RUSSIAN MARITIME REGISTER OF SHIPPING

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RULES

FOR THE CLASSIFICATION AND CONSTRUCTION OF PLEASURE CRAFT

PART V

MACHINERY INSTALLATIONS. MACHINERY. SYSTEMS AND PIPING

HD No. 2-020101-159-E

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RULES FOR THE CLASSIFICATION AND CONSTRUCTION OF PLEASURE CRAFT (PART V)

The present version of the Rules for the Classification and Construction of Pleasure Craft of Russian Maritime Register of Shipping (RS, the Register) has been approved in accordance with the established approval procedure and come into force on 1 November 2025.

The present version is based on the version dated 1 January 2018 taking into account the amendments and additions developed immediately before publication (refer to the Revision History).

REVISION HISTORY[1]

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

[1] With the exception of amendments and additions introduced by Rule Change Notices (RCN), as well as of misprints and omissions.

1 GENERAL

1.1 APPLICATION

1.1.1 The requirements of this Part of the Rules for the Classification and Construction of Pleasure Craft[1] apply to machinery installations, machinery, propellers, systems and piping used in the small pleasure craft.

1.1.2 Application of the requirements of this Part is defined in Sections 2 — 4.

1.1.3 In addition to the requirements of this Part, the applicable provisions of Directive 2013/53/EU of 20 November 2013 shall be met.

[1] Hereinafter referred to as "these Rules".

1.2 DEFINITIONS AND EXPLANATIONS

1.2.1 Definitions and explanations relating to general terminology of these Rules are given in 1.2 Part I "Classification" of these Rules.

For the purpose of this Part the following definitions and explanations have been adopted.

Fittings mean stop, regulating and other devices intended for distribution control and regulation of consumption and other parameters of the conveyed medium by means of entire or partial closing of flow section.

Auxiliary machinery means machinery necessary for operation of main machinery, supply of the craft with electric power and other kinds of energy, as well as functioning of the systems and arrangements subject to supervision of the Register.

Auxiliary active means of the craft's steering means a propulsion and steering unit ensuring propulsion and steering of a craft at low speed or steering of a craft at zero speed when the craft is equipped with main means of propulsion and steering, and is used either in combination with the latter or when the main means of propulsion and steering are inoperative.

Exit means an opening in bulkhead or deck provided with closing means and intended for the passage of persons.

Means of escape means an escape route leading from the lowest part of the machinery space floor plates to the exit from that space.

Main engines mean the machinery intended for driving propellers.

Main machinery means machinery being part of the propulsion plant.

Main active means of the craft's steering means a propulsion and steering unit being part of the propulsion plant.

Outboard engines mean main engines installed on the transom of the craft.

Remote control means changing of the speed and direction of rotation as well as starting and stopping of the machinery from a remote position.

Engine room means a machinery space intended for the main engines, and in case of craft with electric propulsion plants, the main generators.

Machinery spaces mean spaces containing main machinery, shafting, boilers, internal combustion engines, electric generators and other major electrical machinery, ventilation and air — conditioning installations, steering engines and similar spaces.

Local control station means a control station fitted with controls, indicators, means of communication (if necessary) intended for control, located in proximity to, or directly on, the engine.

Torsional vibration stresses mean stresses resulting from the alternating torque, which is superimposed on the mean torque.

Equipment means all types of filters, heat exchangers, tanks and other arrangements ensuring normal operation of the machinery installation.

Pipeline fire resistance means the ability of pipeline to maintain strength and functional properties within the set period of time at flame exposure.

Plastic materials mean thermoplastic (thermoplasts) and thermosetting (thermosets) materials with or without reinforcement, such as polyvinylchloride (PVC) and fiber reinforced plastic (FRP).

Propulsion engine means any spark or compression ignition, internal combustion engine used directly or indirectly for propulsion purposes.

Propulsion plant means the totality of machinery and arrangements intended for generating, converting and transmitting power ensuring propulsion of the craft at all specified rates of speed and comprising propellers, shafting, main gearing and main engines.

Rated power means the maximum continuous (not time-limited) power adopted in calculations under these Rules and stated in documents issued by the Register.

Rated speed means the speed corresponding to the rated power.

System means a combination of pipelines, machinery, apparatus, devices, appliances and reservoirs intended for performance of certain functions providing craft's operation.

Inboard engines mean main engines installed permanently in the engine room or in a special compartment or in a specially allocated space on deck.

Active means of the craft's steering (AMCS) mean special propulsion and steering units and any combination of them or with the main propulsion devices, capable of producing thrust or traction force both at a fixed angle to the center line plane of the craft and at a variable angle, either under all running conditions or part thereof, including low and zero speed.

The active means of the craft's steering comprise steerable propellers including tiltable and retractable units, active rudders, vertical-axis propellers, water-jets, propellers in transverse channels (transverse thrust units), separate steering nozzles and other devices of similar purpose, special propulsion and steering units and outboard engines of the craft and any combination of them or with the main propulsion devices, capable of producing thrust or traction force both at a fixed angle to the center line plane of the craft and at a variable angle, either under all running conditions or part thereof, including low and zero speed.

Pipeline means a combination of pipes, fittings, formed components, pipe joints, any internal and external linings, insulation coatings, fastening elements and components for protection of pipes intended for conveying of liquid, gaseous and compound media, as well as for transmission of pressure and sound waves.

Pipelines formed components mean bends, T-pieces, bulkhead and deck penetrations and other elements of pipelines, intended for pipeline branching, changing of conveying medium direction and ensuring of hull structure tightness.

Navigating bridge means a space or part thereof, open area or an area enclosed by detachable structures, from which navigation and control of the craft is normally exercised and where controls of the main steering gear (steering gear control system), remote controls of the main and auxiliary engines, CP-propellers, main and auxiliary active means of the craft's steering, instruments, alarm devices and means of communication are located.

2 MACHINERY INSTALLATIONS

2.1 APPLICATION

2.1.1 The requirements of this Section apply to craft machinery installations subdivided in accordance with 2.1.2, equipment of machinery spaces, shafting lines, propellers and spare parts of motor, motor-sailing, sailing-motor and self-propelled craft, as well as non-self-propelled and berth-connected craft fitted up with machinery and systems as specified in 1.2, Part I "Classification" of these Rules.

2.1.2 The machinery installations of the craft are subdivided:

.1 by the main engines location:

in enclosed machinery space;

in exposed machinery area (cockpit, machinery compartment);

on craft's transom;

on weather deck or in a pod (with aerial propeller);

.2 by the type of fuel oil used by the main engines:

diesel engines with flash point of fuel not lower than 55 °C;

carburetor (petrol) engines.

2.1.3 For craft intended for operation in offshore and sheltered areas of navigation (design categories **C, C1, C2, C3** and **D**, refer to 1.4.2.2 and 1.4.2.3, Part I "Classification" of these Rules), the internal combustion engines which are serially manufactured for automobile industry and have the Manufacturer's certificate may be used as main engines.

2.1.4 For craft intended for operation in offshore areas of navigation (design categories **C, C1, C2** and **C3**, refer to 1.4.2.2, Part I "Classification" of these Rules), updating of such an engine and testing of it shall be carried out under the Register's technical supervision, in accordance with the technical documentation and test program being part of the craft's design documentation.

2.1.5 For craft intended for operation in sheltered areas of navigation (design category **D**, refer to 1.4.2.3, Part I "Classification" of these Rules), in case of use of the main engines and propulsion systems (reduction gear — shafting line — propeller) manufactured without the Register technical supervision, if their power output does not exceed 25 kW, technical substantiation of possibility of their use shall be submitted.

2.2 SCOPE OF TECHNICAL SUPERVISION

2.2.1 Subject to the Register technical supervision, including the approval of technical documentation according to 3.1.7, Part I "Classification" of these Rules are the following components and items:

.1 shafting as assembled, including propeller shafts, shaft bearings, thrust blocks and sterntube bearings, sterntube seals as assembled;

.2 propellers, including vertical-axis propellers and water-jets, aerial propellers, steerable propellers, outboard engines, transverse thrusters, pitch control units and control systems of propellers.

2.2.2 Subject to the Register technical supervision is the assembling of the machinery space equipment and testing of the following components of the machinery installation:

.1 main machinery;

.2 heat exchangers and pressure vessels;

.3 auxiliary machinery listed in 3.1.1.3 — 3.1.1.13;

.4 control, monitoring and alarm systems of the machinery installation;

.5 shafting and propellers;

.6 active means of the craft's steering.

2.2.3 After assembling of machinery, equipment, systems and piping arrangements on board the craft, the machinery installation shall be tested according to the program approved by the Register.

At that the test conditions and power measurements of the engine forming part of the propulsion plant requested by the manufacturer may be specified taking into consideration ISO 8665 "Small craft — Marine propulsion engines and systems — Power measurements and declarations".

2.3 POWER OF THE MAIN ENGINES

2.3.1 The power of the main engines providing running of a small pleasure craft shall ensure:

.1 speed in calm water not less than:

for craft of design categories **A, A1, A2, B, C, C1** and **C2** — 6 kn (about 11 km/hr);

for craft of design categories **C3** and **D** — 6 km/hr, but not less than the speed ensuring fulfillment of the requirements set out in 2.2.2.2, Part III "Arrangements, Equipment and Outfit" of these Rules;

.2 capability of running astern to maintain necessary maneuvering of the craft under all normal service conditions;

.3 with the potential speed increase over 14,0 m/s, the craft shall additionally meet the requirements of the Rules for the Classification and Construction of High-Speed Ships[1], and in this case craft with hull length equal to and less than 8 m shall be tested in accordance with the requirements of ISO standard 11592-2001.

2.3.2 When installing the main engines having total power output in excess of the requirements of 2.3.3 — 2.3.5, technical substantiation shall be submitted.

2.3.3 The maximum allowable power output of the main engines being part of the propulsion plant installed on the transom of a pleasure craft having hull length equal to and below 8,0 m shall be determined in accordance with 2.3.4, depending on:

.1 factor λ calculated by the formula

$$\lambda = L_H \cdot B_T \qquad (2.3.3.1)$$

where L_H = the craft hull length, in m, refer to 1.3.2.4 of Part I Classification" of these Rules;
B_T = the transom width, in m, refer to 1.3.2.9 of Part I Classification" of these Rules.

.2 structural design of the propulsion plant:

ensuring active steering of the craft (refer to definition of the "Active Means of the Craft Steering", given in 1.2);

not ensuring active steering of the craft;

.3 deadrise angle β, determined according to 1.3.2.24 of Part I Classification" of these Rules.

2.3.4 The maximum allowable power output of the propulsion plant installed on the transom of a pleasure craft having hull length equal to and below 8,0 m shall be determined in accordance with 2.3.4.1 and 2.3.4.2:

.1 factor $\lambda \leq 5{,}1$ according to the graph shown in Fig. 2.3.4.1 and in this case:

the upper line of the graph is used at the deadrise angle $\beta \geq 5{,}0°$;

the lower line of the graph is used at the deadrise angle $\beta < 5{,}0°$;

[1] Hereinafter referred to as "the HSC Rules".

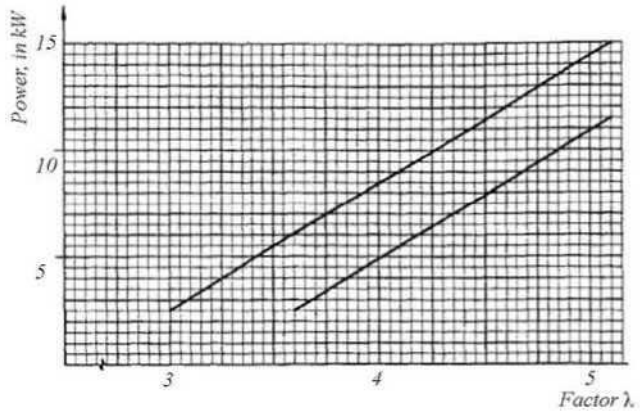

Fig. 2.3.4.1

.2 using the formulae given below at factor $\lambda > 5{,}1$ for a propulsion plant, in kW, ensuring active steering of the craft, regardless of the value of the deadrise angle:

$$N_e = 16\lambda - 67; \qquad (2.3.4.2\text{-}1)$$

for a propulsion plant, in kW, not ensuring active steering of the craft, at the deadrise angle $\beta \geq 5{,}0°$:

$$N_e = 6{,}4\lambda - 19; \qquad (2.3.4.2\text{-}2)$$

for a propulsion plant, in kW, not ensuring active steering of the craft, at the deadrise angle $\beta < 5{,}0°$:

$$N_e = 4{,}2\lambda - 11. \qquad (2.3.4.2\text{-}3)$$

2.3.5 It is advisable to determine the maximum allowable power of the outboard engines of craft having the overall length of the hull equal to and below 5,5 m, depending on the coefficient K, from a combined graph (refer to Fig. 2.3.5), having regard to the following:

.1 for motor boats with remote control and transom height more than 510 mm at $K \geq 52$, by graph N1;

.2 for motor boats with transom height less than 510 mm, by graph N2;

.3 for all motor boat with rounded chine, by graph N3;

.4 for motor boats mentioned in 2.3.5.1 and 2.3.5.2 at $K < 52$, by graph N4;

.5 the maximum allowable power output of the outboard engines in all cases shall not be less than 100 kW.

Coefficient K is determined from the combined graph, Fig. 2.3.5, depending on the transom width or hull length, or by the formula

$$K = 10{,}6 \cdot \lambda \qquad (2.3.5.5)$$

where λ, refer to 2.3.3.1.

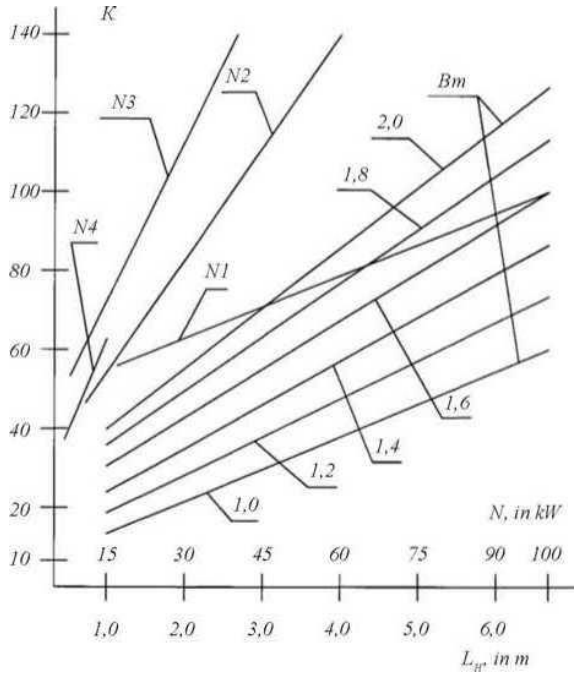

Fig. 2.3.5
The maximum allowable power output of the outboard engines of craft with the overall hull length equal to and below 5,5 m

2.4 CONTROL DEVICES AND STATIONS. MEANS OF COMMUNICATION

2.4.1 Main and auxiliary machinery essential for the propulsion, control and safety of the craft shall be provided with effective means for their operation and control.

2.4.2 Main engines of craft of design categories **A, A1, A2, B** and **C** shall be fitted with pneumatic or electric starting system.

The electrically-started engines shall be fitted with attached generators and provided with a device for automatic recharging the starting accumulator batteries.

2.4.3 Main engines of craft of design categories **C1, C2, C3** and **D** may be fitted both with electrical starting system and with a device for manual starting by means of a starting handle or a starter cord.

2.4.4 In case where in addition to electric starting, manual drive of the engine is also provided, such manual drive shall be automatically disengaged when the electric drive is actuated, and an interlocking system shall be provided to preclude simultaneous operation of the two drives.

The starting handle of the manual drive and starter cord shall be made so that the safety of starting is provided.

The starter cord shall be provided with a device which ensures self-disconnection of the cord from the engine.

The starting handle shall be provided with a device which precludes translational travel in the direction opposite to the applied force necessary for engine starting.

2.4.5 Starting and reversing arrangements shall be so designed and placed that each engine can be started or reversed by one operator. The force applied to one handle in this case shall not exceed 160 N.

The proper working direction of control handles and handwheels shall be clearly indicated by arrows and relevant inscriptions.

The setting of maneuvering handles of the main machinery from, or to the right of the operator, or turning the handwheel clockwise, at control stations on the navigating bridge, shall correspond to the ahead speed direction of the craft.

Control arrangements shall be so designed as to eliminate the possibility of spontaneous changing the positions prescribed.

The outboard engines shall be provided with a device which excludes starting of the engine in engagement with the propeller, except when:

static thrust provided by the engine does not exceed 500 N;

engine is fitted with a limiter which provides a thrust up to 500 N at the time of starting.

2.4.6 The duration of reversing (a period of time from the reversing of a steering control to the beginning of the propeller operation with a thrust opposite in direction) shall not exceed:

.1 for internal combustion engines of power output

55 kW and above:

25 s at full speed;

15 s at low speed;

.2 for internal combustion engines of power output less

than 55 kW:

10 s at full speed;

5 s at low speed.

2.4.7 The inboard main engines and outboard engines of power output more than 15 kW, as a rule, shall be provided with remote control or remote automated control system.

The remote automated control system shall meet the requirements of Part VI "Automation".

The main engines of power output less than 25 kW to be installed in exposed machinery spaces or on transom (refer to 2.1.2.1) of craft of design categories **C2, C3** may be devoid of the remote control or remote automated control system.

2.4.8 The main machinery remote automated control system operable from the navigating bridge, shall be designed so as to provide an alarm in the event of failure. As far

as practicable, the prescribed propeller speed and thrust direction shall remain unchanged until control is transferred to a local station. Among other factors, the loss of power supply (electric, pneumatic or hydraulic power) shall not substantially affect the power of main engines or change the direction of propeller rotation.

In case of remote control with the use of mechanical linkage, activation of the alarm to warn of the remote control failure need not be provided.

2.4.9 The bridge control stations of main machinery and propellers, with any type of remote control, shall be equipped with:

.1 controls for the operation of main engines and propellers. For installations comprising CP-propellers, vertical-axis and similar type propellers, the navigating bridge may be equipped with means for remote control of propellers only;

.2 indicators of:

propeller shaft rotation speed and direction if a fixed pitch propeller is installed;

propeller shaft speed and blade position if a controllable pitch propeller is installed;

main engine speed if a disengaging clutch is provided;

.3 indicating means to show that the main engines and remote control systems are ready for operation;

.4 indicating means to show from which station the control is exercised;

.5 means of communication in accordance with 2.4.17;

.6 main machinery emergency stop device, independent of the control system. If disengaging clutches are provided for disconnection of main machinery from propellers, it is permissible that emergency disengagement of these clutches only is effected from the navigating bridge;

.7 device to override the automatic protection covering full range of parameters, except those parameters which being exceeded, may result in serious damage, complete failure or explosion;

.8 indication for the override operation, alarm for activation of protection devices and the emergency stop;

.9 alarm for low starting air pressure, set at the level permitting three starting attempts of main engines duly prepared for operation;

.10 alarm for minimum oil pressure in pitch control system, overload alarm where the main engines operates with a CP-propeller.

2.4.10 Control stations on the navigating bridge, where outboard engines and main engines permanently installed in exposed machinery spaces are remotely controlled with the use of mechanical linkage, shall be equipped with:

.1 controls for the operation of main engines and propellers;

.2 indicators of:

propeller shaft or main engine speed;

propeller shaft speed and blade positions if CP-propeller is installed;

.3 indicating means to show that the main engines and remote control systems are ready for operation (recommendational);

.4 main engine emergency stop device. If disengaging clutches are provided for disconnection of main engines from propellers, it is permissible that emergency disengagement of these clutches only is effected.

2.4.11 The emergency stop devices of main engines and the overrides of protection arrangements shall be so constructed as to preclude inadvertent operation thereof.

2.4.12 With a remote control system in use, provision shall also be made for local control of main engines and propellers.

Where, however, mechanical linkage is fitted for remote control, the local controls may be dispensed with.

The local control station of main engines shall be equipped with instruments as specified in 3.2.3.

2.4.13 Remote control of main engines and propellers shall be performed only from one control station. The transfer of control between the navigating bridge and engine room shall be possible only from the engine room.

2.4.14 Main engines shall be remotely controlled from the wheelhouse by means of a single control element per propeller with all operating modes automatically executed, including, if appropriate, the means preventing overloading and continuous running of the main engines within the restricted rotation speed ranges. In installations with CP-propellers, systems with two control elements may be used.

2.4.15 The sequence of the main engine operation modes assigned from the navigating bridge, including reversal from the full ahead speed in case of emergency, shall be automatically controlled with the time intervals admissible for main engines. The modes assigned shall be indicated at the local control stations of the main engines.

2.4.16 All the indicating instruments, with the exception of liquid-filled thermometers, shall be checked by competent bodies recognized by the Register.

Tachometers accuracy shall be within ±2,5 per cent. With restricted speed ranges, the accuracy shall not be below ±2,0 per cent, and the ranges shall be marked with bright color on the scales of tachometers or in another way.

2.4.17 Means of communication.

2.4.17.1 For craft of design categories **A, A1, A2** and **B**, where local control station of main machinery is available, at least two independent means shall be provided for communicating orders from the navigating bridge to the position in the machinery space or in the control station, from which the speed and direction of thrust of the propellers are normally controlled.

One of these means shall provide visible indication of orders and responses both in the machinery space and on the navigating bridge and which is fitted with a sound signal clearly audible in any part of the machinery space while the machinery is at work, and distinct in tone from all other signals in that machinery space.

2.4.17.2 For craft of design categories **C, C1, C2** and **C3**, where local control station of main machinery is available, a means shall be provided for communicating orders from the navigating bridge to the position in the machinery space or in the control station, from which the speed and direction of thrust of propellers are normally controlled, and which shall provide visible indication of orders and responses both in the machinery space and on the navigating bridge and shall be fitted with a sound signal clearly audible in any part of the machinery space while the machinery is at work, and distinct in tone from all other signals in that machinery space.

2.5 MACHINERY SPACES

2.5.1 Enclosed machinery spaces.

2.5.1.1 A watertight bulkhead meeting the requirements of 2.2.2 and 2.3, Part X "Fire Protection" of these Rules shall isolate the machinery space from all other adjacent compartments.

2.5.1.2 The main and auxiliary machinery shall be so arranged in the machinery space as to provide free passageways from their control stations and servicing flats to the escape routes from these spaces. The width of passageways shall not be less than 500 mm over the whole length.

2.5.1.3 The width of ladders serving as escape routes and the width of exit doors shall not be less than 500 mm.

2.5.1.4 Escape routes from machinery spaces shall lead to such places which provide ready access to the exposed deck.

Workshops, spaces for fuel oil units, boilers, oil equipment testing, etc., enclosed within machinery spaces may have exits into these spaces.

The engine control room and the main switchboard space enclosed within the engine room shall have their own independent escape routes, in addition to entrances to the engine room.

In case of small engine room (not more than 35 m²), or where exits from these spaces are located close (not farther than 5 m) to the engine room exit, an independent escape route from the engine control room may be omitted on agreement with the Register.

If two adjacent machinery spaces communicate through doors and each of them has only one escape route through the casing, these escape routes shall be located on opposite sides.

The second escape route is not required:

.1 from machinery spaces of not more than 25 m² in area if the available escape route does not lead to the adjacent machinery or accommodation space;

.2 from auxiliary spaces enclosed within the machinery space provided with two escape routes;

.3 from enclosed engine control rooms where main switchboards are located;

.4 from spaces which contain no oil-fired machinery.

2.5.1.5 All the doors as well as the covers of companionways and skylights which may serve as means of escape from machinery spaces, shall be capable of being opened and closed both from inside and outside. The covers of companionways and skylights shall bear clear inscription prohibiting stowage of any load on them.

2.5.1.6 Ventilation of enclosed machinery spaces shall comply with the requirements of 4.9.

2.5.1.7 Moving parts of machinery and equipment shall be guarded.

2.5.1.8 Detachable plating (floor ceiling) in machinery spaces shall be made of ribbed metal. Plates shall be reliably installed on special frames or on the hull framing and provided with securing devices to prevent them from displacement out from their standard positions in case of heavy heel and trim of the craft and have non-slip surface. All the moving parts of machinery and drives which may constitute a threat to the attending personnel shall be protected by handrails and guards.

2.5.2 Exposed machinery spaces (cockpits, motor compartments).

2.5.2.1 In craft the hull of which is made of non-combustible materials, the boundary structures of the machinery space where internal combustion engine is permanently installed shall be protected by non-combustible heat-insulating material and sheet steel.

2.5.2.2 Floors installed in front of, or behind, the engine shall be watertight and form a collecting tray. The upper edge of the watertight floors enclosing the machinery space (engine) shall be by 150 mm above the floor plating level of the engine room abutting thereon from the outside.

Trays shall be installed under the fuel oil tanks, canisters, filters, fittings and all other units of fuel oil system in which fuel oil leakage is likely to occur.

2.5.2.3 When arranged in one compartment the fuel oil tanks and canisters shall be located at a distance of not less than 800 mm from the engine and exhaust piping.

2.5.2.4 Detachable flooring shall be suitably installed, secured and have non-slip surface.

2.5.3 All inboard mounted engines shall be placed within an enclosure separated from living quarters and installed so as to minimize the risk of fires or spread of fires as well as hazards from toxic fumes, heat, noise or vibrations in the living quarters.

Engine parts and accessories that require frequent inspection and/or servicing shall be readily accessible.

The insulating materials inside the engine compartment shall not sustain combustion.

The engine compartment shall be ventilated. The ingress of water into the engine compartment through openings must be minimized.

Exposed moving or hot parts of the engine that could cause personal injury shall be effectively shielded to meet the requirements of 2.5.1.7 and 2.8.

2.6 ARRANGEMENT OF MACHINERY AND EQUIPMENT

2.6.1 Main engines, auxiliary machinery, equipment, pipes and fittings shall be so arranged as to provide easy access for servicing and damage repair; the requirements stated in 2.5.1.1 shall also be met.

2.6.2 Main engines and machinery with horizontal arrangement of the shaft shall be installed parallel to the center line of the craft.

Such machinery may be installed in any other direction about the center line provided that the construction of machinery provides for operation under the conditions stated in 2.3, Part VII "Machinery Installations" of the RS Rules/C.

2.6.3 The machinery and equipment constituting the machinery installation shall be installed on strong and rigid seatings and securely attached thereto. The construction of seatings shall comply with the requirements set out in Part II "Hull".

2.6.4 The main engines, their gears, thrust bearings of shafts shall in part be secured to seatings with fitted bolts. The bolts may be omitted, if appropriate stops are provided.

2.6.5 The bolts securing the main engines and auxiliary machinery and shaft bearings to their seatings, end nuts of shafts as well as bolts connecting the length of shafting shall be fitted with appropriate lockers against spontaneous loosening.

2.6.6 Where the machinery shall be mounted on shock absorbers, the requirements of 4.4.6, Part VII "Machinery Installations" of the Rules for the Classification and Construction of Sea-Going Ships [1]shall be met.

2.6.7 Installation of the machinery, machinery equipment, craft arrangements and their components on pads made of polymeric material or their mounting with application of polymeric materials, the processing technique shall be submitted to the Register for review.

2.6.8 Installation of the outboard engines on the transom of the craft shall ensure a secure attachment and provide for an additional cable for attaching the engine to the transom or to any robust hull structure.

2.6.9 Mounting of inboard engines and installation of carburetor (petrol) engines.

2.6.9.1 The inboard carburetor (petrol) engines as well as outboard engines shall not be used in craft of design categories **A, A1, A2** and **B**.

2.6.9.2 The inboard carburetor (petrol) engines as well as outboard engines may be used in craft of design categories **C1, C2, C3** and **D**, having the product of the craft length by its breadth which does not exceed 20, provided that the following requirements for the inboard engines are complied with.

2.6.9.2.1 In craft of open type and in exposed machinery spaces (motor compartments), the inboard engines shall be protected by casings manufactured of noncombustible materials.

2.6.9.2.2 The detachable engine casings shall be provided with vent pipes of not less than 80 mm in diameter. One such pipe shall stop short of the craft hull bottom by 70 mm and the other pipe shall come from opening in the highest part of the casing cover.

The upper ends of vent pipes shall be fitted with ventilator heads with flame arresters.

2.6.9.2.3 Suction pipes of the carburetors shall be led outside the detachable casings and elevate above those by at least 500 mm. The ends of the suction pipes shall be fitted with ventilator heads with flame arresters.

2.6.9.2.4 Where engines are installed in enclosed machinery spaces the inlets of the carburetor suction pipes shall be located at a height of not less than 300 mm above the cylinder covers and fitted with flame arresting screens. Where suction pipes at the carburetor air inlet are not provided, flame arresters shall be fitted.

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[1] Hereinafter referred to as "the RS Rules/C".

2.7 ARRANGEMENT OF FUEL OIL TANKS

2.7.1 Arrangement of fuel oil tanks shall meet the requirements of 4.10.2.

2.7.2 Fuel oil tanks shall not be located above ladders, internal combustion engines, machinery and equipment with surface temperature under insulation over 220 °C, exhaust pipes, smoke uptakes, electrical equipment and main machinery control stations and, as far as practicable, shall be arranged far apart therefrom. The fuel oil tanks shall be located at not less than 800 mm from the engine and exhaust unless a metal bulkhead is provided in between.

2.8 INSULATION OF HEATED SURFACES

2.8.1 All parts of machinery, equipment and piping which may be heated to a temperature over 60 °C and constitute a threat to the attending personnel shall be provided with means that prevent or restrict thermal radiation.

2.8.2 Surfaces of machinery, equipment and piping with temperatures above 220 °C shall be insulated. Measures shall be taken to prevent destruction of insulation from vibration and mechanical damages.

2.8.3 Insulating materials and surface of insulation shall comply with the requirements of 2.3.7, 2.3.8 and 2.5.2, Part X "Fire Protection" of these Rules.

2.9 SHAFTING

2.9.1 General.

2.9.1.1 The minimum shaft diameters without allowance for subsequent turning on lathe during service life shall be determined by the formulae given in this Section. It is assumed that torsional vibrations are comply with the requirement of 2.11.

2.9.1.2 In craft with no obstruction for the propeller shaft to slip out of the sterntube, means shall be provided which, in the event of the propeller shaft breaking, will prevent its slipping out of the sterntube gland; or measures shall be taken to preclude flooding of the engine room, should the propeller shaft is lost.

2.9.1.3 Shafts are recommended to be manufactured from steel with tensile strength of 400 to 800 MPa.

In all cases, the tensile strength in Formula (2.9.2.1) shall be taken to be not more than 800 MPa for intermediate and thrust shafts and not more than 600 MPa for the propeller shaft.

2.9.1.4 It is advisable to install propeller shafts having one thrust bearing which takes up the ahead and astern loads and two line shaft bearings which take up weight loads of the shaft itself and bending loads due to possible deformations of the craft hull in heavy sea.

Any constructions and units (reduction gears, cardan and flexible shafts, etc.), if justified, may be used in shafting.

It is advisable to use such construction of the reduction gear which would make it possible to house the ahead and astern thrust bearings and the forward line shaft bearing of propeller shaft in the reduction gear case. The aft line shaft bearing of propeller shaft is recommended to be installed either on a pedestal on the craft hull or immediately ahead of the propeller shaft exit from the hull in way of sternpost or countertimber.

2.9.2 Construction and diameters of shafts.

2.9.2.1 Intermediate shaft.

The diameter of the intermediate shaft d_{int} or the diameter of the propeller shaft in case of a common shaft from the engine to the propeller, in cm, shall not be less than that determined by the following formula:

$$d_{int} = 677{,}7\sqrt[3]{N(1+k)\,(n\cdot\tau_{all})} \qquad (2.9.2.1)$$

where N = rated power transmitted by intermediate shaft, in kW;
n = rated speed of intermediate shaft, in min^{-1};
τ_{all} = allowable tangential stress in shaft cross-section, in MPa;
$k = q\,(a - 1)$ – for installations with internal combustion engines;

$q = 1{,}4\,J_p/\,(J + 1{,}4\,J_p)$, or if there are no data on the mass moments of inertia, the value q may be specified, respectively:

$q = 0{,}5$ for installations with two-stroke engines;
$q = 0{,}4$ for installations with four-stroke engines;

J_p = mass moment of inertia of propeller shaft with propeller without considering the added water mass, in kg·m²;
$J = J_{ENG} + J_M$ = mass moment of inertia of propulsion plant without reduction gear, in kg·m²;
$J = (J_{ENG} + J_M)(n_{ENG}/n)^2$ = mass moment of inertia of propulsion plant with reduction gear, in kg·m²;

J_{ENG} = moment of inertia of all gyrating and reciprocating masses of propulsion plant, in kg·m²;
J_{FW} = mass moment of inertia of flywheel, in kg·m²;
n_{ENG} = rated speed of engine shaft, in min^{-1};

a = factor defined as a ratio of maximum indicated torque as based on the aggregate

of measurements made throughout the engine to the mean indicated torque. Value of the factor shall be determined from cumulative diagram of tangential forces constructed for the whole engine or from Table 2.9.2.1 which holds true only at equal crank angles.

Table 2.9.2.1

Number of cylinders	Type of internal combustion engine		Number of cylinders	Type of internal combustion engine	
	Four-stroke	Two-stroke		Four-stroke	Two-stroke
1	14,0	8,0	7	2,20	1,30
2	6,40	3,8	8	2,00	1,20
3	4,50	2,6	9	1,85	1,15
4	2,80	2,2	10	1,60	1,15
5	2,40	1,8	11	1,50	1,10
6	2,15	1,5	12	1,40	1,05

The diameter of intermediate shaft shall be taken to be not less than 25 mm.

2.9.2.2 The design diameter of the propeller shaft, d_p, in cm, shall be not less than that determined by the following formula:

$$d_p = k \cdot d_{int}. \qquad (2.9.2.2)$$

where k = factor assumed as follows proceeding from the shaft design features:
for the portion of propeller shaft between the propeller shaft base cone or the aft face of the propeller shaft flange and the forward edge of the aftermost shaft bearing, (subject to a minimum of $2{,}5 \cdot d_p$):
1,22, where the propeller is keyless fitted onto the propeller shaft taper or is attached to an integral propeller shaft flange;
1,26 where the propeller is keyed onto the propeller shaft taper;
for the portion of propeller shaft between the forward edge of the aftermost shaft bearing and the forward edge of the forward sterntube seal $k = 1{,}15$ for all types of design.

On the portion of propeller shaft forward of the forward edge of the forward sterntube seal, the diameter of the propeller shaft may be tapered to the actual diameter of the intermediate shaft.

Where surface hardening is used, the diameters of propeller shafts may be reduced.

Portions of the propeller shaft which are in contact with water, in case where the shaft has no continuous liner or is not effectively protected by some other method, shall have the outer diameter which exceeds by 5 per cent the diameter determined by Formula (2.9.2.2).

2.9.2.3 The diameter of thrust shaft in external sliding bearing on a length equal to thrust shaft diameter on either side of the thrust collar and, where roller thrust bearings are used, on a length within the housing of thrust bearing, shall not be less than 1,05 times the intermediate shaft diameter determined by Formula (2.9.2.1).

Beyond the said lengths, the diameter of the thrust shaft may be tapered to that of the intermediate shaft.

2.9.2.4 Propeller shafts shall be effectively protected against corrosion.

For shafts made of corrosion-resistant steel, no protective coating is required, subject to the condition that the surfaces which are in contact with sea water are polished.

For craft of design categories **A, A1, A2, B, C** and **C1**, the propeller shaft made of carbon or low-alloyed steel, shall have a liner made of such alloys which posses sufficient corrosion resistance in sea water.

For craft of design categories **C2, C3** and **D**, liners are recommended to be used.

The thickness of the liner shall not be less than 5 mm.

In case of non-continuous liners, the portion of the shaft between the liners shall be protected against the action of sea water by a method approved by the Register.

The liners shall be shrunk on the shaft in such a way as to provide tight interference between mating surfaces. The use of pins or other parts for securing the liners to the shaft is not permitted.

2.9.2.5 If the shaft has a central hole, its bore shall not exceed 0,4 of the design diameter of the shaft.

If considered necessary, the bore of the central hole may be increased to the value obtained from the formula

$$d_c \leq (d_a^4 - 0{,}97\, d^3\, d_a)\, 1/4 \qquad (2.9.2.5)$$

where d_c = bore of central hole;
d_a = actual shaft diameter;
d = design diameter of the shaft without the central hole.

2.9.2.6 The diameter of a shaft having a longitudinal slot shall be increased by at least 0,2 of the design diameter of the shaft. The slot length shall be not more than 1,4 and the slot width not more than 0,2 of the design diameter of the shaft.

The bossed portion of the shaft shall be of such length as to extend beyond the slot, either side, for 0,25 of the design diameter of the shaft.

Transition from one diameter to another shall be smooth. The ends of the slot shall be rounded to a radius of half the width of the slot and the edges — to a radius of at least 0,35 times the width; the surface of the slot shall have a smooth finish.

2.9.2.7 Where the shaft has a radial or transverse hole, the shaft diameter shall be increased over a length of at least seven bores of the hole. The hole shall be located at mid-length of the bossed portion of the shaft and its bore shall not exceed 0,3 of the shaft design diameter.

In all cases, irrespective of the hole bore, the shaft diameter shall be increased by not less than 0,1 times the design diameter. The edges of the hole shall be rounded to a radius not less than 0,35 times its bore and the inner surface shall have a smooth finish.

2.9.2.8 The diameter of a shaft having a keyway shall be increased by at least 0,1 times its design diameter. After a length of not less than 0,2 of the design diameter from the ends of the keyway, no increase of the shaft diameter is required.

If the keyway is made on the outboard end of the propeller shaft, the diameter need not be increased.

Fillet radii in the transverse section of the bottom of the keyway shall not be less than 0,0125 of the shaft diameter, but at least 1 mm.

2.9.2.9 On the cone base side, the keyways in shaft cones shall be ski-shaped, while in propeller shaft cones they shall be spoon-shaped in addition.

For the outboard end of a propeller shaft having the diameter in excess of 100 mm, the distance between the cone base and the spoon-shaped keyway end shall be at least:

0,2 of the design shaft diameter — with the ratio of the keyway depth to the shaft diameter less than 0,1;

0,5 of the required shaft diameter — with the ratio of the keyway depth to the shaft diameter more than 0,1.

In coupling shaft cones, the ski-shaped keyway end shall not extend beyond the cone base.

For shafts of less than 100 mm in diameter, the spoon-shaped keyway ends may be dispensed with.

Where the key is secured by screws in the keyway, the first screw shall be positioned at least 1/3 of the shaft cone length from the shaft cone base. The bore depth shall not exceed the screw diameter. The bore edges shall be rounded off. Where the shaft has blind axial bores, the bore edges and end shall also be rounded off. The fillet radius shall not be less than specified in 2.9.2.8.

2.9.2.10 Where keys are used to fit the propeller on the propeller shaft cone, the latter shall have a taper not in excess of 1:12, and in case of keyless fitting — according to 2.9.2.11.

2.9.2.11 In case of keyless fitted propellers and shaft couplings, the taper of the shaft cone shall not exceed 1:15.

A keyless assembly shall generally be constructed without an intermediate sleeve between the propeller boss and shaft.

2.9.2.12 When fitting the keyless shrunk assembly, the axial pull-up of the propeller boss or coupling in relation to the shaft, as soon as the contact between mating surfaces is obtained after eliminating the clearance, shall be determined by formulae given in 5.4, Part VII "Machinery Installations" of the RS Rules/C.

2.9.2.13 End nuts by which the propellers or couplings are secured to the propeller shaft cone shall be fitted with effective stoppers.

The major thread diameter of the end nut used for securing the propeller to the propeller shaft cone shall not be less than 0,6 of the cone base diameter.

2.9.2.14 The stoppers of the end nuts shall be secured to the shaft.

In case of shafts having diameter less than 100 mm, the nut is allowed to be stopped in relation to the propeller boss.

2.9.3 Shaft couplings.

2.9.3.1 The bolts used at the coupling flanges of shafts shall be fitted bolts. In case of using coupling flanges without fitted bolts, technical substantiation shall be submitted to the Register for review.

2.9.3.2 The coupling bolt diameter, in mm, shall be not less than that determined by Formula (5.3.2), Part VII "Machinery Installations" of the RS Rules/C.

2.9.3.3 The thickness of coupling flanges of the intermediate and thrust shafts as well as the inboard end of the propeller shaft shall not be less than 0,2 of the required diameter of the intermediate shaft or not less than the bolt diameter determined according to 2.9.3.2 for the shaft material, whichever is the greater.

2.9.3.4 The keyways at the shaft ends for the coupling flange muffs shall conform to the requirements of 2.9.2.8 and 2.9.2.9.

2.9.4 Shaft bearings

2.9.4.1 The length of the bearing nearest to the propeller shall be taken according to Table 2.9.4.1.

Table 2.9.4.1

Relative length of bearing

Bearing material	L/d[1]
White metal	2[2]
Lignum vitae	4
Rubber or other synthetic water-lubricated materials approved by the Register	4[3]

[1] L=bearing length; d=design shall diameter in way of bearing.

[2] The bearing length may be reduced if the pressure on the bearing does not exceed 0,8 MPa. In this case, the mass of the propeller shall and the propeller shall be taken as the load, assuming that it acts on the all bearing only. In all cases, the length of the bearing shall not be less than twice the actual shall diameter in way of the bearing.

[3] The bearing length may be reduced to two design diameters of the shall in way of the bearing.

2.9.4.2 The water cooling and lubrication of sterntube bearings shall be of forced type.

The water supply system is recommended to be provided with a flow indicator or with the minimum water flow alarms having regard to the sterntube arrangement design.

The shut-off valve controlling the supply of water to sterntube bearings shall be fitted on the sterntube or on the afterpeak bulkhead.

2.9.4.3 If the sterntube bearings are oil-lubricated, the propeller shaft seals of a type approved by the Register shall be used.

The lubricating oil gravity tanks shall be located above the margin line and fitted with oil level indicators.

Forced lubricating oil cooling and oil or bearing liner temperature monitoring are recommended to be implemented having regard to the sterntube arrangement design.

2.9.4.4 The distance between the centers of adjacent shaft bearings, where there are no concentrated masses in the span, shall meet the following condition:

$$5{,}5\sqrt{d} \leq l \leq \lambda\sqrt{d} \qquad (2.9.4.4)$$

where l = distance between the centers of adjacent bearings, in m;
d = shaft diameters between bearings, in m;
λ = factor taken equal to:
14 for $n \leq 500$ rpm;
$300 / \sqrt{n}$ for $n > 500$ rpm;
n = rated shaft speed, in rpm.

2.9.4.5 It is recommended to seek the minimum number of shafting supports and the maximum possible length of span between them.

The maximum allowable length of the spans between the shaft supports (bearings) determined according to 2.9.4.4, shall be checked by the bending vibration calculation.

2.9.5 The shafting shall comprise the appropriate braking devices. Such devices may be a brake, a stopper preventing rotation of the shaft in the event the main engine goes out of action.

For shafting of less than 60 mm in diameter such devices are recommended to be used

2.9.6 Cardan shafts.

2.9.6.1 Shafting is allowed to comprise cardan shafts to be used as intermediate shafts, subject to condition that appropriate strength calculations of the shafts and articulated joints are submitted to the Register.

2.9.7 Hydraulic tests.

2.9.7.1 Propeller shaft liners and sterntubes shall be hydraulically tested by a pressure of 0,2 MPa upon completion of machining.

2.9.7.2 After assembling, the sterntube seals, where sterntube bearing are oil-lubricated, shall be tested for tightness by a pressure head up to the working level of liquid in gravity tanks. In general, the test shall be carried out while the propeller shaft is turning.

2.10 PROPELLERS

2.10.1 The requirements of this Chapter apply to metal fixed-pitch propellers, both solid and detachable-blade propellers, as well as to controllable-pitch propellers.

When using the propellers or blades made of non-metal materials, their design with the technical substantiation of their use for specific craft shall be submitted to the Register for review

2.10.2 Blade thickness.

2.10.2.1 Propeller blade thickness, in mm, in two sections being controlled shall not to be less than that determined by the following formula:

$$S_p = \frac{3{,}2A}{\sqrt[3]{(0{,}312+H/D)^2}}\sqrt{\frac{N}{nB_pZM}} \qquad (2.10.2.1)$$

where S_p = maximum thickness of expanded blade in the coaxial cylindrical section which is measured normally away from the driving surface (leading edge) or the standard blade section chord, for the blade section being measured, which is the nearest section to the boss, i.e. at the radius:
$0{,}20\ R$ — for solid propellers where the propeller boss radius is smaller than $0{,}20\ R$;
$0{,}25\ R$ — for solid propellers where the propeller boss radius is greater than or equal to $0{,}20\ R$;
$0{,}30\ R$ — for detachable-blade propellers;
$0{,}35\ R$ — for CPP;
$0{,}6\ R$ — for all propellers irrespective of the propeller boss diameter;

A = coefficient to be determined from Table 2.10.2.1 for the radius to be calculated and also depending on the blade rake angle; if the blade rake angle differs from the values listed in the Table, the coefficient A shall be taken as for the nearest greater value of the angle;

N = rated power of main engine, in kW;

n = rated propeller speed, in min^{-1};

Z = number of blades;

B_p = expanded blade width at the design radius, in m;

D = propeller diameter;

R = propeller radius, m;

H/D = pitch ratio at the radius $0{,}7\ R$;

$M = 0{,}6\ R + 180$ MPa, but not more than:

610 MPa — for copper alloys;
570 MPa — for steel;

$R_{m(s)}$ = tensile strength of blade material, in MPa.

Table 2.10.2.1

Blade radius	Blade rake angle measured on the blade driving surface, in deg.								
	0	2	4	6	8	10	12	14	16
0,20 R	390	391	393	395	397	400	403	407	411
0,25 R	378	379	381	383	385	388	391	394	398
0,30 R	367	368	369	371	373	376	379	383	387
0,35 R	355	356	357	359	361	364	367	370	374
0,60 R	236	237	238	240	241	243	245	247	249

2.10.2.2 The blade tip thickness shall not be less than $0{,}0035\ D$. The intermediate blade thicknesses shall be so selected that the lines connecting the maximum thicknesses points of sections, from the root section through the intermediate one up to the tip section, are fair.

In sound cases, the blade thickness calculated according to 2.10.2 and 2.10.3 may be reduced, provided detailed strength calculations are submitted to the Register.

2.10.3 Propeller boss and blade fastening parts.

2.10.3.1 Fillet radii of the transition from the root of a blade to the boss shall not be less than $0{,}04\ D$ on the suction side and shall not be less than $0{,}03\ D$ on the pressure side (D is

the propeller diameter). If the blade has no rake, the fillet radius on both sides shall be at least 0,03D.

Smooth transition from the blade to the boss using a variable radius may be allowed.

2.10.3.2 Empty spaces between the propeller boss and the shaft cone, as well as inside the propeller cap shall be filled with non-corrosive mass.

2.10.3.3 The diameter of the bolts (studs), by which the blades are secured to the propeller boss or the minor diameter of the thread of such bolts (studs), whichever is less, shall not be less than that determined by the following formula:

$$d_s = ks\sqrt{\frac{b\,R_{mbl}}{bR_{mb}}} \qquad (2.10.3.3)$$

where k = 0,33 in case of three studs in blade flange at the driving surface;
0,30 in case of four studs in blade flange at the driving surface;
0,28 in case of five studs in blade flange at the driving surface;
s = maximum actual thickness of the blade at the design root section (refer to 6.2.1 Part VII "Machinery Installations" of the RS Rules/C), in mm;
b = width of expanded cylindrical section of the blade at the design root section, in mm;
R_{mbl} = tensile strength of blade material, in MPa;
R_{mb} = tensile strength of bolt/stud material, in MPa;
d = diameter of bolt pitch circle; with other arrangement of bolts;
$d = 0{,}85\,l$, where l = the distance between the most distant studs, in m.

2.10.4 Propeller balancing.

The completely finished propeller shall be statically balanced.

2.10.5 Controllable pitch, adjustable pitch, foldable blade and other propellers.

2.10.5.1 The hydraulic power system of the CPP, the overload protection system of the main engines, the lubrication system of the CPP shall meet the requirements of 6.5, Part VII "Machinery Installations" of the RS Rules/C.

2.10.5.2 Construction of the adjustable pitch propellers, foldable blade propellers, as well as other propellers (e.g. water-jet propellers, paddle wheels, aerial propellers) shall be agreed with the Register.

2.11 TORSIONAL VIBRATION

2.11.1 The requirements of this Chapter apply to machinery installations with the main engines having a power output of 37 kW and over.

2.11.2 For the machinery installations with the main engines having a power output from 37 up to 75 kW, the torsional vibration calculations shall include:

.1 specifications of the basic installation components;

.2 natural frequency calculation results for all modes of vibration having resonances within the rated shaft speed range from 0,2 to 1,2;

.3 results of determination of the design stresses in critical sections of shafts caused by the existing resonances. If the resonance zone of the basic order is situated in the proximity to the range from 0,85 to 1,05 of the working shaft speeds (idle running, rated speed on ahead or astern run) or natural frequencies of hull structures, stresses due to non-resonance forced vibration caused by the resonance frequencies of basic order shall be calculated for these ranges.

The permissible stresses due to resonance, near-resonance and non-resonance forced vibration under conditions of continuous running shall not exceed those defined in 2.11.3.

2.11.3 For the machinery installations with the main engines having a power output of 75 kW and over, the requirements set out in Section 8, Part VII "Machinery Installations" of the RS Rules/C shall be complied with in so much as they are applicable, depending on the installation type. Where the technical opportunity of making torsional vibration measurement on board (e.g. in installations with water-jets, outboard engines, steerable propellers, etc.) is unavailable or impracticable, absence of dangerous torsional vibration over the entire working speed range in all specified operating modes of the installation shall be supported by a calculation.

2.12 ACTIVE MEANS OF CRAFT'S STEERING

2.12.1 General.

2.12.1.1 The requirements of this Section apply to AMCS as defined in 1.2.

The requirements for steering nozzles and steering system of active rudders are given in Part III "Arrangements, Equipment and Outfit" of these Rules.

2.12.1.2 Where AMCS is intended for the main propulsion and steering of the motor craft of design categories **A, A1, A2** and **B,** a minimum of two AMCS shall be provided.

In this case, provision shall be made for control stations equipped with the necessary devices and, if required, means of communication, as specified in 2.4.

2.12.1.3 A single AMCS may be installed for the main propulsion and steering of the motor craft of design categories **C, C1, C2, C3** and **D,** as well as the sailing-motor and motor-sailing craft.

2.12.1.4 The requirements for installation of AMCS machinery and equipment are given in 2.2.

2.12.1.5 For the main AMCS, size and materials of shafts, couplings, coupling bolts, propulsors, gearings, as well as electrical equipment shall meet the requirements of the relevant Parts and Sections of these Rules. Moreover, the applicable requirements of the relevant Sections of these Rules which relate to the rudder and steering gear shall be met as well.

2.12.1.6 Calculations of the AMCS gearing shall be made following the procedure outlined in 4.2, Part IX "Machinery" of the RS Rules/C, in so much as they are applicable and sufficient, unless otherwise specified in these Rules.

2.12.1.7 Spaces containing AMCS machinery shall be equipped with appropriate ventilating, fire extinguishing, drainage, heating and lighting arrangements.

2.12.2 The requirements for construction, alarm devices, hydraulic tests shall be fulfilled consistently with those set out in 7.2 to 7.4, Part VII "Machinery Installations" of the RS Rules/C, in so much as they are applicable and sufficient, unless specified otherwise in these Rules.

2.12.3 Tiller-controlled outboard propulsion engines shall be equipped with an emergency stopping device which can be linked to the helmsman.

2.13 VIBRATION

2.13.1 Where necessary, appropriate measures shall be taken so that the vibration arising during operation of machinery and equipment has no detrimental effect upon the people and does not interfere with the normal operation of the craft.

2.13.2 Vibration standards are extended to cover the internal combustion engines with 55 kW and above in power output and rotational speed ≤ 3000 min^{-1}, the requirements for which are specified in Section 9, Part VII "Machinery Installations" of the RS Rules/C, in so much as they are applicable and sufficient in each particular case.

2.14 MATERIALS AND WELDING

2.14.1 Materials intended for the manufacture of parts of the shafts and propellers shall comply with the requirements given in column 4, Table 1.3.2.3 and in 2.4.1 — 2.4.6, Part VII "Machinery Installations" and in the relevant Sections of Part XIII "Materials" of the RS Rules/C, in so much as they are applicable and sufficient, unless specified otherwise in these Rules.

2.14.2 Welding procedures and non-destructive testing of welded joints shall comply with the requirements of Part XIV "Welding" of the RS Rules/C, in so much as they are applicable and sufficient, unless specified otherwise in these Rules.

2.14.3 Any use of asbestos-containing materials is prohibited in machinery installations, machinery, machinery and another one equipment, as well as in the craft systems, which are subject to the requirements of this Part and Part X "Fire Protection".

2.15 SPARE PARTS

2.15.1 The required minimum of spare parts is not regulated. It is advisable to keep on board a minimum amount of spare parts for machinery and equipment essential for propulsion and safety of the craft and to have a set of special tools and appliances necessary for dismantling and assembling of the machinery in service conditions.

The spare parts and special appliances (if available) shall be properly secured in easily accessible places and efficiently protected against corrosion.

3 MACHINERY

3.1 APPLICATION. SCOPE OF TECHNICAL SUPERVISION

3.1.1 The requirements of this Section apply to the following engines and machinery:

.1 main internal combustion engines;

.2 internal combustion engines driving electric generators or auxiliary machinery, units in assembly;

.3 gears and coupling;

.4 pumps included into systems covered by the requirements of Section 4 of this Part and Part X "Fire Protection" of these Rules, except for manually operated pumps;

.5 power driven air compressors;

.6 centrifugal separators for fuel oil and lubricating oil;

.7 turbochargers of internal combustion engines;

.8 fans included into systems covered the requirements by Section 4;

.9 steering gear;

.10 anchor machinery;

.11 mooring machinery;

.12 hydraulic drives.

3.1.2 Subject to the Register technical supervision during manufacture are engines and machinery listed in 3.1.1.

The scope of technical supervision, hydraulic tests, operation tests, general technical requirements, materials and welding shall comply with the requirements of 1.2 to 1.6, Part IX "Machinery" of the RS Rules/C, in so much as applicable and sufficient unless expressly specified otherwise in these Rules.

3.2 INTERNAL COMBUSTION ENGINES

3.2.1 General provisions.

3.2.1.1 The requirements of this Chapter apply to all internal combustion engines of power output 37 kW and above.

Application of these requirements to the internal combustion engines of power output less than 37 kW may be reduced depending on their design, purpose and application for specific craft.

3.2.1.2 The engines shall be capable of working with an overload exceeding the rated power by at least 10 per cent for not less than 1 h.

3.2.1.3 The engines intended to be used as main engines shall also comply with the requirements of 2.3.

3.2.1.4 Irregularity of speed of a.c. diesel generating sets intended for parallel operation shall be such that the amplitude of angle oscillations of the generator shaft does not exceed $3{,}5°/P$, where P is the number of pairs of generator poles.

3.2.1.5 The diesel generating sets intended to be used as emergency units shall be provided with self-contained fuel supply, cooling and lubrication systems.

3.2.1.6 Engines intended to drive emergency generators which may also be used as electrical power sources for non-emergency consumers shall be equipped with fuel oil and lubricating oil filters, as well as with instruments, alarm and protective devices as required for the prime movers of the main sources of electrical power when in unattended operation. Along with that, their fuel oil service tanks shall be fitted with an alarm for low fuel oil level which corresponds to the capacity of the fuel oil daily service tank of the emergency diesel generator.

Moreover, such engines shall have design and maintenance system ensuring their constant availability for use as emergency units when the craft is at sea.

3.2.1.7 The rated power output of the engines shall be determined under environmental conditions cited in 2.2.7, Part VII "Machinery Installations" of the RS Rules/C.

3.2.1.8 Fuel oil and lubricating oil pipes, fittings, flanged connections, filters shall be screened or otherwise protected so that in case of their failure petroleum products falling onto hot surfaces is prevented.

3.2.2 Engine frame, crankshaft, scavenging and supercharging, fuel oil system, lubrication, starting arrangements, exhaust arrangements, control, protection and regulation, torsional vibration damper, antivibrator.

3.2.2.1 Engine frame, crankshaft, scavenging and supercharging, fuel oil system, lubrication, starting arrangements, exhaust arrangements, control, protection and regulation, torsional vibration damper, antivibrator shall comply with the requirements of 2.3 to 2.11, 2.13, Part IX "Machinery" of the RS Rules/C in so much as applicable and sufficient unless expressly specified otherwise in these Rules.

3.2.3 Instruments and alarm devices.

3.2.3.1 Main and auxiliary engines shall be fitted with instruments for measuring:

.1 lubricating oil pressure at engine inlet;

.2 freshwater pressure (or flow) in the engine cooling system;

.3 starting air pressure at main starting valve or starting device inlet (where compressed air starting system is provided);

.4 exhaust gas temperature in exhaust gas pipe;

.5 lubricating oil temperature at engine inlet;

.6 freshwater (coolant) temperature at engine outlet and inlet.

The engines with a compensating tank installed on the engine, only the freshwater (cooling water) temperature at engine outlet is allowed to be measured;

.7 temperature of cylinder multiple head of the directly air cooled engines.

N o t e . Proceeding from the structural features of the engines, changes may be introduced to the list of measuring instruments with the technical substantiation submitted to the Register for review.

3.2.3.2 Each driving engine with a power output exceeding 37 kW shall be fitted with audible and visual warning alarm device actuating signals when the lubricating oil pressure in the circulating lubrication system drops below the permissible level.

3.2.3.3 Local control stations of main engines shall be equipped with instruments for measuring:

.1 lubricating oil pressure at engine and reduction gear inlet;

.2 freshwater (coolant) pressure (or flow) in the engine cooling system;

.3 starting air pressure at main starting air valve or starting device inlet (where compressed air starting system is provided);

.4 current strength and voltage in the starter battery charging circuit (where electrical starting system is provided);

.5 crankshaft speed, and where disengaging clutches are fitted, with an instrument for measuring propeller shaft speed as well;

.6 temperature of cylinder multiple head of the directly air cooled engines.

N o t e . Proceeding from the structural features of the engines, changes may be introduced to the list of measuring instruments with the technical substantiation submitted to the Register for review.

3.2.3.4 Local control stations of main reversible engines or main engines with reverse-reduction gear, in addition to the instruments listed in 3.2.3.3, shall be equipped with:

propeller shaft rotation indicators;

devices for emergency stop of the engine or disengaging of the clutches, operating irrespective of remote control.

N o t e . Outboard engines (attached to transom) are fitted with measuring instruments with consideration for their structural features and the Manufacturer's recommendations.

3.2.3.5 Local control stations of auxiliary engines shall be equipped with instruments for measuring:

.1 lubricating oil pressure at engine and reduction gear inlet;

.2 freshwater (coolant) pressure (or flow) in the engine cooling system);

.3 current strength and voltage in the started battery charging circuit (where electrical starting system is provided) — recommendational;

.4 crankshaft speed.

3.2.4 Marking.

3.2.4.1 The marking shall contain the following information:

trade mark or trade name of the engine Manufacturer;

type of engine, its group (family), if any;

identification number of the engine;

power and speed.

3.2.4.2 The marking shall be in indelible paint. When a label or a nameplate is used, their attachment shall remain reliable throughout the standard service life of the engine and preclude their detachment without damaging them.

3.2.4.3 The marking shall be made on those parts of the engine, the removal of which renders operation of the engine impossible.

3.2.4.4 The marking shall be so located that it can be clearly visible to a person of a medium height, after the engine is mounted with all components necessary for its operation.

3.2.4.5 Marking of propulsion engine of craft intended for operation in EU waters shall additionally comply with the requirements of Directive 2013/53/EU of 20 November 2013.

3.3 GEARS, DISENGAGING COUPLINGS

3.3.1 Gears, disengaging couplings of engines and machinery listed in 3.1.1 shall comply with the requirements of Section 4, Part IX "Machinery" of the RS Rules/C, in so much as applicable and sufficient unless expressly provided otherwise below.

3.4 AUXILIARY MACHINERY

3.4.1 Power driven air compressors, fans and turbo-chargers, power driven centrifugal separators shall comply with the requirements of Section 5, Part IX "Machinery" of the RS Rules/C, in so much as applicable and sufficient unless expressly provided otherwise below.

3.5 DECK MACHINERY

3.5.1 Steering gear, anchor and mooring machinery shall comply with the requirements of Section 6, Part VIII "Machinery" of the Rules for the Classification and Construction of Inland Navigation Ships (for European Inland Waterways)[1], in so much as applicable and sufficient unless expressly provided otherwise below.

[1] Hereinafter referred to as "the Rules C/IN".

3.6 HYDRAULIC DRIVES

3.6.1 Hydraulic drives of machinery listed in 3.1.1 shall comply with the requirements of Section 7, Part VIII "Machinery" of the Rules C/IN, in so much as applicable and sufficient unless expressly provided otherwise below.

4 SYSTEMS AND PIPING

4.1 APPLICATION

4.1.1 The requirements of this Part apply to the following systems and piping used in craft:

.1 bilge pumping and drain;
.2 ballast;
.3 fuel oil;
.4 lubricating oil;
.5 water cooling;
.6 compressed air;
.7 air, overflow, sounding;
.8 exhaust gas;
.9 ventilation;
.10 hydraulic drives;
.11 domestic liquefied gas.

Pumping and piping of berth-connected craft shall comply with the requirements of this Part, in so much as applicable and sufficient unless provided otherwise below.

4.1.2 Fuel oil used in craft shall comply with the requirements of 2.1.2.1.

4.1.3 Machinery and other components of the systems indicated in 4.1.1 shall remain operative under environmental conditions specified in 2.3, Part VII "Machinery Installations" of the RS Rules/C.

4.1.4 For the purpose of determining test categories, types of joints, thermal treatment, welding procedures, pipes are subdivided into three classes as indicated in Table 4.1.4.

Table 4.1.4

Media conveyed	Class I	Class II	Class III
Inflammable media heated above flash point or having flash point below 60 °C, liquefied gases	Without special safeguards	With special safeguards[1]	—
Fuel oil, lubricating oil. hydraulic oil with flash point of 60 °C and above[2]	$p > 1{,}6$ or $t > 150$	$p \leq 1{,}6$ and $t \leq 150$	$p \leq 0{,}7$ and $t \leq 60$
Other media[2,3,4]	$p > 4{,}0$ or $t > 300$	$p \leq 4{,}0$ and $t \leq 300$	$p \leq 1{,}6$ and $t \leq 200$

[1] Safeguards for reducing leakage possibility and limiting its consequences through proper pipe installation, use of special ducts, protective casings, screening, etc.
[2] p — design pressure, in MPa; t — design temperature, in °C (refer to 4.2).
[3] Including water, air, gases, non-flammable hydraulic fluids.
[4] For open-ended pipes (drain, overflow, vent, air and steam lines from safety valves) irrespective of the temperature. Class III pipes may be used.

4.1.5 Fittings of pipes of all Classes as well as air pipe covers, flexible joints, expansion joints, mechanical joints, insulating joints may be delivered to pleasure craft with a copy of the Type Approval Certificate of the Register.

In case where the type approval of the Register is unavailable, the above equipment for use on a particular craft may be accepted by the Surveyor to the Register after verification of the Manufacturer's certificates, verification of the conformity of used materials with these Rules requirements and test performance.

4.1.6 Protection and insulation of piping.

4.1.6.1 Steel pipes of sea water, as well as air, sounding and overflow pipes of water tanks and tanks for alternate carriage of water ballast and fuel oil shall be protected against corrosion by a method approved by the Register.

Galvanic coating, zinc coating applied by a hot method, plastic coating and also paint coating applied on external surfaces may be used as such protection.

Upon completion of all welding work during manufacture of pipe sections, the damaged portions of coating shall be restored or protected by other method approved by the Register.

Application of galvanic coating does not supersede the measures for protection of pipes against contact and electrochemical corrosion.

4.1.6.2 Where bottom and side fittings of nonferrous metal alloys are used, provision shall be made for protection of the craft's shell plating and all components coming into contact with those fittings, against contact corrosion. Cathodic protection of welded suction and discharge branch pipes with fittings against contact corrosion shall be made with the use of standard ring end or ring interflange protectors to be mounted on the branch pipe flanges. The use of electric insulating joints of the mating components made in accordance with the approved standards is allowed; in this case, bottom and side fittings shall be insulated on both sides with the obligatory measuring of the joint insulation resistance upon completion of installation.

4.1.6.3 Where steel pipes of sea water systems are connected to fittings, pump casings, machinery units and heat exchangers of non-ferrous metal alloys, provision shall be made for protection against contact corrosion.

4.1.6.4 Flow velocity for pipe portions incorporating formed components, throttle diaphragms, as well as through-hull and seacock distance pieces shall not exceed the values specified in Table 4.1.6.4.

Table 4.1.6.4

Pipe material	Permissible flow velocity, in m/s
Steel, including galvanized steel	2,5
Copper-nickel and aluminum-brass alloys	2,0

4.1.6.5 Protection against excessive pressure.

4.1.6.5.1 Pipelines in which pressure in excess of the design pressure is likely to arise, shall be fitted with safety devices so that the pressure would not exceed the design pressure for the pipes.

The liquied diversion from relief valves of pumps transferring flammable liquids shall be effected into the suction side of the pump or to the suction pipeline. This requirement does not apply to centrifugal pumps.

4.1.6.5.2 Where provision is made for a reducing valve on the pipeline, a pressure gauge and a safety valve shall be installed after the reducing valve. An arrangement for by-passing the reducing valve is allowed for use.

4.1.6.6 Insulation of piping.

Insulation of piping shall comply with the requirements of 2.8.

4.1.7 Flexible joints (hoses).

4.1.7.1 The type and design of flexible joints used in the systems listed in 4.1.1 shall be approved by the Register. The material of flexible joints shall be selected with regard to the used media to be conveyed, pressures, temperatures and environmental conditions. The bursting pressure of the flexible joints (except ventilation systems) shall be at least 4 times higher than the design pressure.

4.1.7.2 In the pipelines conveying fuel oil, lubricating oil and other flammable liquids, as well as in pipelines connected with the drives of watertight doors or with the openings in shell plating only fire-resistant flexible joints made as fabricated inserts with end connections (flanges or nipples) are allowed for use. No clamping arrangements are allowed. Where such flexible joints are installed in machinery spaces, provision shall be made for their disconnection in the event of failure. Disconnecting valves shall be located in readily accessible places, in the immediate vicinity of flexible joints so that any flexible joint can be replaced without having to stop other machinery.

4.1.7.3 A joint is considered fire-resistant if, being connected to a pipeline in which water is circulating at a temperature not lower than 80 °C, at the maximum pressure, it withstands heating by fire during 30 min at a temperature of 800 °C and retains its integrity during and after a proof pressure test. As an alternative to this test, are the above-mentioned fire tests with circulating water pressure equal to 0,5 MPa with subsequent hydraulic test for double design pressure.

4.1.7.4 Where a flexible joint is made of steel or other equivalent material complying with the Register requirements for fire-resistance, fire test is not required.

4.1.7.5 In pipelines listed in 4.1.6.2 with bore not more than 10 mm and design pressure of the medium to be conveyed $p \leq 0{,}34$ MPa, as well as in case of bore in excess of 10 mm and the design pressure of the medium to be conveyed $p \leq 0{,}25$ MPa, fire resistant flexible joints with fire resistant fuel hoses complying with ISO 7840:2004 may be used.

4.1.7.6 Non-fire-resistant fuel hoses complying with ISO 8469:2004 with bore up to and including 63 mm and design pressure of medium to be conveyed $p \leq 0{,}25$ MPa, may be used for taking over and delivery of oily liquids.

4.1.8 Welding and non-destructive testing of welds.

Welding and non-destructive testing of welds in pipes shall be carried out in compliance with the requirements of Part XIV "Welding" of the RS Rules/C.

4.1.9 Machinery, equipment and control devices.

4.1.9.1 Fans, pumps, compressors and their electric drives used in systems covered by this Part shall comply with the requirements of Section 3 of this Part and Part VII "Electrical Equipment" of these Rules.

4.1.9.2 Control and monitoring devices of piping systems shall comply with the requirements of Part VI "Automation" of these Rules.

4.1.9.3 Heat exchangers and pressure vessels used in the systems shall comply with the requirements of Part X "Boilers, Heat Exchangers and Pressure Vessels" of the RS Rules/C.

4.2 METAL PIPING

4.2.1 Materials used for pipes and fittings, as well as the methods of testing the materials shall comply with the requirements of Part XIII "Materials" of the RS Rules/C.

The fuel oil pipes shall be manufactured of steel or other material meeting the Register requirements as to its strength and fire-resistance.

These requirements apply also to lubricating oil pipes in machinery spaces and to pipes conveying other flammable oil products including hydraulic and thermal liquids, if they are located in spaces containing sources of ignition.

4.2.2 In general, pipes and fittings of carbon steel and carbon-manganese steel shall be used for media with temperature not exceeding 400 °C and those of low-alloy steel — with temperature not exceeding 500 °C.

These steels may be admitted for temperatures higher than above mentioned, if their mechanical properties and ultimate long-term strength comply with the effective standards and are guaranteed by the steel Maker as suitable for the high temperature service.

Pipes and fittings for media with temperature above 500 °C shall be manufactured of alloy steel. This requirement does not cover exhaust gas pipes.

4.2.3 Copper and copper alloy pipes shall be seamless pipes or of other type approved by the Register.

Copper pipes for Classes I and II shall be seamless.

Pipes and fittings of copper and copper alloys shall generally be used for media having temperature not exceeding 200 °C, and those for copper-nickel alloys, for media with temperature not over 300 °C. Bronze fittings may be admitted for media having temperatures up to 200 °C.

4.2.4 In case of use of spheroidal or nodular graphite cast iron or aluminium alloys for pipes listed in 4.1.1, the technical substantiation shall be submitted to the Register for review.

4.2.5 Pipe wall thickness.

4.2.5.1 The wall thickness of metal pipes (except cast iron and aluminium alloy pipes) operating under the internal pressure shall not be less than that specified in Table 4.2.5.1.

The wall thickness of bilge, air, overflow and sounding pipes passing through fuel oil and ballast tanks shall be not less than specified in Table 2.3.8, Part VIII "Systems and Piping" of the RS Rules/C.

Table 4.2.5.1

External diameter, mm	Minimum pipe wall thickness, mm				
	Steel pipes			Copper	Copper alloys
	Pipes of systems other than stated in columns 3 and 4	Venting, overflow, sounding pipes of built-in tanks	Sea water pipes (bilge pumping, ballast, cooling water, fire-extinguishing systems)		
6,0	—	—	—	1,0	0,8
10,2	1,6	—	—	1,0	0,8
12,0	1,6	—	—	1,2	1,0
14,0	1,6	—	—	1,2	1,0
16,0	1,8	—	—	1,2	1,0
22,0	2,0	—	3,2	1,2	1,0
25,0	2,0	—	3,2	1,5	1,0
26,9	2,0	—	3,2	1,5	1,0
30,0	2,0	—	3,2	1,5	1,0
32,0	2,0	—	3,2	1,5	1,2
38,0	2,0	4,5	3,6	1,5	1,2
42,4	2,0	4,5	3,6	1,5	1,2
45,0	2,0	4,5	3,6	1,5	1,2
48,3	2,3	4,5	3,6	2,0	1,5
54,0	2,3	4,5	4,0	2,0	1,5

External diameter, mm	Minimum pipe wall thickness, mm				
	Steel pipes			Copper	Copper alloys
	Pipes of systems other than stated in columns 3 and 4	Venting, overflow, sounding pipes of built-in tanks	Sea water pipes (bilge pumping, ballast, cooling water, fire-extinguishing systems)		
57,0	2,3	4,5	4,0	2,0	1,5
63,5	2,3	4,5	4,0	2,0	1,5
70,0	2,6	4,5	4,0	2,0	1,5
76,0	2,6	4,5	4,5	2,0	1,5
82,5	2,6	4,5	4,5	2,0	1,5
89,0	2,6	4,5	4,5	2,5	2,0
101,6	2,9	4,5	4,5	2,5	2,0

N o t e s : 1. For pipes with thicknesses and diameters indicated in the Table, the nearest values specified in national or international standards may be accepted.
2. The tabulated values require no allowance for negative manufacturing tolerance and reduction in thickness due to bending.
3. The tabulated values do not cover the stainless steel pipes.
4. For the diameters greater than those stated in the Table, the minimum thicknesses shall be not less than specified in Table 2.3.8, Part VIII "Systems and Piping" of the RS Rules/C.
5. If pipes are effectively protected, then the wall thicknesses of pipes stated in columns 3 and 4 may be reduced by an amount of not more than 1 mm.
6. For sounding pipes, the thicknesses stated in column 3 apply to the parts which are outside the tanks for which these pipes are intended.
7. For threaded pipes, the wall thickness shown is the minimum thickness at the bottom of the thread.

The data given in Table 4.2.5.1 do not apply to exhaust gas pipes.

4.2.5.2 The wall thicknesses of pipes made of spheroidal graphite cast iron, aluminium alloys, titanium alloys and corrosion-resistant alloys shall meet the requirements of Section 2, Part VIII "Systems and Piping" of the RS Rules/C.

4.2.5.3 For the carbon dioxide smothering system, the wall thickness of pipes on a length from cylinders to release valves shall not be less than 4,0 mm and from release valves to discharge nozzles the thickness shall not be less than 3,0 mm.

4.2.6 Radii of pipe bends. Heat treatment after bending.

4.2.6.1 Radii of pipe bends and heat treatment after bending shall comply with the requirements of 2.2, Part VIII "Systems and Piping" of the RS Rules/C, in so much as applicable and sufficient unless expressly provided otherwise below.

4.2.7 Pipe joints.

4.2.7.1 Use of welded, flanged, threaded and mechanical joints, made in accordance with the standards approved by the Register may be allowed.

4.2.7.2 The welded, flanged, threaded and mechanical joints shall comply with the requirements of 2.4, Part VIII "Systems and Piping" of the RS Rules/C in so much as applicable and sufficient unless expressly provided otherwise below.

4.3 PLASTIC PIPING

4.3.1 Scope of application. General requirements.

4.3.1.1 The present requirements apply to all pipes made of plastics.

The requirements do not apply to flexible non-metal joints, rubber hoses, as well as to mechanical joints used in systems with metal pipes.

4.3.1.2 General requirements for plastic pipes and formed components are stated in 6.8, Part XIII "Materials" of the RS Rules/C.

4.3.2 Requirements for piping depending on their purpose.

4.3.2.1 Fire-resistance.

4.3.2.1.1 Pipes and formed components, integrity of which has significant influence on safety of a craft, shall meet the requirements of fire-resistance.

4.3.2.1.2 Depending on pipeline ability to maintain integrity during fire tests according to the procedure stated in Annexes 1 and 2 to IMO Resolution A.753(18), three levels of fire-resistance are specified:

L1: for pipelines withstanding fire test in dry condition during 1 h;

L2: for pipelines withstanding fire test in dry condition during 30 min;

L3: for pipelines withstanding fire test in filled condition during 30 min.

The scope of application of plastic pipelines depending on fire-resistance level, location and media conveyed is given in Table 4.3.2.1.2.

Table 4.3.2.1.2

Application of plastic pipelines.

Nos.	Medium to be conveyed	Piping systems	Location					
			A	G	H	I	J	K
1	Flammable liquids with flash point > 60 °C	Fuel oil	+	0	0	0	L1	L1
		Lubricating oil	+	-	-	0	L1	L1
		Hydraulic	+	0	0	0	L1	L1
2	Sea water	Drainage	L1	0	0	0	-	L1
		Drain pipes of internal spaces	L1[1]	0	0	0	0	0
		Sanitary drains (internal)	0	0	0	0	0	0
		Drainage from weather decks	0[2]	0	0	0	0[2]	0
		Fire main systems	L1	-	0	0	+	L1
		Ballast	L3	0	0	0	L2	L2
		Essential cooling systems	L3	-	0	0	-	L2
		Non-essential cooling systems	0	0	0	0	0	0
3	Fresh water	Essential cooling systems	L3	0	0	0	0	0
		Non-essential cooling systems	0	0	0	0	0	0
4	Other media	Air, sounding and overflow pipes: water tanks and dry compartments	0	0	0	0	0	0
		Flammable liquids. T_{flash}> 60 °C	+	0	0	0	+	+
		Pneumatic control systems	L1[3]	0	0	0	L1[3]	L1[3]
		Air pipes for domestic services	0	0	0	0	0	0
		Low pressure steam, water heating	L2	0	0	0	0	0

Symbols:
A — machinery spaces;
G — fuel oil tanks and trunks;
H — ballast tanks and trunks;
I — cofferdams, dry compartments, etc.;
J — accommodation, service spaces and control stations;
K — weather decks;
0 — fire test is not required;
"-" — not applicable;
"+" — only metal materials with fusion point above 925 °C.
[1] For drainage pipes serving only the particular space, "0" may be used instead of "L1".
[2] Scupper holes of weather decks shall be "+", if they are not provided with the appropriate blanking means.
[3] When control functions are not foreseen, "0" may be used instead of "L1"

4.3.2.2 Flame spreading, fire-retardant coatings.

4.3.2.2.1 All pipes, with the exception of pipes located on exposed decks, in cofferdams, etc., shall have the characteristic of slow flame-spread on the surface, not exceeding the average values fixed in IMO resolution A.653(16) and determined according to the procedure given in Annex 3 to the resolution, considering the changes arising from curved surface of pipes or specified by other standards approved by the Register.

4.3.2.2.2 When fire-retardant coatings are applied to provide the required level of fire-resistance, they shall comply with the requirements of Part XI "Materials".

Fire-retardant coatings shall be used according to the approved recommendations of the Manufacturer.

4.3.2.2.3 Fire-retardant coatings in junctions shall be applied after conducting of hydraulic tests of the system in compliance with the pipe Manufacturer's recommendations, according to the procedure approved by the Register in each case.

4.3.3 Installation requirements.

4.3.3.1 Installation work shall be performed in accordance with the Manufacturer's recommendations.

4.3.3.2 Distances between supports shall not exceed the values recommended by the Manufacturer.

In selecting supports and distances between them, pipe sizes, mechanical and physical properties of pipe material, mass of pipes and liquid contained therein, working temperature, influence of heat expansion, loads due to external forces, axial forces, hydraulic impacts, vibration, which may occur in the system, shall be taken into consideration. Allowance shall be made for possible simultaneous effect of the above mentioned loads.

The load from pipe weight shall be equally distributed over the entire load-bearing face of the support. Measures shall be taken to minimize pipe wear at junctions of the pipes with the supports.

4.3.3.3 Components of the system having significant mass shall be fitted with separate supports. In pipe laying, allowance shall be made for periodically involved concentrated loads.

When necessary, pipes shall be protected from mechanical damage.

4.3.3.4 Where plastic pipelines pass through watertight and fire-resistant decks and bulkheads, the requirements of 4.5.1.1, 4.5.1.4 and 4.5.1.5 shall be met.

4.3.3.5 When assembling plastic pipelines, account shall be taken of the compensation tolerance for relative displacement between piping and steel structures with regard to difference in heat expansion ratios and craft's hull deformation.

When calculating heat expansions, the working temperature of the system and the temperature at which assembling is carried out, shall be taken into consideration.

4.3.3.6 When laying pipes, allowance shall be made for periodically involved concentrated loads, if their action is possible. As a minimum, the force caused by one person of 100 kg in mass at the middle of span of any pipe with outer diameter over 100 mm shall be taken into consideration.

4.3.3.7 In systems for transferring liquids, such as diesel oil and petrol, pipes of electrically conductive material shall be used.

Regardless of the liquids transferred, the plastic pipes passing through dangerous zones shall be electrically conductive.

Resistance in any point of the piping system as relative to the earth shall not exceed 10^6 Ohm. Pipes and formed components having electrically conductive layers shall preferably be of equal conductivity.

Such pipes shall be sufficiently protected from damage by electric discharge caused by difference in electrical conductivity of layers.

After installation earth connection shall be checked. Earthing wires shall be accessible for examination.

4.3.3.8 Pipelines may be connected with the use of glued, welded, flanged or other joints.

Strength of joints shall not be less than strength of a pipeline where they are mounted.

4.3.3.9 The method of pipe connection (junction) shall be developed and approved prior to installation.

4.3.3.10 Surveys and tests stated in this Section shall precede the approval of the method.

4.3.3.11 To be reflected in the method of joint connection are: the applied materials, used tools and accessories, the requirements for preparation of joints, temperature conditions, the requirements for dimensions and tolerances, as well as the acceptance criteria upon completion of work and tests.

4.3.3.12 For the inspection of pipe joint quality, it is necessary, in accordance with the accepted procedure to prepare test assemblies which shall include at least one pipe joint with a pipe and a pipe with a formed component.

The test assembly shall comprise a pipe with the maximum diameter.

4.3.3.13 Following joint setting, a test connection shall be subjected to a hydraulic test by a pressure 2,5 times higher than the design pressure, during 1 h. Leakage and breaks of joint are not allowed.

4.3.3.14 After installation on board, essential piping system shall be hydraulically tested by a pressure at least 1,5 times higher than the design pressure.

Non-essential piping system, after installation on board, may be tested for tightness with the working pressure.

4.4 FITTINGS

4.4.1 Construction, marking, arrangement and installation of fittings.

4.4.1.1 Construction of valves shall comply with the requirements of 4.1.1, Part VIII "Systems and Piping" of the RS Rules/C.

4.4.1.2 Marking of fittings.

4.4.1.2.1 Shut-off fittings shall be provided with conspicuous nameplates fixed in place and bearing clear inscriptions to show the purpose of fittings.

4.4.1.2.2 Remote-controlled valves at control stations shall have attached identification plates showing their purpose, as well as position indicators "open" and "closed".

Where the remote control is used only to close the valve, the indicators need not be fitted.

4.4.1.3 Arrangement and installation of fittings.

4.4.1.3.1 Fittings arranged on watertight bulkheads shall be secured to welded pads by studs, or alternatively the fittings may be welded to bulkhead pieces.

The stud holes in welded pads shall not be through holes.

4.4.1.3.2 Measuring instruments of fuel oil and lubricating oil systems shall be provided with valves or cocks to cut the instruments off from piping.

Thermometer sensors shall be encased in compact sleeves.

4.4.1.3.3 Sight glasses in fuel oil and lubricating oil pipes shall be heat-resistant.

4.4.2 Filters.

4.4.2.1 Filters shall be provided with a device to indicate that there is no pressure therein before they are opened.

The tubes of such devices shall be carried to trays so that spillages are not sprayed around.

4.4.2.2 Filters forming part of systems with combustible working medium shall be located as far away as practicable from potential sources of ignition.

4.4.3 Sea chests and ice boxes. Bottom and side fittings. Openings in shell plating.

4.4.3.1 Sea chests and ice boxes.

4.4.3.1.1 On craft with special ice strengthening meeting the requirements of these Rules and with a mark "**Ice**" added to the class notation, which allows operation in cake ice, one of the sea chests shall function as an ice box.

4.4.3.1.2 Sea inlet valves shall be secured directly to sea chests.

4.4.3.1.3 The sea inlet valves may be attached to welded pads or fitted on distance pieces directly welded to the hull bottom shell plating.

The distance piece shall have welded flange joint. The wall thickness of a distance piece shall not be less than the thickness of the bottom plate, but in no case it shall be less than 6 mm.

4.4.3.1.4 All the openings in shell plating for sea chests, welded inlet connections and inlet distance pieces shall be fitted with gratings. Instead of gratings, holes or slots in the shell plating are allowed. The net area through the gratings or slots shall not be less than 2,5 times the area of the valve connected to the sea inlet.

The diameter of holes or the width of slots in gratings or shell plating shall be about 20 mm.

The sea chest gratings are recommended to be cleared by compressed air. The pressure of compressed air in the clearing system shall not exceed 0,3 MPa. Clearing pipes shall be provided with non-return shut-off valves.

4.4.3.1.5 Provision shall be made for the access into sea chests via detachable gratings or manholes of the side sea chests and ice boxes, if the manhole is located above the deepest load line.

4.4.3.1.6 In craft assigned mark "**Ice**" attached to the class notation, cooling water recirculation shall be used for ice boxes and bottom sea chests.

For ice boxes, the recirculated water pipes shall be laid to the upper and lower part of the box, and the total sectional area of these pipes shall not be less than the sectional area of the cooling water discharge pipe.

For sea chests, the diameter of the water recirculated pipe shall not be less than 0,85 of the discharge pipe diameter.

4.4.3.2 Openings in shell plating. Bottom and side fittings.

4.4.3.2.1 The location of sea inlet and discharge openings in shell plating shall be such as to prevent:

.1 sewage, domestic waste water and other wastes being sucked by sea water pumps;

.2 sewage, domestic and discharge water penetrating into the craft's spaces through side scuttles, as well as any discharge of water into lifeboats and liferafts when lowered.

Where it is impracticable to comply with the requirements of 4.4.3.2.1, discharge openings shall be fitted with appropriate arrangements to prevent water penetration into the craft's spaces, lifeboats and liferafts.

4.4.3.2.2 The overboard discharges from the enclosed spaces below the freeboard deck may be provided only with one locally controlled non-return shut-off valve.

4.4.3.2.3 The scuppers and overboard discharge pipes from open decks and spaces, led outboard at less than 600 mm above the deepest waterline, shall be fitted with non-return valves (dampers) at the outer shell.

No valves may be provided if the wall thickness of these pipes installed below the freeboard deck is not less than the thickness of the shell plating, but in no case it shall be less than 5 mm.

4.4.3.2.4 In machinery spaces, all the sea inlets and discharges of systems and piping in connection with operation of the main and auxiliary machinery shall be provided with readily accessible shut-off valves or sluice valves, locally controlled. The controls shall be fitted with an indicator to show whether the valve is open or closed.

4.4.3.2.5 The controls of bottom and inlet fittings shall be located in readily accessible places and shall be fitted with a device to indicate whether the valve is open or closed.

4.4.3.2.6 In machinery spaces, the controls of the bottom inlet and side outlet fittings of the sea water system that lie located below the waterline, and the control gear of the ejector drainage system shall be so arranged that there is enough time to access and activate them from a position above the level of water incoming to the space.

It is recommended that the controls of the bottom and side fittings of the sea water system, which lie below the waterline, be located above the freeboard deck.

4.4.3.2.7 Bottom and side fittings shall be attached to welded pads.

Fittings may be also installed on welded distance pieces with welded flange joints.

The wall thickness of a distance piece shall not be less than the minimum thickness of shell plating in the ends of the craft.

Stud holes in welded pads shall not penetrate the shell plating.

4.4.3.2.8 Flange gaskets of bottom and side fittings shall not be manufactured of materials easily deteriorating in case of fire.

4.4.3.2.9 Spindles and closing parts of bottom and side fittings shall be manufactured of corrosion-resistant materials.

4.5 PIPING LAYING

4.5.1 Piping laying through watertight and fire-resistant structures.

4.5.1.1 The number of pipelines passing through the watertight bulkheads shall be kept to a minimum.

The collision bulkhead shall not be pierced below the bulkhead deck by more than one pipeline for dealing with the contents of the forepeak.

Each pipe passing through the collision bulkhead shall be fitted with a screw-down valve installed directly on the collision bulkhead inside the forepeak, operable from a readily accessible position on the bulkhead deck.

The shut-off valve may be omitted on the pipelines passing through the collision bulkhead above the bulkhead deck or freeboard deck.

4.5.1.2 Where pipelines pass through watertight bulkheads, decks and other watertight structures, the appropriate sockets, welded pads and other details to ensure the integrity of the structure concerned shall be used.

The holes for studs shall not penetrate watertight structures and shall be kept within the welded pads.

Gaskets made of materials readily deteriorated in the event of fire, shall not be used.

4.5.1.3 Where pipelines pass through fire-resistant divisions, the requirements of Part X "Fire Protection" shall be met.

4.5.1.4 Where plastic pipes pass through watertight bulkheads and decks forming boundaries of watertight compartments, valves capable of being operated from a position above the bulkhead deck shall be fitted.

The valves shall be of steel or another material equivalent to steel in fire resistance.

4.5.1.5 Where plastic pipes pass through a division of the main vertical fire zone, provision shall be made for steel bulkhead sockets of appropriate length and valves that may be closed from either side of the bulkhead. The valves shall be of steel or another material equivalent to steel in fire resistance.

4.5.2 Piping laying in spaces and tanks.

4.5.2.1 Fresh water pipelines shall not be laid through fuel oil and lubricating oil tanks, nor shall fuel oil and lubricating oil pipes pass through fresh water tanks, unless the pipes are laid in oiltight ducts.

Sea water and lubricating oil piping, as well as air, sounding and overflow pipes may pass through fuel oil tanks if these pipes are of seamless type and have no detachable joints inside the tanks.

4.5.2.2 Pipes passing through chain lockers and other spaces, in which they are subject to mechanical damage, shall be adequately protected.

4.5.2.3 Pipes conveying fuel oil shall not be laid through the accommodation and service spaces as well as under the lining, with the exception of fuel filling pipes which are allowed to be laid through sanitary spaces, provided the pipes used have no detachable joints.

4.5.2.4 The pipes of all the systems and the ventilation ducts shall, where necessary, be fitted with arrangements for blow-down of the working medium or draining of liquid.

4.5.2.5 Pressure pipes are not allowed to be laid above and behind the main switchboards as well as the control panels of essential machinery and equipment.

Such pipes may be carried at a distance not less than 500 mm from the fronts and sides of these switchboards and control panels, provided that at a distance within 1000 mm from switchboards and control panels no detachable joints are used, or the flanged joints have protective casings.

4.5.2.6 On twin-hulled craft, the pipes connecting identical systems of both hulls, when routed along the common upper deck, shall be provided with compensators, where necessary, and protected against damage.

Damage to these pipes shall not involve failure of the systems connected by them.

4.6 BILGE-PUMPING SYSTEM. BALLAST SYSTEM

4.6.1 Pumps.

4.6.1.1 Each self-propelled craft with main engines having total power output of 220 kW and above, installed in a separate hull compartment, shall be provided with at least two power driven bilge pumps one of which shall be a stationary pump connected to the bilge-pumping system.

Sanitary or general service pumps of sufficient capacity may be used as bilge pumps. One of the bilge pumps may be a main engine driven pump or a water ejector.

If fire pumps are used as bilge pumps, the requirement of 5.5.2, Part X "Fire Protection" shall be met.

4.6.1.2 Each self-propelled craft with main engines having total power output of less than 220 kW, installed in a separate hull compartment, shall be provided with at least two bilge-pumping arrangements; one of these arrangements may be stationary power driven pump or an ejector, while the other arrangement may be a manual pump with a capacity of each pump not less than that specified in Table 4.6.1.2. The use of a portable power pump instead of the stationary one is allowed.

On craft having no water fire fighting system, one manual bilge pump may be installed. In this case, compartments may be drained using flexible hose.

Table 4.6.1.2

Hull length, L_H in m	Total bilge pump capacity, in m³/h	Piping diameters, in mm	
		Main bilge lines	Bilge suctions
$L_H < 7$	3	25	
$7 \leq L_H < 12$	5	32	
$7 \leq L_H < 15$	5	32	
$15 \leq L_H < 24$	6	40	32

4.6.1.3 On self-propelled craft with engines installed in exposed locations (in cockpit or on transom), pump capacities and internal diameters of the bilge pipes shall not be less than those specified in Table 4.6.1.2.

Also, depending on the craft size, the following requirements shall be met:

.1 if the hull length is less than or equal to 7 m, at least one manual bilge pump which may be a portable pump shall be installed. On agreement with the Register, a non-sinking bailer may be used;

.2 if the hull length is of 7 to 12 m, use shall be made of at least one stationary manual pump operable from the cockpit, with all access ladders and hatches closed;

It is advisable to have on board a secondary pump, permanently installed or portable, of the same capacity;

.3 if the hull length is greater than or equal to 12 m, the craft shall be provided with two pumps one of which shall be a power driven pump.

In this case, one pump shall be operable from the cockpit, with all access ladders and hatches closed.

4.6.1.4 Non-self-propelled craft and berth-connected craft provided with power sources or supplied with power from shore shall be equipped with drainage arrangements as self-propelled craft with main engines of power output less than 220 kW, installed in a separate hull compartment or with engines installed in exposed location (in cockpit or on transom).

4.6.1.5 For non-self-propelled manned craft having no power-driven machinery, it is sufficient to install one or several manual pumps with a total capacity not less than that specified in Table 4.6.1.5.

Table 4.6.1.5

$0{,}8\ L \cdot B \cdot D^1$, in m³	Total pump capacity, in m³/h
Up to 50	4
More than 50	6
[1] Definitions of L, B, D (length, breadth and depth), in m, are given in Section 1, Part II "Hull". D is measured in each particular case up to the freeboard deck level.	

4.6.1.6 On multi-hulled craft (catamarans, trimarans), each hull shall be provided with an independent bilge-pumping system complying with the relevant requirements of this Chapter.

4.6.1.7 Centrifugal bilge pumps shall be of self-priming type, or alternatively the system shall be provided with a vacuum arrangement.

4.6.1.8 Each bilge pump required in 4.6.1.1 shall have a capacity Q, in m³/h, not less than that determined from the formula

$$Q = 5{,}65 \cdot 10^{-3} \cdot {d_1}^2 \qquad (4.6.1.8)$$

where d_1 = inner diameter of the main line, in mm, determined by Formula (4.6.2.1).

One of the bilge pumps may be replaced by two pumps with a total capacity not less than determined by Formula (4.6.1.8).

4.6.1.9 Cockpits may be drained by gravity in accordance with the requirements of Section 10, Part III "Arrangements, Equipment and Outfit".

4.6.2 Piping diameters.

4.6.2.1 The internal diameter d1, in mm, of the main bilge line and that of bilge suctions directly connected to the pump, except specified in 4.6.2.2, shall be determined by the following formula:

$$d_1 = 1{,}5\sqrt{L\,(B + D)} + 25 \qquad (4.6.2.1)$$

where L, B, D, refer to 4.5.1.4.

However, when connected directly to the pump, it is not required that it be larger than the diameter of the corresponding pump connection.

4.6.2.2 The internal diameter d_0, in mm, of the branch bilge suctions connected to the main bilge line and that of the manual pump suction shall be determined by the formula

$$d_0 = 2{,}0\sqrt{l\,(B + D)} + 25 \qquad (4.6.2.2)$$

where l = length of the compartment to be drained, as measured at its bottom, in m;
B, D = refer to 4.6.1.4. In case of multi-hulled craft, B is assumed to be the breadth of one hull.

4.6.2.3 The internal diameter of the main bilge line and bilge suctions determined from Formulae 4.6.2.1 and 4.6.2.2 shall not be less than 40 mm. On craft of less than 10 m in length, this value of the internal diameter may be reduced to 20 mm. The internal diameter of the main bilge line and bilge suctions directly connected to the pump shall not, in any case, be less than the bilge pump suction diameter.

4.6.2.4 The cross-sectional area of the pipe connecting the distribution chest with the bilge main shall not be less than the total cross-sectional area of two largest branch bilge suctions connected to the chest, but it need not be greater than the sectional area of the bilge main.

4.6.2.5 The diameter of the emergency bilge suction in the engine room shall not be less than that of the pump suction.

4.6.3 Piping laying.

4.6.3.1 The bilge lines and their branch suctions shall be so arranged as to enable any watertight compartment to be drained by any one of the pumps required in 4.6.1.1, 4.6.1.2, 4.6.1.4 and 4.6.1.8.

4.6.3.2 The system shall be arranged so as to prevent the possibility of sea water penetrating inside the craft, or water from one watertight compartment into another, in the event of pipe breaking or any other pipe damage in any other compartment because of collision or grounding. For this purpose, the suction valves of the drainage pipes open ends, connected directly to the chests, shall be of non-return type. In case where only one common piping system for all pumps is available, provision shall be made for control of the required valves serving the suctions from positions above the main deck. Other equivalent arrangements are also allowed.

4.6.3.3 The arrangement of the bilge pipes shall be such as to make it possible to drain the engine rooms through the suctions directly connected to the pump, the other compartments being simultaneously drained by other pumps.

4.6.3.4 The arrangement of the bilge pipes shall be such as to enable one of the pumps running in case when the rest of pumps are inoperative or are used for other purposes.

4.6.3.5 In general, the bilge pipes shall be laid outside the double bottom space. Where the pipe is laid within the double bottom space, the bilge suctions in each watertight compartment shall be fitted with non-return valves.

4.6.3.6 The arrangement and number of the bilge suctions shall be determined in each case depending on the shape and size of the compartment.

The bilge suctions in each compartment shall be arranged in such a manner as to ensure most complete drainage of the compartment with the craft been heeled 5° either way.

4.6.3.7 Lengthwise, bilge suctions shall be arranged in the following manner:

on craft operating in upright position — near the aft bulkheads of forward compartments and near the forward bulkheads of aft compartment;

on craft constantly operating with a trim by stern — near the aft bulkheads of compartments.

4.6.3.8 Peaks and steering engine rooms may be drained by their own manual pumps or water ejectors as well as through drain pipes laid into the engine room or the adjacent compartment.

Drain pipes shall have readily accessible self-closing valves or gate valves fitted on the bulkheads on the adjacent compartment side, provided that the gate valves are controlled from the deck, and shall be not less than 39 mm in diameter.

4.6.3.9 Drainage of chain lockers may be carried out by means of manual pumps, water ejectors or by removing water through drain openings into the forepeak.

4.6.4 Drainage of enclosed machinery spaces.

4.6.4.1 The arrangement and number of bilge suctions in the engine and boiler rooms shall comply with 4.6.3.1 — 4.6.3.7. One of the bilge suctions shall be connected directly to an independent bilge pump.

4.6.4.2 Suctions for bilge drainage of machinery spaces shall be fitted with mud boxes or strum boxes, provided they are accessible for cleaning. Pipes between mud boxes and bilges shall be as straight as practicable. The lower ends of these pipes need not be fitted with strum boxes.

4.6.4.3 In all self-propelled craft of design categories **A, A1, A2** or **B** with main engines having total power output of 220 kW and over, provision shall be made for an emergency bilge drainage of machinery spaces, in addition to bilge suctions required by 4.6.3.1. For this purpose, the largest available sea water power pump shall be fitted with direct suction pipe at the drainage level and also fitted with a non-return stop valve. The diameter of this direct suction shall be equal to that of the pump suction branch.

The capacity of this pump shall exceed that required in 4.6.1.8 by an amount satisfactory to the Register.

The spindles of the non-return stop valves fitted to the suction branches shall extend above the engine room floor plates to a sufficient height and shall bear a notice "For emergency use only".

Use of fire pumps for emergency drainage of machinery spaces shall be in compliance with 5.5.2, Part X "Fire Protection" of these Rules.

For sailing-motor and motor-sailing craft, this requirement is of recommendatory character.

No strum boxes and strainers shall be fitted on the suction for emergency drainage.

4.6.4.5 In craft having an electric propulsion plant, the arrangement shall be such that the bilge wells under the propulsion motors are properly drained and automatic alarms are fitted to give warning at excess of permissible level in the wells.

4.6.5 Ballast system.

4.6.5.1 The ballast system shall be served by at least one pump. The capacity of the ballast pump shall be such as to ensure the speed of water not less than 2 m/s, with the suction pipe diameter taken from Formula (4.6.5.4) for the largest ballast tank.

Each hull of twin-hulled craft shall be provided with an independent ballast system, as appropriate.

4.6.5.2 General service pumps of sufficient capacity, as well as bilge, fire or standby cooling pumps may be used as ballast pumps.

The pumps used for pumping out ballast water from the double-bottom tanks shall be of self-priming type.

Fire pumps may be permitted subject to compliance with 5.5.2, Part X "Fire Protection" of these Rules.

4.6.5.3 Ballast tanks shall not, generally, be intended for the carriage of fuel oil.

Possible relaxations from this requirement shall be specially considered by the Register in each particular case.

The standby pump shall not be used for ballasting, nor shall the ballast pump be used as a standby cooling pump or fire pump.

4.6.5.4 The internal diameter, d_B, in mm, of ballast pipe suctions for separate tanks shall be determined by the following formula:

$$d_B = 16\sqrt[3]{v} \qquad (4.6.5.4)$$

where v = ballast tank capacity, in m³.

The diameter may be adopted by the nearest standard size.

The diameter of the ballast main line shall not be less than the maximum diameter of the suction determined by Formula (4.6.5.4).

4.6.5.5 The arrangement of the suctions shall be such as to ensure pumping of water from any ballast tank, whether the craft is upright or heeled to 5°.

4.7 AIR, OVERFLOW AND SOUNDING PIPES

4.7.1 Air and overflow pipes, overflow tanks.

4.7.1.1 Each tank intended for the storage of liquid and each cofferdam to be filled, as well as the sea chests and ice boxes shall have air pipes meeting the requirements of this Chapter.

Air pipes of ice boxes and sea chests shall have shut-off valves fitted directly on them.

Air pipes of double bottom tanks and tanks adjoining the shell plating, as well as air pipes of sea chests and ice boxes, shall be carried to above the bulkhead deck (main deck).

4.7.1.2 The air pipes of tanks shall be fitted at the highest parts of the tanks and, as a rule, at a place that is at maximum distance from the filling pipe. The number and arrangement of the pipes shall be selected depending on the shape and size of the tank, and shall also preclude the formation of air pockets.

If air pipes of fuel oil tanks are used as overflow (air/overflow) pipes, the requirements of 4.7.1.8 shall be complied with.

The air pipes of tanks carrying liquids of different kinds are not permitted to be laid into a common line.

4.7.1.3 The height of the air pipes measured from the deck to the level to which liquid may have access from below shall not be less than:

in craft of design categories **A** and **A1**: 760 mm — for pipes on the freeboard deck, and 450 mm — for pipes on the decks arranged above;

in craft of design categories **A2** and **B**: 600 mm — for pipes on the freeboard decks, and 380 mm — for pipes on the decks arranged above;

in craft of design categories **C** and **C1**: 450 mm — for pipes on the freeboard deck, and 300 mm — for pipes on the decks arranged above;

in craft of design categories **C2**, **C3** and **D**: 250 mm.

The air pipes shall be located in places where there is no possibility of their damage.

4.7.1.4 The upper end of each air pipe shall be made as a bend, with its opening faced downwards, or shall have another construction agreed upon with the Register.

Outlets of air pipes situated on the open deck are recommended to have permanently attached automatically operating covers preventing the sea water from penetrating into the tanks, but allowing a free access to air and liquid.

The air pipes of independent lubricating oil tanks not fitted with heating arrangements, may terminate in spaces where the tanks are installed, if precautions are taken that will preclude spillage of oil onto electrical equipment or heated surfaces in case the tank is overflowing.

4.7.1.5 The total cross-sectional area of air pipes in tank filled by gravity shall not be less than the total cross-sectional area of the filling pipe of that tank.

The total cross-sectional area of air pipes in tank filled by the craft's pumps or shore pumps shall not be less than 1,25 times the cross-sectional area of the filling pipe of that tank.

The cross-sectional area of a common air pipe from several tanks shall be at least 1,25 times the cross-sectional area of the common filling pipeline of these tanks.

4.7.1.6 The air pipes of fuel oil and lubricating oil tanks in way of accommodation spaces shall not have detachable connections.

4.7.1.7 Nameplates shall be attached to the upper ends of all air pipes.

4.7.1.8 Fuel oil tanks filled by pumps shall be provided with overflow pipes directing fuel oil to an overflow tank or storage tank the capacity of which shall not be less than that of the overflow tank as stipulated in 4.7.1.15.

The cross-sectional area of an air pipe of a tank fitted with overflow pipe shall not be less than 1/3 of the cross-sectional area of the filling pipe.

Where the air pipes from several tanks fitted with over-flow pipes are combined into a common pipe, the sectional area of the common air pipe shall not be less than 1/3 of the sectional area of the common filling pipe of these tanks.

Where air pipes are simultaneously used as overflow pipes, they shall not be connected to the air pipes of over-flow tanks.

4.7.1.9 The inner overflow pipe diameter shall be at least 40 mm under all conditions.

The arrangement of air pipes shall preclude the formation of hydraulic seals in the pipes.

4.7.1.10 Where the overflow pipes from several integrated tanks located in different watertight compartments are laid to a common header or pipe, this header or pipe shall be located above the deepest waterline.

4.7.1.11 The overflow pipes of fuel oil and lubricating oil daily and settling tanks shall be laid to tanks located below the tanks mentioned above.

4.7.1.12 Overflow pipes shall be extended to the bottom of the overflow tanks with a minimum clearance. The flow area of the clearance shall not be less than the sectional area of the overflow pipe.

4.7.1.13 Minimum overflow pipe bore shall be 50 mm.

4.7.1.14 A sight glass shall be fitted on vertical sections of the overflow pipes, or an alarm device shall be provided to give warning when the predetermined level is reached in the overflow tank.

Sight glasses on the fuel oil and lubricating oil pipes shall be heat-resistant.

4.7.1.15 The capacity of an overflow tank shall be not less than the maximum permissible throughput of the fueling system within 10 min.

The overflow tank shall be provided with visual and audible alarms actuated whenever the tank filling reaches 75 per cent.

4.7.1.16 The air pipes from crankcases of internal combustion engines shall comply with the requirements of 3.2.2.

4.7.2 Sounding arrangements.

4.7.2.1 Each tank intended for the storage of liquid, cofferdams and void spaces with bilge connections, as well as bilges and bilge wells in spaces which are not readily accessible at all times, shall be provided with sounding pipes for level measurement, generally extended to the exposed decks. Other sounding arrangements of design approved by the Register may be used in tanks.

Sounding pipes shall be as straight as practicable and shall not interfere with taking soundings with a sounding rod.

Sounding pipes of independent tanks are not required to be carried to the exposed deck.

Upper ends of the sounding pipes of fuel oil and lubricating oil tanks shall not be laid to the spaces which may present a risk of ignition of leakages from sounding pipes. The sounding pipes of the fuel tanks must not be laid to accommodation and service spaces.

Other oil-level gauges may be permitted provided they are protected by casings of steel or another fire-resistant material.

Level indicators in the fuel oil and lubricating oil tanks shall comply with the requirements of 4.10.2.3.8.

4.7.2.2 The sounding pipes of fuel oil and lubricating oil tanks are allowed to be laid to positions above the machinery space floor plates, provided that such pipes are fitted with self-closing valves and their height is at least 0,5 m above the floor level. Self-closing test cocks shall be fitted below the above-mentioned self-closing valves. The said pipes shall not be used as air pipes.

4.7.2.3 Provision shall be made under the open ends of sounding pipes for welded-on striking plates or other strengthening to protect the bottom plating from damage by sounding rod.

In case of slotted sounding pipes with closed ends, adequately strong closing plugs shall be provided.

4.7.2.4 The internal diameter of sounding pipes shall not be less than 25 mm.

Nameplates shall be attached to the upper ends of sounding pipes.

4.7.2.5 The ends of sounding pipes carried to the exposed deck shall be fitted with tight plugs.

Self-closing fittings of sounding pipes of the double bottom fuel oil tanks shall be corrosion-resistant and shall not initiate sparks.

If the sounding pipes project above the open deck, they shall be located at such positions where they cannot be damaged, otherwise they shall have appropriate guards.

4.8 EXHAUST GAS SYSTEM

4.8.1 Exhaust gas piping.

4.8.1.1 The exhaust gas pipes shall, as a rule, be laid to the open deck.

4.8.1.2 Where the exhaust gas pipes are laid through the side plating or transom in the vicinity of the waterline or below it, provision shall be made for arrangements precluding the possibility of sea water entering the engine.

Inside the machinery space a loop shall be arranged with its upper part located above the deepest waterline.

4.8.1.3 The exhaust gas pipes shall be laid at a distance not less than 450 mm from the fuel oil tanks.

4.8.1.4 Each main engine shall have an individual exhaust gas pipe.

The exhaust gas pipes of auxiliary engines may be connected to a common exhaust gas pipeline provided that the common exhaust gas pipeline is fitted with reliable devices precluding gases of the common line entering the pipes of the engines not actually in work as well as damage of any of the engines when started.

In craft intended for operation in offshore areas of navigation, the exhaust gas pipes of the main and auxiliary engines may be permitted to be connected to a common exhaust line provided that the foregoing precautions are taken.

4.8.1.5 The gas exhaust pipes of the internal combustion engines shall be generally made of steel.

The exhaust gas pipelines of the engines with "wet" exhaust or when the exhaust gases are cooled by the engine cooling water, may be completely or partly manufactured of plastic pipes or flexible hose.

4.8.1.6 The exhaust gas pipes of the internal combustion engines shall be thermally insulated by means of suitable insulating material or double walls. The temperature of the insulation surface shall not exceed 60 °C.

The material used for thermal insulation shall be non-combustible. In machinery space, the surface of the insulating material shall be oil- and oily vapor-impermeable.

The exhaust gas pipes with "wet" exhaust or double walls cooled by water may not be insulated if the temperature of the pipe surface does not exceed 60 °C.

4.8.1.7 The exhaust gas pipes of engines shall be fitted with thermal compensators.

4.8.1.8 Exhaust gas pipes passing through accommodation spaces or the wheelhouse shall be enclosed by a protective casing inside these spaces. The interspace between the exhaust gas pipes and protective casing shall communicate with the open atmosphere.

4.8.2 Silencers, spark arresters and heat exchangers.

4.8.2.1 The exhaust gas pipes shall be generally fitted with silencers and, whenever necessary, with spark arresters.

4.8.2.2 The silencers and spark arresters shall be so arranged as to permit cleaning or draining of tar and condensate from the nearest pipeline portion, and shall be provided with appropriate handholes or drain cocks and plugs.

4.8.2.3 Where waste heat-exchanging apparatus are installed, arrangements shall be provided to prevent possible ingress of water into the engine due to leakages in the heat exchangers or damage thereof.

4.9 VENTILATION SYSTEM

4.9.1 Ventilation ducts and ventilation heads. Air inlets.

4.9.1.1 Ventilation ducts shall not be laid through watertight bulkheads below the bulkhead deck (main deck).

4.9.1.2 Where trunkways and vertical ducts of ventilation system pass through watertight decks, they shall be watertight and equivalent in strength to adjacent hull structures within a single watertight compartment below the bulkhead deck.

4.9.1.3 Where ventilation ducts pass through the main fire-retarding bulkheads, they shall be fitted with steel fire dampers installed generally on the bulkheads. The fire dampers shall be capable of being locally closed from both sides of the bulkhead.

Places where dampers and their driving gear are installed shall be readily accessible and painted red. Indicators shall be provided to show whether the damper is open or closed. Where the damper is not installed on the bulkhead, the duct between the bulkhead and the damper shall have insulation corresponding to the degree of fire integrity of the bulkhead.

4.9.1.4 Ventilation ducts leading to machinery and other spaces fitted with fire smothering facilities shall have closing arrangements to preclude movement of gas. The inlets and outlets of the ventilation systems of these spaces shall be provided with tight covers or closing arrangements and, where they are arranged in the said spaces, also with actuators for closing them from positions outside the spaces fitted with fire smothering facilities.

4.9.1.5 In places of possible sweating, the ventilation ducts shall be properly insulated. Drain plugs shall be provided for portions of ducts where water is likely to accumulate.

4.9.1.6 Ventilation heads of supply ducts and air inlets of ventilation system shall be so located that the risk of drawing in air contaminated by gas, oil vapors, etc. is minimized and admission of sea water into the ventilation ducts is precluded.

On ice-strengthened craft, the ventilation ducts shall be protected against penetration of snow.

It is recommended to arrange air intakes on both sides of the craft and to provide them with heating arrangements.

4.9.1.7 Provision shall be made for closing all the main air inlets and outlets of ventilation systems of spaces in accordance with 4.9.1.9.

4.9.1.8 Ventilators to spaces below the freeboard deck shall be fitted with strong coamings.

Construction of the coamings shall meet the requirements of Part II "Hull".

Thickness of the metal coaming shall not be less than the thickness of the deck in way of the coaming.

4.9.1.9 The requirements for the closing arrangements of the air inlets and outlets and for the height of their coamings shall be consistent with 9.2.2 and 9.2.4, Part III "Arrangements, Equipment and Outfit" of these Rules.

4.9.1.10 Galley ventilation systems shall be separated from ventilation systems serving other spaces.

Exhaust ducts from galley ranges shall be made of steel where they pass through accommodation spaces or spaces containing combustible materials. Each exhaust duct shall be fitted with a readily removable grease trap and with a fire damper located in the lower end of the duct.

4.9.2 Ventilation of machinery spaces.

4.9.2.1 Ventilation of machinery spaces shall be such that under all service conditions including heavy weather a supply of air is maintained which is sufficient for operation of machinery at full load as well as for the safety and comfort of the attending personnel.

The ventilation shall ensure removal of gases heavier than air from the lower zones of those spaces, from below floor plates, from where fuel system equipment and daily tanks are installed.

Provision shall be made for disabling of the artificial ventilation from a readily accessible position outside the machinery space.

4.9.2.2 Enclosed machinery spaces in which carburetor (petrol) engines are installed, shall, in addition to the natural supply ventilation, be fitted with a forced exhaust ventilation ensuring at least 10 air changes per hour, proceeding from the volume of empty spaces.

The forced exhaust ventilation shall be served by a fan of intrinsically safe design. The electric motor shall be of safe type or located outside the exhausted air flow.

The natural ventilation ducts shall have the cross-sectional area:

$$F = 40\,V,\ \text{in cm}^2,\ \text{but not less than 45 cm}^2 \qquad (4.9.2.2)$$

where V = volume of empty space, in m³.

4.9.2.3 Enclosed spaces where carburetor (petrol) engines and petrol tanks or canisters with fuel are installed, shall be provided with a natural supply-exhaust ventilation with separate supply and exhaust ducts.

The ducts shall have cross-sectional area not less than that determined from Formula (4.9.2.2).

4.9.2.4 Spaces for portable canisters with petrol shall be provided with a natural supply-exhaust ventilation ensuring removal of air from the upper zone of the ventilated space.

The inlet air shall be supplied into the lower part of the ventilated space.

The cross-sectional area of the ventilation ducts shall be at least 20 cm².

The discharges of the exhaust ducts shall be carried to places where issuing gases do not present a fire hazard.

4.9.3 Ventilation of accumulator battery rooms and boxes.

4.9.3.1 The accumulator battery rooms and boxes shall be provided with an independent ventilation system capable of removing air from the upper part of the ventilated spaces.

The exhaust ducts shall be gastight.

4.9.3.2 The inlet air shall be supplied into the lower part of the ventilated space.

4.9.3.3 The outlets of ventilation ducts shall be so constructed as to preclude penetration of sea water, atmospheric precipitation and solids.

No flame arresting fittings shall be installed.

The discharges of the exhaust ducts shall be carried to places where issuing gases do not present a fire hazard.

4.9.3.4 The boxes of accumulator batteries having a charging capacity not over 0,2 kW may be ventilated through the openings in the lower and upper parts of the box to ensure removal of gases.

4.9.3.5 The rate of air flow, Q, in m³/s, for the ventilation of an accumulator battery room or box shall not be less than that determined by the formula

$$Q = 3{,}06\,I \cdot n \cdot 10^{-5} \qquad (4.9.3.5)$$

where I = maximum charging current during gas emission, but not less than 0,25 of the maximum current of the charging device, in A;

n = number of battery cells.

4.9.3.6 The cross-sectional area, F, in m², of the duct, in case of natural ventilation of accumulator battery rooms and boxes, shall not be less than that determined by the formula

$$F = 1{,}04\,Q,\ \text{but not less than 0,004 m}^2 \qquad (4.9.3.6)$$

where Q = rate of air flow determined by Formula (4.9.3.5).

4.9.3.7 Natural ventilation of the spaces may be used in the following cases:

.1 required amount of air calculated by Formula (4.9.3.5), is less than $2{,}36 \cdot 10^{-2}$ m²/s;

.2 angle of the duct deflection from the vertical is 45°;

.3 number of bends of the duct does not exceed two;

.4 length of the duct does not exceed 5 m;

.5 operation of the ventilation system does not depend on the direction of the wind;

.6 cross-sectional area of the duct is taken not less than that determined by Formula (4.9.3.6).

Where the rate of air flow determined by Formula (4.9.3.5) is $2{,}36 \times 10^{-2}$ m³/s and over, the accumulator battery room shall be provided with forced exhaust ventilation.

The internal surfaces of exhaust ducts and fans shall be protected against the action of the electrolyte.

The motors of fans shall not be located in way of gas exhaust.

The construction of fans shall comply with the requirements of Section 3.

4.10 FUEL OIL SYSTEM

4.10.1 Pumps. Piping laying.

4.10.1.1 A power driven fuel oil transfer pump and a standby pump which may be a manual pump shall be provided for fuel oil transfer.

Any suitable pump, including the fuel oil separator pump may be used as a standby pump.

On craft intended for operation in offshore areas of navigation, one pump may be installed.

On craft with daily consumption of fuel oil less than 1000 kg, a manual pump is allowed.

4.10.1.2 Where fuel oil tanks are regularly used also for water ballast, provision shall be made for reliable arrangements disconnecting the ballast system from these tanks when carrying fuel oil and also the fuel oil system when containing water ballast.

4.10.1.3 The fuel oil transfer pumps and separator pumps, besides local control, shall be provided with stopping means operable from always accessible positions outside the spaces where the pumps are installed.

Shut-off valves shall be fitted on the pressure side and suction side of fuel oil pumps.

4.10.1.4 Laying of diesel oil piping.

4.10.1.4.1 The diesel oil pipes, their fittings and joints shall comply with the requirements of 4.2.1, 4.2.2, 4.2.3 and 4.2.5.

The fuel oil pipes shall be properly secured and protected against mechanical damage.

4.10.1.4.2 The fuel oil pipelines shall have no communication with other piping systems, shall not be laid above the internal combustion engines, exhaust gas pipes, electrical switchboards and control panels.

In exceptional cases, it is allowed to lay fuel oil pipes above the said equipment, provided that in these positions the pipes have no detachable joints.

4.10.1.4.3 Such pipes may be carried at a distance not less than 500 mm from the fronts and sides of the switchboards and control panels, provided that at a distance of 1000 mm from switchboards and control panels no detachable joints are used or the joints have protective casings, and trays are installed in appropriate positions to prevent the spillage of fuel oil on the equipment or sources of ignition.

4.10.1.4.4 The fuel oil suction pipes from tanks of more than 50 l in capacity, as well as the pipes intended to equalize the level of fuel in tanks, where such tanks are located outside the double bottom, shall be provided with shut-off valves fitted directly on the tanks. These valves shall be capable of being closed from always accessible positions located outside the space containing the tanks.

4.10.1.4.5 For draining water from daily service and settling tanks, these tanks shall be fitted with self-closing valves and pipes connected to drain tanks.

The drain pipes shall be fitted with heat-resistant sight glasses. Where trays are available, open funnels may be used instead of sight glasses.

4.10.1.4.6 Tanks, pumps, filters and other equipment shall be fitted with drip trays where there is a possibility of fuel oil leakage.

Drain pipes from the drip trays shall be laid into the fuel oil drain tanks.

The internal diameter of the drain pipes shall be at least 25 mm.

Drainage of fuel oil into the bilges is not permitted.

On craft intended for operation in offshore areas of navigation, drip trays may be fitted with plugs or local drain pipes with shut-off devices enabling the fuel oil leaks to be collected in portable tanks.

4.10.1.4.7 The drain tanks shall be fitted with an alarm sensor to give warning when the tank is filled to 80 per cent of its volume.

If the drain pipes from drip trays or tanks fitted in different watertight compartments are laid into common drain rank, structural precautions shall be made to prevent water from one flooded compartment to enter the other compartment via the open ends of drains.

4.10.1.5 Petrol piping.

4.10.1.5.1 Compliance with the requirements of 4.10.1.4.1 and 4.10.1.4.2 is mandatory.

4.10.1.5.2 The fuel oil pipeline shall de accessible for inspection over its entire length. Number of detachable joints shall be kept to a minimum. Pipe joints shall have no gaskets.

4.10.1.5.3 For draining water from daily service and settling tanks, these tanks shall be fitted with self-closing valves and pipes connected to drain tanks.

Drain pipes shall be fitted with heat-resistant sight glasses.

Where drain tanks are unavailable, water from the daily service tanks shall be drained into a portable tank fitted with flame-arresting screen.

In this case, the self-closing valve shall be fitted with a dome nut on the draining end.

4.10.2 Arrangement of fuel oil tanks.

4.10.2.1 Arrangement of fuel oil tanks intended for fuel oil with a flash point not lower than 55 °C (diesel oil).

4.10.2.1.1 In general, the fuel oil tanks shall be integral with the hull and, as far as practicable, located outside the machinery spaces.

Where the fuel oil tanks, other than the double bottom tanks, are arranged adjacent to, or within, the machinery space, their surfaces in the machinery space shall be as small as possible and shall preferably have a common boundary with the double bottom tanks.

Fuel oil tanks located in a machinery area (refer to 1.2.1, Part X "Fire Protection") shall be made of steel or other equivalent material.

Where the fuel oil tanks are arranged within the machinery space, they shall not contain fuel with a flash point below 55 °C.

4.10.2.1.2 The fuel oil tanks shall have no common walls with the fresh water storage tanks.

4.10.2.1.3 Air space between the fuel oil tank and accommodation shall have sufficient ventilation.

Fuel oil tanks shall not be located in front of a collision bulkhead.

4.10.2.1.4 The fuel oil tanks and independent fuel oil tanks shall be provided with on-tight drip trays in the areas of possible fuel leakage.

4.10.2.2 Fuel oil with a flash point below 43 °C.

4.10.2.2.1 Fuel oil with a flash point below 43 °C shall be stored in independent tanks located in a specially dedicated compartment isolated from the machinery space and accommodation compartments by a gas-tight bulkhead and provided with an independent natural ventilation which ensures removal of fuel vapors from any point of the compartment. It is permitted to arrange the fuel oil tanks on open deck in well-ventilated areas.

4.10.2.2.2 Each tank and compartments in which the tank is located shall be fitted with an air pipe laid to the exposed place on the deck.

Air pipes of the compartment and tanks shall be separated.

Outlets of the air pipes shall be fitted with permanently attached heads with a float seal and double flame-arresting screens.

4.10.2.2.3 The fuel oil tanks located in exposed machinery spaces (compartments), in superstructures as well as in other exposed places shall be protected against the action of sunrays.

4.10.2.2.4 The fuel oil tanks shall be earthed by connection to engine seating or earth plate.

4.10.2.2.5 Enclosed compartment in which independent petrol storage tanks are installed shall be provided with carbon dioxide or aerosol fire extinguishing system.

4.10.2.2.6 Fuel oil tanks delivered complete with outboard engines shall be appropriately secured to avoid displacement thereof and damage to fuel oil pipe or flexible fuel oil hose.

4.10.2.3 Fuel oil tanks.

4.10.2.3.1 Fuel oil tanks shall be made of carbon steel, corrosion resistant steel or aluminium alloys. Copper-base alloy fittings shall not be installed on aluminium fuel oil tanks.

4.10.2.3.2 The wall thickness of the independent fuel oil tanks shall not be less than given in Table 4.10.2.3.2.

Materials used for manufacture of the fuel oil tanks shall comply with the requirements of Part XI "Materials".

Table 4.10.2.3.2

Tank capacity, in dm³	Minimum wall thickness in mm		
	Carbon steel	Corrosion-resistant steel	Aluminium alloy
<100	2[1]	1	2
100 — 200	3	1,5	3
200 — 500	4	2	4
500 — 1000	5	3	5
[1] For externally galvanizes tanks 1,5 mm may be allowed.			

4.10.2.3.3 Components of the independent fuel oil tank fastenings made of aluminium alloys shall be manufactured of aluminium alloys or corrosion resistant steel.

4.10.2.3.4 The inner surfaces of the fuel oil tanks shall not be painted or galvanized. The outer surface of the fuel oil tanks shall be efficiently protected against corrosion.

The fuel oil tanks shall be designed and installed so that no exterior surface will trap water.

4.10.2.3.5 The fuel oil tanks shall be so designed as to withstand s test pressure not less than 0,02 MPa. Whenever necessary, tanks shall be reinforced or have internal bulkheads.

4.10.2.3.6 Wherever possible, all fittings and openings shall be on top of petrol tanks.

Nevertheless, where fittings are installed on the sides, welded pads shall be used for direct mounting of the fittings on the tank side.

4.10.2.3.7 The fuel oil tanks shall have manholes for inspection of the interiors:

150 mm in diameter — for tanks from 50 up to 500 dm³ in capacity;

350 · 450 mm — for tanks over 500 dm³ in capacity.

4.10.2.3.8 Each fuel oil tank shall be provided with a means to determine fuel level or quantity.

4.10.2.3.8.1 Diesel oil tanks may be fitted with sounding pipes or column-type sight gauges.

The column-type sight gauges shall have transparent, unbreakable inserts made of artificial material or glasses retaining their properties under effect of fuel.

A self-closing shut-off valve shall be installed between the level indicator and the lower part of the tank. If the level indicator is connected with the tank below the highest possible liquid level, such device shall be also installed in the upper part of the tank.

4.10.2.3.8.2 The petrol tanks shall be provided with a level detector with an indicator installed in the conning station.

The detector shall be of an intrinsically safe design.

4.10.2.3.9 Diesel oil and petrol tanks complying with the requirements of ISO 21487:2006 may be used.

4.10.3 Filling of fuel oil storage tanks and portable canisters.

4.10.3.1 The bunkering of the craft shall be carried out through a permanent pipeline provided with fittings necessary for filling of all the basic fuel oil storage tanks.

On multi-hulled craft, the suction pipes shall ensure the filling of fuel oil tanks of any of the hulls as well as transfer of fuel oil from the tanks of one hull into the tanks of the other.

The end of the filling pipe shall be carried to the tank bottom with a clearance not less than 1/4 of the internal diameter of the pipe.

4.10.3.2 The bunkering point shall be protected by coamings preventing spillage of fuel oil due to leakage from the filling pipe.

The suction pipe shall have reliable closing arrangements. Where deck sockets are used as fuelling arrangements, they shall have a plug made of copper-base alloys.

4.10.3.3 The filling pipes of tanks located above the double bottom, as well as filling pipes of the double bottom tanks shall be connected to the tanks near the top.

Where this is impracticable, the filling pipes shall be fitted with non-return valves installed directly on the tanks.

When the filling pipe is used as a suction pipe, the non-return valve shall be replaced by a remote-controlled shut-off valve operable from an accessible position outside the space in which the tank is located.

4.10.3.4 The petrol suction pipe shall ensure electrical conductance from the suction socket up to the tanks being filled.

4.10.3.5 The petrol suction pipe shall be fitted with a readily accessible water separator, in the absence of which fuelling shall be performed through a funnel with a water separating gauze (with mesh of 0,5×0,5 mm).

4.10.3.6 For filling of fuel oil tanks located in exposed machinery spaces (compartments) provision shall be made for a branch pipe led to the open deck level, provided with a barrier to prevent penetration of fuel oil into the hull. The branch pipe shall be fitted with a closing arrangement made of a metal which preclude spark formation, or of non-combustible material resistant to the action of fuel and which does not absorb it.

4.10.3.7 Portable fuel oil tanks which are delivered complete with outboard engines shall be filled outside the craft.

4.10.4 Fuel oil supply to internal combustion engines.

4.10.4.1 The equipment of fuel oil system shall be capable of supplying fuel oil duly prepared and cleaned to an extent required for the given engine.

4.10.4.2 The system of fuel oil supply to engines installed in machinery spaces or compartments shall be permanently installed.

The daily service tanks are recommended to be fitted with a quick-closing valve remotely operable from a readily accessible position outside the space in which the tank is installed.

4.10.4.3 The system of fuel oil supply to engines (outboard engines) installed on the craft transom may consist of flexible connections (hoses) meeting the requirements of 4.1.6.2.

4.10.4.4 The fuel oil filters fitted in the fuel oil supply lines shall be such that any filter can be cleaned without interrupting the operation of the engine.

4.10.4.5 Fuel oil supply to carburetor (petrol) internal combustion engines.

4.10.4.5.1 Compliance with the requirements of 4.10.1.5, 4.10.4.1, 4.10.4.2, 4.10.4.3, and 4.10.4.4 is mandatory.

4.10.4.5.2 The pipeline and fittings shall be located on the engine side opposite to the exhaust manifold.

4.10.4.5.3 The pipeline from the daily service fuel oil tank (or daily service canister which is delivered complete with the outboard engines) to the engine shall be fitted with quick-closing valve remotely operable from an accessible position outside the space/area where the tank or canister is installed.

The valve shall be installed directly on the wall of the tank or the daily service canister.

4.11 LUBRICATING OIL SYSTEM

4.11.1 Lubricating oil pumps of internal combustion engines, gears and couplings.

4.11.1.1 For an installation with one main engine on motor craft of design categories **A, A1, A2** and **B,** provision shall be made for not less than two circulating lubrication pumps, main and standby, of the same capacity. One of these pumps may be driven by the main engine.

The standby pump may be dispensed with, if the craft has a spare pump, provided that it is accessible for mounting under operating conditions.

In sailing-motor and motor-sailing craft the standby pump may not be installed.

4.11.1.2 Where two and more main engines are installed in craft of design categories **A, A1, A2** and **B**, each of them shall have its own lubricating oil pump, with provision for one standby pump driven independently and having a capacity sufficient to ensure operation of each engine.

The standby pump may be dispensed with, if the craft has a spare pump, provided it is accessible for mounting under operating conditions.

In sailing-motor and motor-sailing craft the standby pump may not be installed.

4.11.1.3 Lubricating oil pumps of main gearing, if they are independent of the main engine lubrication system, shall comply with the requirements of 4.11.1.1 and 4.11.1.2 for the main engines.

4.11.2 Lubricating oil supply to engines and gears.

4.11.2.1 The pipes of the lubricating oil system shall not communicate with other piping systems.

4.11.2.2 The circulating lubrication system shall provide for cleaning of oil and along with that, provision shall be made for cleaning of lubricating oil filters without having to stop the engine and the following filters shall be fitted:

.1 magnetic filter generally on the suction side of the pump of the gears;

.2 one coarse filter (strainer) on the suction pipe of the pump; two parallel filters or one switch-over duplex filter or one self-cleaning filter on the pressure pipe of the main engine pump.

The capacity of each filter shall exceed by 10 % the maximum capacity of the pump.

4.11.2.3 The lubricating oil system shall be fitted with a pressure gauge indicating pressure of the oil after the filter and before it enters the engine.

A pressure gauge indicating the pressure of oil after the oil cooler or after the filter before it enters the inboard engine shall be placed at the control station.

4.11.2.4 As regards collection of the lubricating oil leakage in a drain tank, the requirements of 4.10.1.4.7 may be applied.

4.11.3 Lubricating oil tanks.

4.11.3.1 The lubricating oil tanks shall be separated from the fresh water tanks.

4.11.3.2 In craft of design categories **A, A1, A2** and **B**, provision shall be made for a spare tank with a capacity sufficient for filling the system with oil to the working condition.

The tank shall be situated outside the double bottom.

In sailing-motor and motor-sailing craft the spare tank may be dispensed with.

4.11.3.3 The suction pipes from the tanks shall be fitted with shut-off valves installed directly on the tanks.

4.11.3.4 For the lubricating oil tanks situated in machinery spaces, the requirements of 2.7.2 and 4.10.1.4.6 shall be met.

4.12 COOLING SYSTEMS OF INTERNAL COMBUSTION ENGINES

4.12.1 Pumps.

4.12.1.1 The water cooling system of main engines in craft of design categories **A, A1, A2** and **B** shall comply with the following requirements:

4.12.1.1.1 Sea water cooling system of one main engine shall include two pumps, one of which shall be a standby pump. The capacity of the standby pump shall not be less than that of the main pump. At least, one pump shall be driven independently.

The standby pump may not be installed if the craft has a spare pump, provided it is accessible for mounting under operating conditions.

A fresh water cooling system of the main engine shall also comply with the same requirements.

One common independently driven standby pump may be used for both fresh and sea water cooling; the capacity of this pump shall not be less than that of the main pumps; precautions shall be taken to prevent mixing of fresh and sea water.

In sailing-motor and motor-sailing craft the standby pump may be dispensed with;

4.12.1.1.2 One independently driven standby pump ensuring the operation of each engine running at maximum load shall be installed in sea water cooling system of two and more main engines, each served by a separate cooling water pump.

No standby pump may be provided where a spare pump is available, which is accessible for mounting under operating conditions.

A fresh water cooling system shall also comply with the same requirements.

It is permitted to install one common independently driven standby pump for fresh and sea water, the capacity of which shall be such as to ensure fresh or sea water cooling of any engine; precautions shall be taken to prevent mixing of fresh and sea water.

In sailing-motor and motor-sailing craft the standby pump may be dispensed with;

4.12.1.1.3 It is allowed to cool several engines by one independently driven pump. In this case, the capacity of the pump shall be sufficient for simultaneous cooling of all engines when running at maximum load. One standby pump, the capacity of which shall not be less than that of the main pump cooling simultaneously all engines, shall be provided.

The cooling pipe shall be fitted with a water control valve at inlet to each engine;

4.12.1.1.4 In installations with an automation mark in the class notation provision shall be made for separate fresh water and sea water standby pumps, the capacity of which shall not be less than that of the main pumps.

4.12.1.2 The water cooling system of main engines in craft of design categories **C, C1** and **C2** shall comply with the following requirements.

4.12.1.2.1 Sea water cooling system of one main engine shall be provided generally with one pumps driven by the main engine; however, provision in this case shall be made for direct sea water cooling of the main engine or for a spare pump available on board, which is accessible for mounting under operating conditions;

4.12.1.2.2 In a sea water cooling system of two and more engines, each served by a separate cooling pump driven by the main engine, the standby sea water cooling is not compulsory.

4.12.1.3 The bilge or other general purpose pumps operated only for clean water may be used as standby cooling pumps.

The use of fire pumps for this purpose is permitted if the requirements contained in Part X "Fire Protection" are complied with.

4.12.2 Piping laying.

4.12.2.1 The water cooling system of the main engines in craft of design categories **A, A1, A2** and **B** shall be supplied from at least two sea chests: bottom and side or bottom and ice box arranged in engine room and interconnected.

4.12.2.2 The water cooling system of the main engines in craft of design categories **C** and **C1** may be supplied from one sea chest: bottom, side or ice box.

4.12.2.3 The water cooling system of the main engines in craft of design categories **C2, C3** and **D** be provided only with bottom sea inlet fittings complying with the requirements of 4.4.3.1.

4.12.2.4 The water cooling system of the main engines installed on transom is allowed to be separately supplied with sea water.

The water cooling system of the auxiliary engines is allowed to be separately supplied with sea water only from bottom sea inlets which shall comply with the requirements of 4.4.3.1.

4.12.2.5 Filters shall be fitted on suction lines of sea water cooling system serving the main and auxiliary engines. Filters shall be provided with a device making it possible to be sure, before the filters are opened, that there is no pressure. Means shall be provided to enable the filters to be cleaned without having to stop the cooling pumps.

4.12.3 Cooling of internal combustion engines.

4.12.3.1 In the fresh water cooling system of the engine, provision shall be made for an expansion tank where the level of water is higher than the maximum level of water in the engine. The expansion tank shall be connected to the suction pipes of the pumps and may be common for the cooling system of several engines.

The tank shall be provided with a device for monitoring the water level.

In the cooling system of engines, the arrangement of the sea water discharge pipes shall be such that the highest cooled spaces of engines, water and oil coolers are always filled with water and formation of stagnant pockets is excluded.

4.12.3.2 In the cooling system of the internal combustion engines, the cooling fresh water may be cooled in water coolers cooled by sea water, by air flow or in the keel cooling systems.

4.12.3.3 The cooling system shall be fitted with thermometers and cooling water temperature control device.

It is recommended that suitable alarms shall be provided to warn of the limit value of the cooling water temperature.

4.12.4 Keel cooling systems of inboard internal combustion engines.

4.12.4.1 For craft of design categories **A, A1** and **A2** equipped with one main engine, not less than two sea water coolers, one of which is standby, shall be provided.

For craft equipped with two or more main engines, one standby cooler shall be provided to keep each engine running.

4.12.4.2 Each cooler shall be provided with air discharge arrangement.

Arrangements for drainage of cooling medium from the coolers shall be provided.

4.12.5 Air cooling system.

4.12.5.1 The main internal combustion engines with a direct air cooling system in sailing-motor and motor-sailing craft as well as craft intended for operation in offshore area of navigation shall be provided with an engine driven cooling air blower.

The craft shall be provided with a spare cooling air blower and its drive elements which will make it possible to mount the blower on board under operating conditions.

For auxiliary engines, this requirement is not compulsory.

4.12.5.2 In case of internal combustion engines with direct air cooling or with air cooling of the fresh water heat exchanger, released air shall not cause an inadmissible heating of the machinery space atmosphere.

In general, special ducts shall be provided to lead the exhaust air out to the exposed part of the deck.

4.13 COMPRESSED AIR SYSTEM

4.13.1 Number of air receivers, compressors, amount of starting air and piping laying.

4.13.1.1 Where a craft is provided with main or auxiliary internal combustion engines started by compressed air or by compressed gas from gas bleeding arrangements of the engines, the requirements for the number of starting air receivers, compressors and amount of starting air with consideration for all consumers, piping laying shall comply with those set out in Section 16, Part VIII "Systems and Piping" of the RS Rules/C, in so much as applicable and sufficient unless specified otherwise below.

4.13.1.2 Air receivers shall be equipped with a device for complete moisture removal.

The air receivers shall meet the requirements given in Section 6, Part X "Boilers, Heat Exchangers and Pressure Vessels" of the RS Rules/C, in so much as applicable and sufficient unless specified otherwise below.

4.13.2 Compressed air pipes of pneumatic devices, craft's service consumers, control and automation systems in craft where the engines are not started by compressed air.

4.13.2.1 Where a tyfon is provided on board, the capacity of a special air receiver for the tyfon shall be determined so that the tyfon will be able to work continuously for 2 min, with hourly performance of compressor being not less than required to provide continuous operation of tyfon during 8 min.

If air from the air receiver is consumed also for other purposes, the capacity of the air receiver shall be increased as compared with that designed for the tyfon only, with provision for automatic replenishment or signaling means which shall operate as soon as the amount of air in the air receiver is such as required for the tyfon only.

4.13.2.2 Where a tyfon is provided on board, it is allowed to install one independently driven compressor with a capacity not less than required to operate the tyfon as specified in 4.13.2.1.

Where a tyfon is not provided on board, the compressor may be attached to the engine or manually driven, provided that air receiver can be filled by shore means.

4.13.2.3 The air receivers shall meet the requirements of 4.13.1.2.

4.14 LIQUEFIED GAS SYSTEMS

4.14.1 General.

4.14.1.1 The requirements of this Chapter apply to fixed liquefied gas installations designed to operate at a pressure of 500 mm water g. and consisting generally of one gas cylinder with a gas mass not more than 11 kg, one or several pressure regulators, distribution network and, maximum, two appliances consuming gas simultaneously.

4.14.1.2 Installations of approved type, complying with the requirements of this Part and manufactured in accordance with the regulations of a competent body shall be used on board craft. Installations which are not fixed installations may be used only when they meet special requirements prescribed by a competent body.

4.14.1.3 Only fuel hydrocarbon liquefied gas termed "propane, butane, propylene, butylene" complying with the requirements of current national standards are allowed to be used on board the craft. Installations working on gas shall in every particular be suitable for use of "propane".

4.14.1.4 It is allowed to use on board the craft liquefied gas installations for domestic purposes only: cooking, and in water- and air heaters consuming not more than 1,5 kg of liquefied gas per hour. Use of liquefied gas for other purposes may be allowed, provided the requirements are met given in Section 9, Part XVII "Distinguishing Marks and Descriptive Notations in the Class Notation Specifying Structural and Operational Particulars of Ships" of the RS Rules/C.

4.14.1.5 Components of the liquefied gas installations shall not be located in machinery spaces.

4.14.1.6 Components of the liquefied gas installations shall not be located within cargo spaces.

4.14.1.7 Gas-consuming appliances separated by the cargo area or integral tank shall not be served by the installation.

4.14.1.8 Openings in deck located at least 3 m from the doors or other closing arrangements of spaces or areas where components of the domestic liquefied gas installations are located shall have coamings of at least 150 mm in height.

4.14.1.9 All the equipment of the domestic liquefied gas installations arranged on board craft, including gas supply lines, shall be reliably secured.

4.14.1.10 A warning inscription: "Gas cylinder. Open the valve while the gas cylinder is being used. Close the valve before the flame dies out" shall be displayed near the gas cylinder.

4.14.2 Liquefied gas cylinders.

Only standard cylinders approved by the supervisory bodies are permitted to be installed on board the craft.

4.14.3 Gas-consuming appliances and spaces for their installation.

4.14.3.1 All gas-consuming appliances installed in craft shall be approved by a competent body.

4.14.3.2 The gas-consuming appliances shall be provided with devices effectively preventing gas leakage in the event of the burner and starter flame-jet failure. For the water- and air heaters such device shall have pilot flame.

Upon agreement with the Register, such device may be dispensed with for appliances installed in spaces above the upper deck and operated only in the presence of attending personnel.

4.14.3.3 The water- and air-heaters shall be fitted with flues designed so as to provide outgoing of the products of combustion outside the craft.

4.14.3.4 The gas-consuming equipment may be arranged in the wheelhouse only when there are no ducts which would make penetration of gas into the interiors of the craft possible.

4.14.3.5 Spaces in which the gas-consuming appliances are installed shall be equipped in accordance with requirements set out in 2.4 and also shall comply with the following requirements:

.1 they shall be arranged not lower than the upper deck level and have natural ventilation ensuring effective removal of the products of combustion and the air exchange and having no shut-off arrangements on ventilation ducts and air gratings.

Installations with cylinders having capacity not more than 3 kg of liquefied gas may be located below the deck in accommodation spaces, provided that the gas appliance is mounted directly on the cylinder or is connected with the cylinder by a flexible gas supply line of no more than 1,5 m in length, and the cylinder is arranged so as to provide free and fast access to the valve which cuts off supply of gas;

.2 they shall have an access to exposed deck and a pivoted side scuttle (window). Pivoted side scuttle (window) may not be provided in galley if the pivoted side scuttle or door opening directly onto the exposed deck are located in an adjacent uninhabited space or corridor;

.3 where a space, even if partially, is located below the upper deck, it shall be provided with forced ventilation and a hood shall be fitted above the gas range;

.4 in the lower part of the heater space, provision shall be made for an air grating with cross-sectional area not less than 0,02 m² for each heater;

.5 bulkheads and decks shall be tight; sills of the door openings shall be not less than 150 mm high. Installation of ladders and lifts from these spaces to underlaying spaces is not permitted;

.6 height of the space shall be not less than 2,2 m. Where an exhaust hood which extends beyond the overall dimensions of the range is fitted, the height of the spaces may be reduced to 1,9 m;

.7 a powder or carbon dioxide fire extinguisher shall be installed near the entrance to the space of gas-consuming appliances;

.8 a warning label shall be affixed in a conspicuous position which shall provide instructions for operation and maintenance and safety precautions.

4.14.3.6 The distance from the gas appliances to the bulkheads shall not be less than 75 mm.

4.14.4 Distribution station.

4.14.4.1 The distribution station shall be situated on the open deck in a special locker or in a gastight enclosure of the superstructure with a door which shall be opened from the outside, from the exposed deck.

4.14.4.1.1 Whenever necessary, structural measures shall be taken to preclude elevation of the temperature of the cylinders located at the station above 40 °C.

4.14.4.1.2 Artificial illumination shall not be provided; in exceptional cases, the station shall be illuminated by ap proved electric safety-type lamps, in this case the switch shall be fitted on the outside of the station.

4.14.4.1.3 Gas leakage shall not present a risk of its penetration into the inner spaces of the craft or its contact with the potential sources of ignition.

4.14.4.1.4 A clearly visible inscription "DANGER. GAS" and a cryptogram (symbol) warning of explosion hazard and prohibiting use of open flame shall be displayed on the outside of the station or on the door.

4.14.4.1.5 The distribution station shall be adequately ventilated via the openings in its upper and lower parts.

4.14.4.1.6 The special locker of the distribution station shall be manufactured of non-combustible material and shall not be located near the bulwark.

4.14.4.2 Depending on the number of the cylinders installed, the distribution station shall comply with the following requirements:

4.14.4.2.1 Where one cylinder connected to the network is installed; in this case, in order to connect a pressure-reducing valve placed on the cylinder head to the liquefied gas pipeline, a rubberized fabric hose with metal clamps to ensure tightness and security of coupling may be used. One spare cylinder may be installed at the station;

4.14.4.2.2 Where two cylinders connected to the network are installed, one of which is used as a daily service cylinder and the other is used as a standby cylinder, the both cylinders shall be connected to the distribution network manifold in accordance to 4.14.4.2.1. In this case, a shut-off valve or cock shall be fitted between each cylinder and manifold, and the station shall be provided with a no tice prohibiting simultaneous use of both cylinders. One spare cylinder may be installed at the station.

4.14.4.3 The cylinders installed on board the craft shall bear brands of competent authorities, as well as information on the date of hydraulic tests by proof pressure and on the kind of gas contained.

4.14.4.4 The liquefied gas cylinders shall be installed vertically, with their valves faced upwards, in special housings made of material precluding spark formation and shall be secured to the station structures by means of quick-detaching joints.

4.14.4.5 The distribution station shall not contain equipment which is not associated therewith.

4.14.4.6 Spare and empty cylinders shall be stored in locker or in an enclosed space meeting the requirements of 4.14.4.

4.14.5 Liquefied gas piping and fittings.

4.14.5.1 Liquefied gas piping shall consist of seamless steel or copper pipes with inside diameter not less than 6 mm.

4.14.5.2 The wall thickness of pipes shall comply with the requirements of columns 2 or 5 of Table 4.2.5.1.

4.14.5.3 The pipe joints shall be welded. Threaded or flanged joints shall be allowed only at connections of instruments, gas-consuming appliances and fittings.

4.14.5.4 Inside the distribution station, a shut-off valve or cock operable from a position outside the space shall be installed on the pipeline, near its way out from the station. If such arrangement is impracticable, a second shut-off valve or cock shall be installed outside the station where the pipeline leaves the station.

4.14.5.5 The pipelines from the distribution station to gas consumers shall be laid on the open deck and protected against mechanical damage.

The liquefied gas pipelines shall not pass through accommodation, service and machinery spaces.

4.14.5.6 Where several gas consumers are available on board the craft, each branch line from the common pipeline to the consumer shall be fitted with shut-off fittings.

4.14.5.7 Pressure-reducing valves fitted in the system shall be designed to provide a pressure of gas delivered to the consuming appliances not higher than 0,005 MPa.

Where a double-stage pressure-reducing valves are used, the intermediate pressure shall be not higher than 0,25 MPa.

The pressure-reducing valve or the first stage of pressure reduction which is a constituent of the double-stage pressure-reducing valves shall be fitted at the distribution station. The valve shall be fitted on the pipeline section between the cylinder and shut-off valve and attached to the station bulkheads or manifold.

4.14.5.8 The pipeline shut-off valves shall be fitted in readily accessible positions.

The shut-off valve shall be provided with a limiting device which allows it to rotate through 90° and with an indicator of "open" and "closed" positions.

4.14.5.9 All the fittings shall be made of bronze, brass or another corrosion-resistant material.

4.14.6 Testing of the liquefied gas installation.

4.14.6.1 The liquefied gas pipes from the cylinders to the pressure-reducing valves shall be tested as follows:

in shop — by hydraulic pressure of 2,5 MPa;

on board — by air pressure of 1,7 MPa.

The liquefied gas pipes from the pressure-reducing valves to gas consumers, after installation on board the craft, shall be tested for tightness by air with an excessive pressure of 0,02 MPa.

4.14.6.2 The whole liquefied gas installation, once mounted on board the craft, shall be tested for tightness while the system is subjected to a normal working pressure. The test shall be carried out with the use of soap solution; no gas seepage shall be observed.

4.14.6.3 The normal operation of the gas-consuming appliances, including the arrangement used to cut off gas supply to the consuming appliance shall be checked.

4.15 AIR HEATING INSTALLATIONS AND SPACE HEATING APPLIANCES

4.15.1 Air heating installations.

4.15.1.1 The air heating installation is an installation intended to heat air, wherein the air is heated while passing through the combustion chamber of the air heater.

4.15.1.2 Air heaters shall not be located in accommodation and service spaces.

The spaces containing air heaters shall be considered as machinery spaces of Category **A**; the air to be heated shall be taken in from outside of the machinery spaces. Air intakes of the air heaters located on exposed areas of the deck shall be protected from penetration of spray and precipitation.

4.15.1.3 Heat exchangers of the air heater combustion chambers shall be tight and tested by a pressure not lower than 0,1 MPa.

4.15.1.4 Ventilation ducts for hot air and pipes for carrying off the combustion products shall be made of steel or of a material equal to steel in fire resistance. No shut-off fittings shall be installed on pipes for carrying off the combustion products.

4.15.1.5 Combustion air shall be supplied by an independent air blower. Before the burner of the air heater is alight, the furnace chamber shall be pre-ventilated with the use of the air blower during at least 5 s.

4.15.1.6 Pipes for air supply to the air heaters shall comply with the requirements of 4.10. The possibility of fuel oil coming into contact with the hot air and outgoing gas pipes shall be precluded.

4.15.1.7 Fuel oil supply to the air heater shall be cut off automatically in case of:

burner flame-jet cut-off;

loss or low head of combustion air;

temperature of the air heated exceeding the pre-determined limit;

electric power loss.

Upon operation of protective devices, the air heater shall be capable of being actuated only locally.

4.15.1.8 Provision shall be made for fuel oil supply, hot air blowers and combustion air supply cutting off from two positions, one of which shall be located outside the machinery space.

4.15.2 Space heating appliances.

4.15.2.1 All space heating appliances shall be so designed and arranged that they cannot cause ignition of equipment, as well as clothes and baggage of people present in the space.

4.15.2.2 The space heating appliances shall be located at a distance at least 50 mm from the craft sides or from the bulkheads. If the sides or bulkheads are lined with wood, veneer or with another combustible material, the areas where the space hating appliances are located shall be protected by thermal insulation of non-combustible material.

With no thermal insulation, the heating appliances shall be located at least 150 mm away from the wooden, veneer or another combustible lining.

Russian Maritime Register of Shipping

Rules for the Classification and Construction of Pleasure Craft
Part V
Machinery Installations. Machinery. Systems and Piping

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