

RULES

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

PART VII ELECTRICAL EQUIPMENT

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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 The requirements of this Part are applicable to electrical installations and individual kinds of electrical equipment of ships intended for the carriage of liquefied gases and other products in bulk specified in 1.1, Part I "Classification" of the Rules for the Classification and Construction of Ships Carrying Liquefied Gases in Bulk¹ and supplement the requirements of Part XI "Electrical Equipment" of the Rules for the Classification and Construction of Sea-Going Ships².

1.1.2 In addition to the electrical equipment listed in 1.3.2, Part XI "Electrical Equipment" of the Rules for the Classification, subject to survey on board the ship is the electrical equipment of:

- .1 cargo containment system;
- .2 gas re-liquefaction plants;
- .3 inert gas system;
- .4 cargo pressure/temperature control system;
- .5 liquefied gas refrigeration plant drives and control systems;
- .6 cargo pumps and compressors;
- .7 ventilation systems of dangerous spaces and air locks;
- .8 gauging, alarm and indication systems for:
 - .8.1 liquid level in cargo tanks;
 - .8.2 temperature in cargo piping;
 - .8.3 pressure in cargo tanks and cargo piping;
 - .8.4 pressure in ventilation systems for pressurization of air locks, spaces, safe-type electrical equipment enclosures;
 - .8.5 cargo (gas) vapour concentration in controlled spaces and areas;
 - .8.6 cargo leakage;
 - .8.7 presence of water in interbarrier spaces;
 - .8.8 explosive concentration and high toxicity level of gases;
 - .9 automatic and remote shutdown systems for driving motors;
 - .10 remote control systems of hull structure heater valves.

1.1.3 In addition to 1.3.3, Part XI "Electrical Equipment" of the Rules for the Classification, the electrical equipment of ships carrying liquefied gases in bulk³ specified in [1.1.2](#) of this Part is subject to survey during manufacture.

1.2 Definitions and explanations.

1.2.1 Hazardous zones and spaces.

Hazardous zone means an area where an explosive gas mixture is or may be expected to be present, in quantities such as to require special protection measures during the design, manufacture and operation of electrical installations.

Depending on the frequency and duration of the presence of an explosive gas atmosphere, hazardous zones are divided into:

zone "0" being an area in which an explosive gas atmosphere (a mixture of combustible substances in the form of gas, steam or fog) is present often, continuously or is present for long periods;

zone "1" being an area in which explosive gas atmosphere (a mixture of combustible substances in the form of gas, steam or fog) is likely to occur under normal operating conditions;

¹ Hereinafter referred to as "the LG Rules".

² Hereinafter referred to as "the Rules for the Classification".

³ Hereinafter referred to as "the LG carriers".

zone "2" being an area in which an explosive gas atmosphere (a mixture of combustible substances in the form of gas, steam or fog) is not likely to occur under normal operating conditions, and if does occur, it will exists for a short period only.

1.2.2 Spaces containing gas detectors devices and spaces for utilization of gas fuel as required by Section 11, Part VI "Systems and Piping" shall not be considered as hazardous spaces spaces.

2 ELECTRICAL INSTALLATION

2.1 General.

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

2.1.2 Electrical equipment or wiring shall not be installed in gas-dangerous spaces or zones unless essential for operation in these spaces and zones provided the requirements set forth in this Part are complied with.

2.1.3 Where electrical equipment is installed in gas-dangerous spaces or zones, it shall satisfy the requirements of the LG Rules and IEC 60092-502:1999 "Electrical Installation in Ships — Tankers — Special features", be approved by the Register and permitted (i.e. certified) for operation in the explosive atmosphere by the relevant (competent body).

2.1.4 Electrical generation and distribution systems, and associated control systems shall be designed such that a single fault will not result in the loss of ability to maintain cargo tank pressures, as required by Part VI "Systems and Piping", and hull structure temperature, as required by Part IV "Cargo Containment", within normal operating limits. The designer shall develop and submit for approval the procedure for failure mode and effects analysis (FMEA) (in compliance with IEC 60812).

2.2 Electrical equipment in hazardous spaces and zones.

2.2.1 To facilitate the selection of suitable electrical equipment and devices, hazardous areas and spaces shall be divided into zones, as specified in IEC 60092-502:1999 "Electrical installations in ships — Tankers — Special features"..

2.2.1.1 Only safe-type electrical equipment certified by the relevant competent body for the appropriate type of protection may be fitted in gas-dangerous spaces and zones as specified below. Automatic isolation of non-certified equipment on detection of a flammable gas shall not be accepted as an alternative to the use of certified equipment.

2.2.1.2 The following electrical equipment may be considered for spaces of zone "0" in compliance with IEC 60092-502:1999:

certified intrinsically-safe apparatus of category (*ia*);

simple electrical apparatus and components (e.g., switches, junction boxes, resistors and simple semiconductor devices), included in intrinsically-safe circuits of category (*ia*) and complying with the requirements of IEC 60079-14:2013;

other electrical equipment specifically designed and certified by the appropriate authority for use in zone "0";

submersible cargo pumps with electric drives specified in [2.2.2.1](#).

2.2.1.3 Where circuits pass into zone "0" areas and spaces, protection systems shall be arranged so that manual intervention is necessary for reconnection of power supply circuits after disconnection caused by short circuit, overload or short circuit to casing.

2.2.2 Cargo containment systems.

2.2.2.1 Submerged cargo pump motors and their supply cables may be fitted in cargo containment systems. Submerged pumps shall be fitted with at least two independent arrangements to automatically shut down the motors in the event of liquid level falling below the allowable value. Operation of the specified protection arrangements may be alarmed due to the following monitored parameters:

low pump delivery/discharge pressure;

low motor load current;

low liquefied gas level.

This shutdown shall to be alarmed at the cargo control station. Cargo pump motors shall be provided with arrangements to isolate them from their electrical supply (including feeders) to be actuated in advance for the period of gas-freeing operations.

2.2.3 Cargo spaces and certain other spaces.

2.2.3.1 In cargo spaces (tanks) where cargo is carried in a cargo containment system requiring a secondary barrier, supply cables for submerged cargo pump motors may be installed.

2.2.3.2 In cargo spaces (tanks) where cargo is carried in a cargo containment system not requiring a secondary barrier and in spaces separated from cargo containment spaces by a single gastight bulkhead, the following may be installed:

through runs of cables;

lighting fittings with pressurized enclosures (*Exp*) or of flameproof type (*Exd*). The lighting system shall comply with the requirements specified in [Section 9](#);

electrical level gauges, log and echo sounder devices and impressed current cathodic protection system anodes (electrodes). These devices shall be housed in gastight enclosures.

In spaces separated from cargo spaces described in this paragraph by gastight bulkheads the following may be installed:

safe-type motors for remote valve operation for cargo or ballast systems;

safe-type general alarm audible indicators.

2.2.4 Cargo pump and cargo compressor rooms.

2.2.4.1 Lighting fittings shall have pressurized enclosures (*Exp*) or shall be of flameproof type (*Exd*). The lighting system shall be supplied by at least two feeders. All switches and protective devices shall interrupt all poles or phases and be located in gas-safe spaces.

2.2.4.2 Electric motors for driving cargo pumps or cargo compressors shall be separated from the cargo pump (compressor) rooms by a gastight bulkhead or deck.

Flexible couplings or equivalent means of maintaining alignment shall be fitted to the shafts between the driven equipment and its motors and, in addition, suitable glands shall be provided where the shafts pass through the gastight bulkhead or deck. Such electric motors and associated equipment (starters, etc.) shall be located in gas-safe spaces.

2.2.4.3 Where operational or structural requirements are such as to make it impossible to comply with the method described in [2.2.4.2](#), motors of the following certified safety types may be installed: of increased safety (*Exe*), of flameproof type (*Exd*), with pressurized enclosures (*Exp*).

2.2.4.4 General alarm audible indicators shall be of flameproof type (*Exd*).

2.2.5 Zones on open deck, spaces other than cargo spaces.

2.2.5.1 In zones on open decks or non-enclosed spaces on open deck, with 3 m of any cargo tank outlet, gas or vapour outlet, cargo pipe flange, cargo valves or entrances and ventilation openings to cargo pump rooms and cargo compressor rooms; in zones on the open deck over the cargo area and 3 m forward and aft of the cargo area on the open deck and up to a height of 2,4 m above the deck; in zones within 2,4 m of the outer surface of a cargo containment system where such surface is exposed to the weather the following may be installed:

.1 certified safe-type equipment;

.2 through runs of cables.

2.2.5.2 In enclosed or semi-enclosed spaces in which pipes containing cargoes are located and in compartments for cargo hoses the following may be installed:

.1 lighting fittings with pressurized enclosures, or of the flameproof type.

The lighting system shall be divided and supplied by at least two feeders. All switches and protective devices shall interrupt all poles or phases and be located in gas-safe spaces as specified in [Section 9](#);

.2 through runs of cables.

2.2.5.3 In enclosed or semi-enclosed spaces having a direct opening into any gas-dangerous space or zone there shall be installed electrical installations complying with the requirements for the installations located in these gas-dangerous spaces or zones.

2.2.5.4 Electrical equipment within spaces protected by air locks shall be of the certified safe type unless arranged to be de-energized upon loss of overpressure in the space.

2.2.5.5 Classification and dimensions of dangerous spaces for ships with regasification unit shall be determined in compliance with IEC 60092-502:1999. However, in any case they shall be no less no than given in [2.2.5.1](#).

3 EARTHING

3.1 Metal means of protecting cables installed on the upper deck and passing through dangerous areas against mechanical damage, shall be earthed at least at both ends of each protective means (housing, steel pipe, armoured braiding).

3.2 Cargo tanks and piping shall be earthed in compliance with 3.10.4, Part VI "Systems and Piping".

4 SOURCES OF ELECTRICAL POWER

4.1 Generators' driving engines which utilize gas fuel shall comply with 11.15, Part VI "Systems and Piping".

5 POWER SUPPLY OF ESSENTIAL SERVICES

- 5.1** The following consumers shall be supplied from the main switchboard busbars:
- .1** switchboards of cargo pumps;
 - .2** switchboard of gas re-liquefaction compressors;
 - .3** inert gas plant switchboard;
 - .4** switchboard of alarm to indicate presence of gas in spaces;
 - .5** switchboard of cargo storage and transfer system alarm and control;
 - .6** switchboard of fans for pressurization of air locks and safe-type electrical equipment enclosures;
 - .7** switchboards of buster pumps and gas-air blowers.
- 5.2** Consumers listed in [5.1.4](#) and [5.1.5](#) may be supplied from the integrated control console of cargo containment system. It is recommended to supply these consumers through the emergency switchboard.
- 5.3** Power supply of electric (electronic) automation systems shall comply with the requirements of Part XV "Automation" of the Rules for the Classification, except for power supply of automation devices for starting the emergency diesel generator which shall meet the requirements of 4.4.2, Part XI "Electrical Equipment" of the Rules for the Classification.

6 DISTRIBUTION OF ELECTRICAL POWER FROM EMERGENCY SOURCES

6.1 The following consumers shall be supplied through separate feeders from the emergency switchboard busbars:

- .1** switchboard of alarm to indicate presence of cargo vapours in spaces;
- .2** switchboard of fans for pressurization of air locks and safe-type electrical equipment enclosures;
- .3** air lock door position alarm switchboard;
- .4** all necessary components of at least one heating system for hull structures (refer to 19.2.6.2, Part IV "Cargo Containment");
- .5** electric heaters of the heating system for hull structures, if such heaters are required by 19.2.6.3, Part IV "Cargo Containment".

7 LOCATION OF SWITCHBOARDS AND SWITCHGEAR

- 7.1** Switchboards and switchgear shall not be located in the air lock spaces.

8 ELECTRIC DRIVES FOR SHIPBOARD MECHANISMS AND EQUIPMENT

8.1 General.

8.1.1 Electric motors of non-safe type installed in spaces, the access to which is provided through air locks shall be fitted with interlocking devices that will switch off the power upon loss of overpressure in the air lock and prevent switching-on until the pressure is restored to its original value.

8.2 Electric drives of pumps.

8.2.1 The electric drives of cargo pumps, buster pumps and compressors shall be provided with switches for automatic disconnection thereof upon closure of quick-closing valves in the piping.

8.2.2 The electric drives of submerged cargo pumps shall be provided with switches for automatic disconnection thereof in the event of low liquid level in a cargo tank as specified in [2.2.2](#).

8.2.3 The electric motors of cargo pumps, buster pumps, gas-air blowers and compressors of the gas re-liquefaction plant shall be located in spaces separated from the associated dangerous spaces by a gastight bulkhead and shall be connected with their mechanisms through flexible couplings. Where the motor shafts pass through the bulkhead, gastight glands shall be fitted.

8.3 Electric drives of fans.

8.3.1 The electric drives of ventilation fans for pressurizing of air locks, spaces protected by air locks and safe-type electrical equipment enclosures shall not be used for other purposes.

8.3.2 The electric motors of fans shall not be located in the ventilation ducts of the exhaust and supply ventilation of dangerous spaces.

8.3.3 Opening of the doors and switching-on of the electrical equipment installed in these spaces shall be interlocked with the fan drive in such a way that the entrance into the spaces and switching-on of the electrical equipment is only possible after starting of the fans and their operation during a time period necessary to provide 3 to 4 air changes in this space.

9 LIGHTING

9.1 The lighting system of dangerous spaces and areas shall be divided between at least two branch circuits and shall be supplied from different switchboards.

9.2 Switches and protective devices of the lighting system of dangerous spaces and areas shall be located outside the dangerous spaces and areas and interrupt all phases.

9.3 Lighting fittings of dangerous spaces and areas shall have pressurized enclosures (*Exp*) or shall be of flameproof type (*Exd*).

10 ALARM SYSTEM

10.1 A permanently installed cargo vapour detection alarm system shall be provided for spaces and areas listed in 6.3, Part VIII "Instrumentation and Automation Systems".

10.2 Visible and audible alarms to indicate a dangerous cargo vapour concentration shall be located in the gas-sampling locations (spaces), on the navigation bridge and in the cargo control room.

In the locations where permanent watch is kept, common alarms shall be activated when the gas concentration exceeds the prescribed limit.

10.3 Two independent power supply sources shall be provided for the alarm system. The main source shall be the ship's mains, the standby source — an accumulator battery.

10.4 If the alarm system is supplied from the ship's mains through the emergency generator switchboard, the capacity of the accumulator battery shall be sufficient for continuous supplying this system during 30 min. In all other cases, this time shall be not less than specified in 9.3.1, Part XI "Electrical Equipment" of the Rules for the Classification.

10.5 Alarms to indicate automatic shutdown of submerged cargo pumps, closure of quick-closing valves, presence of water in the interbarrier spaces, cargo leakage into the cargo heater condensate and operation of the inert gas generation plant shall be located in the cargo control room.

The alarm to indicate presence of water in the interbarrier space shall be duplicated in the wheelhouse.

10.6 When gas is utilized as fuel, the alarms to indicate the pressure drop in the fuel piping or the failure of gas fuel supply to the machinery of the engine room shall be located in the main machinery control room.

10.7 The alarms to indicate the loss of overpressure in the air locks and in the safe-type electrical equipment with pressurized enclosures (*Exp*), shall be located in the main machinery control room and in the locations where permanent watch is kept.

11 CONSTRUCTION OF ELECTRICAL EQUIPMENT

11.1 Parts of electrical equipment and cables which are in permanent contact with the liquefied gases or their vapours, or come into short-time contact with them shall be manufactured of materials resistant to chemical attack.

11.2 Cables intended for the installation in dangerous spaces and areas shall withstand, without damage, the temperatures encountered in the said spaces over a long period of time, as well as elongation equal to 1/700 of the length of the metal structures on which they are installed.

12 CRYOGENIC CABLES

12.1 The requirements of this Section apply to cable products (cryogenic cables) designed for operation at low temperatures and laid inside cargo and fuel oil tanks containing cryogenic liquids (liquefied natural gas, liquefied petroleum gas, etc.).

12.2 Cryogenic cables shall be tested in accordance with national, international standards or manufacturer's standards.

12.3 Cryogenic cables shall be protected against mechanical damage and securely fixed. Structures for laying and securing cryogenic cables shall be fit for operation in conditions of direct exposure to cryogenic liquids. Measures shall be taken to avoid loosening of fasteners of structures for cable laying, mechanical protection and cable fixing devices during operation.

12.4 Connections of cryogenic cables and cables laid outside cargo and fuel oil tanks shall be performed by means of transition couplings specially designed for these purposes.

12.5 Methods to connect cryogenic cables to the transition couplings and equipment located inside cargo or fuel oil tanks shall ensure a reliable electrical contact and exclude loosening of contact connection during operation.

12.6 Where deformation of hull structures may occur, measures shall be taken to avoid tension and bending of cryogenic cables.

Russian Maritime Register of Shipping

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