RUSSIAN MARITIME REGISTER OF SHIPPING

CIRCULAR LETTER **No. 311-09-1920c** dated 11.04.2023

Re:

amendments to the Rules for the Classification and Construction of Sea-Going ships, 2023, ND No. 2-020101-174-E

Item(s) of supervision:

sea coastal ships

Entry-into-force date:
01.05.2023

~~Cancels / amends / adds Circular Letter No.~~ ~~dated~~

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Appendices:

Appendix 1: information on amendments introduced by the Circular Letter

Appendix 2: text of amendments to Parts I "Classification" and XVII "Distinguishing Marks and Descriptive Notations in the Class Notation Specifying Structural and Operational Particulars of Ships"

Director General Sergey A. Kulikov

Text of CL:

We hereby inform that the Rules for the Classification and Construction of Sea-Going Ships shall be amended as specified in the Appendices to the Circular Letter.

It is necessary to do the following:

1. Bring the content of the Circular Letter to the notice of the RS surveyors, interested organizations and persons in the area of the RS Branch Offices' activity.
2. Apply the provisions of the Circular Letter during review and approval of the technical documentation on sea coastal ships (or equipment installed on board the sea coastal ships, or products/machinery installed on board the sea coastal ships) contracted for construction or conversion on or after 01.05.2023, in the absence of a contract, during review and approval of the technical documentation on sea coastal ships requested for review on or after 01.05.2023.
3. Apply the provisions of the Circular Letter during review of the technical documentation on sea coastal ships under construction and in service requested for review by interested parties.

List of the amended and/or introduced paras/chapters/sections:

Part I: paras 1.1.1, 2.2.5.4, 2.2.7, 2.2.54 and Table 2.5

Part XVII: Sections 26 — 28

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Appendix 1 to Circular Letter
No. 311-09-1920c dated 11.04.2023

Information on amendments introduced by the Circular Letter
(for inclusion in the Revision History to the RS Publication)

Nos.	Amended paras/chapters/ sections	Information on amendments	Number and date of the Circular Letter	Entry-into-force date
1	Part I, para 1.1.1	New definition "Sea coastal ship" has been introduced	311-09-1920c of 11.04.2023	01.05.2023
2	Part I, para 2.2.5.4	New para has been introduced containing requirements for assignment of distinguishing marks **RN(SCI)** and **RN(SCII)** for areas of navigation of sea coastal ships	311-09-1920c of 11.04.2023	01.05.2023
3	Part I, para 2.2.7	Reference to the applicable requirements has been specified	311-09-1920c of 11.04.2023	01.05.2023
4	Part I, para 2.2.54	Reference to the applicable requirements has been specified	311-09-1920c of 11.04.2023	01.05.2023
5	Part I, Table 2.5	In item 1.4, new distinguishing marks **RN(SCI)** and **RN(SCII)** for areas of navigation of sea coastal ships have been introduced. In item 2.4, reference to the applicable requirements has been specified. In item 2.30, reference to the applicable requirements has been specified	311-09-1920c of 11.04.2023	01.05.2023
6	Part XVII, Sections 26 — 28	New Section 26 has been introduced containing requirements for sea coastal ships with restrictions on area of navigation. Existing Sections 26 and 27 and references thereto have been renumbered Sections 27 and 28 accordingly	311-09-1920c of 11.04.2023	01.05.2023

Appendix 2 to Circular Letter
No. 311-09-1920c dated 11.04.2023

RULES FOR THE CLASSIFICATION AND CONSTRUCTION OF SEA-GOING SHIPS, 2023,

ND No. 2-020101-174-E

PART I. CLASSIFICATION

1 GENERAL

1 **Para 1.1.1.** Before the definition "Supply vessel" new definition "Sea coastal ship" is introduced reading as follows:

"Sea coastal ship is a self-propelled or non-self-propelled ship designed for operation in coastal sea areas and on inland waterways, taking into account the restrictions on the navigation conditions (boundaries of the navigation area, navigation season, permissible wave height with 3 % probability of exceeding level).".

CLASS OF A SHIP

2 **New para 2.2.5.4** is introduced reading as follows:

"**2.2.5.4** Sea costal ships flying the flag of the Russian Federation not engaged on international voyages and complying with the requirements of Section 26 of Part XVII "Distinguishing Marks and Descriptive Notations in the Class Notation Specifying Structural and Operational Particulars of Ships" are assigned the distinguishing mark **RN(SCI)** or **RN(SCII)** added to the character of classification to clarify restrictions of the ship navigation as follows:

.1 **RN(SCI)** — harbor, roadstead and coastal navigation, including inland waterways, with a wave height up to 3 m with 3 % probability of exceeding level with due regard for particular restrictions on the area and conditions of navigation resulting from the wind and wave conditions of the basins in accordance with Table 2.2.5.4-1, or with restrictions imposed on the distance from the place of refuge and the height of the wave with 3 % probability of exceeding level based on the justifications submitted to the Register taking into account the wind and wave conditions in specific restricted sea areas (where **RN** — restricted navigation, **SC** – sea coastal);

.2 **RN(SCII)** — harbor, roadstead and coastal navigation, including inland waterways, with a wave height up to 2 m with 3 % probability of exceeding level with due regard to particular restrictions on the area and conditions of navigation resulting from the wind and wave conditions of the basins in accordance with Table 2.2.5.4-2, or with restrictions imposed on the distance from the place of refuge and the height of the wave with 3 % probability of exceeding level based on the justifications submitted to the Register taking into account the wind and wave conditions in specific restricted sea areas (where **RN** — restricted navigation, **SC** — sea coastal).

Particular restrictions on the area and conditions of navigation for sea costal ships **RN(SCI)** and **RN(SCII)** are determined as the geographical place names of basins or their parts with the indication, where necessary, of the geographical boundary of the navigation area within the basin, the restrictions imposed on the distance from the place of refuge and the restrictions on ship navigation by calendar periods, or an indication of voyage between the terminal ports. In this case, the restrictions with due regard to the wind and wave conditions of the basins shall be determined by using the data of Tables 2.2.5.4-1 and 2.2.5.4-2 or the data

from the submitted to the Register justifications of possibility of sea costal ship's navigation in the certain area or passage, made in accordance with the procedure approved by the Register.

The allowable conditions of sea costal ship's navigation resulting from ship's stability and strength are indicated in the Classification Certificate. Particular restrictions on the area and conditions of navigation of such ships with due regard to the wind and wave conditions of the basins specified in Tables 2.2.5.4-1 and 2.2.5.4-2 or the data from the justifications approved by the Register are indicated in section "Permanent restrictions" of the Classification Certificate or in the Annex to the Classification Certificate.

Table 2.2.5.4-1

Basin, geographical restrictions for area of navigation **RN(SCI)**					
Nos.	Basin	Geographical boundaries of the basin	Additional $h_{3\%}$ restriction, in m	Navigation season	Restrictions on ship types
1	The Sea of Azov[1]	No restrictions[1]	—	March — November	—
2	The Black Sea[2]	10-mile coastal area from the Kerch Strait to the sea port of Novorossiysk	—	April — October	—
		10-mile coastal area around the Crimea peninsula from the Kerch Strait to 45°00'00,0" N at the western coast of the Crimea peninsula	—	April — September	—
		20-mile coastal area in the north-western part to the north of 45°00'00,0" N from the Kalamita Bay to the port of Chornomorsk (Illichivsk)	—	April — October	—
		10-mile coastal area from the port of Chornomorsk (Illichivsk) to Dunayskaya Prorva	—	April — October	—
		Coastal area between the lines connecting the point with coordinates 45°05'30,0" N, 36°35'30,0" E with Cape Panagiya and the Cape of Zhelezny Rog	2,0	March, November	Only for self-propelled cargo ships
3	The Sea of Azov and the Black Sea[2]	The Kerch Strait to the north of the line passing through the end of Tuzla Spit	—	March — November	—
		The Kerch Strait from the line passing through the end of Tuzla Spit to the line consequently connecting Takil Cape, anchorage with coordinates 45°05'30,0" N, 036°33'00,0" E, 45°05'30,0" N, 036°35'00,0" E and Panagiya Cape	—	April — 20 November	—
			2,0	March, 21 — 30 November	Only for self-propelled cargo ships
4	The Caspian Sea	To the north of 44°30'00,0" N	—	March — November	Except for self-propelled displacement passenger ships
5	The Baltic Sea[2]	The Gulf of Finland to the east of the line consequently connecting the Cape Piyytenina, Vigrund Island, Moshchny Island, Somers Island, southern edge of Cape Konek, the Gulf of Riga	—	April — November	—
		10-mile coastal area along the southern coast of the Gulf of Finland from the Cape Piyytenina to the Gulf of Riga	2,0	April — November	Except for towed non-self-propelled cargo ships and tugs, and self-propelled displacement passenger ships

Basin, geographical restrictions for area of navigation **RN(SCI)**					
Nos.	Basin	Geographical boundaries of the basin	Additional $h_{3\%}$ restriction, in m	Navigation season	Restrictions on ship types
6	The Barents Sea[2]	Pechorskaya Guba bay to the line consequently connecting Chernaya village, the Gulyaevskie Koshki Islands, Cape Russky Zavorot; Khaypudyrskaya Guba bay to the south of 68°45'00,0" N	—	July — September	—
		Kola Bay to the south of 69°11'30" N	—	Throughout the year	Except for self-propelled displacement passenger ships
7	The White Sea[1]	The Gulf of Onega to the south of the line consequently connecting Kem village, northern edge of the Solovetsky Islands, Zhizhginsky Island	—	May — October	—
		The Gulf of Dvina to the south of the line connecting Zhizhginsky Island and the northern edge of Mudyugsky Island	—		Except for towed non-self-propelled cargo ships and tugs
			2,0		For towed non-self-propelled cargo ships and tugs
		4-mile coastal area around Zhizhginsky Island	—		—
8	The Kara Sea[1]	Obskaya Guba bay to the north of the line consequently connecting the points with the following coordinates: 68°26'00,0" N, 073°35'00,0" E (Cape Kamenny); 68°25'00,0" N, 073°48'00,0" E; 69°04'00,0" N, 073°52'00,0" E (Cape Trekhbugorny)	—	July — October	—
		Gydansky and Enisey Gulfs to the south of the line consequently connecting the northern edge of Shokalsky Island, northern edge of Sibiryakova Island, Dikson Island; 3-mile coastal area around Shokalsky Island	—	July — September	—
		5-mile coastal area along the northern coast of the Yamal Peninsula from Cape Poelovo to Cape Khasalya; the Malygina Strait between the line connecting Cape Khasalya and Cape Shuberta and the line connecting Cape Golovina and Cape Malygina	—	July — October	Except for self-propelled displacement passenger ships
9	The Laptev Sea and the East Siberian Sea[2]	From the sea port of Tiksi to the mouth of the Yana River and 20-mile coastal area along the southern coast from the mouth of the Yana River to the mouth of the Kolyma River	—	20 July — September	—
10	The Sea of Okhotsk and the Sea of Japan[2]	The Tatar Strait to the north of the line connecting Chikhacheva Bay and Cape Uandi, and the Amur Firth to the south of the line connecting Cape Menshikova and Cape Tamlavo	—	June — October	—
11	The Sea of Okhotsk[2]	20-mile coastal area along the south-eastern coast of the Gulf of Sakhalin from Cape Tamlavo to the sea port of Moskalvo	—	June — October	—

Basin, geographical restrictions for area of navigation **RN(SCI)**					
Nos.	Basin	Geographical boundaries of the basin	Additional $h_{3\%}$ restriction, in m	Navigation season	Restrictions on ship types
N o t e . $h_{3\%}$ — wave height of 3 % probability. [1] The self-propelled displacement passenger ships designed for navigation on inland waterways and accepted to the RS class with the area of navigation extended to sea coastal areas, are assigned with the areas of navigation in Taganrog Bay of the Sea of Azov at the lines Azov — Taganrog — Yeysk, in the White Sea, in Gydansky and Enisey Gulfs of the Kara Sea (according to item 8 of this Table) and in 3-mile coastal area around Shokalsky Island. [2] Except for self-propelled displacement passenger ships designed for navigation on inland waterways and accepted to the RS class with the area of navigation extended to sea coastal areas.					

Table 2.2.5.4-2

Basin, geographical restrictions for area of navigation **RN(SCII)**					
Nos.	Basin	Geographical boundaries of the basin	Additional $h_{3\%}$ restriction, in m	Navigation season	Restrictions on ship types
1	The Sea of Azov[1]	Taganrog Bay to the line consequently connecting Dolgaya Spit, Berdyanskaya Spit, the port of Berdyansk and 20-mile coastal area along the eastern coast to 45°21'00,0" N	—	March — November	—
		20-mile coastal area along the north-western coast from the port of Berdyansk to the port of Genichesk	—	March — November	—
2	The Black Sea[2]	5-mile coastal area along the northern coast from the port of Skadovsk to the port of Odessa	—	March — November	—
		5-mile coastal area along the north-western coast from the port of Odessa to Dunayskaya Prorva	—	March — October	—
3	The Caspian Sea	To the north of the line consequently connecting Cape Suyutkina Spit, southern edge of Tyuleny Island, point with coordinates, 45°00'00,0" N, 048°35'00,0" E and thence passing along the parallel 45°00'00,0" N to the coast line; Mangyshlaksky Bay to the north of 44°45'00,0" N	—	April — November	—
		To the east of the line connecting the point with coordinates 45°00'00,0" N, 049°30'00,0" E and the point with coordinates 44°30'00,0" N, 050°15'00,0" E	—	April — November	Except for towed non-self-propelled cargo ships and tugs
			1,5		—
4	The Baltic Sea[2]	5-mile coastal area of the Gulf of Riga from the mouth of the Daugava River to the mouth of the Gauja River	1,5	April — October	—
		The Gulf of Finland to the east of the line connecting Kotlin Island and Zelenogorsk, Kronshtadt ship channel and 10-mile coastal area along the northern coast from Zelenogorsk to the sea port of Vyborg	—	May — October	—
5	The White Sea[1]	The Gulf of Mezen: 5-mile coastal area from the mouth of the Mezen River to the mouth of the Kuloy River; the Gulf of Onega: 5-mile coastal area from Belomorsk to Kem; the Gulf of Dvina: 5-mile coastal area from the mouth of the Northern Dvina River to Severodvinsk	1,5	June — September	—

Basin, geographical restrictions for area of navigation **RN(SCII)**					
Nos.	Basin	Geographical boundaries of the basin	Additional $h_{3\%}$ restriction, in m	Navigation season	Restrictions on ship types
6	The Laptev Sea[2]	The Olenek Gulf: 10-mile coastal area from Olenek arm to the mouth of the Olenek River	1,5	August — September	Except for self-propelled displacement passenger ships
7	The Sea of Okhotsk[2]	The Gulf of Sakhalin from the line connecting Cape Menshikova and Cape Tamlavo within the Nevelskoy channel and the Sakhalin channel, to the south of the point with coordinates 53°29'30,0" N, 141°22'48,0" E and coastal area limited with the line connecting the point with coordinates 53°29'30,0" N, 141°22'48,0" E and the entrance channel of the Baikal Bay	1,5	June — September	Except for self-propelled displacement passenger ships
8	The Sea of Okhotsk and the Sea of Japan[2]	The Amur Firth to the south of the line connecting Cape Menshikova and Cape Tamlavo and to the north of the line connecting Cape Yuzhny and Cape Tyk	—	June — September	—
		The Tatar Strait: 10-mile coastal area along the western coast from Cape Yuzhny to Chikhacheva Bay	1,5		Except for self-propelled displacement passenger ships.
9	The Sea of Azov and the Black Sea[2]	The Kerch Strait to the north of the line passing through the ends of Tuzla Spit	—	March — November	—
		The Kerch Strait from the line passing through the ends of Tuzla Spit to the line consequently connecting Cape Takil, anchorage with coordinates 45°06'00,0" N, 036°33'00,0" E and Cape Panagiya	1,5	April — 20 November	—
10	The Barents Sea	Kola Bay to the south of 69°06'36" N	—	Throughout the year	Except for self-propelled displacement passenger ships
N o t e . $h_{3\%}$ — wave height of 3 % probability. [1] The self-propelled displacement passenger ships designed for navigation on inland waterways and accepted to the RS class with the area of navigation extended to sea coastal areas, are assigned the areas of navigation in Taganrog Bay of the Sea of Azov at the lines Azov — Taganrog — Yeysk and in the White Sea. [2] Except for self-propelled displacement passenger ships designed navigation on inland waterways and accepted to the RS class with the area of navigation extended to sea coastal areas.					

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3 **Para 2.2.7**. The reference to "Section 27" is replaced by the reference to "Section 28".

4 **Para 2.2.54**. The reference to "Section 26" is replaced by the reference to "Section 27".

5 **Table 2.5.** In **item 1.4** after the distinguishing marks **R2-RSN**, **R2-RSN(4,5)** and **R3(RSN)** the distinguishing marks **RN(SCI)** and **RN(SCII)** are introduced reading as follows:

"

RN(SCI) **RN(SCII)**	Distinguishing marks for restricted area of navigation for sea coastal ships	**Rules for the Classification and Construction of Sea-Going Ships** Part I "Classification", 2.2.5.4 Part XVII "Distinguishing Marks and Descriptive Notations in the Class Notation Specifying Structural and Operational Particulars of Ships", Section 26

".

6 **Table 2.5**. In **item 2.4**, the reference to "Section 27" is replaced by the reference to "Section 28".

7 **Table 2.5**. In **item 2.30**, the reference to "Section 26" is replaced by the reference to "Section 27".

PART XVII. DISTINGUISHING MARKS AND DESCRIPTIVE NOTATIONS IN THE CLASS NOTATION SPECIFYING STRUCTURAL AND OPERATIONAL PARTICULARS OF SHIPS

8 **New Section 26** is introduced reading as follows:

"26 ADDITIONAL REQUIREMENTS FOR SEA COASTAL SHIPS IN RESTRICTED AREAS RN(SCI) AND RN(SCII)

26.1 GENERAL

26.1.1 Application.

The requirements of this Section apply to sea coastal ships (hereinafter referred to as "ships") flying the flag of the Russian Federation not engaged on international voyages, with restrictions specified in 2.2.5.4 of Part I "Classification".

26.1.2 Technical documentation.

26.1.2.1 The requirements for the scope of submitted technical documentation are specified in Section 3 of Part I "Classification".

In order to establish other restrictions on the area and conditions of navigation than those specified in 2.2.5.4 of Part I "Classification", the following shall be submitted to the Register for review and approval (A):

.1 Design justifications taking into account the wind and wave conditions in particular restricted sea areas.

26.2 TECHNICAL REQUIREMENTS

In addition to the applicable requirements of these Rules the ships of areas of navigation **RN(SCI)** and **RN(SCII)** shall comply with the requirements of this Section.

26.2.1 Hull.

26.2.1.1 General.

Requirements of 26.2.1 apply to steel ships of welded construction, from 12 to 140 m in length whose proportions are taken within the limits given in Table 26.2.1.1.

Table 26.2.1.1

Proportion of ship	Area of navigation	
	RN(SCI)	**RN(SCII)**
L/D	22	23
B/D	3	4[1]
[1] For floating cranes, not less than 4,5.		

26.2.1.2 Requirements for hull structures.

26.2.1.2.1 The requirements of 1.1.4.6, 1.4.1.1, 1.4.1.2, 1.4.5.3, 1.6.4.6, 1.6.5.1, 1.6.5.2, 2.2.2.1, 2.4.4.6, 2.6.5.2, 2.10.4.1, 2.10.4.2, 2.10.4.6, 3.6.1.2 of Part II "Hull" apply to ships of areas of navigation **RN(SCI)** and **RN(SCII)** as ships of area of navigation **R3**.

26.2.1.2.2 The requirements in 1.3.1.5 of Part II "Hull" apply to ships of areas of navigation **RN(SCI)** and **RN(SCII)** taking into account the reduction factor φ_r, obtained from Table 26.2.1.2.2.

Table 26.2.1.2.2

Area of navigation	φ_r
RN(SCI)	0,81–0,18 $L \cdot 10^{-2}$
RN(SCII)	0,70–0,18 $L \cdot 10^{-2}$

26.2.1.2.3 The requirements in 1.4.4.3 of Part II "Hull" apply to ships of areas of navigation **RN(SCI)** and **RN(SCII)** taking into account the reduction factor φ, obtained from Table 26.2.1.2.3.

Table 26.2.1.2.3

Area of navigation	φ
RN(SCI)	0,66–0,21 $L \cdot 10^{-2}$
RN(SCII)	0,55–0,19 $L \cdot 10^{-2}$

26.2.2 Equipment, arrangements and outfit.

26.2.2.1 Rudder and steering gear.

26.2.2.1.1 General.

Definitions and explanations given in this Section are specified in Part II "Hull" and Part III "Equipment, Arrangements and Outfit".

26.2.2.1.1.1 The requirements of this para apply to steering gears with rudders (ordinary, balanced, semi-balanced) and nozzles (turning, non-turning) as well as thrusters, steering means of steerable propellers, waterjet and vertical-axis propellers.

26.2.2.1.1.2 All self-propelled ships shall be equipped with a steering gear. Non-self-propelled ships intended for towing by rope shall be equipped with fixed stabilizers.

Stabilizers may be omitted in non-self-propelled ships intended for navigation only by pushing.

26.2.2.1.1.3 In case of failure in main drive or main power source of the steering engine, the time of transition to the standby drive or the time of power supply pause shall not exceed 5 s.

26.2.2.1.2 Rudder and nozzle.

26.2.2.1.2.1 The rudder blade and the nozzle shall be made of steel with carbon content not more than 0,22 %.

Construction of the nozzle may be either welded or cast-welded.

26.2.2.1.2.2 The plate thickness of streamlined rudder blade casing t, in mm, shall be not less than determined by formula:

$$t = sa\sqrt{p/R_{eH}} + \Delta s, \qquad (26.2.2.1.2.2)$$

where $s = 32{,}6 - 7{,}56\left(a/b\right)^2$

a = distance between horizontal stiffeners or vertical diaphragms, whichever is less, in m;
b = distance between horizontal stiffeners or vertical diaphragms, whichever is the greater, in m;
p = design pressure on a rudder blade plating, in kPa, determined in accordance with 26.2.2.1.2.3;
R_{eH} = the yield stress of the rudder plating material, in MPa;
Δs = 0,6 – corrosion allowance, in mm.

26.2.2.1.2.3 Design pressure on a rudder blade plating, p, in kPa, shall be taken equal to the greater value of pressures on the pressure (p_{ps}) and suction (p_{ss}) sides of the rudder profile:

for a plating area falling into the propeller jet and located within 0,35 the rudder blade width from its leading edge:

$$\left.\begin{aligned} p_{ps} &= 0{,}5(1{,}706C_T + 1{,}538)\rho V_A^2 + 9{,}81T \\ p_{ss} &= 0{,}5(5{,}505C_T + 6{,}093)\rho V_A^2 \end{aligned}\right\}; \qquad (26.2.2.1.2.3\text{-}1)$$

for a plating area falling into the propeller jet and located within 0,65 the rudder blade width from its trailing edge:

$$\left.\begin{aligned} p_{ps} &= 0{,}5(0{,}734C_T + 0{,}662)\rho V_A^2 + 9{,}81T \\ p_{ss} &= 0{,}5(2{,}369C_T + 2{,}622)\rho V_A^2 \end{aligned}\right\}; \qquad (26.2.2.1.2.3\text{-}2)$$

for a plating area not falling into the propeller jet and located within 0,35 the rudder blade width from its leading edge:

$$\left.\begin{aligned} p_{ps} &= 0{,}5\rho V_A^2 + 9{,}81T \\ p_{ss} &= 2{,}5\rho V_A^2 \end{aligned}\right\}; \qquad (26.2.2.1.2.3\text{-}3)$$

for a plating area not falling into the propeller jet and located within 0,65 the rudder blade width from its trailing edge:

$$\left.\begin{aligned} p_{ps} &= 0{,}25\rho V_A^2 + 9{,}81T \\ p_{ss} &= 1{,}25\rho V_A^2 \end{aligned}\right\}, \qquad (26.2.2.1.2.3\text{-}4)$$

where $C_T = {8T_p}/{(\rho V_A^2 \pi D^2)}$ — propeller loading factor;

T_p = propeller thrust, in kN;
ρ = water density, in t/m^3;
$V_A = V(1 - W_T)$ – propulsion and steering system inflow velocity, in m/s;
V = design speed of a ship in loaded condition (for pushers – together with the convoy), in m/s;
W_T = wake factor for straight motion of the ship by calculation of propulsion ability;
D = propeller diameter, in m;
T = ship draught, in m.

Pressure p_{ss} shall not be taken to be more than 96,9 kPa.

Jet diameter is taken to be equal to propeller diameter.

26.2.2.1.2.4 In order to prevent resonance, natural oscillation frequencies of the first tone of the rudder plating plates shall exceed the propeller blade frequency which is the product of a number of propeller blades by shaft revolution frequency by at least 50 %.

Natural oscillation frequencies of the first tone of the rudder plating plates shall be determined in accordance with requirements of 26.2.2.1.2.4.1 and 26.2.2.1.2.4.2 as for the plate washed by liquid from one side.

.1 Natural oscillation frequency N, in Hz, of the first tone of the rudder plating plates supported by webs and not supported by framing or stiffeners shall be determined by the formula:

$$N = \pi(1 + a^2/b^2)\sqrt{t^2 \mathrm{E}/[12\rho(1 - \mu^2)]}/(2a^2) \qquad (26.2.2.1.2.4.1)$$

where a = short side of the plate, in m;
b = long side of the plate, in m;
t = plate thickness, in m;
E = Young's modulus of plate material, in Pa;
ρ = density of plate material, in kg/m^3;
μ = Poisson ratio of plate materials.

.2 Natural oscillation frequency N^*, in Hz, of the plate taking into account added-liquid mass shall be determined by the formula:

$$N^* = N/\sqrt{k_a} \qquad (26.2.2.1.2.4.2)$$

where N = refer to 26.2.2.1.2.4.1;
$k_a = 1 + \alpha\rho_l a/(\rho t)$
ρ_l = liquid density, in kg/m^3;
ρ = density of plate material, in kg/m^3;
α = factor determined depending on ratio between plate sides according to Table 26.2.2.1.2.4;
t = plate thickness, in m.

Table 26.2.2.1.2.4

Factor α

a/b, c/l	α	a/b, c/l	α
0,1	0,76	0,6	0,51
0,2	0,71	0,7	0,47

$a/b,\ c/l$	α	$a/b,\ c/l$	α
0,3	0,65	0,8	0,45
0,4	0,61	0,9	0,43
0,5	0,55	1,0	0,42

26.2.2.1.2.5 The edge plate thickness of the rudder blade and stabilizer shall be not less than the shell thickness determined according to 26.2.2.1.2.2.

26.2.2.1.2.6 The plate thickness of lamellar rudder blade casing t_{lrb} , in mm, shall be not less than determined by formula:

$$t_{lrb} = k \cdot d_0 + 4 \qquad (26.2.2.1.2.6)$$

where k = factor taken equal for ships of areas of navigation:
RN(SCI) 0,080
RN(SCII) 0,055

d_0 = rudder stock diameter, in mm, determined according to 26.2.2.1.3.1 or 26.2.2.1.3.3 at R_{eH} = 260 MPa.

26.2.2.1.2.7 The minimum thickness of hollow nozzle shell and the stabilizer casing plates t_1, in mm, shall be not less than determined by formula:

$$t_1 = k_1 \cdot d_o + 4, \qquad (26.2.2.1.2.7\text{-}1)$$

where k_1 = factor taken equal for ships of areas of navigation:
RN(SCI) 0,025
RN(SCII) 0,020

d_o = rudder stock diameter, in mm, determined according to 26.2.2.1.3.1 or 26.2.2.1.3.3 at R_{eH} = 260 MPa.

The minimum thickness of nozzle internal plating t_2, in mm, shall be not less than determined by formula:

$$t_2 = 1{,}25 \cdot t_1 \qquad (26.2.2.1.2.7\text{-}2)$$

26.2.2.1.2.8 Inner plating of the hollow nozzle in the middle part shall have a strengthened belt, in mm, with thickness not less than determined by formula:

$$t_3 = 2 \cdot t_2 \qquad (26.2.2.1.2.7\text{-}3)$$

Plates of the strengthened belt are recommended to be made of stainless steel.

26.2.2.1.2.9 The plating thickness of streamlined rudder blade, hollow nozzle and its stabilizer shall be not less than shell plating thickness of the ship's aft extremity.

26.2.2.1.2.10 The plating thickness of the rudder blade and the nozzle with stabilizer for ships with ice strengthening shall be increased by 20 % as compared with that determined in accordance with 26.2.2.1.2.2, 26.2.2.1.2.3, 26.2.2.1.2.5 — 26.2.2.1.2.9.

26.2.2.1.2.11 The plating of the rudder blade and the stabilizer shall be strengthened from the inside by vertical stiffeners and horizontal diaphragms.

26.2.2.1.2.12 The nozzle plating shall be strengthened from the inside by longitudinal stiffeners and circular diaphragms.

At least four longitudinal diaphragms uniformly distributed along the circumference of the nozzle shall be provided.

26.2.2.1.2.13 Stiffener and diaphragm thickness shall be not less than plate thickness of streamlined rudder (stabilizer) or the nozzle shell plating.

26.2.2.1.2.14 Cut-outs shall be provided in stiffeners and diaphragms.

26.2.2.1.2.15 Plugs made of anti-corrosion material shall be provided in the rudder blade edge plates, in the lowermost and the uppermost points of the nozzle.

26.2.2.1.2.16 The rudder blade and the nozzle shall not protrude beyond the ship overall dimensions. When it is impracticable, protective arrangements shall be provided (housings, crinolines).

26.2.2.1.2.17 The rudder and the nozzle shall be so located as to prevent their damage due to stroke on ground when ship sails with the maximum design stern trim.

N o t e . The rudder and the nozzle intended for work on shallow water shall be designed with the lower support.

26.2.2.1.2.18 The plating thickness of fixed stabilizer installed instead of the rudder shall be determined in accordance with the requirements of 26.2.2.1.2.2, 26.2.2.1.2.3, 26.2.2.1.2.5, 26.2.2.1.2.9, 26.2.2.1.2.10. The design of fixed stabilizer shall meet the requirements of 26.2.2.1.2.11 — 26.2.2.1.2.14, 26.2.2.1.2.16.

26.2.2.1.3 Rudder stock and rudder piece.

26.2.2.1.3.1 The diameter of the rudder stock and the steering nozzle in the area of lower supporting bearing shall be proved by the calculation carried out in accordance with requirements of this Section. Hydrodynamic loads, bending moments, shear forces and support reaction forces acting in the stock – rudder system shall be calculated in accordance with Appendix 1.

26.2.2.1.3.2 The full ahead speed shall be taken as the design speed: for self-propelled ships — not less than 3,5 m/s, and for non-self-propelled ships — not less than 3,0 m/s.

The design astern speed shall be taken not less than 60 % of the design ahead speed.

26.2.2.1.3.3 If there are no hydrodynamic calculations, the rudder stock diameter, in mm, in the area of lower supporting bearing shall be not less than determined by formulas:

for suspended rudder (refer to Fig. 26.2.2.1.3.3-1)

$$d_0' = 46{,}2\sqrt[3]{k_2\sqrt{M_{torque}^2 + M_b^2}/(9{,}81 \cdot 10^{-3} R_{eH})}, \qquad (26.2.2.1.3.3\text{-}1)$$

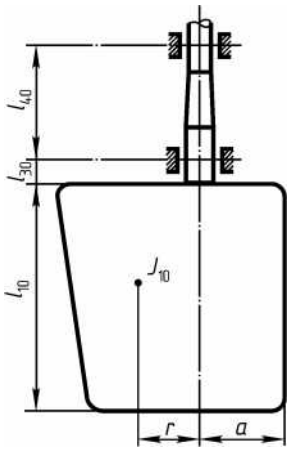

Fig. 26.2.2.1.3.3-1
Calculation method for suspended rudder

for rudder with lower support on sternframe heel (refer to Fig. 26.2.2.1.3.3-2)

$$d_0'' = 46{,}2\sqrt[3]{k_2 R\sqrt{r^2 + 0{,}029 l_{10}^2}/(9{,}81 \cdot 10^{-3} R_{eH})} \qquad (26.2.2.1.3.3\text{-}2)$$

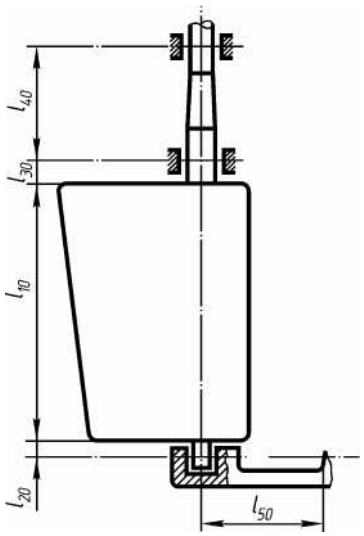

Fig. 26.2.2.1.3.3-2
Calculation method for rudder with lower support on sternframe heel

for rudder with pins on sternframe hinges

$$d_0''' = 46{,}2\sqrt[3]{k_2 M_{torque}^2/(9{,}81 \cdot 10^{-3} R_{eH})} \qquad (26.2.2.1.3.3\text{-}3)$$

where k_2 = safety factor of the rudder stock material taken equal to 2,5.
M_{torque} = torque calculated by the following formula, in kN·m;

$$M_{\text{torque}} = R \cdot r \qquad (26.2.2.1.3.3\text{-}4)$$

where R = resultant force on a rudder calculated by the following formula, in kN,

$$R = 9{,}81 \cdot 10^{-3} c \cdot \xi \cdot A \cdot v^2; \qquad (26.2.2.1.3.3\text{-}5)$$

c = coefficient determined by the formula

$c = \sqrt{13{,}87 + 22{,}025\lambda}$;
λ = relative elongation of the rudder blade determined by one of the following formulae:

$$\lambda = l_{10}/b;\ \lambda = l_{10}^2/A;\ \lambda = A/b^2;$$

ξ = factor taken equal for rudders located:
within the propeller jet 1,0
beyond the propeller jet 0,9
A = the rudder blade area, in m^2;
v = design speed of a ship in loaded condition, in km/h;
r = distance between the application point of an assumed design load and the rudder blade rotation axis at the level of its centre of gravity, in m, determined by the formula:

$$r = b \cdot [0{,}33 + 1{,}5(A_1/A)^2] - a, \qquad (26.2.2.1.3.3\text{-}6)$$

b = width of the rudder blade, in m;
A_1 = part of the rudder blade area forward of the rotation axis, in m^2;
a = distance between the rotation axis and the leading edge of the rudder blade edge at the level of the centre of gravity of its area, in m;
M_b, kN·m = bending moment determined by the formula

$$M_b = R \cdot (0{,}5 \cdot l_{10} + l_{30}); \qquad (26.2.2.1.3.3\text{-}7)$$

l_{10} = height of the rudder blade, in m;
l_{20} = distance between the lower edge of rudder blade plating and the support on sternframe heel, in m;
l_{30} = distance between the upper edge of rudder blade plating and the lower bearing of the rudder stock, in m;
R_{eH} = yield point of the rudder stock material, in MPa.

26.2.2.1.3.4 Minimum permissible external diameter of hollow rudder stock, in mm, is determined by the formula:

$$d_{outer} = \alpha \cdot d_0, \qquad (26.2.2.1.3.4)$$

where α = coefficient taken from Table 26.2.2.1.3.4 depending on the set ratio of the rudder stock wall thickness to the external diameter (δ/d_{outer});

Table 26.2.2.1.3.4

Coefficient α

δ/d_{outer}	α	δ/d_{outer}	α
0,50	1,00	0,15	1,10
0,25	1,02	0,10	1,20
0,20	1,05	0,08	1,26

d_0 = rudder stock diameter determined according to 26.2.2.1.3.1 or 26.2.2.1.3.3, in mm.

26.2.2.1.3.5 Permissible stresses shall be taken according to Table 26.2.2.1.3.5 while calculating the steering gear element dimensions.

Table 26.2.2.1.3.5

Permissible stresses for calculation of steering gear element dimensions

Kind of stressed state	Permissible stress in portions of the material yield point R_{eH} for ships of areas of navigation **RN(SCI)** and **RN(SCII)**
Torsion and shear	0,30
Bending and bending with torsion	0,45
Tension and compression (bearing strain)	0,75

26.2.2.1.3.6 The rudder stock strength shall be checked for maximum forces induced by steering engines in case of rudder or nozzle seizure.

In this case, the design stresses shall not exceed $0{,}8R_{eH}$ or 0,67 R_m, where R_m is tensile strength of rudder stock material.

26.2.2.1.3.7 For ships intended for navigation in broken ice the diameters of the rudder stock design cross-sections calculated in accordance with 26.2.2.1.3.1 and 26.2.2.1.3.3, shall be increased by 15 %.

26.2.2.1.3.8 Rudder stocks and rudder pieces may be forged or welded.

Cast-welded and cast-forged-welded constructions are permissible, with the diameter of cast part of the rudder stock being increased by 15 % as compared with the design diameter of forged rudder stock.

For ships less than 25 m in length the rudder stocks and rudder pieces may be made of rolled steel.

26.2.2.1.3.9 The rudder piece cross-section area in the upper part shall be equal to the rudder stock cross-section area. The rudder piece cross-section area below the upper edge of the rudder blade may be smoothly reduced down to 50 % of cross-section area in the upper part.

Connection of the rudder stock with the rudder blade or steerable nozzle shall be equal in strength to the rudder stock.

26.2.2.1.3.10 Streamlined hollow rudders may have no rudder piece.

In this case the constructions substituting the rudder piece are continuous vertical diaphragms of the rudder blade with adjacent plating of rectangular or tubular cross-section as shown in Fig. 26.2.2.1.3.10.

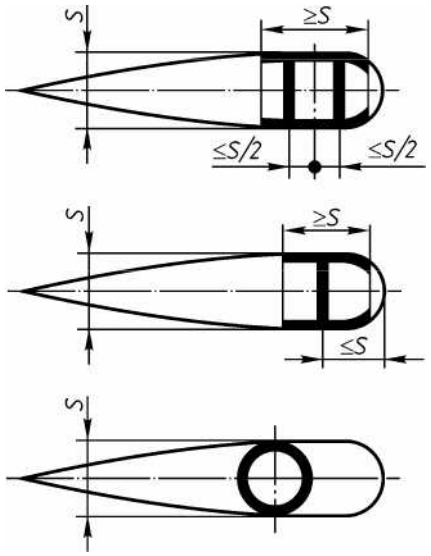

Fig. 26.2.2.1.3.10
Distance for installation of diaphragms for balanced and non-balanced rudders

Balanced rudders shall be fitted with two diaphragms at a distance not exceeding a half of maximum dimension s along the rudder blade width from the rotation axis (refer to Fig. 26.2.2.1.3.10), and non-balanced rudders — one diaphragm at a distance not exceeding the dimension s from the leading edge of the rudder. A diameter of the tube substituting the rudder piece is taken to be equal to s along the rudder blade width. A thickness of the diaphragms, adjacent shell plating and the tube wall shall be increased as compared to the plating thickness calculated by the formula (26.2.2.1.2.2) at least twice.

A width of thickened plates of the shell plating shall be not less than maximum thickness of the rudder blade profile.

26.2.2.1.3.11 The rudder blade or steerable nozzle with the rudder stock shall be connected by means of a horizontal flange or other structure (conic, stirrup, etc.) which ensures the required connection properties.

For ships with a length of 10 m and less with manual steering drive the connection of the rudder stock with the rudder blade may be welded.

26.2.2.1.3.12 Connecting bolts (studs) shall be tightly fitted. The number of tightly fitted bolts shall be at least two for keyed joints. Minimum permissible total cross-section area, in mm^2, of all bolts is determined by the formula:

$$F_{\Sigma} = 0{,}3 \cdot d_0^2 \qquad (26.2.2.1.3.12)$$

where d_0 = rudder stock diameter determined according to 26.2.2.1.3.1 or 26.2.2.1.3.3, in mm.

26.2.2.1.3.13 Fastening joints of the rudder stock and the rudder blade or steerable nozzle shall be reliably locked to prevent spontaneous unscrewing.

26.2.2.1.3.14 The distance from the edge of bolt hole to the outer edge of connecting flange shall be not less than $0{,}65 \cdot d_b$, where d_b is the bolt diameter.

26.2.2.1.3.15 Flange thickness shall be not less than the connecting bolt diameter.

26.2.2.1.3.16 A radius of the fillet at the junction of the rudder stock with the flange shall be not less than $0{,}12 \cdot d_0$, (for d_0 refer to 26.2.2.1.3.12).

26.2.2.1.3.17 For conic connection of the rudder stock with the rudder blade or the nozzle the length of cone shall be not less than 1,5 the rudder stock diameter, and the conicity — not more than 1:10. The conic part of the rudder stock shall change into the cylindrical part without a shoulder.

A key shall be placed in the conic connection which dimensions shall be calculated for the case of maximum hydrodynamic torque transfer acting on the rudder stock or steerable nozzle. The key slot shall have ski-shaped exits.

26.2.2.1.3.18 Plain bearings or rolling bearings may serve as the rudder stock supports.

Plain bearing sleeve height h_{bush}, in mm, shall be determined by the formula:

$$h_{bush} = 1000 \cdot B_{\text{н}}/(p \cdot d_1) \qquad (26.2.2.1.3.18)$$

where $B_{\text{н}}$ = assumed reaction of the rudder stock support while calculating the rudder stock – rudder piece bar for bending determined according to 26.2.2.1.3.19, in kN;

p = permissible contact pressure for bearing materials taken from Table 26.2.2.1.3.18, in MPa;

Table 26.2.2.1.3.18

Permissible contact pressure for bearing materials

Materials	Permissible contact pressure p, in MPa, during	
	water lubrication	oil lubrication
Steel against bronze	6,85	—
Steel against babbit	—	4,41
Steel or bronze against lignum vitae	2,36	—
Steel or bronze against synthetic materials or rubber	Subject to technical justification	

d_1= diameter of the rudder stock in the support (including facing, if any), in mm.

In any case, the rudder stock bearing sleeve supporting surface height shall be not less than 0,8 d_1.

26.2.2.1.3.19 Minimum assumed design reaction, in kN, from the rudder stock side shall be determined by the formula:

For suspended rudder

$$\boldsymbol{B_{\text{H}} = R \cdot (0,5 \cdot l_{10} + l_{30} + l_{40})/l_{40}}; \qquad (26.2.2.1.3.19\text{-}1)$$

for the rudder with lower support

$$B_{\text{H}} = 0{,}549 \cdot R. \qquad (26.2.2.1.3.19\text{-}2)$$

where R, l_{10}, l_{30}, l_{40} shall be taken in accordance with 26.2.2.1.3.3.

26.2.2.1.3.20 Standard rolling bearings may be used for the rudder stock supports provided their reliable lubrication and protection against water is ensured.

The rudder stock sealings shall be designed to prevent leakage of lubricants from supporting units of bearings.

26.2.2.1.3.21 Measures shall be taken to prevent axial displacement of the rudder stock or steerable nozzle while designing the rudder stock bearings.

26.2.2.1.3.22 The rudder trunk shall be so designed as to prevent the ingress of sea water into the ship's hull.

Glands situated above the load waterline shall be accessible for inspection and service afloat.

26.2.2.1.3.23 The elements of the rudder trunk subject to loads of rudder stock or steerable nozzle shall be sized so that the occurring stresses do not exceed 0,35 R_{eH}.

26.2.2.1.3.24 The height of the hubs of loose segment racks and auxiliary tillers shall not be less than 0,8 of the diameter of the rudder stock head.

The hub external diameter shall be not less than 1,6 times the diameter of the rudder stock head.

26.2.2.1.3.25 The split hubs shall be fastened with at least two bolts on each side and have two keys. The keys shall be arranged at an angle of 90° to the split joints plane.

26.2.2.1.3.26 The connection of the steering engine or gear with the elements coupled with the rudder stock shall eliminate the possibility of breakdown on the steering gear when the rudder stock is shifted in the axial direction by not more than 0,1 times the rudder stock diameter.

26.2.2.1.4 Steering gears.

26.2.2.1.4.1 Steering devices available with steering gears.

26.2.2.1.4.1.1 The ship rudder shall be fitted with two gears: main gear and standby gear.

26.2.2.1.4.1.2 A standby gear may be omitted in ships with several rudders or nozzles driven by separately controlled engine.

26.2.2.1.4.1.3 Main and standby steering gears shall be so arranged that any one of them can work despite the damage of the other. It is allowed to have common parts of a power drive to the rudder stock (tiller, quadrant, cylinder block).

26.2.2.1.4.1.4 The main steering gear control system shall be independent of the standby steering gear control system. It is allowed to have common steering wheel or control handle.

26.2.2.1.4.1.5 The main and standby gears may be manually controlled. In this cases, requirements of 26.2.2.1.4.3.1 — 26.2.2.1.4.3.4 shall be met. In all other cases the steering gear shall be driven from the power source.

26.2.2.1.4.1.6 The standby steering gear shall provide the rudder or steerable nozzle being put over to the same maximum angle as the main steering gear.

26.2.2.1.4.1.7 Rope for steering line pilotage shall be flexible, galvanized, cross-twisted and unravelling.

26.2.2.1.4.1.8 Main and standby steering gear control stations shall be fitted with rudder (steerable nozzle) position indicators.

26.2.2.1.4.1.9 If main and standby gears are hydraulic, each of them shall have a pump with independent motor and the drive pipelines shall be laid apart as far as practicable.

26.2.2.1.4.1.10 If main and standby gears are electric, their supply and control systems shall be independent of each other. Each of these two gears shall have its own electric motor.

26.2.2.1.4.2 Power of steering gear.

26.2.2.1.4.2.1 The power of the main steering gear shall be sufficient to put the rudder stock (steerable nozzles) over to the angle from 35° of either side to 35° of the other side in not longer than 30 s at maximum ahead service speed and the draught corresponding to the load waterline.

26.2.2.1.4.2.2 The power of the standby steering drive shall be sufficient to put the rudder stock (steerable nozzles) over to the angle from 20° of either side to 20° of the other side in not longer than 60 s at ahead speed equal to 0,6 times the maximum one and the draught corresponding to the load waterline.

26.2.2.1.4.2.3 The steering gear power units shall permit a torque overload of at least 1,5 times the rated torque for a period of 1 min.

26.2.2.1.4.3 Hand-operated and standby steering gears.

26.2.2.1.4.3.1 The main hand-operated steering gear shall be of self-braking design or be fitted with an automatic brake.

The main hand-operated steering gear shall meet the requirements of 26.2.2.1.4.2.1 when handled by one man with a force of not over 120 N applied to the steering wheel handles and with not more than 25 revolutions per one wheel turn.

26.2.2.1.4.3.2 The standby hand-operated steering gear shall be of self-braking design or shall have a locking device.

The standby hand-operated steering gear shall comply with the requirements of 26.2.2.1.4.2.2 when operating with a force on the handle not more than 160 N per each operator with not more than 25 revolutions per one wheel turn.

26.2.2.1.4.3.3 The standby steering gear shall be independent of the main steering gear and shall act directly on the rudder stock if possible.

26.2.2.1.4.3.4 The steering wheels of the main and standby hand-operated non-self-braking gears shall have external rims.

26.2.2.1.4.4 Mechanical steering gear with remote control.

26.2.2.1.4.4.1 Chain cables, pull rods and galvanized steel ropes which are included in the steering line convoy pilotage shall be fitted with devices for taking slack of a rope; moreover, tightening springs shall be fitted on each side in the steering line pilotage.

26.2.2.1.4.4.2 Rudder indicators (supports, transmissions, joints, couplings) shall be designed so as to prevent seizure or damage of their parts due to the hull deformation because of cargo movement or waves.

26.2.2.1.4.4.3 Transmissions of mechanical steering gears of oil tankers intended for transportation, pumping and storage of liquids with a flash point of 60 °C and below shall be led above the deck in chutes or ducts. Construction of rubbing units and parts of these drives shall prevent spark formation.

26.2.2.1.4.5 Protection against overload and reverse rotation.

26.2.2.1.4.5.1 For the hand-operated steering gear it is sufficient to provide the gear with buffer springs instead of the protection against overload.

When the hand-operated steering gear is used as a standby gear, overload protection need not be fitted.

26.2.2.2 Anchor arrangement.

26.2.2.2.1 General.

26.2.2.2.1.1 This Section covers standards of anchor equipment and anchor chain cables, as well as requirements for the machinery and elements of anchor arrangements.

26.2.2.2.1.2 Every ship shall be equipped with an anchor arrangement for holding the ship at the place when she is anchored.

26.2.2.2.1.3 Anchor equipment of floating cranes, oil-transfer stations shall be substantiated in a ship design depending on nature and features of her service.

The required conditions (depth, current speed, wind speed), at which anchoring of any of the above ship types shall be provided, are assigned by the design specification.

26.2.2.2.1.4 The requirements of the present Section apply to normal holding power anchors.

When using high holding power anchors their weight shall be taken in accordance with GOST 25496.

Sizes of chains are determined in accordance with 26.2.2.2.3.6 — 26.2.2.2.3.9 for a weight of an anchor calculated in accordance with 26.2.2.2.3.1.

26.2.2.2.1.5 Cable chain lockers of oil tankers (when located in dangerous spaces and areas) shall be tight and be fitted with arrangements for water filling.

26.2.2.2.2 Equipment number.

26.2.2.2.2.1 Equipment number N_{eq} is calculated by the following formula:

$$N_{eq} = L \cdot (B + D) + k \sum_{i=1}^{n} (l_i h_i) \qquad (26.2.2.2.2.1)$$

where L, B, D = design dimensions of the ship in accordance with 1.1.3 of Part II "Hull", in m;
l_i = length of separate superstructures and deckhouses, in m;
h_i = average height of separate superstructures and deckhouses, in m.
k = coefficient assumed equal to 1,0 for ships with the total length of superstructures and deckhouses, located on all decks, exceeding a half of the ship's length and 0,5 for ships with the total length being in the range of 0,25 to 0,5 of the ship's length. The superstructures and deckhouses may be neglected for calculation of equipment number at the total length of the superstructures and deckhouses less than 0,25 of the ship's length.

26.2.2.2.2.2 Equipment number of catamaran-type ships shall be determined by the following formula:

$$N_{eq} = 2L(B_{hull} + d) + \big(L + B_{ship}\big)(D - d) + k \sum_{i=1}^{n} (l_i h_i) \qquad (26.2.2.2.2.2)$$

where B_{hull} = breadth of one hull body, in m;
B_{ship} = breadth of the ship, in m;
D = side depth, in m;
d = load draught, in m.

26.2.2.2.3 For ships carrying cargoes on deck parameter $\sum_{i=1}^{n} (l_i h_i)$ in the formula (26.2.2.2.2.1) shall be calculated by multiplication of the side projection length of cargo stowed on the deck together with cargo limiting structures by its average height, and coefficient k shall be assumed equal to 0,5 for ships intended for transportation of bulk cargoes only, and 1,0 – for transportation of other deck cargoes.

26.2.2.2.3 Anchor, anchor chain and wire rope outfit.

26.2.2.2.3.1 Total weight of bow anchors $\sum m_{anch}$ with normal holding power (refer to 26.2.2.2.1.4) for self-propelled, non-self-propelled and towing displacement ships shall be determined by the following formula:

$$\sum m_{\text{anch}} = k_1 k_2 N_{eq} \qquad (26.2.2.2.3.1)$$

where N_{eq} = equipment number;
k_1 = coefficient which accounts for forces acting on the ship when anchored to be taken based on data or determined by formulas given in Table 26.2.2.2.3.1-1;

Table 26.2.2.2.3.1-1

Coefficient k_1

Area of navigation	for self-propelled and non-self-propelled ships		for tugboats	
	N_{eq}, m^2	k_1	N_{eq}, m^2	k_1
RN(SCI)	50 ≤ N_{eq} < 200	k_1 = 1,5	—	$k_1 = 1{,}342 + 0{,}5/\left[1 + (N_{eq}/287)^{3{,}861}\right]$
	200 ≤ N_{eq} < 2000	$k_1 = 1{,}245 + 1{,}127 \cdot \exp\left(-\frac{N_{eq}}{206{,}917}\right)$		
	2000 ≤ N_{eq} < 5200	$k_1 = 1{,}147 + 32{,}154 \cdot \exp(-\frac{N_{eq}}{388{,}564})$		
RN(SCII)	<2000	k_1 = *1,0*	50 ≤ N_{eq} < 100	k_1 = 1,5
	≥2000	$k_1 = k_1 = 0{,}844 + 295/N_{eq}$	100 ≤ N_{eq} < 1600	$k_1 = 0{,}8 + 3{,}169/\ln(N_{eq})$

k_2 = coefficient which accounts for requirements for anchor equipment due to navigation area category to be taken based on data or determined by formulas given in Table 26.2.2.2.3.1-2.

Table 26.2.2.2.3.1-2

Coefficient k_2

Area of navigation	Value of k_2 (at N_{eq} m^2)	
	for self-propelled and non-self-propelled ships	for tugboats
RN(SCI)	1,025	1,160
RN(SCII)	at 50 ≤ N_{eq} < 100 and N_{eq} ≥ 700 k_2 = 1,0	at 50 ≤ N_{eq} < 100 k_2 = 1,0
	at 100 ≤ N_{eq} < 700 k_2 = 1,0 + 49,98/N_{eq}	at 100 ≤ N_{eq} ≤ 1600 k_2 = 0,9+2,515/$\sqrt{N_{eq}}$

The calculated values of $\sum m_{anch}$, in kg, are rounded to the nearest greater value of weight M_{anch} of the anchor of dimension-type series regulated by normative document according to which the chain is manufactured.

One bow anchor shall be available onboard the ships of the following classes at N_{eq} not exceeding:

	N_{eq}, not exceeding
RN(SCII)	100
RN(SCI)	75

Otherwise the ships shall be equipped with two bow anchors.

26.2.2.2.3.2 Dredgers may be fitted with one bowing anchor of a weight equal to at least one half of a total weight determined in accordance with 26.2.2.2.3.1. On self-propelled dredgers anchor arrangement shall be fitted in the bow end and on non-self-propelled dredgers – in the extremity which is opposite to that where the main dredger working arrangement is fitted (dredging pipe, bucket ladder, etc.).

26.2.2.2.3.3 Stern anchor arrangements of ships other than self-propelled ships (refer to 26.2.2.2.3.4), are installed at shipowners' discretion.

Where bow anchor arrangement cannot be located in ships with a length less than 25 m, such ships may be fitted with stern anchor arrangement only.

26.2.2.2.3.4 Self-propelled ships with equipment number of 1000 m^2 (refer to 26.2.2.2.2) and over shall be fitted with the stern anchor arrangement in addition to the bow anchor arrangement, when:

.1 navigation area of those ships includes areas without current or with a low current rate. Weight of the stern anchor for such ships shall be not less than 0,25 of total mass of bow anchors;

.2 navigation area of those ships includes numerous fairway sections which do not allow the ship for turning to come to bow anchors against the current due to its breadth. The stern anchor weight in this case shall be at least 0,4 of the total weight of bow anchors;

26.2.2.2.3.5 Weight of each of two installed bow anchors shall be equal to a half of a total weight of bow anchors Σm_{anch}. The weight of one anchor (starboard anchor) may be taken equal up to 0,6 Σm_{anch} with respective reduction of the weight of another anchor.

26.2.2.2.3.6 Length L_{anch} of the anchor chain of one bow anchor is determined as follows.

.1 The approximate total length of bow anchor chains is calculated by the following formula:

$$l_{\Sigma} = a \,/\, \left[b + c\, ln\, N_{eq})/\, N_{eq}\right] \qquad (26.2.2.2.3.6)$$

where a = coefficient equal to 1;
b and c = coefficients to be taken from Table 26.2.2.2.3.6.

Table 26.2.2.2.3.6

Coefficients b and c

Type of a ship	Area of navigation	$b \cdot 10^2$	c
Self-propelled	**RN(SCI)**	0,275	0,172
	RN(SCII)	0,364	0,229
Non-self-propelled	**RN(SCI)**	0,305	0,172
	RN(SCII)	0,417	0,233
Tugboat	**RN(SCI)**	0,240	0,180
	RN(SCII)	0,303	0,231

.2 Obtained value l_{Σ} shall be rounded for ships equipped with two bow anchors (refer to 26.2.2.2.3.1) to the nearest greater value l_{Σ}, multiple of shot length (25 m), and for ships equipped with one bow anchor to the nearest value l_{Σ} from the range of 25, 30, 40, 50, 60 and 75 m.

For ships of areas of navigation **RN(SCI)** and **RN(SCII)** with equipment number of 1000 m^2 and over except tugboats, the total length of anchor chains shall be increased by one shot length.

.3 If total length of anchor chains of two bow anchors is characterized with even number of shots, then chain length of one bow anchor L_{anch} is taken equal to one half of l .

If total length of anchor chains of two bow anchors is characterized with odd number of shots, then length of one of chains shall be taken one shot more and connected to a heavier anchor if anchors are different in weight.

The anchor chain cable length for self-propelled ships equipped with stern anchor arrangement in addition to bow anchor arrangement shall be at least 75 % of the shorter chain length of the bow anchors.

26.2.2.2.3.7 Anchor chain diameter shall be determined as follows.

.1 the approximate value k_{str} of anchor chain diameter is calculated:

for stud link anchor chains, in mm:

$$k_{str} = c + d \cdot M_{anch} + eM_{anch}^2 + f/M_{anch} \qquad (26.2.2.2.3.7\text{-}1)$$

where M_{anch} = weight of an anchor to be fitted on the ship (refer to 26.2.2.2.3.1), for which the anchor chain is intended, in kg;
c, d, e and f = coefficients to be taken from Table 26.2.2.2.3.7 for stud link anchor chains;

Table 26.2.2.2.3.7

Coefficients c, d, e and f

Coefficient	Value of coefficient for ships of areas of navigation **RN(SCI)** and **RN(SCII)**	
	for the chain strength category	
	1	2
c	17,890	17,939
d	0,0196	0,0139
e 10^6	-2,541	-1,361
f	-1560,571	-1884,867

for studless anchor chains, in mm:

$$k_{str} = a_1 + b_1 M_{anch}/\ln(M_{anch}) \qquad (26.2.2.2.3.7\text{-}2)$$

where a_1= 6,197, b_1= 0,253.

.2 the appropriate values of anchor chain diameter shall be rounded to the nearest value from dimension-type range of diameters regulated by the normative document in accordance with which the chain is manufactured.

26.2.2.2.3.8 When using cast chain cables instead of welded ones, their diameter may be reduced by 12 %.

26.2.2.2.3.9 On non-self-propelled technical and auxiliary fleet vessels equipped with bow winches which ensure rope slippage at loose drum anchor, chain cables of a diameter up to 31 mm may be replaced with steel wire ropes. In both cases the requirements shall be met:

.1 ropes shall be flexible and of the same strength as the chain cable of the required diameter, their length shall be at least 20 % greater than that of the anchor chain to be replaced;

.2 steel wire ropes shall be galvanized and hemp ropes shall be tarred;

.3 the rope shall be connected to the anchor by means of a chain cable section of the same strength as the rope and of a length sufficient for stowing the anchor for sea by means of chain stopper. The chain cable section is not required, if a design of the anchor arrangement provides other stopper device for securing the raised anchor.

26.2.2.2.3.10 For ships of area of navigation **RN(SCI)** with equipment number of 1000 m^2 and over engaged in coastal navigation of the Kara Sea, weight of anchors determined in accordance with 26.2.2.2.3.1 shall be increased by 20 % and length of anchor chain cables determined in accordance with 26.2.2.2.3.6 – by 25 %.

26.2.2.2.4 Securing attachments for anchors, anchor chain cables and ropes.

26.2.2.2.4.1 Two stoppers shall be provided for each anchor chain cable: one for securing the chain cable at anchorage and the other one for securing the raised anchor. An anchor hoisting gear brake may be used as the stopper device for securing the chain cable at anchorage.

Cam, friction or chain anchor stoppers shall be used for securing of raised anchor. For Matrosov anchors up to 25 kg and Hall anchors up to 50 kg, one stopper device is permissible ensuring riding the ship at anchor. Bollards and cleats may be used as stoppers.

26.2.2.2.4.2 Inboard shots of anchor chains or bitter ends of ropes shall be securely attached to the hull and fitted with detachable joints in order to enable releasing of these ends from easily accessible place at tight chain cable or rope.

Attachment elements of the chain cables and ropes connection and of their detachable joints shall be of the same strength as the chain cable or the rope.

The capacity of chain lockers shall be sufficient for free arrangement of the whole anchor chain.

In ships less than 25 m in length bitter ends of synthetic or hemp ropes need not be fitted with detachable joints.

26.2.2.2.4.3 Anchor hawses and their location shall comply with the following requirements:

.1 inner hawse pipe diameter shall not be less than 10 chain cable diameters and the wall thickness shall not be less than 0,4 of the chain cable diameter;

.2 easy entering of the anchor shank into the hawse pipe and easy taking off the hawse pipe when the chain cable is released due to the gravity force shall be provided;

.3 bend of the chain cable when passing through the stopper and the hawse pipe shall be minimal. If the small bend is not practicable, lead roll may be fitted.

26.2.2.2.5 Anchor machinery.

26.2.2.2.5.1 General.

26.2.2.2.5.1.1 When dropping and hoisting the anchors having a weight of 50 kg and over as well as holding the ship at anchorage a capstan or windlass shall be provided. When anchor weight is 150 kg and over that machinery shall be fitted with chain sprockets.

26.2.2.2.5.1.2 When chains are replaced by ropes, anchor winches may be used. Towing winches may be used as anchor hoisting gear.

26.2.2.2.5.2 Remote-controlled anchor release device.

26.2.2.2.5.2.1 In self-propelled ships over 60 m in length intended for carriage of inflammable liquids, the hoisting gear brake of bow starboard anchor shall be fitted with a remote-controlled anchor release device. The remote-controlled release device shall prevent from spontaneous anchor release.

26.2.2.2.5.2.2 The remote-controlled anchor release device shall provide the following:

.1 control from the wheelhouse of release of the bow starboard anchor as well as indication of the released chain cable;

.2 stopping the anchor chain from the wheelhouse at any released chain cable;

.3 the duration of the anchor release of max. 15 s from the moment of actuation of the anchor release remote control.

26.2.2.2.5.2.3 Stoppers and other anchor equipment for which remote control is provided shall also be fitted with means of local manual control.

26.2.2.2.5.2.4 Anchor appliances and the associated means of local manual control shall be designed to ensure normal operation of anchor arrangement in the event of failure of separate elements or the whole remote control system.

26.2.2.3 Mooring arrangement.

26.2.2.3.1 General.

26.2.2.3.1.1 Every ship shall be fitted with mooring arrangements for warping to shore or floating berths structures and reliable attachment of the ship to them.

26.2.2.3.1.2 Selection of number, type of machinery and elements of the mooring arrangements, and also their arrangement on board shall be carried out by a designer in accordance with design features and the ship purpose subject to the requirements of this Section.

26.2.2.3.2 Mooring equipment.

26.2.2.3.2.1 Mooring bollards shall be made of steel or cast iron. Small ships equipped only with natural fibre or synthetic fibre ropes are permitted to use bollards made of light alloys.

26.2.2.3.2.2 The outside diameter of the bollard column shall be not less than 10 diameters of the steel wire rope or not less than one circumference of the natural or synthetic fibre rope.

26.2.2.3.2.3 Bollards shall be installed on foundations which shall be fixed on the deck and be attached to the ship framing. It is allowed to weld bollards to strengthened plates of the deck flooring. No side bollards welded to the deck flooring are allowed in cargo ships.

26.2.2.3.2.4 Bollards, mooring chocks and other elements of mooring equipment as well as their foundations shall be so designed that stresses in the elements do not exceed 0,95 times the yield point of their material due to acting of force equal to the breaking strength of the mooring rope for which they are intended.

26.2.2.3.2.5 Mooring bollards located in dangerous spaces and areas, shall be installed on foundations designed so as to provide natural air circulation under the bollards.

26.2.2.3.2.6 Hull structures in way of the mooring equipment installation shall be supported by ordinary framing or stiffeners.

26.2.2.3.2.7 For hauling mooring ropes the mooring machinery may be used (mooring capstans, mooring winches, etc.) or other deck machinery (windlasses, cargo winches, etc.) fitted with mooring drums.

26.2.2.3.3 Mooring ropes.

26.2.2.3.3.1 Mooring ropes may be made of steel, natural fibres or synthetic fibres.

26.2.2.3.3.2 Breaking load F_{br}, in kN, of the mooring rope shall be not less than:

for ships with equipment number of 100 to 1000 m^2

$$F_{br} = 0{,}147 \cdot N_{eq} + 24{,}5; \qquad (26.2.2.3.3.2\text{-}1)$$

for ships with equipment number more than 1000

$$F_{br} = 171 + 3{,}92 \cdot 10^{-2}\ (N_{eq} - 1000) \qquad (26.2.2.3.3.2\text{-}2)$$

where N_{eq} = equipment number calculated in accordance with 26.2.2.2.2.

26.2.2.3.3.3 Number and length of mooring ropes shall be selected depending on the ship type and operating conditions. However, there shall be at least three mooring ropes on the ship:

length of the first rope shall be at least L + 20 but max. 100 m, where L is the length of a ship, in m, in accordance with 1.1.3 of Part II "Hull";

length of the second rope shall be at least two thirds the length of the first rope;

length of the third rope shall be at least one third the length of the first rope.

For ships with length L less than 20 m, the third rope is not required.

26.2.2.3.3.4 Steel wire mooring ropes shall not be used or stored in dangerous spaces and areas.

26.2.2.4 Towing arrangement.

26.2.2.4.1 General.

26.2.2.4.1.1 Towing arrangement of tugs shall include:

.1 at least two devices for towing rope securing: the main device and the reserve one. Towing rope may be also secured by means of:

towing winch and towing hook;

towing hook and towing bollards or bitts;

towing winch and towing bollards or bitts;

.2 towing rope;

.3 towing arches and other rope guides;

.4 towing rope limiters.

N o t e s : 1. Towing hooks may be used instead of towing bollards or bitts, and towing winch – instead of towing hook.

2. Where two towing winches of the same type or two towing hooks of the same type are installed in a tug, one of them is considered as the main and another – as the reserve one.

26.2.2.4.1.2 Tugboats shall be fitted with automatic towing winches with a towing rope at least 500 meters long.

26.2.2.4.1.3 Ships of all other types with main engines with output over 300 kW, with towing arrangements and not equipped with towing winches, shall be fitted with arrangements for hauling and laying of towing ropes.

26.2.2.4.1.4 Number and arrangement of towing bollards, bitts, mooring chocks, guiding blocks, stops shall correspond to the design features and general arrangement of the main towing equipment (winches, hooks).

26.2.2.4.1.5 Every self-propelled and non-self-propelled ship shall be fitted with arrangement allowing its towing, including the following equipment:

.1 two towing bollards or bitts situated in the fore and after parts of the ship;

.2 towing hawses for passing the towing ropes through the bulwarks.

26.2.2.4.1.6 Floating cranes, technical and auxiliary fleet vessels and other ships with transom extremities shall be fitted with two pairs of bollards or bitts installed in the fore or aft end of the ship on either side.

26.2.2.4.1.7 It is allowed to replace towing hawses with roller fairleads or guiding bollards.

26.2.2.4.2 Towing hooks.

26.2.2.4.2.1 A ship may be fitted with standard folding towing hooks of opened and closed types, with spring shock absorbers and without them, with mechanical and hydraulic locks.

Hooks of non-folding type may be used as the main means for securing of the towing rope on towed ships and as reserve means in tugs.

26.2.2.4.2.2 All carrying elements of the towing hook and parts securing it to the hull shall be designed for the breaking load of the towing rope taken by calculation. Stresses in these shall not exceed 0,95 the yield point of the material.

26.2.2.4.2.3 Load at which the shock absorber spring is compressed against the stop shall be not less than 1,3 times the nominal traction on the hook.

26.2.2.4.2.4 The cramp irons of the towing hooks shall be solid-forged.

26.2.2.4.2.5 Prior to installation on board the ship, the towing hooks shall be tested by test load equal to doubled design tractive force on the hook determined for ships in mooring mode.

26.2.2.4.2.6 Attachment of the towing hook to the ship structures shall be of such design that at any possible towing angles the hook is not subject to the bending forces in the horizontal plane and does not touch any hull structures within the set angle of side stops, directly or by the rope thimble.

26.2.2.4.2.7 When in non-working position, the towing hook shall be stowed for sea.

26.2.2.4.2.8 Towing rope release shall be possible from two stations:

.1 from the wheelhouse (remote control);

.2 from the local station located in the immediate vicinity of the towing hook in a safe area.

26.2.2.4.2.9 Towing rope releasing arrangement shall operate in the range of loads on the hook from zero to the breaking load at any possible rope deviation from the centreline.

26.2.2.4.3 Towing equipment.

26.2.2.4.3.1 Bollards, bitts, rope locks.

26.2.2.4.3.1.1 Bollards, bitts and towing arrangement machinery shall be installed on foundations which shall be fixed on the deck and connected with the hull framing.

Deck shall be strengthened in way of installation of the foundations.

Bollards located in dangerous spaces and areas of the second category of explosion risk shall be installed on foundations so designed as to provide natural air circulation under the bollards.

26.2.2.4.3.1.2 The outside diameter of the bollard or bitt column shall be not less than 10 diameters of the steel wire rope or not less than one circumference of the natural fibre rope.

26.2.2.4.3.1.3 Rope locks shall be designed so as to withstand a load equal to a half of design tractive force on the hook.

26.2.2.4.3.2 Towing arches.

26.2.2.4.3.2.1 In the after part of tugs in way of possible displacement of the towing rope towing arches shall be installed in the transverse direction of the ship from side to side or other structures guiding the rope. The number of towing arches shall be determined for each tug depending on the length of its after part.

26.2.2.4.3.2.2 The height of the towing arches and protective rails shall ensure the safe work and movement of the crew in way of possible displacement of the towing rope.

26.2.2.4.3.2.3 The towing arches, supporting counterforts and other parts of the towing arrangement being touched by the towing rope shall be made of pipes or other proper profile with the rounding radius not less than the towing rope diameter.

26.2.2.4.3.3 Towing rope limiters.

26.2.2.4.3.3.1 In all ships equipped with the towing arrangement the side limiters of towing rope shall be fitted.

26.2.2.4.3.3.2 The side limiters of the towing rope shall be designed to take the load equal to the breaking load of the towing rope. Stresses in carrying elements of the limiters and also in the fastenings securing them to the ship's hull or other structures shall not exceed 0,95 times the yield point of the material.

26.2.2.4.4 Towing ropes.

26.2.2.4.4.1 Strength characteristics of the towing ropes shall be determined depending on the design tractive force on the hook in the mooring mode established by hydrodynamic calculation agreed by the Register or by prototype and the results of trials of lead ships. If such calculations are not performed or a prototype is not available, the tractive force on the hook F, in kN, shall be assumed not less than the value calculated by the following formula:

$$F = 0{,}16 \cdot P_e \qquad (26.2.2.4.4.1)$$

where P_e = the total output of main engines, in kW.

26.2.2.4.4.2 Minimum permissible breaking load, in kN, of the rope as a whole used for towing on the hook shall be not less than determined by the following formula:

$$F_0 = k \cdot F\,, \qquad (26.2.2.4.4.2)$$

where F = design tractive force on the hook, in kN;

k = safety factor equal to:

for design tractive factor on the hook up to 120 kN	5
for design tractive force on the hook of 120 kN and more	4
for ropes of automatic towing winches	3
for ropes of natural and synthetic fibres	6

26.2.2.4.4.3 The length of the towing rope is selected depending on the area of navigation.

26.2.2.4.4.4 Ropes must be untwistable in all cases. Wires shall be galvanized.

26.2.2.4.4.5 Manila ropes with increased strength may be used as the towing ropes. It is allowed to use three-rowed, ordinary and special tarred hemp ropes, and also ropes made of synthetic fibres – three-rowed, with circumference up to 200 mm.

26.2.2.4.4.6 Each rope shall be provided with a splice from one end, either with a thimble or without it, or a mark (on one end or both ends). A splice without thimble is allowed only when the towing rope is being fixed on the columns of a bollard or a bitt.

26.2.2.4.4.7 No steel towing ropes may be used or stowed in dangerous spaces and areas.

26.2.2.5 Signal masts.

26.2.2.5.1 General.

26.2.2.5.1.1 General provisions and requirements for signal masts are specified in Section 6 of Part III "Equipment, Arrangements and Outfit".

26.2.2.6 Openings in hull, superstructures and deckhouses and their closing appliances.

26.2.2.6.1 Height of coamings from the upper surface of deck plating of cargo and other hatches located on the freeboard deck and not protected by superstructures or deckhouses shall be not less than that specified in Table 26.2.2.6.1.

Table 26.2.2.6.1

Hatch coaming heights

Area of navigation	Minimum height, in mm, of the hatch coamings	
	cargo	other*
RN(SCI)	400	300
RN(SCII)	300	250
* Other hatches include trunks, access holes, non-cargo holds, outer exits to the superstructures and wheelhouses, awnings.		

The coaming height of hatches in passenger ships where passengers are located in the hull compartments not closed by a deck or superstructure, shall be not less than the coaming height on open cargo ships.

26.2.2.6.2 Where the hatches are located inside the superstructures fitted with the closures as specified in this Chapter, the height of the hatch coamings may be taken as 75 mm for the ships of areas of navigation **RN(SCI)** and **RN(SCII)**.

26.2.2.6.3 Cargo and other hatches located on the open areas of the freeboard deck for the closed ships shall be fitted with watertight closures,

26.2.2.6.4 Closures of the cargo hatches for the ships of area of navigation **RN(SCI)** shall be rated for loading by the cargo weight which is assumed to be stowed on those closures. Herewith, the minimum specific load on cargo hatches depending on the ship's length shall be assumed as linearly increased from 4,90 kPa at the ship's length 24 m up to 9,81 kPa at the ship's length 100 m. For the ships of less than 24 m and more than 100 m in length the specified weight load shall be taken as not dependent on the ship's length and equal to the above limit values of 4,90 kPa and 9,81 kPa accordingly.

26.2.2.6.5 Cargo hatchway covers and closures of other hatches and openings on open parts on the weather deck, air-locks, entrances and other openings in the superstructure on the main deck of ships of area of navigation **RN(SCII)** shall be rated for the weight loads from the cargo which is assumed to be stowed on those covers. The minimum specific load on the cargo hatch covers depending on the ship's length shall be assumed as linearly increased from 2,45 kPa at the ship's length of 24 m up to 5,40 kPa at the ship's length of 100 m. For the ships less than 24 m and more 100 m in length the specific weight load shall be taken as not dependent on the ship’s length and equal to the above limit values of 2,45 kPa and 5,40 kPa accordingly.

26.2.2.6.6 Ventilation heads located on the open parts of the freeboard deck shall have strong steel coaming with the height being not less than that required for coamings of the cargo hatches. Ventilation openings on all the ships shall be fitted with tight closures. Coamings of portable ventilation heads shall be fitted with covers or similar closing means.

26.2.2.6.7 All outer doors and windows of the superstructures, wheelhouses and air-locks located on the freeboard deck shall be watertight.

Doors of the closed spaces (e. g., storerooms, boatswain's stores) located on the freeboard, forecastle and poop decks, may be weathertight.

26.2.2.6.8 Scuttles in superstructures and wheelhouses of the first and second tiers located outside the areas and structures, in the outer shell plating below the freeboard deck, in frontal bulkheads of closed superstructures and wheelhouses of the first tier as well as in frontal bulkheads of closed superstructures and wheelhouses of the second tier on 0,25 of the

ship's length from the forward perpendicular shall be supplied with permanently attached deadlights and the thickness of glass shall be at least 8 mm at clear diameter of 250 mm or less and at least 12 mm at clear diameter of 350 mm or more. Clear diameter shall not exceed 400 mm.

26.2.2.6.9 On ships of area of navigation **RN(SCI)**, the side scuttles located in spaces below the freeboard deck shall be fitted with permanently attached deadlights; here, the scuttle glass thickness shall be at least 8 mm at a clear diameter up to 250 mm inclusive and at least 12 mm at a clear diameter of 350 mm and more. However, the clear diameter shall not exceed 450 mm. For intermediate clear diameters the glass thickness is determined by linear interpolation.

The lower edge of side scuttles shall be clear of the maximum draught line on at least 150 mm.

Side scuttles of passenger ships of area of navigation **RN(SCI)** located less than 2,5 % of the ship's breadth apart from the maximum draught line shall be dead.

On ships of area of navigation **RN(SCI)**, in the superstructures located on the freeboard deck and extended from side to side, the scuttles shall be fitted with deadlights. In superstructure spaces located on the freeboard deck and not being extended to the sides may be fitted with watertight windows with heavy glass (at least 10 mm).

On the passenger ships, the scuttles located in the spaces below the freeboard deck, except rescue scuttles, shall be dead (non-opening) or shall have a structure allowing to open them only by the crew members. The scuttles, except for the non-opening ones, located below the freeboard deck, including rescue scuttles, shall be provided with an automatic alarm of their open position given at the wheelhouse.

26.2.2.6.10 On oil tankers and flush deck ships all openings in the freeboard deck shall be fitted with strong watertight closures.

26.2.2.7 Arrangement and equipment of spaces. Other arrangements and equipment.

26.2.2.7.1 General.

26.2.2.7.1.1 Requirements of this Section apply to arrangement and equipment of accommodation and service spaces for the crew and passengers, wheelhouse, dry cargo holds, to passageways, doors, ladders and rescue manhole-scuttles.

26.2.2.7.2 Passageways, doors, ladders.

26.2.2.7.2.1 The breadth of passageways shall not be less than:

.1 0,8 m in main corridors of common passenger spaces, corridors of passenger accommodation and public spaces as well as deck passages of passenger ships leading to muster stations;

.2 0,6 m on decks between the bulwark and the wheelhouse for ships with power below 590 kW, or less than 25 m in length, or with a gross tonnage below 300 t, and 0,7 m for ships with greater power, length or gross tonnage values;

.3 0,7 m in the crew accommodation corridors;

.4 0,6 m in corridors of spaces in ships less than 25 m in length;

.5 0,5 m in corridors of spaces on dynamically supported craft less than 25 m in length;

.6 0,5 m on decks in places of installation of bollards, stanchions, hatchways.

26.2.2.7.2.2 Doors of superstructures and wheelhouses leading to the open deck shall be designed to open outwards.

Doors of public spaces (saloons, messrooms) shall be designed to open outwards or to either side. Cabin doors shall open inwards and be fitted with detachable panels of 0,4 × 0,5 m in their lower part. On the passenger cabin doors from the inner sides of those panels there shall be provided the inscriptions "Means of escape — knock out in case of emergency".

Where cabins are fitted with rescue manhole-scuttles or opening windows with clear dimensions of at least 400 mm, detachable panels need not be fitted.

26.2.2.7.2.3 Passenger spaces located in superstructures of second and third tiers shall be fitted with at least two ladders located at the opposite ends of the superstructures.

26.2.2.7.2.4 In hold passenger spaces with a number of passengers less than 20 persons one ladder per each space may be provided.

26.2.2.7.2.5 When a number of passengers in the hold passenger space is 20 persons and more, there shall be two ladders located at the opposite ends of the space with one of them giving access to an open deck outside the deck structures as far as practicable.

26.2.2.7.2.6 When a number of passengers in the hold passenger space is from 20 to 50 persons inclusive, emergency ladder may be replaced by vertical ladder.

26.2.2.7.2.7 In addition to exits from hold spaces specified in 26.2.2.7.2.4 — 26.2.2.7.2.6, each space shall be fitted with rescue scuttles with one scuttle at each side according to 26.2.2.7.3.

26.2.2.7.2.8 Hold crew accommodation spaces for 20 persons and more shall be provided with at least two ladders located at the opposite ends of the space and giving access to the main deck; one of them (emergency ladder) shall be led to an open deck outside the deck structures or through insulated steel enclosure in the superstructure which provides safe exit to an open part of the main deck or deck overboard extension in the event of fire. Emergency ladder may be replaced by vertical ladder.

26.2.2.7.2.9 Where hold spaces are intended for accommodation of 10 to 20 crew members and there is an exit giving access to an open deck, additional ladder need not be fitted provided that rescue scuttles are fitted at the side opposite to the main exit, with one scuttle at each side of the ship.

26.2.2.7.2.10 Where hold spaces are intended for accommodation of less than 10 crew members and there is an exit giving access to the open deck, additional ladder or rescue scuttles need not be fitted.

26.2.2.7.2.11 The ladders shall be arranged to provide free access of escape. Before entering/leaving a ladder as well as places where the next ladder builds on previous one shall be provided with free areas of a lengths not less than 0,8 m — for outer ladders and 0,6 m — for inner and vertical ladders, and a breadth not less than ladder breadth. The areas shall not have transverse coamings or shoulders. Angle of ladder slope to horizontal plain shall not exceed 50° — for accommodation and service spaces, and 55° — on decks and in machinery spaces. In order to access to equipment located in rooms and compartments of a ship the ladders with slope angle of 60° may be installed, and in periodically unattended machinery spaces where the ladders are difficult to install the vertical ladder may be used.

26.2.2.7.2.12 Intermediate areas stated in 26.2.2.7.2.11 shall be arranged if the ladder length, in mm, exceeds, for:

inclined ladder	4000
vertical ladder	9000

26.2.2.7.2.13 Ladder breadth for a number of passengers of 50 and less in the given space shall be at least 0,8 m. Ladder breadth shall be increased by 5 cm per each 10 passengers in excess of 50 persons. In crew spaces the ladder breadth shall be at least 0,8 m and in ships up to 25 m in length — not less than 0,65 m.

In ships of a length up to 25 m the ladder breadth may be decreased to 0,5 m if the requirement of this para is not technically feasible.

26.2.2.7.2.14 Ladders with more than three steps shall be equipped with handrails or guardrail.

26.2.2.7.3 Scuttles.

26.2.2.7.3.1 The side scuttles shall be arranged to meet the requirements of 26.2.2.6.8 and 26.2.2.6.9.

No scuttles are allowed in spaces intended for cargo carriage.

26.2.2.7.3.2 In hold spaces intended for passengers and crew as well as in engine room rescue scuttles shall be provided with a clear breadth of 400 mm.

N o t e . Rescue scuttles are required only in ships where a freeboard height is sufficient for its free arrangement.

26.2.2.7.3.3 In hold spaces intended for passengers and crew rescue scuttles shall be located in common cabins or in corridors with one scuttle at each side of the ship.

26.2.2.7.3.4 In the machinery spaces one rescue scuttle shall be provided at each side of a ship. Where a door is arranged in the bulkhead separating the machinery space and the boiler room, at least one scuttle shall be provided in each of the spaces being located at the opposite ends of the space.

26.2.2.7.3.5 Where an emergency exit is provided in the hold space for passengers or crew as well as in the machinery space which gives access directly to the open main deck, rescue scuttles need not be fitted.

26.2.2.7.3.6 Lower edges of rescue scuttles shall not be located below the lower edges of ordinary side portholes.

26.2.2.7.3.7 Free access shall be provided to rescue scuttles. Hand irons shall be fitted in sides to facilitate the access to scuttles.

26.2.2.7.3.8 Frames of rescue scuttles shall be painted red and shall bear relevant inscriptions. Location indicators of rescue scuttles shall be placed on visible places.

26.2.2.7.4 Accommodation and service spaces.

26.2.2.7.4.1 Accommodation spaces and galleys as well as canteens used as recreation spaces may be located in the vicinity of tanks with fuel or above them only when a horizontal cofferdam at least 600 mm high or a vertical cofferdam of breadth equal to the spacing is provided.

Cofferdams shall be equipped with ventilation independent of the ventilation of accommodation spaces.

No cutouts for manholes or other cutouts are allowed in decks and bulkheads in way of the above spaces.

26.2.2.7.4.2 Above the emergency exits there shall be provided illuminated inscriptions "Emergency exit".

26.2.2.7.5 Halls and spaces for multimedia presentations.

26.2.2.7.5.1 Halls and spaces equipped for multimedia presentations, film exhibition, etc. on passenger ships shall be fitted with exits giving access directly to an open deck with one exit per 50 spectators, but at least two exits at the opposite ends of the space. Each exit shall be fitted with a door which opens outwards; minimum breadth of the door and the passage shall be not less than 1,1 m.

Above each exit there shall be provided illuminated inscriptions "Exit" or "Emergency exit".

26.2.2.8 Railing, handrails, gangways, companionways.

26.2.2.8.1 General.

26.2.2.8.1.1 Along the perimeter of open decks, bridges and superstructures as well as around the open areas and workplaces located at a height over 0,5 m, the bulwark and guard rails shall be provided. Openings and doorways in decks, sides, bulkheads, bulwark shall be provided with railings preventing the possible fall or injury of people while operating a ship.

26.2.2.8.1.2 Fixed railings (coamings, bulwark, rails and guard rails) with regard to type, purpose and operating conditions of a ship shall eliminate the risk of man-overboard, falls into machinery space trunk, opening in deck, from bridge wings, from maintenance area, from other workplaces.

In order to protect passengers and crew against overboard risk, ships are fitted with handrails, gangways, companionways in addition to the fixed railings.

Companion hatchways and other openings in decks, bulkheads, sides shall be equipped with movable or removable railings.

26.2.2.8.1.3 The railings shall withstand loads arising during operation. Connections and fittings of railings shall be so designed that they are not reduced by vibration. Structural provisions shall be taken to prevent loss of fittings (bolts, nuts, pins).

26.2.2.8.1.4 Height of bulwark or guard rail along a perimeter of decks and bridges as well as around the open areas located at a height more than 0,5 m above the deck shall be not less than 1100 mm, and the railings height inside rooms and compartments shall not be less than 1000 mm. Guard rail on the upper awnings may be omitted.

For ships less than 20 m in length the height of a bulwark or a guard rail may be reduced, but shall be not less than 900 mm when relevant grounds of adequate protection of the crew and passengers are submitted to the Register.

26.2.2.8.1.5 Bulwark or guard rail shall be fitted on all open decks of the hull, superstructures and wheelhouses. On self-propelled ships up to 10 m in length handrail may be fitted along the perimeter of a superstructure or a deck.

26.2.2.8.1.6 On passenger ships of areas of navigation **RN(SCI)** and **RN(SCII)** railings on decks accessible for passengers shall be made as solid bulwark or guard rail with protective mesh screen.

26.2.2.8.1.7 In areas where bollards and fairleads are installed, the guard rail or bulwark shall not have parts that require change of their position when operating with mooring lines.

26.2.2.8.1.8 In places where gangways are handled, the doors or removable, telescopic, hinged and similar types of railings shall be provided.

26.2.2.8.1.9 Removable railings shall have special safety hooks, design of which provides quick installation and easy removal of railings and prevents spontaneous release under the weight of falling person.

26.2.2.8.1.10 Decks of ferries and other ships intended for transportation of wheeled vehicles shall be fenced by fender beams with a height of at least 0,45 m.

26.2.2.8.2 Bulwark.

26.2.2.8.2.1 Exit cutouts in the bulwark shall have folding doors which open inwards, or a removable railing.

26.2.2.8.3 Guard rail.

26.2.2.8.3.1 The distance between guard rail stanchions shall not exceed three spacings.

26.2.2.8.3.2 The guard rail of 1100 mm high shall be four-row, of 1000 mm high – three-row. The lower rail shall be located not higher than 230 mm above the deck. The distance between other rails shall not exceed 380 mm. The guard rail of decks accessible for passengers shall be fitted with protective screens. Side of screen cell shall not exceed 100 mm.

26.2.2.8.3.3 On non-self-propelled ships of areas of navigation **RN(SCI)** и **RN(SCII)** handrail shall be provided in way of superstructures and wheelhouses, and on non-attended ships – in way of forecastle and poop.

On flush deck barges without cargo bunker in the area of cargo platform a waist bar shall be installed.

On flush deck barges being unloaded by inclination or capsizing method a guard rail may be dispensed with provided that through passage is provided under the deck.

26.2.2.8.3.4 The upper edge of the waist bar shall be raised above the deck for at least 100 mm. The waist bar shall not impede water drainage from the deck.

26.2.2.8.3.5 In places of interruption of the bulwark and the guard rail (the deck machinery area, ladder flights, etc.) removable chain rails shall be provided.

26.2.2.8.3.6 Clearances (gaps) between guard rails as well as between railings and other structures of a ship shall not exceed 150 mm.

26.2.2.8.3.7 Design of removable rigid or flexible guard rails shall provide their quick removal. In case of flexible guard rails (chain, rope) the possibility to tighten rails shall be provided.

26.2.2.8.3.8 In people passages, the chain railings may be used only. Length of such railing (distance between stays) shall not exceed one meter. The maximum sagging of chain guard rail shall not exceed 40 mm.

26.2.2.8.4 Handrails, gangways, companionways.

26.2.2.8.4.1 Ladders shall be fitted with railings and handrails of a height not less than required by the Rules.

26.2.2.8.4.2 Where a passage is provided along the deck extension, handrails shall be fitted on outer walls of the superstructures.

26.2.2.8.4.3 On oil tankers of areas of navigation **RN(SCI)** and **RN(SCII)** between separate accommodation spaces and service spaces as well as in order to provide the crew with safe access to the fore part of the ship in any operating conditions gangways shall be provided raised above the deck. The gangways shall:

.1 be at least 1 m wide and be located in way of the centre line;

.2 be fitted with handrails at least 1,1 m high with stanchions not more than three spacings apart;

.3 have side entries from the deck not more than 40 m apart from each other.

When the open deck is extended for more than 70 m, shelters of practicable design shall be arranged along the entire length of the gangways at intervals not more than 45 m apart from each other.

Each shelter shall be sufficient for at least one person and shall protect him/her against bad weather.

Appendix 1 (mandatory)

Calculation Method for Hydrodynamic Loads, Bending Moments, Shear Forces and Support Reaction Forces Acting in the Stock - Rudder System

1. This Appendix establishes the method for accounting for a non-uniform nature of hydrodynamic load distribution over the height of ship's rudders and calculation methods for

bending moments, shear forces and support reaction forces acting in the stock - rudder system.

2. Hydrodynamic loads (resultant of hydrodynamic forces and torque) acting on the rudder shall be determined based on experimental or calculation results for all possible range of rudder angles.

3. When calculating hydrodynamic forces acting on the rudder within the propeller jet or steerable nozzle, the effects of the ship's hull and propeller jet shall be taken into account.

4. When determining hydrodynamic forces acting on the rudder within the propeller jet or steerable nozzle experimentally, the compliance between load factors for model and full-scale propeller shall be ensured

$$C_T = {8T_p}\Big/{(\rho V_A^2 \pi D^2)} \tag{4}$$

where T_p = propeller thrust, in kN;
ρ = water density, in t/m^3;
V_A = propulsion and steering system inflow velocity, in m/s;
$V_A = V(1 - W_T)$
V = design speed of a ship in loaded condition (for pushers – together with the convoy), in m/s;
W_T = wake factor for straight motion of the ship by calculation of propulsion ability;
D = propeller diameter, in m.

5. Bending moments, shear forces and support reaction forces acting in the stock-rudder system shall be calculated according to methods shown in Figs. 5-1 — 5-3.

Calculation shall be performed for such combination of hydrodynamic loads when the stock is subject to maximum equivalent stresses defined in accordance with 1.5.1 of Part III "Equipment, Arrangements and Outfit".

Maximum unit load intensity q, in kN, shall be calculated by the following formula:

$$q = R/\{l_{10}[(0{,}45D/l_{10} - 0{,}975)f + 0{,}95]\} \tag{5-1}$$

where D = propeller diameter, in m;
l_{10} — l_{60} = lengths of steering gear elements (refer to Figs. 5-1 — 5-3), in m;
R = resultant force on a rudder, in kN;
f = coefficient considering non-uniformity of load distribution for suspended rudders and rudders with support on sternframe heel determined by Table 5 depending on load factor C_T and relative height of the part of the rudder protruding from the jet (l_{10} - D)/l_{10}.

Table 5

Coefficient considering non-uniformity of load distribution f

(l_{10} - D)/l_{10}	f at C_T				
	0	2	6	12	>25
0	0,000	0,133	0,196	0,226	0,256
0,1	0,000	0,226	0,326	0,373	0,418
0,2	0,000	0,315	0,447	0,506	0,561
0,3	0,000	0,435	0,597	0,664	0,722
0,4	0,000	0,540	0,715	0,779	0,827
0,5	0,000	0,631	0,801	0,850	0,876
0,6	0,000	0,707	0,856	0,879	0,880

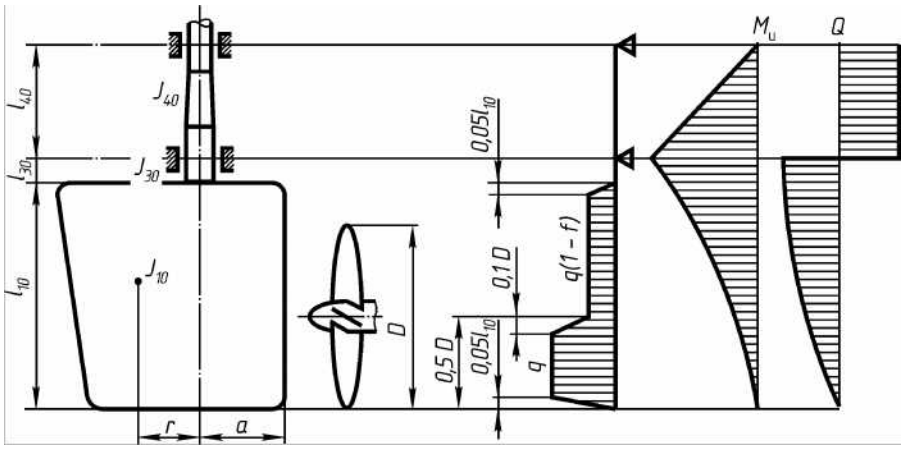

Fig. 5-1
Calculation method for moments, forces and reaction forces acting in the stock – suspended rudder system

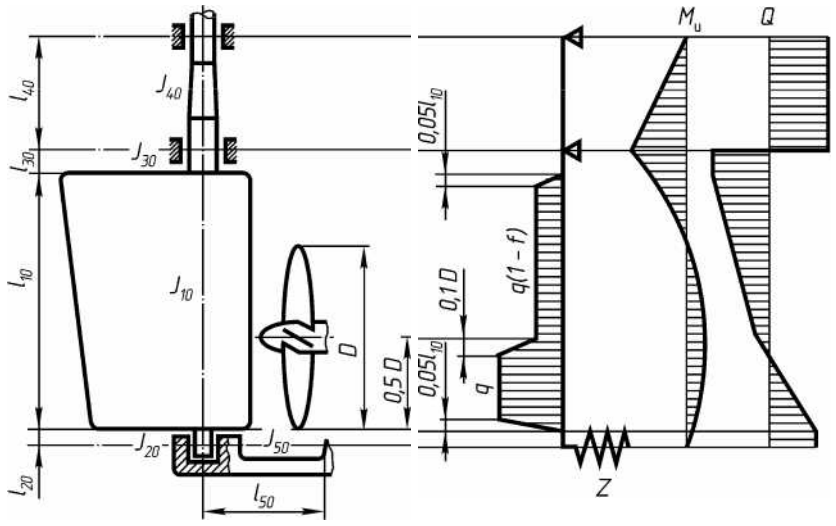

Fig. 5-2
Calculation method for moments, forces and reaction forces acting in the system of stock and rudder with lower support on sternframe heel

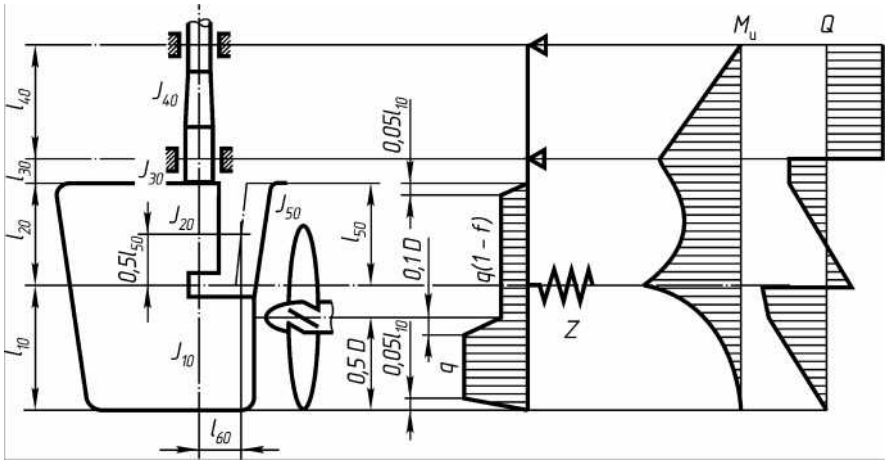

Fig. 5-3
Calculation method for moments, forces and reaction forces acting in the system of stock and rudder with pins on sternframe hinges

For semi-suspended rudders, totally or partially falling into the propeller jet when the ship is moving ahead at $(l_{10} - D)/l_{10}$< 0,4 coefficient considering non-uniformity of load distribution shall be taken

$$f = -1{,}625[(l_{10} - D)/l_{10}]^2 + 1{,}275\,(l_{10} - D)/l_{10} + 0{,}65 \quad (5\text{-}2)$$

For rudders totally beyond the propeller jet, f is taken equal to 0.

Jet diameter is taken equal to propeller diameter.

For rudders downstream of the propeller, for the astern motion of the ship f is taken equal to 0.

Support rigidity factor Z, in kN/m, shall be determined as follows:

for support on sternframe heel

$$Z = 1/u_b; \quad (5\text{-}3)$$

for support in the rudder horn

$$Z = 1/(u_b + u_5 + u_t) \quad (5\text{-}4)$$

where u_b = displacement of the support due to bending when the force of 1 kN is applied to the support centre:
$u_b = l_{50}^5 \cdot 10^3/(3EJ_{50})$;
u_5 = displacement of the support due to shear when the force of 1 kN is applied to the support centre:
$u_5 = l_{50} \cdot 10^3/(GF)$;
u_t = displacement of the support due to horn torsion when the force of 1 kN is applied to the support centre:
$u_t = l_{50}l_{60}^2 \cdot 10^3/(GJ_t)$;
E = Young's modulus of the horn and sternframe heel material, in MPa;
G = shear modulus of horn material, in MPa;
F = average cross-sectional area of the rudder horn, in m^2;
J_t = average polar moment of inertia of cross-sectional area of the rudder horn, in m^4;
J_{10} — J_{50} = moments of inertia of appropriate sections of steering gear elements, in m^4.

Where a bending moment applied to the rudder stock is determined experimentally, the idealized law of load distribution over height as shown in Figs. 5-1 — 5-3 may be neglected.

6. When the lateral force from the steering drive is transmitted to the rudder stock, this force and corresponding bending moments shall be taken into account when stock strength is calculated.

7. When calculating the height of the plain bearing sleeve, assumed design reaction from the rudder stock bearing b_h, in kN, for suspended rudder and rudder with lower support on sternframe heel shall be not less than determined by the formula:

$$B_{low} = [R(\eta l_{10} + l_{30} + l_{40}) - B_{str}(l_{10} + l_{20} + l_{30} + l_{40})]/l_{40}; \quad (7)$$

where η = non-dimensional arm of bending moment (Table 7).

Table 7

Non-dimensional arm of bending moment η

$(l_{10}$ - $D)/l_{10}$	η at C_T				
	0	2	6	12	>25
0,0	0,50	0,52	0,53	0,54	0,54
0,1	0,50	0,54	0,55	0,56	0,57
0,2	0,50	0,55	0,58	0,59	0,60
0,3	0,50	0,57	0,61	0,63	0,65
0,4	0,50	0,60	0,64	0,67	0,69
0,5	0,50	0,62	0,68	0,71	0,74
0,6	0,50	0,64	0,71	0,75	0,78

B_{str} shall be taken in accordance with 8, for suspended rudders, B_{str} = 0.

Element lengths l_{10}, l_{30}, l_{40} shall be determined in accordance with Figs. 5-1 and 5-2.

For the rudders with lower support on sternframe heel, calculation for η = 0,5 shall be additionally performed.

8. Reaction force in the sternframe heel, in kN, shall be determined by formula (8), where R is a yield point of the stock material, in MPa.

$$B_{str} = \frac{R(\eta l_{10}+l_{30})^3\left\{1+1{,}5\frac{l_{10}-\eta l_{10}+l_{20}}{\eta l_{10}+l_{30}}+l_{40}J_{10}\left(1+\frac{l_{10}-\eta l_{10}+l_{20}}{\eta l_{10}+l_{30}}\right)/[J_{40}(\eta l_{10}+l_{30})]\right\}}{\frac{J_{10}l_{10}^3}{J_{50}}+(l_{10}+l_{20}+l_{30})^3+\frac{l_{40}J_{10}(l_{10}+l_{20}+l_{30})^2}{J_{40}}} \quad (8)$$

26.2.3 Stability, subdivision, freeboard.

26.2.3.1 Stability.

The requirements for stability specified in this Section shall apply instead of requirements in 2.1, 2.2 and 2.3 of Part IV "Stability".

Definitions and explanations specified in this Section are given in Part IV "Stability".

26.2.3.1.1 Stability criteria K.

26.2.3.1.1.1 The ship stability is considered sufficient by the criterion K, when it withstands dynamically applied wind pressure, i.e. the following condition is met:

$$K \geq \frac{M_{al}}{M_h}, \quad (26.2.3.1.1.1)$$

where M_h = heeling moment due to dynamic wind pressure, in t·m, determined according to 26.2.3.1.1.2;
M_{al} = allowable moment, in t·m, determined in accordance with 26.2.3.1.1.4.

26.2.3.1.1.2 The heeling moment applied to a ship due to the dynamic wind pressure, in t·m, is calculated by the formula:

$$M_h = 0{,}001 p_v A_v z_h / g \quad (26.2.3.1.1.2)$$

where p_v = wind pressure, in Pa, determined in accordance with 26.2.3.1.1.3;
z_h = heeling lever arm, in m, determined in accordance with 26.2.3.1.1.4;
A_v = windage area, in m^2, determined in accordance with 1.4.6 of Part IV "Stability".

26.2.3.1.1.3 The wind pressure p_v, in Pa, shall be taken from Table 26.2.3.1.1.3.

Table 26.3.3.1.1.3

Distance from the windage center to the plane of the waterline of floatation, m	Wind pressure p_v, Pa, for ships of area of navigation	
	Restricted **RN(SCI)**	Restricted **RN(SCII)**
0.5	177	157
1.0	196	177
1.5	216	196
2.0	235	216
2.5	255	235
3.0	265	245
4.0	284	265
5.0	304	284
6.0	324	304

26.2.3.1.1.4 The heeling lever arm z, in m, is calculated by the formula:

$$z_h = z + a_1 a_2 T \quad (26.2.3.1.1.4)$$

where z = distance from the windage center to the plane of the waterline of floatation, in m;
a_1, a_2 = coefficients determined in accordance with 26.2.3.1.1.5;
T = ship draught, in m.

26.2.3.1.1.5 Values of coefficients a_1 and a_2 are determined in accordance with Tables 26.2.3.1.1.5-1 and 26.2.3.1.1.5-2.

Table 26.2.3.1.1.5-1

B/d	a_1
≤2,5	0,40
3,0	0,41
4,0	0,46
5,0	0,60
6,0	0,81
7,0	1,00
8,0	1,20
9,0	1,28
≥10	1,30

Table 26.2.3.1.1.5-2

z_g/B	a_2
0,15	0,66
0,20	0,58
0,25	0,46
0,30	0,34
0,35	0,22
0,40	0,10
>0,45	0

26.2.3.1.1.6 The allowable moment M_{all} , in t·m, is determined by the allowable heeling angle.

26.2.3.1.1.7 The allowable heeling angle θ_{al} shall be taken equal to either the capsizing angle θ_{cap} or the angle of down-flooding θ_f, whichever is less.

26.2.3.1.1.8 In order to determine the moment M_{all} the value of rolling amplitude, θ_m, calculated in accordance with the requirements of 26.2.3.1.1.12-18 is plotted to the left from the point of origin (Figs. 26.2.3.1.1.9 and 26.2.3.1.1.10) and corresponding point A is fixed in the left leg of the curve.

26.2.3.1.1.9 For determination of the allowable moment M_{all1} corresponding to the capsizing angle θ_{cap}, tangent line AK to the right leg of the curve of arms is drawn from the point A (refer to Fig. 26.2.3.1.1.9).

An abscissa of the point of contact K defines the capsizing angle. Further, a line parallel to abscissa axis is drawn via the point A, and segment AB equal to 1 rad (57,3°) is laid.

A perpendicular is conducted from point B up to intersecting tangent line AK in a point E.

Segment BE presents the numerical value of the arm l_{al1}, of the allowable moment corresponding to the capsizing angle. The allowable moment M_{al1}, in t·m, is calculated by the formula:

$$M_{al1} = \Delta \cdot l_{al1} \qquad (26.2.3.1.1.9)$$

where Δ = ship displacement, in t;

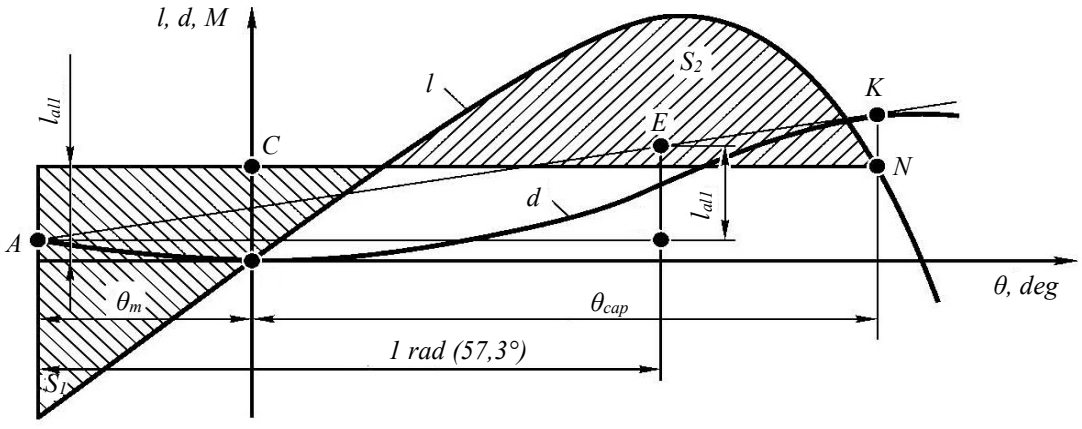

Fig. 26.2.3.1.1.9

26.2.3.1.1.10 For determination of allowable moment M_{al2} corresponding to the angle of down-flooding θ_f, a value of the angle of down-flooding θ_f is plotted on the curve's X axis (refer to Fig. 26.2.3.1.1.10) and a perpendicular is drawn from the obtained point up to intersecting the curve of arms in a point F.

Further plotting on the curve are performed by the same way as stated in 26.2.3.1.1.9, except that instead of the tangent line to the curve, a secant line AF is conducted to intersecting, in point E with perpendicular BE, constructed to segment AB equal to 1 radian.

The segment BE is equal to the arm l_{al2} of the allowable moment corresponding to the angle of down-flooding. The allowable moment M_{al2}, in t·m, is calculated by the formula:

$$M_{al2} = \Delta \cdot l_{al2} \qquad (26.2.3.1.1.10)$$

where Δ = ship displacement, in t;

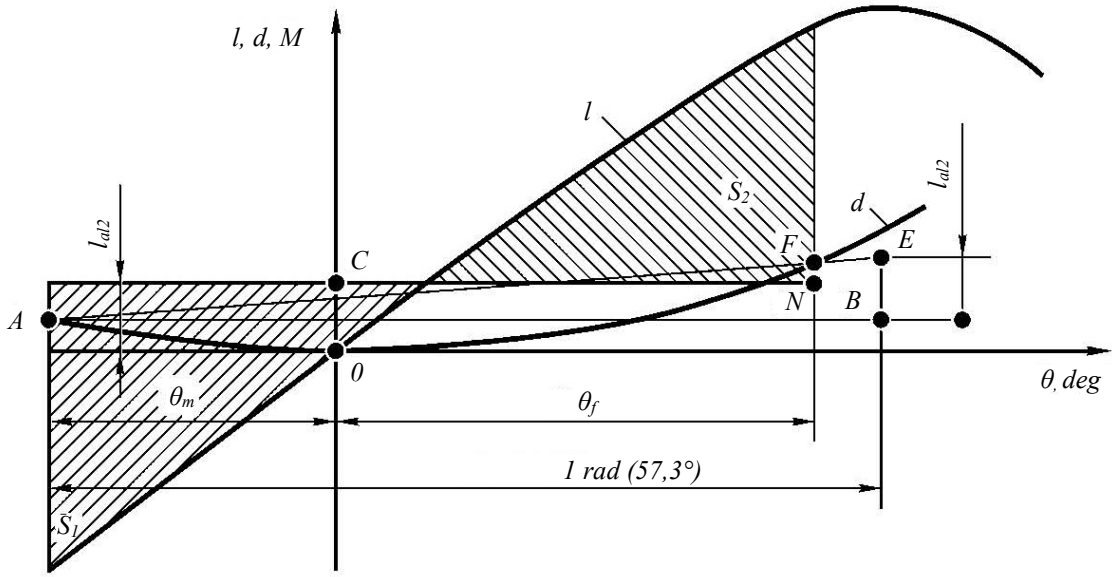

Fig. 26.2.3.1.1.10

26.2.3.1.1.11 The arms l_{al1} and l_{al2} of the allowable moment may be determined according to the static stability curve as a result of plottings shown on Figs. 26.2.3.1.1.9 and 26.2.3.1.1.10, formed based on equality of areas S_1 and S_2.

Segments OC shown on Figs. 26.2.3.1.1.9 and 26.2.3.1.1.10 represents arms l_{al1} and l_{al2} accordingly.

26.2.3.1.1.12 Rolling amplitudes θ_m, in deg, for ships with a rounded bilge and without bilge keels or bar keel shall be taken from Table 26.2.3.1.1.12 depending on frequency m, in s^{-1}, calculated by the formula

$$m = m_1 m_2 m_3 \qquad (26.2.3.1.1.12)$$

where m_1, m_2, m_3 = coefficients determined in accordance with 26.2.3.1.1.14 — 26.2.3.1.1.15;

Table 26.2.3.1.1.12

m, in s^{-1}	Rolling amplitude θ_m, in deg, for ships of the area of navigation	
	RN(SCI)	**RN(SCII)**
0,40	14°	9°
0,60	18°	10°
0,80	24°	13°
1,00	28°	17°
1,20	30°	20°
1,40	31°	23°

m, in s^{-1}	Rolling amplitude θ_m, in deg, for ships of the area of navigation	
	RN(SCI)	**RN(SCII)**
1,60	31°	24°
≥1,80	31°	24°

26.2.3.1.1.13 For the ships with sharp bilges the rolling amplitude shall be taken equal to 0,75 of the values taken from Table 26.2.3.1.1.12.

26.2.3.1.1.14 The coefficient m_1 shall be determined by the formula:

$$m_1 = {m_0}\Big/{\sqrt{h_0}}, \qquad (26.2.3.1.1.14)$$

where h_0 = non-corrected metacentric height, in m;

m_0 = coefficient taken from Table 26.2.3.1.1.14 depending on parameter n_1, determined by the formula;

$$n_1 = {h_0 B}\Big/{(z_g \sqrt[3]{V})}$$

where B = breadth at the waterline, in m;

z_g = vertical center of gravity;

V = ship's volume displacement, in m^3.

Table 26.2.3.1.1.14

n_1	m_0
≤0,10	0,42
0,15	0,52
0,25	0,78
0,50	1,38
0,75	1,94
1,00	2,40
1,50	3,00
2,00	3,30
2,50	3,50
≥3,00	3,60

26.2.3.1.1.15 The values of coefficients m_2 and m_3 are determined according to Tables 26.2.3.1.1.15-1 and 26.2.3.1.1.15-2.

Table 26.2.3.1.1.15-1

B/d	m_2
≤2,50	1,00
3,00	0,90
3,50	0,81
4,00	0,78
5,00	0,81
6,00	0,87
7,00	0,92
8,00	0,96
9,00	0,99
≥10,00	1,00

Table 26.2.3.1.1.15-2

δ	m_3
≤0,45	1,00
0,50	0,95
0,55	0,86
0,60	0,77

δ	m_3
0,65	0,72
0,70	0,69
0,75	0,67
≥0,80	0,66

26.2.3.1.1.16 Rolling amplitude θ'_m, in deg, for the ships with bilge keels and/or bar keel is determined by the formula:

$$\theta'_m = k\theta_m, \qquad (26.2.3.1.1.16)$$

where θ_m = rolling amplitude for ship without keels determined according to 26.2.3.1.1.12 — 26.2.3.1.1.13;
k = coefficient determined in accordance with Table 26.2.3.1.1.16 depending on parameter q calculated by the formula

$$q = r\alpha\sqrt{B}$$

where B = ship's breadth at the waterline, in m;
α = waterplane coefficient for waterline;
r = coefficient determined according to 26.2.3.1.1.17.

Table 26.2.3.1.1.16

q	k
0	1,00
1,00	0,95
2,00	0,85
3,00	0,77
4,00	0,72
5,00	0,68
6,00	0,65
7,00	0,63
≥8,00	0,62

26.2.3.1.1.17 The coefficient r shall be determined by the formula:

$$r = (r_1 + r_2)r_3 \qquad (26.2.3.1.1.17)$$

where r_1, r_2, r_3 = coefficients determined in accordance with 26.2.3.1.1.18.

26.2.3.1.1.18 The coefficient r_1 shall be adopted from Table 26.2.3.1.1.18-1 proceeding from the $100A_k/L_{wl}B$ ratio in which A_k denotes the total area, in m^2, of bilge keels or the lateral projected area of the bar keel, or the sum of both areas.

Table 26.2.3.1.1.18-1

$100A_k/L_{wl}B$	0,70	1,0	1,5	2,0	2,5	3,0	3,5	≥4,0
r_1	0,14	0,24	0,44	0,68	0,94	1,20	1,48	1,66

The coefficients r_2 and r_3 shall be taken from Tables 26.2.3.1.1.18-2 and 26.2.3.1.1.18-3.

Table 26.2.3.1.1.18-2

δ	r_2
≤0,45	0
0,50	0,06
0,55	0,18
0,60	0,35
0,65	0,51
0,70	0,65
0,75	0,71
0,80	0,68
≥0,85	0,64

Table 26.2.3.1.1.18-3

B/d	r_3
≤2,50	1,40
3,00	1,48
4,00	1,58
5,00	1,83
6,00	2,00
7,00	2,13
8,00	2,34
9,00	2,50
≥10,0	2,60

26.2.3.1.2 The righting level curve for ships of the restricted area of navigation **RN(SCI)** shall satisfy the following criteria:

.1 the righting lever shall be not less than 0,25 m for ships with $L \leq 80$ m and 0,20 m for ships with $L \geq 105$ m at an angle of heel greater than 25°. For intermediate values of L, the lever value shall be obtained by linear interpolation;

.2 the angle of vanishing of the righting lever curve θ_v and the angle of down-flooding θ_f shall be not less than 50°.

26.2.3.1.3 For all cargo ships with windage centre of 2 m above the waterline, stability shall be checked as per the following condition

$$M_w < M_{al} \qquad (26.2.3.1.3)$$

where M_w = heeling moment due to static effect of wind, in kN·m, determined according to 26.2.3.1.4;
M_{al} = allowable moment, in kN·m, determined according to the static stability curve depending on the value of angle θ_{al}, taken equal to $0{,}8\theta_f$ or open deck edge entrance angle, whichever is less.

26.2.3.1.4 The heeling moment due to static effect of wind M_w, in kN·m, is determined by the formula:

$$M_w = 0{,}001 p A_v (z - a_3 d) \qquad (26.2.3.1.4)$$

where p = static wind pressure, in Pa, which shall be taken equal to 0,47 of the wind pressure determined according to Table 26.2.3.1.1.3;
A_v = windage area, in m^2, determined in accordance with 1.4.6 of Part IV "Stability";
z = height of the centre of windage above the base plane;
a_3 = factor determined according to Table 26.2.3.1.4;
d = draught of a ship, in m.

Table 26.2.3.1.4

B/d	a_3
≤2,50	0,73
3,00	0,50
4,00	-0,27
5,00	-1,27
6,00	-2,33
7,00	-3,38
9,00	-5,40
8,00	-4,45
≥10,00	-6,00

26.2.3.1.5 For cargo ships where the parameter P_e/V in which P_e is a power, in kW, and V is ship displacement, in m^3, exceeds 0,735, the stability on turn shall be checked, i.e. the condition shall be met

$$M_c < M_{al} \qquad (26.2.3.1.5)$$

where M_c = heeling moment, in kN·m, applied to a ship at turn determined according to 26.2.3.1.6;
M_{al} = allowable moment, in kN·m, determined according to the static stability curve depending on the angle θ_{al}, taken equal to deck entrance angle or entrance angle of waterline laying 75 mm below the edges of free-flooding openings, whichever is less.

26.2.3.1.6 The heeling moment applied to a ship on account of turning M_c, in kN·m, shall be calculated by the formula:

$$M_c = 0{,}2\frac{v^2 \cdot \Delta}{L_{wl}}\left(z_g - \frac{a_3 \cdot d}{2}\right) \qquad (26.2.3.1.6)$$

where v_0 = ship's speed before entering the turn taken equal to 0,8 of full ahead speed on a straight course, in m/s;
Δ = displacement, in t;
L_{wl} = length of ship on the waterline, in m;
a_3 = factor determined according to Table 26.2.3.1.4.

26.2.3.2 Subdivision.

Definitions and explanations specified in this Section are given in Part V "Subdivision".

26.2.3.2.1 Forepeak, afterpeak and engine room on all the ships shall be enclosed by watertight bulkheads.

26.2.3.2.2 For floodability calculations, the dimensions of the side and bottom damages shall be taken according to 26.2.3.2.3 and 26.2.3.2.4. A rectangular parallelepiped is assumed as a form of damage.

26.2.3.2.3 The dimensions of the hull side damages shall be taken as follows:

.1 length of damage: 4 % of the ship's length L;

.2 transverse extent measured from the inner surface of the outer plating at right angles to the centre plane: 0,075 B or 0,9 m whichever is less;

.3 vertical extent: from the base line upwards without limit.

26.2.3.2.4 The following extent of bottom damage shall be assumed:

.1 length of damage: 4 % of the ship's length L;

.2 transverse extent: 0,1 B;

.3 vertical extent: from the base plane 0,05 B or 0,8 m whichever is less.

26.2.3.2.5 When ship's damage of extent less than specified in 26.2.3.2.3 and 26.2.3.2.4, may worsen damage trim and/or damage stability, this variant of damage shall be considered when making checking floodability calculations.

26.2.3.2.6 If the distance between two adjacent transverse watertight bulkheads is less than the dimensions of the damage specified in 26.2.3.2.3 and 26.2.3.2.4, then the respective compartment shall be added to any of the adjacent compartments at the discretion of the designer during the damage stability check. In this case for all compartments of the hull the damage mid-length shall be assumed at the compartment mid-length. The forepeak and afterpeak shall be considered as separate compartments.

26.2.3.2.7 In checking floodability calculations the design volume of flooded compartments shall be taken with due consideration of volume permeability coefficient of each room of the compartment which shall be taken for all ships as equal to:

double-side and double-bottom compartments, ballast tanks, empty non-refrigerated holds, free under-deck compartments of flush deck ships	0,98
accommodation and passenger spaces, dry forepeak and afterpeak compartments, spaces occupied by empty vehicles	0,95
empty refrigerated holds	0,93
engine rooms of medium and large ships (L > 40 m)	0,85
engine rooms of small ships (L < 40 m)	0,80
spaces occupied by general cargoes, ship's stores	0,60
holds occupied by cargoes in bulk, including coal	0,55
holds occupied by timber cargo	0,35
holds occupied by flour or cement in bags	0,25

26.2.3.2.8 For compartments that include spaces of different purpose, the volume permeability coefficient shall be calculated by the formula:

$$k_v = k_{vi}V_i/\sum V_i,$$

where V_i = total theoretical volume of separate rooms in the compartment;
k_{vi} = volume permeability coefficient taken with due regard of the purpose of those rooms.

26.2.3.2.9 The surface permeability coefficients k_s used when calculating the areas, static moments and inertia moments of the lost waterline area in flooded compartment for the purpose of taking into account the cargo, machinery, equipment etc., in way of the damaged waterline, shall generally be adopted equal to volume permeability coefficients in accordance with 26.2.3.2.7. For rooms not occupied by cargo, machinery and equipment in way of the damaged waterline, the surface permeability coefficients shall be adopted equal to the arithmetic mean of unity and the volume permeability coefficient.

26.2.3.2.10 The requirements of the Rules for floodability of ships shall be considered met, if at flooding the compartments specified in 26.2.3.2.11:

.1 margin line is not immersed;

.2 lower edges of free-flooding openings through which overboard water may spread to non-damaged compartments are located before righting above the damage waterline at least:

for passenger ships, crew boats, special purpose ships and non-passenger ships carrying organized groups of people with a length of ≥ 25 m — 0,3 m;

for ships of area of navigation **RN(SCI)** except those specified above, as well as passenger ships, crew boats, special purpose ships and non-passenger ships carrying organized groups of people not more than 12 persons with a length of < 25 m — 0,15 m;

for other ships — 0,075 m.

.3 heeling angles before and after righting do not exceed the values specified in 26.2.3.2.16 and 26.2.3.2.17;

.4 damage stability complies with the requirements of 26.2.3.2.18 and 26.2.3.2.19.

26.2.3.2.11 The requirements for floodability shall be provided at flooding:

.1 the forepeak and afterpeak individually;

.2 each compartment individually – for passenger ships and ships carrying organized groups of people and specific personnel more than 12 persons; ice breakers; self-propelled flush deck ships; manned reinforced concrete ships of 25 m in length and over;

.3 the forepeak and afterpeak individually in one hull or both hulls, for catamarans;

.4 the forepeak and afterpeak individually in one skeg and in both skegs simultaneously, for skeg type hovercraft;

.5 each two adjacent compartments adjoining to the board or transom, for all unmanned reinforced concrete ships of 25 m in length and over;

.6 each compartment individually in the dredge cut area, for bucket dredges.

26.2.3.2.12 At floodability calculations, flooding of the machinery space shall be taken into account irrespective of the requirement on providing floodability at flooding the machinery space.

26.2.3.2.13 When designing ships, the damage waterline and damage stability shall be checked by calculations at flooding of each compartment individually with submitting the calculations to the Register. The calculation results shall be stated in the Information on Damage Stability.

26.2.3.2.14 When checking the ship's floodability at flooding the compartments, the parameters of damage trim and stability shall be determined by constant displacement method.

26.2.3.2.15 For passenger ships, damage stability shall be checked on the assumption that all the passengers are crowding on the uppermost decks they are permitted to be. The distribution of passengers shall be assumed according to 3.1.6 — 3.1.8 of Part IV "Stability".

26.2.3.2.16 In the final stage of unsymmetrical flooding before the righting measures, the heeling angle shall not exceed:

for passenger ships 15°;
for non-passenger ships 20°.

26.2.3.2.17 For unsymmetrical flooding after the righting measures, the heeling angle shall not exceed:

for passenger ships 7°;
for non-passenger ships 12°.

26.2.3.2.18 Transverse metacentric height determined by the constant displacement method shall be at least 0,05 m in the final stage of flooding for stable equilibrium state at

symmetrical flooding and for non-inclined position at unsymmetrical flooding, before appropriate measures to increase the metacentric height are taken.

26.2.3.2.19 The static stability curve of a damaged ship shall have a sufficient positive lever arm section. In the final stage of flooding and after righting, for all the ships other than non-self-propelled flush deck ships, the following shall be provided:

.1 the maximum lever arm of the static stability curve of not less than 0,1 m;

.2 the length of the positive arm section of the damage stability curve to the angle of down-flooding is at least 30° at symmetrical flooding and at least 20° at unsymmetrical flooding.

For non-self-propelled flush deck ships, these norms are recommended.

26.2.3.2.20 Calculations to conform compliance with the requirements for damage trim and stability shall be performed for such a number of loading conditions to be encountered in service and being the most unfavourable from the point of view of trim and stability, that, proceeding from those calculations, one could assure that in all other cases the damaged ship would be in a better condition as regards damage trim and stability established by these Rules. Besides, the following shall be considered: the actual configuration of damaged compartments, type of covers, whether longitudinal bulkheads and partitions are provided sufficiently watertight as to render the flow of water through the ship completely or temporarily impossible.

26.2.3.3 Freeboard and load line.

26.2.3.3.1 Freeboard height for ships with sheer taken according to Table 26.2.3.3.10 and coaming heights taken according to Table 26.2.2.6.1 shall be set according to Tables 26.2.3.3.1-1 and 26.2.3.3.1-2.

In this case the tabular values are increased by 1/48 of the respective draught in fresh water.

Table 26.2.3.3.1-1

Tabular freeboard height for self-propelled and non-self-propelled ships except for tankers and flush deck ships

Ship length, in m	Freeboard height H_{fb}, in mm	
	RN(SCII)	**RN(SCI)**
≤30	85	140
40	100	160
50	115	180
60	130	200
70	150	235
80	170	270
90	190	305
100	210	340
110	230	375
120	260	410
≥130	290	450

Table 26.2.3.3.1-2

Tabular freeboard height for tankers and flush deck ships

Ship length, in m	Freeboard height H_{fb}, in mm	
	RN(SCII)	**RN(SCI)**
≤30	60	110
40	70	125
50	80	140
60	90	155
70	100	170
80	120	200
90	140	230
100	160	260
110	180	290
120	200	325
≥130	220	360

26.2.3.3.2 Minimum freeboard is determined by increasing the tabular freeboard determined according to 26.2.3.3.1 by the following corrections in accordance with the maximum values specified in 26.2.3.3.3.

26.2.3.3.3 The freeboard height as obtained from Tables 26.2.3.3.1-1 and 26.2.3.3.1-2, shall be corrected as follows:

.1 for the ships with the B/T < 4,5, the tabular freeboard height, in mm, shall be increased by the correction value calculated by the formula:

$$\Delta H_{B/T} = 0{,}49L(4{,}5 - B/T); \qquad (26.2.3.3.3.1)$$

.2 for the ships with block coefficient δ > 0,75, the tabular freeboard height, in mm, shall be increased by the correction value calculated by the formula:

$$\Delta H_{\delta} = (18{,}2L + 17(4{,}5 - \frac{B}{T})) \cdot (\delta - 0{,}75). \qquad (26.2.3.3.3.2)$$

If B/T ≥ 4,5, in the formula (26.2.3.3.3.2) the B/T ratio shall be taken equal to 4,5;

.3 for the ships with the length to breadth ratio L/B < 5,5, the tabular freeboard height, in mm, shall be increased by the correction value calculated by the formula:

$$\Delta H_{L/B} = 2{,}71L(5{,}5 - \frac{L}{B}) \qquad (26.2.3.3.3.3)$$

26.2.3.3.4 If the sheer or dimensions of the forecastle and poop are different from the values specified in 26.2.3.3.10 and 26.2.3.3.11, the freeboard height shall be increased by a value that provides compliance with two following conditions:

.1 buoyancy reserve shall be not less than that determined for the ships with sheer specified according to 26.2.3.3.10 or with forecastle and poop;

.2 static moments of volumes, which result from the extended freeboard height relative to the midship plane, shall be not less than static moments of volumes for the ships with sheer determined according to 26.2.3.3.10 or with forecastle and poop.

26.2.3.3.5 If the coaming height is less than that specified in the requirements in 26.2.2, the minimum freeboard height shall be increased by the difference between the tabular and the actual coaming heights.

The minimum height of coaming of hatches located on the open decks shall be at least 100 mm.

Decrease of the freeboard height as compared with the value stated in 26.2.3.3.2 due to the increase of the coaming height is not allowed.

The coaming's heights of other hatches may be less than tabular heights without correction of the freeboard height, if the hatch covers comply with the requirements in 26.2.2.

26.2.3.3.6 The cargo platform guard of the flush deck ship shall be designed to prevent washing of the bulk cargo. The sum of the guard height and the freeboard height shall be at least one half of the wave height corresponding to the basin category where the ship operates.

26.2.3.3.7 For dredgers the freeboard height shall be determined in a similar manner as for the closed ships.

26.2.3.3.8 For the cargo ships loaded by hydromechanization means, the freeboard height shall be calculated in a similar manner as for the tankers. While substantiating the possibility of transporting other types of cargo on these ships the freeboard height shall be assigned as for the open ships.

26.2.3.3.9 On ships of area of navigation **RN(SCI)**, with the freeboard height to the forecastle deck in the fore perpendicular area (and in absence of the forecastle, to the freeboard deck) less than the sum of the minimum freeboard height amidships and sheer, the ordinate values of which are specified in this Section, it is recommended to fit the bulwark in the bow.

26.2.3.3.10 The sheer line of ships without forecastle and poop shall be taken as a broken line with ordinates on fore and aft perpendiculars taken according to Table 26.2.3.3.10, and ordinates at points located 0,15 of the ship's length apart from the fore perpendicular and 0,07 of the ship's length apart from the aft perpendicular being equal to 0.

The sheer ordinates shall be measured from a horizontal line coinciding with the upper edge of the deck line.

Table 26.2.3.3.10

Sheer ordinate values

Ship length, in m	Sheer ordinates, in mm			
	RN(SCI)		**RN(SCII)**	
	Bow	Stern	Bow	Stern
≤30	1000	500	550	275
40	1000	500	600	300
60	1000	500	700	350
80	1000	500	800	400
100	1100	550	900	475
120	1200	600	1050	525
130	1300	650	1100	550
Note. Sheer ordinates for the tankers are taken according to this Table with lowering the area of navigation, i.e. for the ships of area of navigation **RN(SCI)** ordinates of the ships of area of navigation **RN(SCII)** are taken.				

26.2.3.3.11 The sheer specified in 26.2.3.3.10 is not required, if the following conditions are met:

.1 the forecastle height above the deck shall be at least: for the ships of area of navigation **RN(SCI)** — 1000 mm, for the ships of area of navigation **RN(SCII)** — 900 mm;

.2 the forecastle length not less than 0,07 of the ship's length;

.3 the poop height above the deck not less than one half of the forecastle height;

.4 the poop length not less than 0,03 of the ship's length but not less than 2 m.

The ships of area of navigation **RN(SCI)** with sheer without forecastle, a bulwark with a length equal to the length of the forecastle determined according to 26.2.3.3.11.2 shall be fitted in the forward end.

Ships without sheer and poop at stern shall be fitted with a bulwark of the same length, but not less than 2 m.

26.2.3.3.12 Load line mark and marks applied together with the load line mark for ships with the assigned freeboard (minimum and greater than minimum) shall be marked in accordance with 2.1.2 and 2.1.3 of the Load Line Rules for Sea-Going Ships.

26.2.3.3.13 Outlet openings of piping when located in sides below the freeboard deck shall be arranged according to the requirements of 26.2.6.

26.2.3.3.14 Covers on sea chests and ice boxes shall be watertight.

The upper edge of openings of the specified items shall be above the maximum draught line not less than by 150 mm.

26.2.3.3.15 All openings in the freeboard deck on oil tankers and flush deck ships shall be fitted with strong watertight covers.

26.2.4 Fire protection.

26.2.4.1 The ships of areas of navigation **RN(SCI)** and **RN(SCII)** shall meet the requirements of Part VI "Fire Protection".

26.2.5 Machinery Installations.

26.2.5.1 General.

The requirements of this Section apply to ship's machinery installations, equipment of machinery spaces, shafting lines, propellers, machinery condition monitoring systems, spare parts and active means of the ship's steering in accordance with the requirements of Part VII "Machinery Installations", including requirements applicable to river-sea navigation ships, in so much as applicable and sufficient, unless provided otherwise.

26.2.5.2 Applied fuel.

On the specified ships the following types of fuel may be used:

.1 liquid fuel with closed-cup vapour flash point not less than 60 °C;

.2 liquid fuel with closed-cup vapour flash point not less than 40 °C — in order to provide operation of generator driving motors, being part of emergency power supply sources, as well as to provide operation of main and auxiliary engines and boilers of different purposes installed on ships the operation of which is allowed in restricted areas with climate conditions under which the temperature in the spaces where the fuel is stored and used is at least 10 °C lower that the vapour flash point. In such cases measures shall be taken to provide temperature monitoring and control in the above spaces;

.3 gasoline to provide operation of main engines (inboard and outboard) of small craft and rescue boats, as well as for portable fire and bilge pumps for all ships except for oil tankers and ships carrying flammable products.

26.2.5.3 Control devices and stations. Means of communication.

Control devices and stations and means of communication shall comply with the requirements of Section 3 in Part VII "Machinery Installations" except for 3.3.1 on obligatory installation of engine-room telegraph for communication between the navigation bridge and the position in the machinery space or in the control room, from which the speed and direction of thrust of the propellers are normally controlled (for ships having the automation mark in the class notation and length less than 25 m).

26.2.5.4 Machinery spaces, arrangement of machinery and equipment.

Machinery spaces, as well as arrangement of machinery and equipment shall comply with the requirements of Section 4 in Part VII "Machinery Installations", and in this case:

.1 main and auxiliary engines, units and equipment shall be so arranged as to provide passageways from the control stations and servicing flats to the means of escape from the machinery spaces. The width of passageway shall be not less than 600 mm over the whole length. The width of passageway may be reduced locally to 500 mm;

.2 in hydrofoil craft, hovercraft and displacement ships of a length less than 25 m, the width of passageways shall be at least 400 mm;

.3 each machinery space, shafting tunnels and each space where main switchboards are installed (for example, main machinery control room) shall be provided with at least two means of escape, one of which may lead to the adjacent space which has an independent escape route. One of the escapes shall lead directly to the open deck. The means of escape shall be as widely separated as possible. Ladder trunks, where vertical ladders for escape routes are arranged, shall have clear dimensions not less than 600 × 600 mm;

.4 if two adjacent machinery spaces communicate through doors and each of them has only one means of escape to the open deck, these means of escape shall be located at the opposite sides;

.5 cargo pump rooms in oil tankers shall have at least one means of escape leading directly to the open deck;

.6 the second means of escape may be omitted:

from machinery spaces with an area not exceeding 25 m^2, where the existing escape route does not lead to the adjacent machinery or accommodation space;

in ships of less than 25 m in length;

from auxiliary spaces without risk of fire and being enclosed inside the machinery space which has two means of escape;

from enclosed central control stations where main switchboards are not located;

from spaces containing no fuel oil fired engines or incinerators.

26.2.6 Systems and piping.

26.2.6.1 For ships having distinguishing marks **RN(SCI)** and **RN(SCII)** in the class notation the requirements of Part VIII "Systems and Piping" shall apply to the extent applicable for ships of the restricted area of navigation **R3**.

26.2.6.2 The requirements in 7.1.2 — 7.1.5 of Part VIII "Systems and Piping" for the ships of areas of navigation **RN(SCI)** and **RN(SCII)** shall not apply. The bilge system of passenger ships having distinguishing marks **RN(SCI)** and **RN(SCII)** in the class notation shall be provided with at least 3 bilge pumps.

26.2.6.3 The requirements in 8.7 of Part VIII "Systems and Piping" shall not apply to the ships of areas of navigation **RN(SCI)** and **RN(SCII)**, if they are not engaged on the international voyages.

26.2.6.4 The requirements in 12.2.4 of Part VIII "Systems and Piping" may be waived as regards the installation of fixed fire extinguishing systems in the galley ventilation duct for ships of areas of navigation **RN(SCI)** and **RN(SCII)**, if they are not engaged on international voyages.

26.2.6.5 A standby fuel pump required by 13.1.1 of Part VIII "Systems and Piping" may be replaced by a hand pump for ships of areas of navigation **RN(SCI)** and **RN(SCII)**.

26.2.6.6 The requirements in 13.3.5.1 and 13.3.5.3 of Part VIII "Systems and Piping" shall not apply to the ships of areas of navigation **RN(SCI)** and **RN(SCII)**.

26.2.7 Machinery.

26.2.7.1 Internal combustion engines.

26.2.7.1.1 The internal combustion engines shall comply with the requirements of Section 2 in Part IX "Machinery".

26.2.7.1.2 If calculation of the crankshaft is performed according to the procedure other than that specified in 2.4 of Part IX "Machinery", the safety factors shall not be less than required by 2.4.

26.2.7.1.3 Gasoline engines and engines operating on different grades of fuels may be installed in compliance with the requirements of 26.2.7.1.4 and 26.2.7.1.5.

26.2.7.1.4 Gasoline engines.

26.2.7.1.4.1 Gasoline engines may be used:

as main and auxiliary engines on ships of 20 m in length and less, except for oil tankers and ships carrying dangerous cargoes;

as main engines on rescue boats provided the fuel tanks are protected against fire and explosion;

as drive engines for mobile fire and bilge pumps on all ships except for oil tankers and ships carrying dangerous goods.

26.2.7.1.4.2 Engines in open ships shall be covered by protective housings. Protective housings made of inflammable materials shall have lining from the inside made of steel roofing on the layer of mineral insulating material.

In enclosed ships all wooden parts in the machinery space shall have sheeting made of steel roofing on the layer of mineral insulating material.

26.2.7.1.4.3 Watertight floors shall be installed in front of the engine and beyond it. Hand pump or motor-driven pump drainage shall be provided in the places of engine installation in enclosed machinery spaces separated by floors as well as in spaces where oil tanks are situated.

26.2.7.1.4.4 Carburettor and engine fuel pumps shall be installed so as to avoid flame ingress from carburettor on fuel pump.

26.2.7.1.4.5 Suction pipes of carburettors shall be led outside the removable housings and be raised over it for at least 500 mm. Suction pipes on the ends shall be fitted with heads with flame arresters.

26.2.7.1.4.6 Carburettor suction pipe inlet shall be located not less than 300 mm above the cylinder heads and provided with flame screens, where engines are installed in enclosed spaces. If there are no suction pipes, flame arresters shall be mounted at carburettor air inlet.

26.2.7.1.4.7 A gasoline tank shall be installed in a compartment (enclosure) isolated from the internal combustion engine compartment in ships with continuous deck. These compartments (enclosures) shall be equipped with natural ventilation for gasoline vapour removal.

26.2.7.1.4.8 Protective housings of the engines, machinery spaces, compartments with fuel tanks shall have plenum-exhaust ventilation.

Ventilation tubes of these compartments shall not be connected with each other.

Ventilation tubes from the engine housings and tubes removing gas from the fuel tanks shall be equipped with flame arresters.

26.2.7.1.4.9 Air pipes from the gasoline tank and from the compartment shall be separate, their outlet holes shall be apart from each other as far as possible and shall be fitted with ejecting heads with flame arresters.

26.2.7.1.4.10 Closed motor spaces shall have ventilation which provides removal of accumulated gasoline vapours before the engine start.

26.2.7.1.4.11 Fuel tanks and oil pipelines shall be made of metal resistant to corrosion caused by influence of fuel environment.

26.2.7.1.4.12 For the purpose of fuel tank filling fill-in branch pipes shall be led out to the deck, which shall prevent the fuel ingress inside the hull.

26.2.7.1.4.13 No tubular glass fuel level indicators shall be installed on fuel tanks.

26.2.7.1.4.14 Electric indicator of gasoline level in the tank shall be of explosion-proof type.

26.2.7.1.4.15 It is not allowed to provide devices for sediment discharge in the fuel tanks. When such device is used, self-locking valves shall be additionally provided with thread plug on the outlet end and a drip tray shall be placed under the tank.

26.2.7.1.4.16 A locking device shall be installed on the fuel pipeline directly before the engine which shall allow locking the pipeline from the ship control station.

Fuel pipelines shall be protected against mechanical damage and be located so as they can be inspected throughout the length. The pipes shall be connected by hard-brazed nipples with coupling nuts.

26.2.7.1.4.17 Gasoline pipeline joints shall be free of gaskets. The gasoline pipeline shall be mounted in easily accessible places and protected against damage.

For installation of engines on shock absorbers it is allowed to use gasoline pipeline flexible joints made of gasoline-proof and fire-proof materials.

26.2.7.1.4.18 All units of the fuel system shall be placed on the opposite side relatively to the exhaust manifold.

26.2.7.1.4.19 In the motor spaces, accumulators shall be installed only in a closed box on the side opposite to the carburettor or fuel injecting equipment. Exhaust ventilation shall be provided.

Accumulators shall not be located under the fuel tanks.

26.2.7.1.4.20 Exhaust manifold and connecting branch pipes shall have water cooling.

26.2.7.1.5 Additional requirements for engines which are permitted to operate on different grades of fuels.

26.2.7.1.5.1 For dual-fuel internal combustion engines the requirements in Section 9 of Part VII "Machinery Installations" shall apply.

26.2.7.1.5.2 The engines can operate on fuel oil meeting the requirements of 26.2.5.2 which substitutes for the corresponding types of the specification fuel listed in the technical documentation of the manufacturer or is produced (extracted) by means of non-conventional sources and types of primary energy (alternative fuel), or is a mixture of alternative and specification fuel with properties differing from the specification fuel, provided the engine characteristics during operation on this fuel in all operating conditions, including variable conditions, which do not differ from the certificate ones.

26.2.7.1.5.3 A possibility to switch promptly to the specification fuel oil for fuel fired engines as specified in 26.2.7.1.5.1 shall be provided. In the process of such transfer the engine output shall not drop by more than 20%.

26.2.7.1.5.4 When the fuel specified in 26.2.7.1.5.1 is used in the engine, the safety valves shall be fitted in the crankcases and the under-piston cavities of the engine near each crankthrow. The design and actuation pressure of safety valves depend on the properties of fuel-air mixture produced in the crankcase and on the engine output at the moment of transfer from one grade of fuel to another one.

26.2.7.1.5.5 When the fuel specified in 26.2.7.1.5.1 with saturated vapours pressure exceeding 25 kPa at 40 °C is used, the devices (sensors or other similar devices) measuring concentration of vapours of the specified fuel flowing through the sealings shall be fitted in the crankcases and under-piston cavities.

26.2.7.2 Steam turbines.

Steam turbines shall comply with the requirements in Section 3 of Part IX "Machinery".

26.2.7.3 Gears, disengaging and elastic couplings.

Gears, disengaging and elastic couplings shall comply with the requirements in Section 4 of Part IX "Machinery".

26.2.7.4 Auxiliary machinery.

Auxiliary machinery shall comply with the requirements in Section 5 of Part IX "Machinery".

26.2.7.5 Deck machinery.

Deck machinery shall comply with the requirements in Section 6 of Part IX "Machinery".

26.2.7.6 Hydraulic drives.

Hydraulic drives shall comply with the requirements in Section 7 of Part IX "Machinery".

26.2.7.7 Gas turbines.

Gas turbines shall comply with the requirements in Section 8 of Part IX "Machinery".

26.2.8 Boilers, heat exchangers and pressure vessels.

26.2.8.1 All requirements of Part X "Boilers, Heat Exchangers and Pressure Vessels" to the extent applicable for ships of the area of navigation **R3** shall apply to the ships of areas of navigation **RN(SCI)** and **RN(SCII)**.

26.2.9 Refrigerating plants.

26.2.9.1 All requirements of Part XII "Refrigerating Plants" to the extent applicable for ships of the area of navigation **R3** shall apply to the ships of areas of navigation **RN(SCI)** and **RN(SCII)**.

26.2.10 Electrical equipment.

26.2.10.1 The electrical equipment on ships shall comply with the requirements specified in Sections 1 and 2 of Part XI "Electrical Equipment". In this case for machinery and devices on ships, except for machinery and devices of essential services, it is allowed to use the electrical equipment (of general commercial type) not fully complying with the requirements in 2.1.3.1 of Part XI "Electrical Equipment".

26.2.10.2 The main source of electrical power shall comply with the requirements in Section 3 of Part XI "Electrical Equipment". In this case on ships (except for passenger ships) with a low power electrical installation as the main source of electrical power, only one generator with an independent prime mover or accumulator batteries may be installed and for ships (except for passenger ones) of less than 300 gross tonnage with a low power electrical installation, only one transformer may be installed.

26.2.10.3 Electrical power distribution systems shall comply with the requirements in Section 4 of Part XI "Electrical Equipment". The supply feeder of anchor gear may be connected to the distribution board of cargo winches or to another distribution board provided the boards are supplied directly from the main distribution board and adequate protection is available.

26.2.10.4 Electric drives for shipboard mechanisms and equipment, lighting, internal communication and signaling, protective devices shall comply with the requirements in Sections 5, 6, 7 and 8 respectively of Part XI "Electrical Equipment".

26.2.10.5 Emergency electrical installations shall comply with the requirements in Section 9 of Part XI "Electrical Equipment". Emergency sources in ships of 300 gross tonnage and above shall ensure the supply of the consumers specified in 9.3.1 of Part XI "Electrical Equipment" during at least 12 hours and in ships of less than 300 gross tonnage, during at least 3 hours.

26.2.10.6 Electrical machines, transformers, power semiconductor units shall comply with the requirements in Sections 10, 11 and 12 respectively of Part XI "Electrical Equipment".

26.2.10.7 Accumulators.

26.2.10.7.1 Accumulators shall comply with the requirements in 13.1 — 13.6, 13.7.2 and 13.7.3.1 of Part XI "Electrical Equipment".

26.2.10.7.2 In a ship equipped with electrically-started internal combustion engines, irrespective of the number of such engines, not less than one starter battery shall be permanently installed for starting each of the main and auxiliary engines. A starter battery shall be charged only from the appurtenant generator.

26.2.10.8 Electrical apparatus and accessories, electrical cooking and heating appliances, cables and wires, electric propulsion plants shall comply with the requirements in Sections 14, 15, 16 and 17 respectively of Part XI "Electrical Equipment".

26.2.10.9 Electrical equipment for a voltage in excess of 1000 V up to 15 kV shall comply with the requirements in Section 18 of Part XI "Electrical Equipment".

26.2.10.10 Electrical equipment depending on the purpose of a ship shall comply with the requirements of respective Chapters in Section 20 of Part XI "Electrical Equipment". In this case, on passenger ships the emergency sources shall ensure simultaneous supply of the consumers specified in 20.1.2.1 of Part XI "Electrical Equipment" during at least 12 hours.

26.2.10.11 Electrical equipment of refrigerating plants shall comply with the requirements in Section 21 of Part XI "Electrical Equipment".

26.2.10.12 Spare parts shall comply with the requirements in Section 22 of Part XI "Electrical Equipment".

26.2.10.13 Electrical equipment of ship's electric power system with electrical distribution for direct current shall comply with the requirements in Section 23 of Part XI "Electrical Equipment".

26.2.10.14 Valve-type generator sets, composite (hybrid) propulsive systems, static sources of electrical power shall comply with the requirements in Sections 24, 25 and 26 respectively of Part XI "Electrical Equipment".

26.2.11 Automation.

26.2.11.1 Automation equipment of ships of areas of navigation **RN(SCI)** and **RN(SCII)** as regards the general provisions, design of automation systems, automation components and control devices, as well as supply of automation systems shall comply with the applicable requirements in Sections 1 — 3, 7 — 9 of Part XV "Automation".

26.2.12 Life-saving appliances.

26.2.12.1 Outfit of ships of classes **RN(SCI)** and **RN(SCII)** shall comply with the requirements of Part II "Life-Saving Appliances" of the Rules for the Equipment of Sea-Going Ships as for ships of the area of navigation **R3**.

26.2.13 Radio equipment.

26.2.13.1 Radio equipment of ships of areas or navigation **RN(SCI)** and **RN(SCII)** shall comply with the applicable requirements of Part IV "Radio Equipment" of the Rules for the Equipment of Sea-Going Ships.

26.2.13.2 Each ship engaged in voyages on inland waterways of the Russian Federation, in addition to the requirements of 26.2.13.1, shall be equipped with:

.1 main VHF radiotelephone station (300,025 MHz — 300,500 MHz);

.2 operational VHF radiotelephone station (300,025 — 300,500 MHz; 336,025 — 336,500 MHz). It is required for passenger ships, ships having the length of 25 m and above, ships with the main engines output of 367 kW and above;

.3 portable VHF radiotelephone station (300,025 to 300,225 MHz) — 2 sets;

.4 public address system.

The type of the VHF radiotelephone station shall be determined by the shipowner based on the system of communications established in the ship's operational area.

26.2.14 Navigational equipment.

26.2.14.1 Navigational equipment for ships of areas of navigation **RN(SCI)** and **RN(SCII)** shall comply with the applicable requirements of Part V "Navigational Equipment" of the Rules for the Equipment of Sea-Going Ships.

26.2.14.2 An additional radar station meeting the following requirements shall be provided on ships engaged in voyages on inland waterways of the Russian Federation.

26.2.14.2.1 The display unit of the radar installed on board ship with the aerial height above sea level being equal to 10 m shall be capable of giving clear presentation of various objects within the ranges (in kilometers) given below:

Object	Dimension	Range, in km
Shore of height	60 m	32
	6 m	13
Ship of gross tonnage	5000	13
	20	4
Buoy with reflecting surface of	10 m^2	4

The display of all objects shall remain visible when the ship is rolling or pitching up to ±10°.

26.2.14.2.2 Basic performance parameters of the shipboard radar with the aerial height of 7 m above sea level shall not be worse than those specified in Table 26.2.14.2.2.

Table 26.2.14.2.2

Basic performance parameters	Value
Minimum radar detection range, in m	15
Range resolution on dials 0,4 to 1,2 km, in m	15
Range resolution on the rest dials in relation to the maximum value of the range dial established, in %	1
Accuracy in range measuring, in m	10
Bearing resolution, in deg	1,0
Accuracy in measuring bearings, in deg	1,0
Accuracy in course indication, in deg	0,5

The equipment performance shall not deteriorate when the ship is rolling and pitching up to ±10.

26.2.14.2.3 The display shall have an effective diameter of at least:

180 mm for ships from 300 to 1600 gross tonnage;

250 mm for ships from 1600 gross tonnage and over.

The display unit of the radar shall be provided with six range scales from 400 m to 5000 m. In this regard there shall be indicated not less than four fixed electronic range rings and a variable electronic marker range with a numeric read-out of range in meters (kilometers) on each range scale.

The variable electronic marker range shall enable the range of an object to be measured with an error not more than 10 m on range scales of 0,4 to 2,0 km and 0,8 % of the range of the following scale established.

26.2.14.2.4 It shall be possible that brightness of the fixed electronic range rings and a variable electronic marker be varied until they are fully removed from the display.

26.2.14.2.5 The display unit of the radar shall be fitted with the electronic or mechanical device for taking bearings of the detected objects.

26.2.14.2.6 In radar, provision shall be made for clockwise, continuous and automatic scan through 360° of azimuth. The scan rate shall be not less than 18 r.p.m. The aerial shall operate satisfactorily in relative wind speeds up to 50 m/s.

26.2.14.2.7 It shall be possible to off-set the radar origin to any display point for a distance of at least 0,5 of the display radius.

26.2.14.2.8 The radar display provided with two sets of range scales, in meters (kilometers) and miles, shall have the means of switching-over and the relevant indication of a measurement unit chosen for range measuring.

26.2.14.3 An additional radar station is not required if ships are equipped with a radar station which fully meets the requirements of 26.2.14.2 and all applicable requirements of Appendix 1 to Part V "Navigational Equipment" of the Rules for the Equipment of Sea-Going Ships.

26.2.15 Signal means.

26.2.15.1 Outfit of ships of classes **RN(SCI)** and **RN(SCII)** shall comply with the requirements of Part III "Signal Means" of the Rules for the Equipment of Sea-Going Ships, including requirements applicable to river-sea navigation ships.".

9 **Existing Sections 26** and **27** and references thereto are renumbered **Sections 27** and **28** accordingly.