a cargo sampling system that minimizes the escape of cargo vapour to the atmosphere by returning product to the cargo tank during sampling.

Insulation space is the space, which may or may not be an interbarrier space, occupied wholly or in part by insulation.

Separate systems are those cargo piping and vent systems that are not permanently connected to each other.

Cofferdam is the isolating space between two adjacent steel bulkheads or decks. This space may be a void space or a ballast space.

Tank dome is the upward extension of a portion of a cargo tank protruding through the weather deck or a tank cover.

MARVS is the maximum allowable relief valve setting of a cargo tank.

Interbarrier space is the space between a primary and a secondary barrier, whether or not completely or partially occupied by insulation or other material.

Thermal oxidation method is a system where the boil-off vapours are utilized as fuel for shipboard use or as a waste heat system subject to the provisions of Chapter 16 or a system not using the gas as fuel complying with the International Code for the Construction and Equipment of Ships Carrying Liquefied Gases in Bulk¹.

Lower flammable limit means the concentration of a hydrocarbon gas in air below when it is impossible to support and propagate combustion.

Primary barrier is the inner element designed to contain cargo when the cargo containment system includes two boundaries.

Vapour density is the relative weight of vapour compared with the weight of an equivalent volume air at the same pressure and temperature.

Cargo control room is a space used in the control of cargo handling operations and complying with the requirements of Section 10 of Part VI "Systems and Piping".

Control stations — refer to 1.5.1 of Part VI "Fire Protection" of the Rules for the Classification.

Gas consumer is any unit within the ship using cargo vapour as a fuel.

Void space is an enclosed space in the cargo area external to a cargo containment system, other than a hold space, ballast space, fuel oil tank, cargo pump or compressor room, or any space in normal use by personnel.

Reliquefaction plant means equipment used for cooling of cargo and reliquefaction of cargo vapours, which includes refrigeration system, reliquefaction unit and associated piping.

Regasification plant means equipment used for regasification operation, which includes supply pump, suction drum, regasification unit, regasification system for heat transfer agent, collecting drum, export manifold and associated piping.

Regasification system for heat transfer agent means piping system for heat energy supply to obtain the set parameters of gas offloading.

Service space — refer to 1.5.3 of Part VI "Fire Protection" of the Rules for the Classification.

LNG is a liquefied natural gas primarily consisting of methane.

LPG is a liquefied petroleum gas, primarily consisting of hydrocarbons (mixtures of propane and butane in any combination), whose composition may include small amounts of other components like hydrogen sulphide or lead alkyls.

Boiling point is the temperature in Celsius degrees at which a product exhibits a vapour pressure equal to the atmospheric pressure.

Hold space is the space enclosed by the ship's structure in which a cargo containment system is situated. Where the secondary barrier is the part of the hull structure, it may be the boundary of the hold space.

Turret compartments are those spaces and trunks that contain equipment and machinery for retrieval and release of the disconnectable turret mooring system, high-pressure hydraulic operating systems, fire protection arrangements and cargo transfer valves.

Gas combustion unit (GCU) is a means of disposing excess cargo vapour by thermal oxidation.

Reliquefaction unit is a process unit of equipment consisting of a separator, a compressor, a heat exchanger, a condenser, piping, electrical and automation equipment serving them.

Regasification unit is a process unit of equipment consisting of a booster pump, a vaporizer, piping, electrical and automation equipment serving them.

¹ Hereinafter referred to as "the Code".

2 CLASS NOTATION

2.1 Class notation of a ship.

2.1.1 The character of classification and additional distinguishing marks are assigned in accordance with the requirements of 2.2 of Part I "Classification" of the Rules for the Classification.

2.2 Descriptive notation in the class notation.

2.2.1 The ships meeting the requirements of the Rules for the Classification and the LG Rules are assigned the descriptive notation: **gas carrier** added to the character of classification (refer to Section 2 of Part I "Classification" of the Rules for the Classification).

2.2.2 The descriptive notation is supplemented with the words: **type 1G, type 2G, type 2PG and type 3G**, depending on the extent, to which a ship meets the requirements of Part III "Stability. Subdivision. Freeboard", as well as on the location of cargo tanks relative to the ship's shell plating and on the extent to which ship's survival capability is ensured taking into account the biological hazard of cargoes permitted for carriage.

2.2.3 If LG carrier is intended for the carriage of one specific cargo only, the name of cargo, its design temperature, in °C, and design density, in kg/m³, may be additionally indicated in brackets after the descriptive notation **Gas carrier**, for example: **Gas carrier type 2G (ethylene, -104 °C, 560 kg/m³)**. In this case, the requirements imposed on the ship shall consider the specific hazards associated with the carriage of that cargo.

For LG carrier intended for the carriage of liquefied natural gas (LNG), an entry (**methane**) shall be additionally added to the descriptive notation **Gas carrier**, for example: **Gas carrier type 2G (methane)**.

2.2.4 If a LG carrier is intended for the carriage of several specific cargoes, the requirements are specified proceeding from the combination of properties of the most dangerous cargoes carried.

2.2.5 When cargo tanks contain products, for which a **type 1G** ship is required, neither flammable liquids having a flashpoint of 60 °C or less, nor flammable products listed in Annex 1, shall be carried in tanks located within the protective zones described in 2.4.1 of Part II "Ship Arrangement".

2.2.6 When cargo tanks contain products, for which a **type 2G/2PG** ship is required, the flammable liquids as described in [2.2.5](#) of this Part, shall not be carried in tanks located within the protective zones described in 2.4.2 of Part II "Ship Arrangement".

2.2.7 In each case, for cargo tanks loaded with products, for which a **type 1G** or **2G/2PG** ship is required, the restriction applies to the protective zones within the longitudinal extent of the hold spaces for those tanks.

2.2.8 The flammable liquids and products described in [2.2.5](#) may be carried within these protective zones when the quantity of products retained in the cargo tanks, for which a **type 1G** or **2G/2PG** ship is required, is solely used for cooling, circulation or fuelling purposes.

2.2.9 Where a ship is fitted with a regasification unit for cargo export to shore and provided the requirements of 3.24 of Part VI "Systems and Piping" are met, the distinguishing mark **RGU (Regasification unit)** shall be added to the ship's class notation. In addition, the requirements of 2.2.5.5 of Part VII "Electrical Equipment" and Part V "Fire Protection" shall be met.

2.2.10 Where a ship is fitted with a reliquefaction unit for cargo vapours complying with 4.2 of Part VI "Systems and Piping", the distinguishing mark **RLU (Reliquefaction unit)** shall be added to the ship's class notation. The documentation specified in [4.5](#) of this Part shall be submitted to confirm the fulfillment of the requirements applying to ships with the distinguishing mark **RLU**.

2.2.11 Where a ship is fitted with a gas combustion unit complying with 4.3 of Part VI "Systems and Piping", the distinguishing mark **GCU (Gas combustion unit)** shall be added to the ship's class notation.

2.2.12 If membrane LNG cargo tanks of LG carrier are capable to withstand vapour pressure exceeding 25 kPa but not more than 70 kPa, the distinguishing mark **highPRESS(pressure)** shall be added to the ship's class notation where a maximum allowable vapour pressure in kPa is indicated in brackets, for example, **highPRESS(50)**. In order to assign **highPRESS(pressure)** mark to the ship, the documentation shall be submitted in accordance with [4.1](#) of this Part confirming fulfillment of the requirements specified in 24.1.4 and 24.4 of Part IV "Cargo Containment", 3.16.6 of Part VI "Systems and Piping" and 4.1 of Part VIII "Instrumentation and Automation Systems".

3 CLASSIFICATION SURVEYS

3.1 Initial and/or periodical surveys of gas carriers to assign and/or confirm the class are carried out in accordance with Section 8 of Part III "Additional Surveys of Ships Depending on their Purpose and Hull Material" of the Rules for Classification Surveys of Ships in Service.

3.2 The survey of a ship to issue the Certificate is carried out during the initial or periodical survey of the ship.

3.3 Ship's annual surveys are carried out within 3 months before or after every anniversary date since the day of issue of the Certificate, and are intended to ascertain that equipment, fittings, arrangements and materials of the ship meet the relevant requirements of the LG Rules.

An appropriate entry on the surveys carried out is made in the Certificate.

4 PLAN APPROVAL DOCUMENTATION

4.1 In addition to the technical documentation specified in Section 3 of Part I "Classification" of the Rules for the Classification, the following technical documentation confirming fulfillment of the LG Rules shall be submitted to the Register¹:

.1 drawings and strength calculations of cargo tanks with their distances from side plating and the bottom specified (*);

.2 drawings of supports and other structures for securing of independent cargo tanks (*);

.3 drawings and diagrams of systems and piping for cargo specifying the components like compensators, flange joints, stop and regulating valves (*);

.4 drawings and descriptions of an inert gas generation plant (*);

.5 justification of fitness of fire-extinguishing media, fire detection and extinction system apparatus for cargoes carried, as well as the documents confirming the design time of fire extinction, the rate of fire extinguishing media delivery and the stores of fire-extinguishing media on board (**);

.6 diagrams and calculations of the ventilation system of spaces in the cargo area and of other spaces to be accessible for cargo operations performance. The diagrams shall contain data on fitness of materials used for manufacture of fan impellers and air ducts (*);

.7 diagrams and calculations of the vent system with indication of all relief valve settings and relevant alarm in case the tanks are equipped with the setting pressure change system (*);

.8 drawings and descriptions of all systems and arrangements for the measurement of cargo amount and characteristics, and for gas detection (*);

.9 calculation of maximum filling level of cargo tanks considering all values of relief valve setting if cargo tanks are equipped with the setting pressure change system (*);

.10 diagrams and calculations of drain and ballast systems in the cargo area, pump rooms, cofferdams, pipe tunnels, spaces for independent cargo tanks, etc. (*);

.11 justification of fitness of insulating materials used in the cargo area, as well as data on the procedure of their manufacture, storage conditions, quality control techniques, the extent of a harmful effect of solar radiation, resistance to vibration and temperature (**);

.12 drawings of quick-closing arrangements of the cargo containment system (*);

.13 diagrams of cargo heating and refrigeration systems and the heat transfer calculation (*);

.14 drawings of relief and vacuum relief valves of cargo tanks (*);

.15 diagrams of cargo pressure and temperature regulation systems (*);

.16 calculations of stresses in cargo and other piping containing cargo at a temperature below $-110\text{ }^{\circ}\text{C}$ (**);

.17 diagrams of piping relating to the use of cargo as fuel with indication of separate units of pipe joints, and of valves location and design (*);

.18 diagrams of electric drives and control systems for a reliquefaction unit for cargo vapours, liquefied gas refrigeration units, cargo pumps and compressors, an inert gas generation plant, fans of dangerous spaces and air locks and functional diagrams of control systems for units as above (*);

.19 functional diagrams of electric measurement and alarm systems (*);

.20 functional diagrams of systems for automatic and remote disconnection of electrical equipment, for remote control over hull structure heating valves (*);

.21 drawings of cable laying in dangerous spaces and areas (*);

¹ Stamp types following the documentation (marked with (*) and (**)) review results according to 3.1.5 of Part I «Classification» of the Rules for the Classification.

.22 drawings of earthing for electrical equipment, cables, piping located in gas-dangerous spaces (*);

.23 block diagram for all intrinsically safe circuits, including data for verification of the compatibility between the barrier and the field components (*);

.24 techniques for mechanical relief of stresses in independent cargo tanks (**);

.25 Failure Mode and Effects analysis (FMEA) for electrical generation and distribution systems and associated control systems (refer to 2.1.4 of Part VII "Electrical Equipment") (**);

.26 an inspection/survey plan for the cargo containment system (*);

.27 cargo system operation manual in accordance with the requirements of Chapter 18 of the Code (*).

4.2 General arrangement drawings or separate drawings shall demonstrate the layout of:

.1 cargo hatches (tank domes) and any other openings in cargo tanks;

.2 doors, hatches and any other openings into gas-dangerous spaces or zones (refer to 2.1 of Part VII "Electrical Equipment");

.3 vent pipes and air inlet and outlet locations of a ventilation system;

.4 doors, scuttles, companions, ventilating duct outlets locations and other openings in spaces of the superstructure and spaces adjacent to the cargo area;

.5 assumed break-down of cargo tanks into groups for cargo separation.

4.3 The list of cargoes to be carried onboard a ship specifying their basic chemical and physical properties, as well as dangerous properties related to their carriage and storage, shall be submitted to the Register for consideration.

4.4 In addition to technical documentation specified in 4.1, the following technical documentation confirming that loading arms comply with the Register requirements shall be submitted to the Register prior to commencement of a ship's construction¹:

.1 arrangement plan of loading arms including their operating envelope scheme (*);

.2 structural drawings including platforms, foundations and reinforcements (*);

.3 drawing and diagram of piping with fittings including the drawing of cargo swivel (*);

.4 drawing of quick connect/disconnect coupler (QCDC) (*);

.5 drawing of emergency release coupling (ERC) (*);

.6 drawings of swivel joints, ropes, blocks and counterweights (*);

.7 diagram of purge and drain system (*);

.8 plan of arrangement and connection of electrical equipment (components of arm constant position monitoring system, components of automation, alarm and protection systems including local control panels, earthing, etc.) (*);

.9 pattern of insulating coating application (*);

.10 justification of material selection for structures and piping with loading arm fitting (**);

.11 strength calculation for structures and piping with loading arm fitting (**);

.12 bollard pull calculation when choosing the rope (**).

4.5 In addition to technical documentation specified in 4.1, the following technical documentation confirming that a ship complies with the requirements applying to ships with the distinguishing mark **RLU** and to a reliquefaction unit for cargo vapours shall be submitted to the Register prior to commencement of a ship's construction²:

.1 technical specification of reliquefaction unit for cargo vapours (**);

.2 calculation of required capacity for reliquefaction unit for cargo vapours considering thermal flows for each cargo tank (**);

¹ Stamp types following the documentation (marked with (*) and (**)) review results are chosen according to 3.1.5 of Part I "Classification" of the Rules for the Classification.

² Stamp types following the documentation (marked with (*) and (**)) review results are chosen according to 3.1.4 of Part I «Classification» of the Rules for the Classification.

.3 arrangement plans of reliquefaction unit for cargo vapours and associated equipment (compressors, heat exchangers, pumps, pressure vessels, scrubbers) onboard with indication of escape routes from the compartment, where the unit is installed, and arrangement of permanently installed gas detection system (*);

.4 arrangement plans for refrigerant, cooling medium and cooling water pipelines with indication of passing through the bulkheads, decks and platforms (*);

.5 arrangement plans for electrical and automation equipment of reliquefaction unit for cargo vapours (*);

.6 circuit diagrams of ventilation systems for compartments, where equipment for reliquefaction unit for cargo vapours is arranged, with indication of watertight and gastight bulkheads and fire-proof divisions, as well as the number of air changes per hour (*);

.7 circuit diagrams of refrigerant, cooling medium and cooling water systems with indication of heat-transfer properties (*);

.8 functional diagram and description of emergency shutdown system for reliquefaction unit for cargo vapours and its interaction with the emergency shutdown system for ship's cargo system (*);

.9 list of mechanisms and equipment for reliquefaction unit for cargo vapours with indication of their technical characteristics (**);

.10 list of electrical and automation equipment for reliquefaction unit for cargo vapours with indication of type of explosion protection and summary technical specification for the equipment (**);

.11 failure mode and effects analysis (FMEA) for reliquefaction unit for cargo vapours (in accordance with IEC 60812 standard) performed against the level confirming the operation of the unit as intended after any single failure (**);

.12 testing procedures during sea and gas trials of reliquefaction unit for cargo vapours (*).

4.6 "Approval in Principle" and "General Approval for Ship Application" of membrane LNG containment tanks.

4.6.1 The service "Approval in Principle" of membrane LNG containment tanks is rendered in accordance with 3.6 of Part II "Technical Documentation" of the Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships.

4.6.2 For the service "General Approval for Ship Application" of membrane LNG containment tanks to be rendered, the following technical documentation^{1 2} shall be submitted to the Register for review:

.1 general information on ship in scope necessary to assess compliance of elements of membrane LNG tanks to applied requirements;

.2 general information on tanks geometrical dimensions and location in the ship's hull;

.3 drawings of tank structures of flat and corner regions, attachments to adjacent hull structures and cargo tank dome regions;

.4 drawings of pump tower including relevant equipment (pumps, pipelines, ladders, etc.) as well as its connection to ship's hull;

.5 drawings of pump tower base support;

.6 description of joining processes to connect tank elements to each other as well as connections with adjacent hull structures;

.7 list of materials and components used in tank structures and their test results;

¹ The Register may require additional information necessary to render service "General Approval for Ship Application".

² The results of rendered service "General Approval for Ship Application" are finalized by drawing up a conclusion letter (expert opinion) according to 8.5 of Part II "Technical Documentation" of the Rules for Technical Supervision during Construction of Ships and Manufacture of Materials and Products for Ships.

- .8** temperature calculations of tank elements and adjacent hull structures including description of applied calculation procedures;
- .9** strength calculations of elements of membrane containment system including description of applied calculation procedures;
- .10** calculation of ship's seakeeping and loads on the elements of membrane tank with description of applied calculation procedures and results of laboratory tests.

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FAI "Russian Maritime Register of Shipping"
8, Dvortsovaya Naberezhnaya,
191186, St. Petersburg,
Russian Federation
www.rs-class.org/en/