



2021

Rules for the Classification of Steel Barges

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Steel Barges

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Guidance Relating to the Rules for the Classification of

Steel Barges

Guidance



2021

Rules for the Classification of Steel Barges

APPLICATION OF "RULES FOR THE CLASSIFICATION OF SHIPS OF STEEL BARGES"

1. Unless expressly specified otherwise, the requirements in the Rules apply to Steel Barges for which contracts for construction are signed on or after 1 July 2021.
2. The amendments to the Rules for 2020 edition and their effective date are as follows;

Effective Date 1 July 2021

CHAPTER 1 GENERAL

Section 3 Materials, Welding and Construction

- 301. 2 has been amended.

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CHAPTER 1 GENERAL

Section 1 Definitions

101. Application

The definitions of terms and symbols which appear in this rule are to be specified in this section, unless otherwise specified elsewhere, and definitions of terms and symbols not specified in this rule are to be as specified in the **Rules for the Classification of Steel Ships** (hereinafter referred to as "the Rules" in this rule).

102. Length of barge

The length of barge (L) is the distance in *meters* from the inside surface of stem to the inside surface of stern on the load line defined in **109.**. However, for barges with shipshape the length of barge (L) is the distance in *meters* on the load line defined **109.** from the fore side of stem to the after side of rudder post in case of a barge with rudder post, or to the axis of rudder stock in case of a barge without rudder post or stern post.

103. Length for freeboard

The length of barge for freeboard (L_f) is 96 % of the length in *meters* measured from the fore side of stem to the aft side of aft end shell plate on a waterline at 85 % of the least moulded depth measured from the top of keel, or the length in *meters* from the fore side of stem to the axis of rudder stock on that waterlines, whichever is the greater. For ships without a rudder stock, the length of ship for freeboard is 96 % of the length measured from the fore side of stem to the aft side of aft end shell plate on the waterline at 85 % of the least moulded depth measured from the top of keel. The waterline on which this length is measured is to be parallel to the load line defined in **109.**

104. Breadth of barge

The breadth of barge (B) is the horizontal distance in *meters* from the outside of frame to the outside of frame measured at the broadest part of the barge.

105. Breadth for freeboard

The breadth of barge for freeboard (B_f) is the maximum horizontal distance in *meters* from the outside of frame to the outside of frame measured at the middle of L_f .

106. Depth of barge

The depth of barge (D) is the vertical distance in *meters* from the top of keel to the top of upper deck beam at side measured at the middle of L .

107. Midship part of barge

The midship part of barge is the part for $0.4L$ amidships. However, for pontoon type cargo barge and similar shaped barge, the midship part of barge is the part for $0.6L$ amidships.

108. End parts of barge

The end parts of barge are the parts within $0.1L$ from both ends of the barge.

109. Load line

The load line is the waterline corresponding to the designed summer load draught in case of a barge which is required to be marked with load lines, and the waterline corresponding to the designed maximum draught in case of a barge which is not required to be marked with load lines .

110. Load draught

The load draught (d) is the vertical distance in *meters* from the top of keel to the load line measured at the middle of L .

111. Freeboard deck

The freeboard deck is normally uppermost continuous deck.

112. Superstructure

The superstructure is the decked structure on the upper deck, extending from side to side of the barge or having its side walls at the position not farther than $0.04B_f$ from the side of barge.

113. Strengthened bottom forward

The strengthened bottom forward of barge is the part of flat bottom forward from the position of $0.15L$ from stem.

114. Important system [See Guidance]

Important system is a system necessary for safety of life and barge .

115. Trusses

Trusses are the structure to connect the bottom and deck members by pillars and diagonals, having ample strength to effectively support deck loads.

Section 2 General

201. Application [See Guidance]

1. The requirements in this rule are applied to steel barges(hereinafter referred to as "barges") generally pulled or pushed by tug, intended to be registered and classed.
2. The requirements in this rule are applied to the barges not less than 30 m and up to 150 m in length as specified in the followings:
 - (1) Barges carrying dry cargoes in holds
 - (2) Barges carrying dry cargoes on upper decks
 - (3) Barges carrying liquid cargoes in bulks
3. The barges carrying special cargoes other than specified in **Par 2** are to be generally as required in this rule with a special consideration being given depending on the kind of cargoes.
4. In the application of relevant provisions in this rule to barges which are not required to be marked with load lines, L_f is to be read as L and B_f as B .
5. In addition to the requirements in this Part, steel barges are to be complied with Regulations of the flag state in which the ship is registered or to be registered.

202. Exception in application

1. The requirements of barges of 150 m and above in length and not specified in this rule are to be in accordance with the **Rules**.
2. In barges of which length is less than 30 m or in barges to which requirements in this rule for some special reason are not directly applicable, hull construction, equipment, arrangement and scantlings are to be at the discretion of the Society.

203. Equivalency

The equivalence of alternative and novel features which deviate from or are not directly applicable to the **Rules** is to be in accordance with **Pt 1, Ch 1, 105.** of the **Rules for the Classification of Steel**

Ships. (2020)

204. Barges of unusual form or construction [See Guidance]

Barges of unusual form or construction are to be in accordance with the discretion of the Society.

205. Classification registry

The classification registry is to be subjected to the requirements in **Pt 1** of the **Rules**, in addition to the requirements of this rule.

206. Class notations

The class notations assigned to the barge classed with the Society are to be in accordance with the requirements in **Pt 1, Ch 2, 201.** of the **Rules**.

Section 3 Materials, Welding and Construction

301. Materials

1. The materials used for hull construction and equipments are to be those complying with the requirements in **Pt 2, Ch 1** of the **Rules**, unless otherwise specified.
2. Application of steels used for the hull construction is to be in accordance with the requirements in **Pt 3, Ch 1, 405.** or **Pt 10, Ch 1, 301.** of the **Rules**.
3. Service limitation for materials of piping, valves and fittings is to be in accordance with the requirements in **Pt 5, Ch 6, 102.** and **103.** of the **Rules**.
4. Materials used for pneumatic piping system with the maximum working pressure above 2 MPa and for fuel oil pipes, valves and fittings in fuel oil piping system, and also for valves, distance pieces and pipes attached to the shell plating and valves attached to the collision bulkheads are to be in compliance with the requirements of standards acceptable by the Society.
5. For materials used for piping system, except for those specified in **Par 4**, the Surveyor may required to submit the results of tests carried out by the manufacturers.

302. Scantlings

1. The scantlings of hull structural members are framed for the case where mild steel is used. Where high tensile steel is used for hull structural members, the scantlings of which are to be in accordance with the discretion of the Society.
2. Unless otherwise specially specified, the section modulus of members required by this rule are those including the steel plates with the effective breadth of $0.1l$ on either side of the members. However, the breadth of $0.1l$ is not to exceed one-half of the spacing of member. l is the length specified in the relevant chapter.
3. The standard depth of girders supporting frames, beams or stiffeners, unless otherwise specified, is to be one-twelfth of l , where l is the length specified in the relevant chapter.
4. The inside radius of flanged plates is not to be less than twice but not more than three times the thickness of steel plates.
5. Girders are to be properly increased in scantlings where angle of inclination between web of the girder and shell plating is small, and suitable means are to be provided for tripping as the case may required.

303. Welding

Welding to be used in hull construction and important equipment is to be in accordance with the requirements in **Pt 3, Ch 1, Sec 5** of the **Rules**.

304. Connection of ends of stiffeners, girders and frames

1. Where the ends of girders are connected to the bulk-heads, tank tops, etc., the end connections of all girders are to be balanced by effective supporting members on the opposite sides of bulkheads, tank tops, etc.
2. Length of the frame-side arm of bracket, connected to the frames or stiffeners of the bulkhead or deep tanks, etc., is not to be less than one-eighth of l specified in the relevant chapter, unless otherwise specially specified.

305. Modification of l

Where brackets of not less thickness than that of the girder plates, the value of l specified in **Ch 11, 12, 14 and 15** may be modified in accordance with the followings:

1. Where the face area of the bracket is not less than one-half of that of the girder and the face plates or flange on the girder is carried to the bulkhead, deck, tank top, etc., the length l may be measured to a point 0.15 m inside the toe of bracket.
2. Where the face sectional area of the bracket is less than one-half of that of the girder and the face plate or flange on the girder is carried to the bulkhead, deck tank top, etc., l may be measured to a point where the sum of sectional area of the bracket out-side the line of girder and its free flanges is equal to the sectional area of free flanges of girder, or to a point 0.15 m inside the toe of bracket, whichever is the greater.
3. Where brackets are provided and the face plate or flange on the girder are extended along the brackets to the bulkhead, deck, tank top, etc., the face plate or flange of bracket may be curved, but l is to be measured to the toe of bracket.
4. Brackets are not to be considered effective beyond the point where the arm on the girder is 1.5 times the length of arm on the bulkhead, deck, tank top, etc.
5. In no case is the allowance in l at either end to exceed one-quarter of the overall length of the girder.

306. Equipment

Masts, riggings, cargo handling gears, anchoring and mooring arrangements, and other than those specified in this rule are to be suitably arranged according to their uses and are to satisfy the tests as may be required by the Surveyor.

307. Ceilings and sparrings

Ceilings and sparrings in hold are to be in accordance with the requirements in **Pt 3, Ch 7, 110.** of the **Rules**.

308. Cementing and painting

Cementing and painting are to be in accordance with the requirements in **Pt 3, Ch 1 801.** of the **Rules**.

309. Carriage of oil or other flammable liquid substances

1. The requirements for construction and arrangement for carriage of fuel oils specified in this rule are to be applied to the case intended to carry fuel oils having a flashpoint of 60 °C or above at a closed cup test.
2. The construction and arrangement for carriage of fuel oils having a flashpoint below 60 °C at a closed cup test, are to be in accordance with the requirements provided in this chapter, or the special requirements are to be applied.
3. The construction and arrangement of deep oil tanks intended to carry cargo oils are to be correspondingly in accordance with the requirements in **Ch 22.** ↓

CHAPTER 2 CLASSIFICATION SURVEYS

Section 1 General

101. General

The classification survey of barges, except where specially required in this chapter, are to be complying with the requirements in **Pt 1, Ch 2** of the **Rules**.

Section 2 Classification Survey during Construction

201. General

In the classification survey during construction, the construction, materials, scantlings, and workmanship of the hull, equipment and machinery are to be examined in detail in order to ascertain that they meet the relevant requirements of the **Rules**, and for barges which are required to be marked with load lines, the load lines are to be assigned.

202. Submission of plans and documents

1. When it is intended to build a barge for classification, the following plans and documents are to be submitted for approval of the Society before the work is commenced.
 - (1) Hull
 - (A) Midship section
 - (B) Construction profile
 - (C) Deck plans (Construction of hold and hatch)
 - (D) Superstructure end bulkheads
 - (E) Shell expansion
 - (F) Single bottoms and double bottoms
 - (G) Bulkheads
 - (H) Arrangements to resist panting in both peaks
 - (I) Skeg constructions
 - (J) Joint part constructions between pusher and barge
 - (K) Stability data
 - (2) Machinery
 - (A) General arrangement of machinery space
 - (B) Particulars and sectional assembly of internal combustion engines used as important system
 - (C) Boilers and pressure vessels: Plans and data specified in **Pt 5, Ch 5** of the **Rules**
 - (D) Piping diagrams
 - (E) Arrangement plan and circuit diagram of switchboards (including materials used for main part)
 - (F) Diagrams of the wiring system including type of cables, normal working Current, and type and rating of protective device
 - (G) Arrangement of electrical equipment
2. When it is intended to build a barge for classification, other than plans and documents in **Par 1**, the following plans and documents are to be submitted for the approval.
 - (1) General arrangement
 - (2) Specifications for hull and machinery
 - (3) In a pontoon barge and a barge with special cargo handling system or special condition of loading, plans showing the particulars of the cargo intended to be carried and of its distribution
 - (4) Manual of towing or Pusher
 - (5) Preliminary stability data
 - (6) Where load lines are intended to be assigned, the following plans in addition to plans from (A) to (D) in **Par 1 (1)**:
 - (A) General arrangement
 - (B) Lines
 - (C) Hydrostatic curves

- (D) Plans showing the height of timber deck cargo and the arrangements of lashing and fixing, if the timber load lines are to be assigned
- (7) Particulars of machinery
- (8) Calculation sheets of torsional vibration for generator shaftings (in case where the maximum continuous output of engine is more than 100 kW)
- (9) Calculation sheets of battery capacity for navigation light
- 3. Submission of other plans and documents than specified in **Par 1** and **2** may be required where deemed necessary by the Society.

203. Presence of surveyor

1. In the classification survey during construction, inspections are to be carried out covering all stages of the work from its commencement until its completion.
2. The presence of the Surveyor is required at the following stages of the work in relation to hull and equipment.
 - (1) Material test.
 - (2) When designated by the Society during shop work or sub-assembly.
 - (3) When each block is assembled.
 - (4) When hydrostatic test, watertight test, etc. are carried out.
 - (5) When hull is completed.
3. The presence of the Surveyor is required at the following stages of the work in relation to machinery.
 - (1) When the tests for boilers and pressure vessels to belong to Group I or Group II are carried out.
 - (2) When the tests for the valves, cocks and distance pieces attached to the shell plating are carried out.
 - (3) When the tests for the explosion-proof type electrical equipments are carried out.
 - (4) When machinery is installed on the barge.
 - (5) When the tests and trials on board are carried out.
 - (6) When the popping test and accumulation test for safety valve of boiler are carried out.
 - (7) When the test for machinery of special type are carried out.
4. The requirements specified in **Par 2** and **3** may be modified having regard to the actual status of facilities, technical abilities and quality control at the works.
5. Submission of the data of the tests carried out in the works as specified in **Ch 20, 1601. 2, 4** and **5** may be required where deemed necessary by the Surveyor.

204. Sea trials

For barges having unconventional construction or special navigation system, sea trials will be required where deemed necessary by the Society.

Section 3 Periodical Surveys

301. General

The due date of annual survey, intermediate survey and special survey of barges is to be in accordance with **Pt 1, Ch 2** of the **Rules**.

302. Annual survey

Annual survey is to be in accordance with the requirement in **Pt 1, Ch 2, 202.** and **203.** of the **Rules**.

303. Intermediate survey

Intermediate survey is to be in accordance with the requirement in **Pt 1, Ch 2, 302.** and **303.** of the **Rules**.

304. Special survey

Special survey is to be in accordance with the requirement in **Pt 1, Ch 2, Sec 4** and **5** of the **Rules**. ↴

CHAPTER 3 STEMS

Section 1 Stems

101. Plate stems

The thickness of steel plate stems at the load waterline is not to be less than obtained from the following formula. Above and below the load water line, the thickness may be gradually tapered toward the stem head and the keel. And at the upper end of stem, it may be equal to the thickness of the side shell plating(at the fore end part) of the barge, and at the lower end of stem, it may be equal to that of plate keel.

$$t = 0.1L + 3.0 \text{ (mm)} \downarrow$$

CHAPTER 4 LONGITUDINAL STRENGTH

Section 1 General

101. Loading manual [See Guidance]

In order to enable the master to adjust the loading of cargo and ballast avoiding occurrence of unacceptable stress in the structure of the barge, loading manual approved by the Society is to be supplied to the master. However, this manual may not be required in the case of barges for which the Society considers that such manual is not necessary.

Section 2 Bending Strength

201. Section modules of hull

1. The section modules of the hull for the midship part is not to be less than obtained from the following formula, whichever is the greater:

$$Z_1 = 0.95 C_1 L^2 B (C_b + 0.7) \quad (\text{cm}^3)$$

$$Z_2 = 6.63 C \left\{ 1.28 C_2 L^2 B C_b \left(1 + 0.04 \frac{L}{B} \right) + M_s \right\} \quad (\text{cm}^3)$$

where:

C_1 = As obtained from the following where L is 90 m and above:

$$C_1 = 10.75 - \left(\frac{300 - L}{100} \right)^{\frac{3}{2}}$$

where L is under 90 m ; $C_1 = 0.03 L + 5$

C_b = Block coefficient, the ratio of the volume of the moulded displacement corresponding to the load line to LBd.

C_2 = As obtained from the following formula:

$$C_2 = 0.0028 L + 0.46$$

C = As given in **Table 4.1**.

Table 4.1 Coefficient C

	Sagging condition	Hogging condition
Upper deck	1.00	1.03
Bottom	1.06	1.03

M_s = Longitudinal bending moment in still water specified in **Par 2** (kN · m).

2. The longitudinal bending moments in still water, M_s , are taken the maximum sagging and hogging moments calculated for all of designed loaded and ballast conditions by the method deemed appropriate by the Society. Furthermore, in a pusher barge, the effect of the joint part is to be considered to the longitudinal bending moment.
3. For barges less than 60 m in length the requirement of Z_2 in **Par 1** above may be dispensed with. However, longitudinal bending moment in still water are to be calculated for barges designed for special loading or ballasting.

202. Calculation of hull section modules

As for calculation of the hull section modules, the following **Par 1** through **6** are to be applied:

1. All longitudinal members which are considered effective to the longitudinal strength of the barge may be included in the calculation.
2. Deck openings on the strength deck are to be deducted from the sectional area used in the section modules calculation. However, small openings not exceeding 2.5 m in length or 1.2 m in breadth need not be deducted, provided that the sum of their breadths in one transverse section is not more than $0.06 (B - \sum b)$. Where, $\sum b$ is the sum of the openings exceeding 1.2 m in breadths or 2.5 m in length (m).
3. Notwithstanding the requirement in **Par 2**, deck openings on the strength deck need not be deducted, provided that the sum of their breadths in one transverse section is not reducing the section modules at deck or bottom by more than 3 %.
4. Deck openings prescribed in **Par 2** and **3** include shadow area which is obtained by drawing two tangential lines with an opening angle of 30 deg having the focus on the longitudinal line of the ship.
5. The section modules at the strength deck is to be calculated by dividing the moment of inertia of the athwartship section about its horizontal neutral axis by the following distance (1) or (2) whichever is the greater.
 - (1) Vertical distance from the neutral axis to the top of the strength deck beam at side.
 - (2) Distance obtained from the following formula :

$$Y \left(0.9 + 0.2 \frac{X}{B} \right)$$

where:

X = Horizontal distance from the top of continuous strength member to the centre line of the barge (m).

Y = Vertical distance from the neutral axis to the top of continuous strength member (m).

X and Y are to be measured to the point giving the largest value of the above formula.

6. The section modules at the bottom is to be calculated by dividing the moment of inertia of the athwartship section about its horizontal neutral axis by the vertical distance from the neutral axis to the top of keel. ⚓

CHAPTER 5 PLATE KEELS AND SHELL PLATINGS

Section 1 General

101. Consideration for corrosion

The thickness of shell plating at such parts that the corrosion is considered excessive due to the location and/or special service condition of the barge is to be properly increased over that required in this chapter.

102. Special consideration for contact with quay, etc.

In case where the service condition of the barge is considered to be such that there is possibility of indent of shell plating due to contact with the quay, etc., special consideration is to be given to the thickness of shell plating.

103. Continuity in thickness of the shell plating

Sufficient consideration is to be paid to the continuity in the thickness of shell plating and to the avoidance of remarkable difference between the thickness of the shell plating under consideration and that of the adjacent shell plating.

Section 2 Plate Keels

201. Breadth and thickness

1. The breadth of plate keel over whole length of the barge is not to be less than obtained from the following formula:

$$L \geq 90 \text{ m} : b = 2L + 1000 \text{ (mm)}, \quad L < 90 \text{ m} : b = 4.5L + 775 \text{ (mm)}$$

2. The thickness of plate keel over whole length of the barge is not to be less than the bottom shell thickness obtained from the requirement in **304.** increased by 1.5 mm. This thickness, however, is not to be less than that of the adjacent bottom shell plating.
3. As for pontoon barges, the thickness of plate keel may be equal to that of bottom shell plating, notwithstanding the **Par 2.**

Section 3 Shell Plating for Midship Part of Barge

301. Minimum thickness

The minimum thickness of shell plating below the strength deck for the midship part of barge is not to be less than obtained from the following formula:

$$t = 0.044L + 4.6 \text{ (mm)}$$

302. Thickness of side shell plating

1. The thickness of side shell plating other than the sheer strake at the strength deck for the midship part of barge is not to be less than obtained from the following formula:

$$t = 4.1S \sqrt{d + 0.04L} + 1.5 \text{ (mm)}$$

where:

S = Spacing of longitudinal or transverse frames (m).

2. In barges with square bilge, the thickness of the lowest strake of side shell plating is not to be less than obtained from the formula in **Par 1** and **304.**, whichever is the greater.

303. Sheer strake for midship part

The thickness of sheer strakes at the strength deck for midship part is not to be less than 0.75 times that of the stringer plate of the strength deck. In no case, however, is the thickness to be less than that of the adjacent side shell plating.

304. Thickness of bottom shell plating

The thickness of bottom shell plating including bilge strake(excluding keel plate) for the midship part of ship is not to be less than obtained from the formula given in **Table 5.1**.

Table 5.1. Thickness of bottom shell plating

Framing	Thickness (mm)
Transverse	$t = 4.7S \sqrt{d+0.035L} + 1.5$
Longitudinal	$t = 4.0S \sqrt{d+0.035L} + 1.5$
S : Spacing of longitudinal or transverse frames (m)	

Section 4 Shell Plating for End Parts

401. Shell plating for end parts [See Guidance]

Beyond the midship part, the thickness of shell plating below the strength deck may be gradually reduced, but at the end parts the thickness is not to be less than obtained from the following formula.

$$t = 0.044L + 4.6 \quad (\text{mm})$$

402. Strengthened bottom forward

The thickness of shell plating at the strengthened bottom forward specified in **Ch 8, 902.** in barges having the bow draught at the ballast condition is not to be less than obtained from the formula given in **Table 5.2**.

Section 5 Side Plating in way of Superstructure

501. Side plating in way of superstructure

The thickness of side plating in way of superstructure is not to be less than obtained from the formula given in **Table 5.3** but in no case is it to be less than 5.5 mm.

Table 5.2 Thickness of shell plating at the strengthened bottom forward

Bow draft d_F	Thickness (mm)
$d_F \leq 0.025 L$	$t = 2.15 S\sqrt{L} + 1.5$
$0.025 L < d_F < 0.037 L$	by interpolation
$d_F \geq 0.037 L$	Value specified in 401 .
S : Spacing of frames, girders or longitudinal shell stiffeners. Whichever is the smallest (m)	

Table 5.3 Thickness of superstructure side plating

Location	Thickness(mm)
For $0.25 L$ from the fore end	$t = 1.15 S\sqrt{L} + 1.0$
Elsewhere	$t = 0.94 S\sqrt{L} + 1.0$
S : Spacing of longitudinal or transverse frames (m)	

Section 6 Local Compensation of Shell Plating

601. Hawse pipes and the plating below

The shell plating fitted with hawse pipes and the plating below is to be increased in thickness or to be doubled, and their longitudinal seams are to be protected against damages by anchors or cables.

602. Shell plating framed transversely [See Guidance]

In barges with transverse framing, sufficient consideration is to be paid to the prevention of buckling of the shell. And stiffeners of suitable scantlings spaced less than two times hold frame space are to be provided to the bottom shell for the midship part of barge. For barges less than 60 m in length, this stiffening may be suitably modified.⤵

CHAPTER 6 DECKS

Section 1 General

101. Steel deck plating

Decks are to be plated from side to side of the barge except deck openings, etc. Decks, however, may be provided with only stringer plates and tie plates, subject to the approval by the Society.

102. Watertightness of decks

Weather decks are to be made watertight according to service condition and service area of barges. Weather decks, however, may be made weathertight, subject to the approval by the Society.

103. Continuity of steps of decks

Where strength decks or effective decks (the decks below the strength deck which are considered as strength members in the longitudinal strength of hull) change in level, the change is to be accomplished by gradual sloping, or each of structural members which form deck is to be extended, and is to be effectively tied together by diaphragms, girders, brackets, etc. and special care is to be taken for the continuity of strength.

104. Compensation for openings

Hatchways or other openings on strength or effective decks are to have well rounded corners, and compensation is to be suitably provided as necessary.

Section 2 Effective Sectional Area of Strength Deck

201. Definition

The effective sectional area of strength deck is the sectional area, on each side of the barge's centre line, of steel deck plating, longitudinal beams, girders and other structural members extending for $0.5L$ amidships.

202. Effective sectional area of strength deck

1. The effective sectional area for the midship part is to be so determined as not to give less modulus of athwart-ship section of the hull specified in **Ch 4**.
2. Beyond the midship part, the effective sectional area may be gradually reduced, and at $0.15L$ from both ends it is not to be less than 0.50 times the area required for the midship part.

Section 3 Deck Plating

301. Thickness

1. The thickness of deck plating is not to be less than obtained from the formula given in **Table 6.1**. However, within such enclosed spaces as superstructures, deckhouses, etc., the thickness may be reduced by 1 mm.
2. Where strength deck is transversely framed, or decks inside the line of openings are longitudinally framed, sufficient care is to be taken to prevent buckling of the deck plating.

302. Thickness of the top of tanks

The thickness of deck plating forming the top of tanks is not to be less than required in **Ch 15, 202**, for deep tank bulkhead plating, taking the beam spacing as the stiffener spacing.

303. Under boilers or refrigerated cargoes

1. The thickness of effective deck plating under boilers is to be increased by 3 mm above the normal thickness.
2. The thickness of deck plating under refrigerated cargoes is to be increased by 1 mm above the normal thickness. Where special means for the protection against the corrosion of the deck is provided, the thickness neednot be increased. ⚴

Table 6.1 Thickness of deck plating

Kind of deck	Location	Framing	Thickness (mm)
Strength deck	Outside the line of openings for the midship part	Longitudinal	$t = 1.47 S\sqrt{h} + 1.5$
		Transverse	$t = 1.63 S\sqrt{h} + 1.5$
	Elsewhere	$t = 1.25 S\sqrt{h} + 1.5$	
Other deck			
S = Spacing of longitudinal or transverse beams (m) h = Deck load as specified in Ch 10, 201 . (kN/m ²)			

CHAPTER 7 SINGLE BOTTOMS

Section 1 General

101. Application

1. The requirements in this chapter are framed for barges less than 90 m in length. The construction and scantlings of single bottoms in barges of greater length are to be in accordance with the discretion of the Society.
2. Notwithstanding the requirements in this chapter, the construction and scantlings of single bottoms in Pontoon Barges are to be in accordance with the requirements in **Ch 21**.

Section 2 Centre Keelsons

201. Arrangements and construction

All single bottom barges are to have centre keelson composed of web plates and face plates and the centre keelsons are to extend as far forward and afterward as practicable.

202. Web plates

1. The thickness of web plates is not to be less than obtained from the following formula. Beyond the midship part, the thickness may be gradually reduced and it may be 0.85 times the midship value at the ends of the barge.

$$t = 0.065L + 4.2 \quad (\text{mm})$$

2. The height of web plates is not to be less than that of floors.

203. Face plates

1. The thickness of face plates is not to be less than that of web plate amidships and the face plates are to extend from the collision bulkhead to the after peak bulkhead.
2. The sectional area of face plates is not to be less than obtained from the following formula. Beyond the midship part, the sectional area may be gradually reduced and it may be 0.85 times the midship value at the ends of the barge.

$$A = 0.6L + 9 \quad (\text{cm}^2)$$

3. The breadth of face plates is not to be less than obtained from the following formula :

$$b = 2.3L + 160 \quad (\text{mm})$$

4. Where the pillars are provided above the face plates, the sectional area of face plates is to be increased or the face plates are to be suitably strengthened by other means.

Section 3 Side Keelsons

301. Arrangements

Side keelsons are to be so arranged that their spacing is not more than 2.5 m between the centre keelsons and the side shell plating.

302. Construction

Side keelsons are to be composed of continuous web plates and face plates, and they are to extend as far forward and afterward as practicable.

303. Web plates

The thickness of web plates is not to be less than obtained from the following formula for the midship part. But the thickness is not to be more than that specified in **202. 1**. Beyond the midship part, the thickness may be gradually reduced and it may be 0.85 times the midship value at the ends of the barge.

$$t = 0.042 L + 4.8 \quad (\text{mm})$$

304. Face plates

The thickness of face plates is not to be less than that required for the web plates, and the sectional area (A) of face plates amidships is not to be less than obtained from the following formula. Beyond the midship part, the sectional area may be gradually reduced and it may be 0.85 times the midship value at the ends of the barge.

$$A = 0.45 L + 8.8 \quad (\text{cm}^2)$$

Section 4 Floor Plates

401. Arrangements

1. In barge with the bottom of transverse framing, the standard spacing of floors is to comply with the requirements in **Ch 9, 201**.
2. In barges with the bottom of longitudinal framing, the floors are to be so arranged that their spacing is not more than about 3.5 m.

402. Shapes

1. Upper edges of floor plates at any part are not to be below the level of upper edge at the centre line.
2. In the midship part, the depth of floors at the toe of frame brackets is is to be not less than 0.5 times d_0 specified in **403. 1**. (See **Fig 7.1**)
3. Face plates provided on the floor plates are to be continuous from the upper part of bilge at one side to the upper part of bilge at the opposite side in case of curved floors, and extending over the floor plate in case of floors connected by frame brackets.

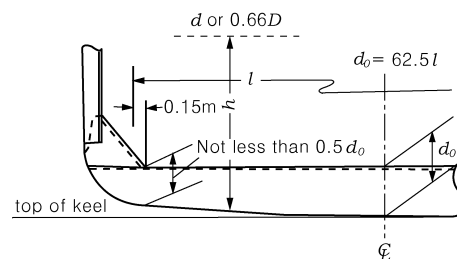


Fig 7.1. Shape of floors

403. Scantlings

1. The scantlings of floor plates are not to be less than obtained from the formula given in **Table 7.1**.
2. The thickness of face plates on the floor plates is not to be less than that required for the floor plates, and the breadth of face plates is to be adequate for lateral stability of the floors.
3. Beyond $0.5L$ amidships, the thickness of floor plates may be gradually reduced and at the end parts of the ship it may be 0.85 times the value specified in **Par 1**, except for the forward flat bottom.

404. Frame brackets

The scantlings of frame brackets are to be determined in accordance with the requirements of the following. The free edge of the bracket is to be flanged.

1. The height of the bracket measured from the top of keel is not to be less than twice the required depth of the floor plate at the centreline of the barge. (See **Fig 7.1**)
2. The arm of the bracket measured along the upper edge of the floor plate from the inner edge of frame is not to be less than the depth of the floor plate required at the centreline of the barge. (See **Fig 7.1**)
3. The thickness of frame bracket is not to be less than that of floor plates. (See **Fig 7.1**)

405. Drainage holes

Drainage holes are to be provided on floor plates on both sides of the centreline and for barges with flatbottom also at the low parts of the turn of bilge.

406. Lightening holes

Lightening holes may be provided on floor plates. Where the holes are provided, appropriate strength compensation is to be made by increasing the floor depth or by some other suitable means.

407. Floor plates forming part of bulkheads

Floor plates forming part of bulkheads are to be in accordance with the requirements in **Ch 14** and **15**.

Table 7.1 Scantlings of floor plates

Items	Scantlings
(1) Depth at the centre line	$d_0 = 62.5l$ (mm)
(2) Thickness	$t^{(1)} = 0.01 d_0 + 2.5$ (mm)
(3) Section modulus	$Z = 4.27 Shl^2$ (cm ³)
S : Spacing of floor (m) h : d or $0.66 D$, Whichever is the greater (m) l : Span between the toes of frame brackets measured at a midship plus 0.3 m. Where curved floors are provided, the length l may be suitably modified. (See Fig 7.1)	
NOTE: ⁽¹⁾ The thickness of floor plates need not exceed 12 mm	

Section 5 Longitudinals**501. Spacing**

The standard spacing of bottom longitudinals is obtained from the following formula:

$$S = 2L + 550 \quad (\text{mm})$$

502. Scantlings

The section modulus of bottom longitudinals is not to be less than obtained from the following formula:

$$Z_b = 9Shl^2 \quad (\text{cm}^3)$$

where:

l = Spacing of solid floors (m)

S = Spacing of bottom longitudinals (m)

h = Vertical distance from the longitudinals to a point of $d + 0.026L$ above the top of keel (m)

Section 6 Strengthened Bottom Forward**601. Application**

Strengthening of the forward bottom is to be in accordance with the requirements in **Ch 8, Sec 9**.



CHAPTER 8 DOUBLE BOTTOMS

Section 1 General

101. Application

1. Barges of 90 m and above in length are to be provided with double bottoms. However, they may be provided with single bottoms subject to the approval by the Society.
2. The requirements in this chapter may be suitably modified, where partial double bottoms are provided and where longitudinal bulkheads are made to reduce the unsupported breadth of double bottoms.
3. Where the longitudinal system of framing is transformed into the transverse system, or depth of double bottom changes suddenly, special care is to be taken for the continuity of strength by means of additional intercostal girders or floors.
4. Bottom structure of holds intended to carry heavy cargoes is to be subjected to special consideration.

102. Manholes and lightening holes

1. Manholes and lightening holes are to be provided in all non-watertight members to ensure accessibility and ventilation, except in way of widely spaced pillars and where such openings are not permitted by this rule.
2. The number of manholes in tank tops is to be kept to the minimum compatible with securing free ventilation and ready access to all parts of the double bottom. Care is to be taken for locating the manholes to avoid the possibility of inter connection of main subdivision compartments through the double bottom so far as practicable.
3. Covers of manholes specified in **Par 2** are to be of steel, and where no ceiling is provided in the cargo holds, the covers and their fittings are to be effectively protected against damages by cargoes.
4. Air and drainage holes are to be provided in all non-watertight members of the double bottom structures. The proposed locations and sizes of manholes and lightening holes are to be indicated in the plans submitted for approval.
5. The proposed location and size of manholes and lightening holes are to be indicated in the plans submitted for approval.

103. Drainage

1. Efficient arrangements are to be provided for draining water on the tank top.
2. Where wells are provided for the foregoing purpose, such wells are not to extend for more than one-half depth of the double bottom nor less than 457 mm from the bottom shell, as far as practicable.

104. Watertight girders

The thickness of watertight girders and floors, and the scantlings of stiffeners attached to them are to comply with the relevant requirements for girders and floors, as well as the requirements in **Ch 14, 202. and 203.**

105. Minimum thickness

No member of the double bottom structure is to be less than 6 mm in thickness.

Section 2 Centre Girders

201. Arrangement and construction

1. Centre girder is to extend as far forward and afterward as practicable.
2. Where double bottoms having non-watertight centre girder are used for carriage of fuel oil, fresh water or water ballast, the breadth of the compartments is to be less than $0.5B$. However, the requirement may be suitably modified, in narrow tanks at the end parts of the barge or where deemed appropriate by the Society.

202. Manholes

1. Manholes may be provided on centre girders in every frame space outside $0.75L$ amidships.
2. Manholes may be provided on centre girders in alternate frame spaces for $0.75L$ amidships in barges under 90 m in length, provided that the depth of holes does not exceed one-third the depth of centre girder.
3. Where manholes are cut in the centre girder plates for $0.75L$ amidships in barges 90 m in length and above, the girder plates are to be compensated.

203. Depth of centre girder

The depth of centre girder is not to be less $B/16$ unless specially approved by the Society, but in no case is it to be less than 700 mm.

204. Thickness of centre girder plate

The thickness of centre girder plate is not to be less than obtained from the following formula:

$$t = 0.05L + 5 \quad (\text{mm})$$

205. Brackets

1. Where longitudinal framing system is adopted in the double bottom, brackets are to be transversely provided between the solid floors with a spacing not more than 1.75 m connecting the centre girder to the bottom shell plating as well as the adjacent bottom longitudinals, and additional stiffeners are to be provided for the centre girder as may be required.
2. The thickness of the brackets specified in **Par 1** is not to be less than obtained from the following formula. However, it needs not be greater than that of the solid floors at the same location.

$$t = 0.6\sqrt{L} + 1.5 \quad (\text{mm})$$

3. The thickness of stiffeners specified in **Par 1** is not to be less than that of a flat bar having the same thickness as that of girder plates and having the depth not less than $0.08d_0$, where d_0 is the depth of centre girder (mm).

Section 3 Side Girders

301. Arrangement

1. Side girders in $0.5L$ amidships are to be so arranged that the distance from the centre girder to the first side girder, between girders or from the outermost girder to the Side shell plating does not exceed approximately 4.6 m.
2. In the strengthened bottom forward and beyond that of barges, side girders and half-height girders are to be provided as required in **902**.

302. Thickness of side girders

The thickness of side girder plates is not to be less than obtained from the following formula:

$$t = 0.65 \sqrt{L} + 1.5 \quad (\text{mm})$$

303. Thickness of half-height girders

The thickness of half-height girders is not to be less than obtained from the formula specified in **302**.

304. Scantlings of vertical stiffeners and struts

1. Vertical stiffeners are to be provided on side girders at every open floor, or at a suitable distance if the double bottom is framed longitudinally, and vertical struts are to be provided on half-height girders at every open floor.
2. The thickness of vertical stiffeners required by **Par 1** is not to be less than that of a flat bar having the same thickness as that of the girder plates and having the depth not less than $0.08d_0$ (m), where d_0 is height of side girder (m).
3. The sectional area of vertical struts required by **Par 1** is not to be less than obtained from the formula in **503**, with necessary modifications.

305. Lightening holes

Within 10 % of the length of a hold from its end bulk-heads, the diameter of lightening holes in the side girders is not to exceed one-third the depth of girders, this requirement may, however, be modified in a short hold and outside $0.75L$ amidships and where suitable compensation is made to the girder plate.

Section 4 Solid Floors

401. Arrangement

1. Solid floors are to be provided at a spacing not exceeding about 3.5 m.
2. In addition to complying with the requirements in **Par 1**, solid floors are to be provided at the following locations:
 - (1) Under transverse bulkheads.
 - (2) At the location specified in **902.**, between the collision bulkhead and the after end of the strengthened bottom forward.
3. Watertight floors are to be so arranged that the sub-division of the double bottom generally corresponds to that of the barge.

402. Thickness of solid floors

The thickness of solid floors is not to be less than obtained from the following formula:

$$\text{Transverse framing: } t = 0.6 \sqrt{L} + 1.5 \quad (\text{mm})$$

$$\text{Longitudinal framing: } t = 0.7 \sqrt{L} + 1.5 \quad (\text{mm})$$

403. Vertical stiffeners

1. Vertical stiffeners are to be provided on the solid floors at a suitable spacing in case of the double bottom framed transversely, and at every longitudinal in case of the double bottom framed longitudinally.
2. The vertical stiffeners prescribed in **Par 1** is to be a flat bar having the same thickness as that of the floor plate and the depth not less than $0.08 d_0$ or the equivalent, where d_0 is the depth of the floor at the point under consideration (mm).

404. Lightening holes

Within $0.1B$ from side shell plating, the diameter of lightening holes provided in the solid floors in the middle half length of a hold is not to exceed about one-fifth the depth of floors. This requirement may, however, be suitably modified at the end parts of barge and in exceptionally short holds and where the solid floors are suitably compensated for.

Section 5 Longitudinals

501. Spacing

The standard spacing of longitudinals is obtained from the following formula:

$$S = 2L + 550 \quad (\text{mm})$$

502. Scantlings

1. The section modulus of bottom longitudinals is not to be less than obtained from the following formula, but in no case is it to be less than 30 cm^3 .

$$Z_b = CShl^2 \quad (\text{cm}^3)$$

where:

l = Spacing of solid floors (m)

S = Spacing of longitudinals (m)

- h = Vertical distance from the longitudinals to a point of $d + 0.026 L$ above the top of keel (m)
 C = Coefficient given in **Table 8.1**.

Table 8.1 Coefficient C

Case		C
In case where no strut specified in 503 . is provided midway between floors		8.6
In case where a strut specified in 503 . is provided midway between floors.	Lower part of deep tanks	6.2
	Elsewhere	4.1

2. The section modules of inner bottom longitudinals is not to be less than obtained from the formula **Par 1** with C equal to 0.85 times the value specified for bottom longitudinals in the same location. Where vertical struts are not provided to the longitudinals under deep tanks, the section modules of inner bottom longitudinals is to be as specified in **Ch 15, 202**.

503. Vertical struts

1. Where the spacing of solid floors exceeds 2.5 m, a strut is to be provided between floor plates. This strut is to be a rolled section other than a flat bar or a bulb plate and to be sufficiently overlapped with the webs of bottom and inner bottom longitudinals.
2. The sectional area of vertical struts is not to be less than obtained from the following formula:

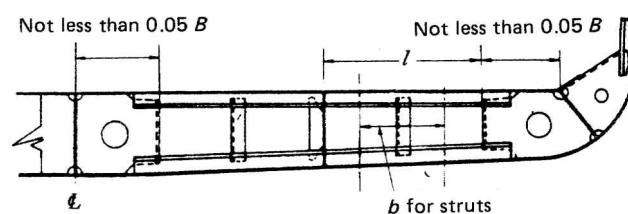
$$A = 2.2 S b h \quad (\text{cm}^2)$$

where:

S = Spacing of longitudinals (m)

b = Breadth of the area supported by the strut (m). (See **Fig 8.1**)

h = As specified in **502. 1**.

**Fig 8.1. Open floor**

Section 6 Inner Bottom Plating and Margin Plates

601. Thickness of inner bottom plating

The thickness of inner bottom plating is not to be less than obtained from the following formula:

$$t = 3.8S\sqrt{d} + 1.5 \quad (\text{mm})$$

where:

S = Spacing of inner bottom longitudinals for longitudinally framed inner bottom plating, or spacing of floor plates for transversely frame dinner bottom plating (m)

602. Barge handling cargoes regularly by mechanical appliances such as grabs

In barges which regularly handle cargoes by grabs or similar mechanical appliances, the thickness of inner bottom plating is to be increased by 2.5 mm above that specified in **601.**, unless ceiling is provided.

603. Arrangements of margin plates

It is recommended that the margin plates are to be of sufficient height to protect the bottom up to the turn of bilge and for forward $0.2L$ from the stem the margin plates are to extend to the barge's sides horizontally as far as practicable.

604. Thickness of margin plates

The thickness of margin plates is to be increased by 1.5 mm above that obtained from the formula in **601.**

605. Breadth of margin plates

Margin plates are to be of adequate breadth and to extend well inside from the line of toes of frame end brackets.

606. Brackets

1. Where the double bottom is framed longitudinally, brackets are to be transversely provided at every hold frame extending from the margin plate to the adjacent bottom and inner bottom longitudinals.
2. The thickness of brackets specified in **Par 1** is not to be less than obtained from the formula in **205. 2.**

Section 7 Frame End Brackets

701. Frame end brackets

1. The thickness of brackets connecting hold frames to margin plates is to be increased by 1.5 mm above that obtained from the formula in **205. 2**.
2. The free edges of brackets are to be stiffened.

Section 8 Open Floors

801. Arrangements

Where the double bottom is framed transversely, open floors are to be provided at every hold frame between solid floors in accordance with the requirements in this section.

802. Scantlings of frames and reverse frames

1. The section modulus of frames is not to be less than obtained from the following formula, but in no case is it to be less than 30 cm³.

$$Z_b = CShl^2 \quad (\text{cm}^3)$$

where:

- l = Distance between the brackets attached to the centre girder and the margin plate (m).
Where side girders are provided, l is the greatest distance between the vertical stiffeners on side girders and the brackets. (See **Fig 8.1**).
- S = Spacing of frames (m).
- h = As obtained from the following formula (m).

$$h = d + 0.026 L \quad (\text{m})$$

C = As specified in **Table 8.2**.

Table 8.2 Coefficient C

Case		C
In case where no vertical strut specified in 803. is provided		6.0
In case where vertical struts specified in 803. are provided	Under deep tanks	4.4
	Elsewhere	2.9

2. The section modulus of reverse frames is not to be less than obtained from the formula in **Par 1** with C equal to 0.85 times the value specified for frames at the same location. Where no vertical strut is provided to the open floors under deep tanks, the scantling of reverse frames is not to be less than required in **Ch 15, 202.** taking the frames as the stiffener of deep tank bulkhead.

803. Vertical struts

1. Vertical struts prescribed in **802.** are to be rolled sections other than flat bars and bulb plates and to be well overlapped with the webs of frames and reverse frames.
2. The sectional area of vertical struts is not to be less than that specified in **503.** with necessary modifications.

804. Brackets

1. Frames and reverse frames are to be connected to the centre girder and margin plates by brackets of not less thickness than obtained from the formula in **205. 2.**
2. The breadth of brackets specified in **Par 1** is not to be less than $0.05B$ and the brackets are to be well over-lapped with frames and reverse frames. The free edges of brackets are to be properly stiffened.

Section 9 Construction of Strengthened Bottom Forward**901. Application**

The requirements in this section are to be applied to barges having the bow draught less than $0.037L$ at the ballast condition.

902. Construction

1. Between the collision bulkhead and $0.2L$ abaft the fore end, side girders or half-height girders are to be provided in accordance with the requirements in **Table 8.3**. Where transverse framing is adopted, however, the half-height girders may be provided between the collision bulkhead and $0.175L$ abaft the fore end.

Table 8.3 Construction of strengthened bottom forward

Double bottom	Members	Side girders	Half-height girders or longitudinals shell stiffeners	Solid floors
	Side			
Transverse framing	Transverse framing	To be provided at interval within 2.5 m	To be provided between side girders	To be provided at every frame
	Longitudinal framing			To be provided at intervals within 2.5 m
	Transverse framing		-	To be provided at alternate frames
	Longitudinal framing			To be provided at intervals within 2.5 m

2. Between the collision bulkhead and $0.15L$ abaft the fore end, solid floors are to be provided in accordance with the requirements in **Table 8.3**.
3. In barges having the bow draught more than $0.025L$ and less than $0.037L$ at the ballast condition, of which structural arrangement of strengthened bottom forward is difficult to comply with the requirements, floor plates and side girders are to be reinforced properly. However, for barges of which speed is specially small compared with L at the towed or pushed condition, this requirements may be suitably modified. ⚓

CHAPTER 9 FRAMES

Section 1 General

101. Application

For barges with long holds or hatch ways in length, additional stiffening is to be made by means of increasing scantlings of frames, provision of web frames, etc. to compensate the transverse strength of hull.

102. Frames in way of deep tanks

The strength of frames in way of deep tanks is not to be less than required for stiffeners on deep tank bulkheads.

Section 2 Frame Spacing

201. Transverse frame spacing

1. The standard spacing of transverse frames is obtained from the following formula:

$$S = 2L + 450 \quad (\text{mm})$$

2. Transverse frame spacing in fore and after peaks is not to exceed 610 mm or the standard spacing specified in **Par 1**, whichever is the smaller.
3. The requirements in **Par 2** may be modified, where structural arrangement or scantlings are suitably considered.

202. Longitudinal frame spacing

The standard spacing of longitudinal frames is obtained from the following formula:

$$S = 2L + 550 \quad (\text{mm})$$

203. Consideration for frame spacing exceeding the standard

Where the spacing of frames is equal to or above the spacing of 250 mm greater than the standard spacing in **201.** and **202.**, the scantlings and structural arrangement of single and double bottoms and of other relevant structures are to be specially considered.

Section 3 Transverse Hold Frames

301. Scantlings

1. The section modules of transverse hold frames provided below the freeboard deck between the collision bulkhead and the after peak bulkhead, is not to be less than obtained from the formula in **Table 9.1**, but in no case is it to be less than 30 cm³.
2. Where the depth of bottom centre girder is less than $B/16$, the scantlings of frames as specified in **Par 1** are to be suitably increased.

302. Connection

Transverse hold frames are to be overlapped with frame end brackets by at least 1.5 times the depth of frame sections and are to be effectively connected there to.

Table 9.1 Section modulus

Location	Section modulus (cm ³)
(1) Between 0.15L from the fore end and the after peak bulkhead	$Z = 2.6Shl^2$
(2) Between 0.15L from the fore end and the collision bulkhead	$Z = 3.4Shl^2$
S = Frame spacing (m) l = Vertical distance from the top of inner bottom plating or single bottom floors at side to the top of deck beams above the frames (m) h = Vertical distance from the lower end of l at the place of measurement to a point as specified in the following (m) 30 m < L ≤ 90 m : $d + 0.044L - 0.54$ (above top of keel) 90 m < L : $d + 0.038L$ (above top of keel)	

Section 4 Side Longitudinals

401. Side longitudinals

1. The section modulus of side longitudinals in the midship part below the freeboard deck is not to be less than obtained from the following formula, which ever is the greater.

$$Z_1 = 8.6Shl^2 \quad (\text{cm}^3), \quad Z_2 = 2.9\sqrt{L}S^2 \quad (\text{cm}^3)$$

where:

S = Spacing of longitudinals (m)

l = Distance between the web frames or between the transverse bulkhead and the web frame including the length of connection (m)

h = Vertical distance (m) from the longitudinals to a point specified in the following

30 m < L ≤ 90 m : $d + 0.044L - 0.54$ (above top of keel)

90 m < L : $d + 0.038L$ (above top of keel)

2. Beyond the midship part, the section modulus of side longitudinals may be gradually reduced towards the end of barges, and may be 0.85 times that obtained from the formula in **Par 1** at the ends. However, the section modulus of side longitudinals between 0.15L from the fore end and the collision bulkhead is not to be less than obtained from the formula in **Par 1**.
3. The depth of flat bars used for longitudinals is not to exceed 15 times the thickness of flat bars.
4. Side longitudinals on sheer strakes in the midship part are to be, as far as possible, of slenderness ratio not greater than 60.
5. The section modulus of bilge longitudinals need not exceed that of bottom longitudinals.

402. Side transverse

1. The side transverse supporting side longitudinals are to be arranged at an interval not exceeding about 4.8 m at positions where solid floors are provided.
2. The scantlings of side transverse are not to be less than obtained from the following formula:

Section modulus: $Z = C_1 S h l^2$ (cm³), Thickness of web: $t = \frac{C_2 S h l}{d_0} + 1.5$ (mm)

where:

S = Side transverse spacing (m)

l = Vertical distance from the top of inner bottom plating or single bottom floors at side to the deck at the top of side transverse. Where, however, there are effective deck transverses, l may be measured up to the lower surface of such transverses (m)

d_0 = Depth of side transverses (mm). However, the depth of slots for side longitudinals is to be deducted from the web depth

h = Vertical distance (m) from the lower end of l to a point specified in the following, but in no case is it to be less than $1.43 l$

30 m < L ≤ 90 m : $d + 0.044 L - 0.54$ (above top of keel)

90 m < L : $d + 0.038 L$ (above top of keel)

C_1 and C_2 = Coefficients given in **Table 9.2**.

Table 9.2 Coefficient C_1 and C_2

Coefficient	For side transverses abaft 0.15L from the fore end	For side transverses between 0.15L from the fore end and the collision bulkhead
C_1	4.7	6.0
C_2	45	58

3. Side transverses are to be provided with tripping brackets at an interval of about 3.0 m and stiffeners are to be provided on the webs at each longitudinals. However, for the middle part of the span of side transverse they may be provided at alternate longitudinals.

Section 5 Superstructure Frames

501. Scantlings

The section modulus of superstructure frames is not to be less than obtained from the following formula:

$$Z = C S l L \quad (\text{cm}^3)$$

where:

S = Frame spacing (m)

l = Tween deck height (m), but not to be less than 1.8 m

C = Coefficient specified in the following

For 0.125L from the fore end : 0.74, For others : 0.57

Section 6 Frames in Both Peaks

601. Transverse frames in fore peaks

The section modulus of transverse frames below the freeboard deck forward of the collision bulkhead is not to be less than obtained from the following formula, but in no case is it to be less than 30 cm^3 .

$$Z = 8Shl^2 \quad (\text{cm}^3)$$

where:

S = Spacing of frames (m)

l = Distance between the supports of transverses (m), but not to be less than 2 m

h = Vertical distance (m) from the midpoint of l to a point of $0.12L$ above the top of keel.

Wherever, the value is less than $0.06L$, it is to be taken as $0.06L$

602. Longitudinal frames in fore peaks

The section modulus of longitudinal frames below the freeboard deck forward of the collision bulkhead is not to be less than obtained from the following formula. However, the section modulus obtained from the formula is to be increased by 25% between $0.15D$ and $0.05D$ from the top of keel and 50 % below $0.05D$ from the top of keel.

$$Z = 8Shl^2 \quad (\text{cm}^3)$$

where:

S, l = As specified in **401**.

h = Vertical distance (m) from the longitudinals to a point of $0.12L$ above the top of keel (m), where, however, the value is less than $0.06L$, it is to be taken as $0.06L$

603. Transverse frames in after peaks

The section modulus of transverse frames below the freeboard deck abaft after peak bulkhead is not to be less than obtained from the following formula, but in no case is it to be less than 30 cm^3 .

$$Z = 8Shl^2 \quad (\text{cm}^3)$$

where:

S = Spacing of frames (m)

l = As specified in **Table 9.1**, where, however, the value is less than 2 m, it is to be taken as 2 m

h = Vertical distance (m) from the midpoint of l to a point specified in the following

$30 \text{ m} < L \leq 90 \text{ m}$: $d + 0.044L - 0.54$ (above top of keel)

$90 \text{ m} < L$: $d + 0.038L$ (above top of keel) \Downarrow

CHAPTER 10 BEAMS

Section 1 General

101. Camber of weather deck

The standard camber of weather decks is $0.02B$ at the midship.

102. End connection of beams

1. Longitudinal beams are to be continuous or to be connected with brackets at their ends in such a manner as to effectively develop the sectional area and to have sufficient strength to bending and tension.
2. Transverse beams are to be connected to frames by brackets .
3. Transverse beams provided at positions where frames are omitted in tween decks or super-structures, are to be connected to the side plating by brackets.

103. Continuity of strength

In the parts where the longitudinal beams are trans-formed to transverse beams, special care is to be taken to keep the continuity of strength.

Section 2 Deck Load

201. Value of h [See Guidance]

1. Deck load h (kN/m^2) for decks intended to carry ordinary cargoes or stores is to be in accordance with the following (1) through (3) :
 - (1) h is to be equivalent to the standards given by 7 times the tween deck height at side of the space(m), or 7 times the height from the deck concerned to the upper edge of hatch coaming of the above deck (m). However, h may be specified as the maximum design cargo weight per unit area of deck (kN/m^2). In this case, the value of h is to be determined by considering the loading height of cargo.
 - (2) Where timber and/or other cargoes are intended to be carried on the weather deck, h is to be the maximum design cargo weight per unit area of deck (kN/m^2), or the value specified in **Par 2**, whichever, is the greater.
 - (3) Where cargoes are suspended from the deck beams or deck machinery is installed, h is to be suitably increased .
2. Deck load h (kN/m^2) for the weather deck is to be as specified in the following (1) to (4):
 - (1) h for the freeboard deck and the superstructure deck and the top of deckhouses on the free-board deck is not to be less than obtained from the following formula:

$$h = a(bf - y) \quad (\text{kN/m}^2)$$

where:

a, b = As given in **Table 10.1**

f = As obtained from the following formula:

$$L < 90 \text{ m} : f = 0.067L, \quad 90 \text{ m} \leq L \leq 150 \text{ m} : f = 0.051L + 1.45$$

y = vertical distance from the load line to weather deck at side (m), and y is to be measured at fore end for deck forward of $0.15L$ abaft the fore end; at $0.15L$ abaft the fore end for deck between $0.3L$ and $0.15L$ abaft the fore end; at midship for deck between $0.3L$ abaft the fore end and $0.2L$ afore the aft end; and at aft end

for deck aftward of $0.2L$ afore the aft end

(2) h for deck in Line II in **Table 10.1**, need not exceed that in Line I.

(3) h is not to be less than obtained from the following formula in **Table 10.2**, irrespective of the provision in (1) and (2). Where h value calculated from the formula in **Table 10.2** is not to be less than **12.8**.

Table 10.1 Values of a and b

Column	Position of deck	a					b
		Deck plating	Beams		Deck girders	Pillars	
			$L < 90\text{m}$	$90\text{ m} \leq L \leq 150\text{ m}$			
I	Forward of $0.15L$ abaft the fore end	14.7	9.80	$9.81 (0.84 L/100 + 0.25)$	7.35	4.90	1.42
II	Between $0.15L$ and $0.3L$ abaft the fore end	11.8	7.85	$9.81 (0.69 L/100 + 0.2)$	5.90	3.90	1.20
III	Between $0.3L$ abaft the fore end and $0.2L$ afore the aft end	6.90	4.60	$9.81 (0.38 L/100 + 0.13)$	$2.25^{(1)}$ $3.45^{(2)}$	2.25	1.0
IV	Afterward of $0.2L$ afore the aft end	9.80	6.60	$9.81 (0.55 L/100 + 0.18)$	4.90	3.25	1.15
NOTES:							
(1) In case of longitudinal deck girders outside the line of hatchway opening of the strength deck in midship part of ship.							
(2) In case of deck girders other than (1).							

Table 10.2 Minimum value of h

Column	Position of deck	h	C			
			Deck plating	Beams		Transverses, Longitudinal deck girders and pillars
				$L < 90\text{m}$	$90\text{ m} \leq L \leq 150\text{ m}$	
I and II	Forward of $0.3L$ abaft the fore end	$C\sqrt{L+50}$	4.20	2.85	$9.81/100 (0.23L + 8.3)$	1.37
III	Between $0.3L$ abaft the fore end and $0.2L$ afore the aft end		2.05	1.37	$9.81/100 (0.12L + 3.2)$	1.18
IV	Afterward of $0.2L$ afore the aft end	$C\sqrt{L}$	2.95	1.95	$9.81/100 (0.17L + 4.7)$	1.47

Section 3 Longitudinal Beams

301. Spacing

The standard spacing of the longitudinal beams is obtained from the following formula:

$$S = 2L + 550 \quad (\text{mm})$$

302. Proportion

1. Longitudinal beams are to be supported by deck transverses of appropriate spacing. In midship part of strength deck, the slenderness ratio of deck longitudinals is not to exceed 60. This requirement may, however, be suitably modified where longitudinal beams are given a sufficient strength to prevent buckling.
2. Flat bars used for longitudinals are not to be of depth thickness ratio exceeding 15:

303. Section modulus

1. The section modulus of longitudinal beams outside the line of openings of strength decks for the midship part of barge is not to be less than obtained from the following formula:

$$Z = 1.14 S h l^2 \quad (\text{cm}^3)$$

where :

S = Spacing of longitudinal beams (m)

h = Deck load specified in **Sec 2** (kN/m²)

l = Horizontal distance between bulkhead and deck transverse or between deck transverses (m)

2. Beyond the midship part of barge, the section modulus of longitudinal beams outside the line of openings on strength decks may be generally reduced, but the section modulus is not to be less than obtained from the following formula:

$$Z = 0.43 S h l^2 \quad (\text{cm}^3)$$

where :

S , h and l : As specified in **Par 1**.

3. The section modulus of longitudinal beams, except where specified in **Par 1** and **2**, is not to be less than obtained from the formula in **Par 2**.

304. Deck transverse supporting longitudinal beams

Deck transverse supporting longitudinal beams are to be provided in line with the solid floors.

Section 4 Transverse Beams

401. Arrangements

Transverse beams are to be provided on every frame.

402. Proportion

The length of transverse beams is not to exceed, as far as possible 30 times the depth of transverse beams for strength deck beams and 40 times for superstructure deck beams, respectively.

403. Section modulus of transverse beams

The section modulus of transverse beams is not to be less than obtained from the following formula:

$$Z = 0.43 S h l^2 \quad (\text{cm}^3)$$

where:

S = Spacing of transverse beams (m)

h = Deck load specified in **Sec 2** (kN/m²)

l = Horizontal distance from the inner edge of beam brackets to the longitudinal deck girder, or between the longitudinal deck girders (m)

Section 5 Beams on Bulkhead Recess and Others

501. Section modules

The section modules of beams at deck forming the top of bulkhead recess is to comply with requirements in this **Chapter** and **Ch 14, 203**.

Section 6 Beams on the Top of Deep Tanks

601. Section modules

The section modules of beams at deck forming the top of deep tanks is to comply with requirements in this **Chapter** and **Ch 15, 202**.

Section 7 Deck Beams Supporting Specially Heavy Loads

701. Reinforcement of deck beams

The deck beams supporting specially heavy loads or arranged at the ends of superstructures or deckhouses, in way of masts, windlasses and auxiliary machinery, etc. are to be properly reinforced by increasing the scantlings of beams, or by the additional deck girders or pillars. ⚓

CHAPTER 11 DECK GIRDERS

Section 1 General

101. Application

Deck transverse supporting longitudinal deck beams and deck girders supporting transverse deck beams are to be in accordance with the requirements in this chapter.

102. Arrangement

In way of the bulkhead recesses and the top of tanks, deck girders are to be arranged at an interval not exceeding 4.6 m as far as practicable.

103. Construction

1. Deck girders are to be composed of face plates provided along the lower edge.
2. Tripping brackets are to be provided at an interval of about 3 m and where the breadth of face plates exceeds 180 mm on either side of the girder, these brackets are to be so arranged as to support the face plates as well.
3. The thickness of face plates forming girders is not to be less than that of web plates and the width of the face plates is not to be less than obtained from the following formula:

$$b = 2.7 \sqrt{d_0 l} \quad (\text{mm})$$

where:

d_0 = Depth of webs (mm)

l = Distance between the supports of girders (m). Where, however, effective tripping brackets are provided, they may be taken as supports

4. The depth of girders is more than 2.5 times that of slots for beams, and is to be kept constant between two adjacent bulkheads for the longitudinal girders.
5. The girders are to have a sufficient rigidity to prevent excessive deflection of decks and excessive additional stresses in deck beams.

104. End connection

1. End connection of deck girders are to be in accordance with the requirements in **Ch 1, 304**.
2. Bulkhead stiffeners or girders at the ends of deck girders are to be suitably strengthened to support deck girders.
3. Longitudinal deck girders are to be continuous or to be effectively connected so as to maintain the continuity at ends.

Section 2 Longitudinal Deck Girders

201. Section modulus

1. The section modulus of longitudinal deck girders outside the lines of hatchway openings of strength deck of midship part is not to be less than obtained from the following formula:

$$Z = 1.29 b h l^2 \quad (\text{cm}^3)$$

where:

- b = Distance between the centres of two adjacent spans of beams supported by the girders or the beam bracket (m)
- h = Deck loads specified in **Ch 10, Sec 2** (kN/m²)
- l = Distance between the supports of longitudinal girders (m)

2. Beyond the midship part of barge, the section modulus of longitudinal deck girders outside the lines of openings of strength deck, may be gradually reduced, but the section modulus is not to be less than obtained from the following formula:

$$Z = 0.484 b h l^2 \quad (\text{cm}^3)$$

b , h and l : As specified in **Par 1**.

3. The section modulus of longitudinal deck girders for the parts other than specified in **Par 1** and **2**, is not to be less than obtained from the formula in **Par 2**.

202. Thickness of web plates

The thickness of web plates is not to be less than obtained from the following formula:

$$t = 10 S_1 + 1.5 \quad (\text{mm})$$

where:

S_1 = Spacing of web stiffeners or depth of the girders (m), whichever is the smaller

Section 3 Transverse Deck Girders

301. Section modules

1. The section modules of transverse deck girders is not to be less than obtained from the following formula:

$$Z = 0.484 b h l^2 \quad (\text{cm}^3)$$

where:

- b = Distance between the centres of two adjacent girders or bulkheads (m)
- h = Deck load specified in **Ch 10, Sec 2** (kN/m²)
- l = Distance between the supports of transverses (m)

302. Thickness of web plate

The thickness of web plates is to be in accordance with the requirements in **202**.

Section 4 Deck Girders in Tanks

401. Section modules

The section modules of deck girders in tanks is to be in accordance with the requirements in **201.** or **301.** and is to be in compliance with the requirements in **Ch 15, 203. 1** as well.

402. Thickness of web plate

The thickness of web plates is to be in accordance with the requirements in **202.** or **302.** and is to be in compliance with the requirements in **Ch 15, 203. 3** as well.

Section 5 Hatch Side Girders

501. Deep coamings on decks

Where deep coamings are provided on decks as in the case of hatchway on weather deck, the horizontal coaming stiffener and the coaming up to its stiffener may be included in the calculation of the section modules, subject to the approval by the Society.

502. Brackets of hatch side girders not extended to bulkheads

Where hatch side girders do not extend to the bulkheads, brackets extending for at least two frame spaces beyond the ends of hatchways are to be provided.

502. Strength continuity

At hatchway corners, the face plates of hatch coamings and longitudinal deck girders or their extension parts and the face plates on both sides of hatch end girders are to be effectively connected so as to maintain the strength continuity.

Section 6 Hatch End Girders

601. Scantling

The scantlings of hatch end girders are to be in accordance with the requirements in **Sec. 3** and **4.**
⚓

CHAPTER 12 PILLARS AND TRUSSES

Section 1 General

101. Arrangement

Pillars and trusses are to be provided in line with girders in single bottom or double bottom or as close thereto as practicable. And the structures under pillars and trusses are to be of sufficient strength to distribute the load effectively.

102. End connection of pillars

The head and heel of pillars and trusses which may be subjected to tensile loads such as pillars and trusses supporting bulkhead recesses or deep tank tops are to be efficiently connected to withstand the tensile loads.

Section 2 Scantling of Pillars

201. Sectional area of pillars

The sectional area of pillars is not to be less than obtained from the following formula:

$$A = \frac{0.223 W}{2.72 - \frac{l}{k}} \quad (\text{cm}^2)$$

where:

l = Length of the pillars (m)

k = Minimum radius of gyration of pillar, obtained from the following formula (cm)

$$k = \sqrt{\frac{I}{A}}$$

where:

I = The least moment of inertia of the pillar (cm⁴)

A = Sectional area of the pillar (cm²)

W = Deck load (kN) supported by pillars as obtained from the following formula:

$$W = Sbh \quad (\text{kN})$$

where:

S = Distance between the mid-points of two adjacent spans of girders supported by the pillars or the bulkhead stiffeners or bulkhead girders (m) (See **Fig. 12.1**).

b = Mean distance between the midpoints of two adjacent spans of beams supported by the pillars or the frames (m) (See **Fig. 12.1**).

h = Deck load specified in **Ch 10, Sec 2** for the deck supported (kN/m²)

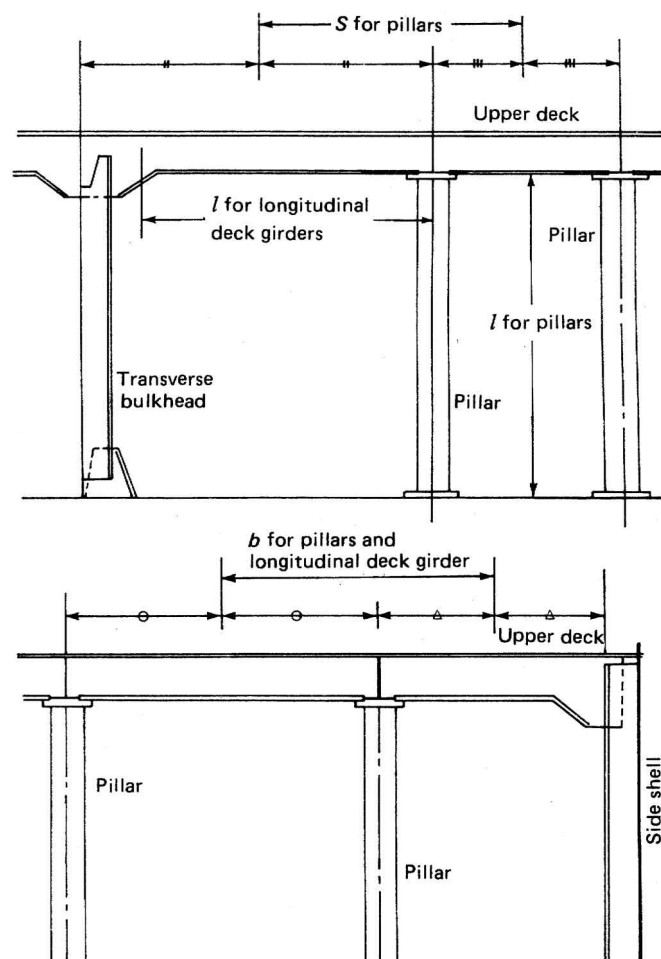


Fig 12.1 The way of measuring S , b and l for pillars, transverse and longitudinal girders.

202. Thickness

1. The plate thickness of tubular pillars is not to be less than obtained from the following formula. This requirement may, however, be suitably modified for the pillars provided in accommodation spaces.

$$t = 0.022d_p + 3.6 \quad (\text{mm})$$

where :

d_p = Outside diameter of the tubular pillar (mm)

2. The thickness of web and flange plate of built-up pillars is to be sufficient for the prevention of local buckling.

203. Outside diameters of round pillars

The outside diameter of solid round pillars and tubular pillars is not to be less than 50 mm.

204. Pillars provided in deep tanks

1. Pillars provided in deep tanks are not to be of tubular pillars.
2. The sectional area of pillars is not to be less than specified in 201. or obtained from the following formula, whichever is the greater.

$$A = 1.09 Sbh \quad (\text{cm}^2)$$

where:

S, b = As specified in **201**.

h = 0.7 times the vertical distance from the top of deep tanks to the point of 2 m above the top of overflow pipe (m)

Section 3 Trusses

301. Scantling

The scantlings of pillars in the truss structure are to be in accordance with the requirements in **201**.

302. Diagonals

1. Diagonals in trusses are to be arranged so as to have angle of inclination of about 45 deg.
2. The sectional area of diagonals is not to be less than 0.5 times the value specified in **201**. ⚡

CHAPTER 13 PEAK CONSTRUCTION

Section 1 General

101. Application

1. The requirements in this chapter are to apply to the bottom and the side constructions in way of both peaks.
2. The side frames are to be in accordance with the requirements in **Ch 9**.

102. Swash plates

In fore and after peaks used for deep tanks, effective swash plates are to be provided at the centre line of the hull or the scantlings of structural members are to be suitably increased.

Section 2 Arrangements of Construction Forward of the Collision Bulkhead

201. Constructions and arrangements

1. In the place forward of the collision bulkhead, the deep centre girder or the longitudinal bulkhead at the centre line is to be provided, or trusses connecting the centre girder with the deck construction by struts and diagonals are to be arranged.
2. In barges with transverse framing, the floors having sufficient depth are to be arranged in every frame and they are to be supported by the side girders provided at an interval of about 2.5 m and below. Frames are to be supported by the construction specified in **202. 5** to **7** with the spacing of about 2.5 m.
3. In barges with longitudinal framing, bottom and side longitudinals are to be supported by bottom and side transverse girders provided at an interval of about 2.5 m. Bottom and side transverse girders are to be supported by side girders and side longitudinal girders or cross tie provided at an interval of about 4.6 m, respectively. And side transverse girders are to be effectively connected with bottom transverse girders.

202. Transverse framing

1. The thickness of floors and centre girders is not to be less than obtained from the following formula, but need not exceed 11 mm.

$$t = 0.045L + 4.5 \quad (\text{mm})$$

2. The floors are to be of adequate depth and to be properly stiffened with stiffeners as may be required.
3. The upper edges of the floors and centre girders are to be properly stiffened.
4. The thickness of side girders is to be approximately equal to that of centre girders and side girders are to extend to such a proper height as may be required according to the height of floors.
5. Where the panting beams are provided at every frame together with perforated steel plates fitted up thereon from side to side, the scantlings of panting beams and steel plates are not to be less than obtained from the following formula:

$$\text{Sectional area of panting beams : } A = 0.1L + 5 \quad (\text{cm}^2)$$

$$\text{Thickness of steel plates : } t = 0.02L + 4.5 \quad (\text{mm})$$

6. Where the side stringers are provided, their scantlings are not to be less than obtained from the following formula:

Depth: $d_1 = 200l$ (mm), 2.5 times the depth of slots for transverse frames or the value obtained following formula, whichever is the greatest.

$$L < 90 \text{ m} : d_2 = 5.3L + 250 \text{ (mm)}, \quad L \geq 90 \text{ m} : d_2 = 2.5L + 500 \text{ (mm)}$$

Section modulus: $Z = 8Shl^2$ (cm³)

Thickness of web: $t = 0.02L + 5.5$ (mm)

where:

S = Breadth of area supported by the side stringer (m)

h = Vertical distance from the centre of S to a point of $0.12L$ above the top of the keel (m), but not to be less than $0.06L$

l = Distance between the supports of side stringers (m)

7. Where panting beams are provided on alternate frames and stringer plates which are connected to the shell plating are provided at each tier of panting beams, the scantling of panting beams and stringer plates are to comply with the following requirements.

Sectional area of panting beam : $A = 0.3L$ (cm²)

Scantlings of stringer plates :

Breadth: $L < 90 \text{ m} : b = 5.3L + 250$ (mm), $L \geq 90 \text{ m} : b = 2.5L + 500$ (mm)

Thickness : $t = 0.02L + 5.5$ (mm)

203. Longitudinal framing

1. Where the bottom transverses are supported along the centre line, their scantlings are not to be less than obtained from the following formula:

Web depth: $d_1 = 200l$ (mm) or $d_2 = 8.5L + 180$ (mm), whichever is the greater.

Section modulus : $Z = 1.2SLl^2$ (cm³)

Web thickness : $t_1 = 5\frac{SLl}{d_0} + 1.5$ (mm) or $t_2 = 0.6\sqrt{L} + 3.0$ (mm), whichever is the greater.

where:

S = Spacing of transverses (m)

l = Span of transverses between the supporting points (m)

d_0 = Depth of transverses deducted by the depth of slot for longitudinals (m)

2. The scantlings of centre girders are not to be less than those of bottom transverses specified in **Par 1**.
3. The scantlings of side transverses supporting longitudinals are not to be less than obtained from the following formula:

Web depth: $d_1 = 200l_0$ (mm) or 2.5 times the depth of slots for longitudinals (mm), whichever is the greatest.

$$L < 90 \text{ m} : d_2 = 5.3L + 250 \text{ (mm)}, \quad L \geq 90 \text{ m} : d_2 = 2.5L + 500 \text{ (mm)}$$

Section modulus: $Z = 8Shl_0^2$ (cm³)

Thickness of web: $t_1 = 42 \frac{SLl_0}{d_0} + 1.5$ (mm) or $t_2 = 0.02L + 5.5$ (mm), whichever is the greater.

where:

S = Spacing of transverses (m)

d_0 = As specified in **Par 1**.

h = Vertical distance from the centre of l_0 to a point of $0.12L$ (m) above the top of keel (m), but in no case is it to be less than $0.06L$ (m)

l_0 = Length of side transverses between the supporting points (m)

4. Side transverses are to be provided with stiffeners on webs at every longitudinal.
5. The scantlings of side stringers which support side transverses are not to be less than obtained from the following formula:

Web Depth: $d_1 = 200l_1$ (mm) or the value obtained from the following formula, whichever is the greater.

$$L < 90 \text{ m} : d_2 = 5.3L + 250 \text{ (mm)}, \quad L \geq 90 \text{ m} : d_2 = 2.5L + 500 \text{ (mm)}$$

Section modulus: $Z = 4Shl_0l_1$ (cm³)

Thickness of web : $t_1 = 31 \frac{Shl_1}{d_0} + 1.5$ (mm) or $t_2 = 0.02L + 5.5$ (mm), whichever is the greater.

where :

S = Breadth of area supported by the stringer (m)

h = Vertical distance from the centre of S to a point of $0.12L$ (m) above the top of keel (m), but in no case is it to be less than $0.06L$ (m)

l_0 = As specified in **Par 3**.

l_1 = Length of side stringers (m)

d_0 = As specified in **Par 1**.

6. The sectional area of cross ties supporting the transverses is not to be less than obtained from the following formula:

$$\text{Where } \frac{l}{k} \text{ is 0.6 and above: } A = \frac{0.77Sbh}{1 - 0.5\frac{l}{k}} \text{ (cm}^2\text{)}$$

$$\text{Where } \frac{l}{k} \text{ is less than 0.6 : } A = 1.1Sbh \text{ (cm}^2\text{)}$$

where :

S = Spacing of transverses (m)

b = Breadth of area supported by the cross ties (m)

h = Vertical distance from the centre of b to a point of $0.12L$ (m) above the top of keel (m), but in no case is it to be less than $0.06L$ (m)

l = Length of cross ties (m)

k = Minimum radius of gyration of cross ties, obtained from the following formula (cm)

$$k = \sqrt{\frac{I}{A}}$$

I = The least moment of inertia of the cross ties (cm⁴)

A = Sectional area of the cross ties (cm²)

204. Trusses

The truss structure connecting the bottom and the deck is to comply with the following requirements:

(1) The sectional area of struts is not to be less than obtained from the following formula:

$$A = \frac{0.33 S b L}{2.72 - \frac{l}{k}} \quad (\text{cm}^2)$$

where:

S = Distance between the mid-points of two adjacent spans of girders supported by the struts or bulkheads (m)

b = Distance between the mid-points of two adjacent spans of beam supported by the struts or the beam brackets at ship side (m)

l = Length of struts (m)

k = Minimum radius of gyration of struts, obtained from the following formula (cm)

$$k = \sqrt{\frac{I}{A}}$$

I = The least moment of inertia of the strut (cm⁴)

A = Sectional area of the strut (cm²)

(2) Diagonals in trusses are to be arranged at an angle of inclination of about 45 deg, and the section area is not to be less than 0.75 times the area specified in (1).

(3) Where the fore peak is used for a deep tank, struts and diagonals are to be of solid section.

Section 3 Arrangements of Construction Aft After Peak Bulkhead

301. Floors

The scantlings and arrangement of floors in the after peak are to be in accordance with the requirements in **202**.

302. Frames

Where the length of girth between the supporting points of frame exceeds 2.5 m, the scantling of frames are to be increased or suitably strengthened to give adequate stiffness to the structure.

303. Other construction members

Where the requirements of the constructions in the after peak are in accordance with the requirements of the fore peak in **Sec 2**, the scantlings of transverses, stringers, longitudinal frames, struts and diagonals are to be 0.67 times the values specified in **Sec 2**. ↓

CHAPTER 14 WATERTIGHT BULKHEADS

Section 1 Arrangement

101. Collision bulkheads [See Guidance]

The barges are to have a collision bulkhead located between $0.05L$ and $0.08L$ from the fore side of stem on the load line. However, in barges of 90 m and under in length, the maximum distance from the fore side of stem may be $0.13L$.

102. After peak bulkheads

The barges are to have an after peak bulkhead situated at a suitable position.

103. Hold bulkheads

The barges are to have hold bulkheads so as to make the spacing of adjacent bulkheads to be under 30 m as possible, in addition to the bulkheads specified in **101.** and **102.**

104. Height of watertight bulkheads

The watertight bulkheads required in **101.** to **103.** are to extend to the freeboard deck with the following exceptions:

- (1) Where a forecastle having openings without closing appliances led to a space below the freeboard deck is provided, or where a forecastle of $0.25L_f$ or above in length is provided, the collision bulkhead is to extend up to the forecastle deck. However, the extended part above the freeboard deck may be provided within the limit of bulkhead position specified in **101.** and may be weathertight.
- (2) The aft peak bulkhead may terminate at a deck below the freeboard deck and above the load line, provided that this deck is made watertight to the stern of the barge.

105. Chain lockers

Chain lockers are to be in accordance with the requirements in **Pt 3, Ch 14 207.** of the **Rules.**

Section 2 Construction

201. Thickness

The thickness of bulkhead plating is not to be less than obtained from the following formula:

$$t = 3.2S\sqrt{h} + 1.5 \quad (\text{m})$$

where:

S = Spacing of stiffeners (m)

h = Vertical distance measured from the lower edge of the plates to the bulkhead deck at the centre line of barge (m), but in no case is it to be less than 3.4 m.

202. Increase of thickness

1. The thickness of the lowest strake of bulkhead plating is to be at least 1 mm thicker than obtained from the formula in **201.**
2. The lowest strake of bulkhead plating is to extend at least about 600 mm above the top of inner bottom plating in way of double bottom or about 900 mm above the top of keel in way of single bottom. Where the double bottom is provided only on one side of the bulkhead, the extension of the lowest strake is to be effected up to either height according to the preceding sentence, which—

ever is the greater.

3. The bulkhead plating in bilge well is to be at least 2.5 mm thicker than given in **201**.
4. The thickness of deck plating in way of bulkhead recesses is to be at least 1 mm greater than that given by **201**., regarding the deck plating as bulkhead plating and the beams as stiffeners respectively. In no case is the thickness to be less than the required for deck plating in the location.

203. Stiffeners

The section modulus of bulkhead stiffeners is not to be less than obtained from the following formula:

$$Z = CShl^2 \quad (\text{cm}^3)$$

where:

C = Coefficients given in **Table 14.1** according to the type of end connection

S = Spacing of stiffeners (m)

h = Vertical distance measured from the mid-point of l for vertical stiffeners, and from the mid-point of the distance between the adjacent stiffeners for horizontal stiffeners, to the top of bulkhead deck at the centre line of barge (m). Where the vertical distance is less than 6.0 m, h is to be taken as 0.8 times the vertical distance plus 1.2 m

l = Span measured between the adjacent supports of stiffeners including the length of connection (m). Where girders are provided, l is the distance from the heel of end connection to the first girder or the distance between the girders.

204. Collision bulkheads

For collision bulkheads, the plate thickness and section modulus of stiffeners are not to be less than those specified in **201**. and **203**. taking h as 1.25 times the specified height.

205. Girders supporting bulkhead stiffeners

1. The section modulus of girders not to be less than obtained from the following formula:

$$Z = 4.75 Shl^2 \quad (\text{cm}^3)$$

where:

S = Breadth of the area supported by the girder (m)

h = Vertical distance measured from the mid-point of l for vertical girders, and from the mid-point of S for horizontal girders, to the top of upper deck at the centre line of barge (m). Where the vertical distance is less than 6.0 m, h is to be taken as 0.8 times the vertical distances plus 1.2 m.

l = Span between the supports of girders (m)

2. The moment of inertia of girders is not to be less than that obtained from the following formula. In no case is the depth of girders to be less than 2.5 times the depth of slots for stiffeners.

$$I = 10 hl^4 \quad (\text{cm}^4)$$

where:

h, l = As specified in **Par 1**.

3. The thickness of web plates is not to be less than obtained from the following formula:

$$t = 0.01 S_1 + 1.5 \quad (\text{mm})$$

where:

S_1 = Spacing of web stiffeners or depth of girders, whichever is the smaller (mm)

Table 14.1 Value of C

Vertical Stiffener	Upper end Lower end		Lug-connection, supported by girders or hard connection	Soft connection	End of stiffener unattached
	Lug-connection or supported by girders		2.80	3.22	3.78
	Bracketed		2.24	2.52	2.80
	Only the web of stiffener attached at end		3.22	3.78	4.48
	End of stiffener unattached		3.78	4.48	5.60
Horizontal Stiffener	One end The other end		Lug-connection, supported by girders or Hard connection		End of stiffener unattached
	Lug-connection bracketed or supported by brackets		2.80		3.78
	End of stiffener unattached		3.78		5.60

NOTES:

1. "Lug-connection" is such a connection as both web and face bar of stiffener are effectively attached to the bulkhead plating, decks or inner bottoms which are strengthened by effective supporting members on the opposite side of plating.
2. "Hard connection" of vertical stiffeners is a connection by bracket to the longitudinal members or to the adjacent members, in line with the stiffeners, of the same or larger section. (See **Fig 14.1 (a)**).
3. "Soft connection" of vertical stiffeners is a connection by bracket to the transverse members such as beams, or other connections equivalent to the connections mentioned above. (See **Fig 14.1 (b)**).

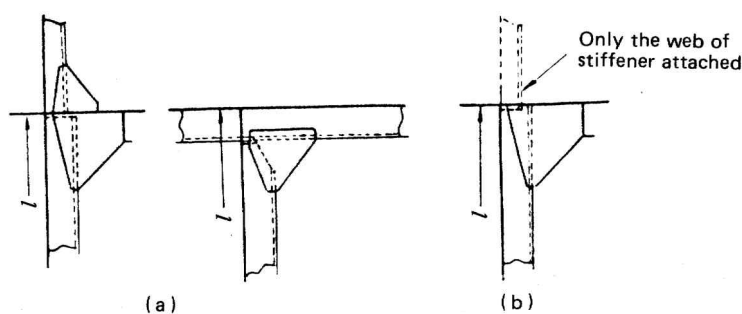


Fig 14.1 Types of end connection

4. Tripping brackets are to be provided at an interval of about 3 m, and these brackets are to be so arranged as to support the face plates. ↓

CHAPTER 15 DEEP TANKS

Section 1 General

101. Definition

The deep tank is a tank used for carriage of water, fuel oil and other liquids, forming a part of the hull construction. The deep tanks used for carriage of oils are designated as "deep oil tanks", if necessary.

102. Application

1. Peak tank bulkheads and boundary bulkheads of deep tank(excluding the deep tanks for carriage of oil having a flash point 60 °C and below) are to be constructed in accordance with the requirements in this chapter. Where the bulkhead of deep tank partly serves as a watertight bulkhead, the part of the bulkhead is to be in accordance with the requirements in **Ch 14**.
2. The requirements in **Ch 22** are to be applied to the bulkheads of the deep tanks for carriage of oils having a flash point 60 °C and below, in addition to those in this chapter.

103. Divisions in tanks

1. Deep tanks are to be of proper size and to be provided with such longitudinal watertight divisions as necessary to meet the requirements for stability of the barge in service conditions as well as while the tanks are being filled or discharged.
2. Tanks for fresh water or fuel oil or those which are not intended to be kept entirely filled in service conditions are to have additional divisions or deep wash plates as are necessary to minimize the dynamic forces acting on the structure.
3. Where it is impracticable to comply with the requirements in **Par 2**, the scantlings required in this chapter are to be properly increased.

Section 2 Bulkheads of Deep Tanks

201. Bulkhead plates

The thickness of deep tank bulkhead plating is not to be less than obtained from the following formula:

$$t = 3.6S\sqrt{h} + 2.5 \quad (\text{mm})$$

where:

S = Spacing of stiffeners (m)

h = Distance given below, whichever is the greater:

- (1) Vertical distance measured from the lower edge of plate to the midpoint of the distance between the top of tanks and the top of overflow pipes (m). For bulkheads of large tanks, additional water pressure is to be considered.
- (2) 0.7 times the vertical distance measured from the lower edge of plate to the point of 2.0 m above the top of overflow pipes (m)

202. Bulkhead stiffeners

The section modulus of bulkhead stiffeners is not to be less than obtained from the following formula:

$$Z = CShl^2 \quad (\text{cm}^3)$$

where :

S, l = As specified in **Ch 14, 203**.

h = Vertical distance given below, whichever is the greater, the lower end being regarded as the mid-point of l for vertical stiffeners and as the mid-point of distance between the adjacent stiffeners for horizontal stiffeners.

- (1) Vertical distance measured from the lower end to the mid-point of the distance between the top of tanks and the top of overflow pipes (m). For bulkhead stiffeners of large tanks, additional water pressure is to be considered.
- (2) 0.7 times the vertical distance measured from the lower end to the point of 2.0 m above the top of overflow pipes (m).

C = Coefficient given in **Table 15.1** according to the type of end connections.

Table 15.1 Value of C

One end of stiffeners The other end of stiffeners	Connection by hard bracket	Connection by soft bracket	Supported by Rule girders or lug connection	Snip
Connection by hard bracket	4.90	8.05	5.95	9.10
Connection by soft bracket	8.05	5.95	9.10	8.05
Supported by Rule girders or lug connection	5.95	9.10	7.00	10.50
Snip	9.10	8.05	10.50	10.50
NOTES: 1. Connection by hard bracket is a connection by bracket to the double bottoms or to the adjacent members, such as longitudinals or stiffeners in line, of the same or larger sections, or a connection by bracket to the equivalent members mentioned above. (See Fig 14.1 (a)). 2. Connection by soft brackets is a connection by bracket to the transverse members such as beams or equivalent thereto. (See Fig 14.1 (b)). 3. The connection by only the web of stiffener attached at end may be provided by girder and lug connection, subject to the approval by the Society.				

203. Girders supporting bulkhead stiffeners

1. The section modulus of girders supporting bulkhead stiffeners (here in after referred to as "girder") is not to be less than obtained from the following formula:

$$Z = 7.13Shl^2 \quad (\text{cm}^3)$$

where :

S = Breadth of the area supported by the girders (m)

h = Vertical distance measured from the mid-point of S for horizontal girders, and from the midpoint of l for vertical girders, to the top of h specified in **202**. (m)

l = Span between the supports of girders (m)

2. The moment of inertia of girders is not to be less than obtained from the following formula. In no case is the depth of girders to be less than 2.5 times the depth of slots for stiffeners.

$$I = 30hl^4 \quad (\text{cm}^4)$$

where :

h, l = As specified in **Par 1**.

3. The thickness of web plates is not to be less than obtained from the following formula:

$$t = 0.01 S_1 + 2.5 \quad (\text{mm})$$

where:

S_1 = Spacing of web stiffeners or the depth of girders, whichever is the smaller (mm)

204. Top and bottom construction

The scantlings of the members forming the top or the bottom of deep tanks are to be in accordance with the requirements in this chapter, regarding the members as the members forming the deep tank bulkheads at the location. In no case are they to be less than required for the deck plating or the bottom plating at the location. For top plating of deep tanks, the thickness of plates is to be at least 1 mm greater than the thickness specified in **201**.

205. Scantlings of members not in contact with sea water

The thickness of plates of bulkheads and girders which are not in contact with sea water in service conditions may be reduced from the requirements in **201**. and **203**, by the values given following. However, bulkhead plates in way of the location such as bilge wells are not to be regarded as the plates in contact with sea water.

For the plates of which only one side is in contact with sea water : 0.5 mm

For the plates of which neither side is in contact with sea water : 1.0 mm

Section 3 Fittings of Deep Tanks

301. Limbers and air holes

Limbers and air holes are to be cut suitably in the structural members to ensure that air or water does not remain stagnated in any part of the tank.

302. Cofferdam

1. The following dedicated tanks are to be separated from adjacent tanks by cofferdams. However, these coffer-dams may be omitted provided that the common boundaries of lubricating oil and fuel oil tank have full penetration welds.
 - (1) Fuel oil
 - (2) Lubricating oil
 - (3) Vegetable oil
 - (4) Fresh water
2. The cofferdams in **Par 1** are to be provided with the air pipes to comply with the requirements in **Pt 5, Ch 6, 201**. of the **Rules** and with the manholes of adequate size which are well accessible.
3. Crew spaces and passenger spaces are not to be directly adjacent to the tanks for carriage of fuel oil. Such compartments are to be separated from the fuel oil tanks by cofferdams which are well ventilated and is not less than 600 mm in width for easy access. Where the top of fuel oil tanks has no opening and is coated with incombustible coverings of 38 mm and over in thickness, the cofferdam between such compartments and the top of fuel oil tanks may be omitted. ⚠

CHAPTER 16 SUPERSTRUCTURE AND DECKHOUSE

Section 1 General

101. Application

1. The construction and scantlings of superstructures and deckhouses are to be in accordance with the requirements in the relevant chapters in addition to this chapter.
2. The requirements in this chapter apply to superstructure and deckhouses up to the first tier above the freeboard deck. The construction and scantlings of the second tier superstructure and deckhouses and over above the freeboard deck are to be in accordance with the discretion of the Society.
3. As for the superstructures and deckhouses in barges with specially large freeboard, the construction of bulkhead may be suitably modified subject to the approval by the Society.

Section 2 Construction and Scantlings

201. Water head h

1. The water head h for the calculation of the scantlings of superstructure end bulkheads and boundary walls of deckhouses is not to be less than obtained from the following formula:

$$h = ac(bf - y) \quad (\text{m})$$

where:

a and b = As given in **Table 16.1**

c = As given in **Table 16.2**

f = As obtained from the following formula :

$$L < 90 \text{ m} : f = 0.067L, \quad L \geq 90 \text{ m} : f = 0.051L + 1.45$$

y = Vertical distance from the load line to a mid-point of the span of stiffeners for calculation of stiffeners, to a mid-point of the panel for calculation of thickness of the bulkhead platings (m)

Table 16.1 Values of a and b

	Forward of the midship		Afterward of the midship	
	a	b	a	b
Fore walls	$\frac{L}{100} + 2.0$	1.2	$\frac{L}{100} + 2.0$	1.15
Side walls	$\frac{L}{150} + 0.5$		$\frac{L}{150} + 0.5$	
After walls	$\frac{L}{1000} + 0.4$		$\frac{L}{1000} + 0.4$	

Table 16.2 Values of c

Locations	c
End bulkheads of superstructures	1.0
Boundary walls of deckhouses	$0.7 \frac{b'}{B} + 0.3$ However, $\frac{b'}{B}$ is less than 0.25, $\frac{b'}{B}$ is to be taken as 0.25
b' = Breadth of deckhouse at the position under consideration (m) B' = Breadth of ship on the exposed deck at the position under consideration (m)	

2. The water head is not to be less than obtained from the formula, In **Table 16.3.** irrespective of the provisions in **Par 1:**

Table 16.3 Water head, h (m)

Length of ship (m)	Exposed front bulkhead of the 1st tier superstructure	Others
$L \leq 50$	3.0	1.5
$50 < L$	$\frac{L}{100} + 2.5$	$\frac{L}{200} + 1.25$

202. Thickness of bulkhead and wall platings

1. The thickness of bulkheads and wall platings for barges is not to be less than obtained from the following formula.

$$t = 3S\sqrt{h} \quad (\text{mm})$$

where:

S = Spacing of stiffeners (m)

h = Water head specified in **201.**

2. The thickness of bulkhead and wall platings is not to be less than obtained from the following formula, irrespective of the requirement in **Par 1.**

$$t = \frac{L}{100} + 4.0 \quad (\text{mm})$$

203. Stiffeners

1. The section modulus of stiffeners on bulkheads and walls is not to be less than obtained from the following formula:

$$Z = 3.5Shl^2 \quad (\text{cm}^3)$$

where :

S, h = As specified in **202.**

l = Tween deck height (m). Where, however, l is less than 2 m, l is to be taken as 2 m.

2. Both ends of stiffeners on the exposed bulkheads and, walls are to be connected to the deck by welding except where otherwise approved by the Society.

Section 3 Access Openings in Superstructure End Bulkheads

301. Closing means for access openings

1. The doors to be provided on the access openings in the end bulkheads enclosed superstructures and deck-houses protecting companion ways giving access to the space under the freeboard deck or space in the enclosed superstructure are to be in accordance with the requirements in (1) through (5):
 - (1) The doors are to be made of steel or other equivalent materials and to be permanently and rigidly fitted up to the bulkheads.
 - (2) The doors are to be rigidly constructed, to be of equivalent strength to that of intact bulkhead and to be weathertight when closed.
 - (3) The means for securing weather tightness are to consist of gaskets and clamping devices or other equivalent devices and to be permanently fitted up to the bulkhead or the door it self.
 - (4) The doors are to be operated from the both sides to the bulkheads.
 - (5) Hinged doors are, as a rule, to open outward.
2. The height of sills of access openings specified in **Par 1** is not to be less than 380 mm above the upper surface of the deck except where higher sills may be required when deemed necessary by the Society. ⚓

CHAPTER 17 HATCHWAYS AND OTHER DECK OPENINGS

Section 1 General

101. Application

1. The requirements of this chapter are to apply to the hatchways and other openings on the exposed parts of freeboard deck of the barges not engaged on international voyages and the barges of less than 24 m in length.
2. For the barges of 24 m and above in length and engaged on international voyages, the hatchways and other deck openings on the exposed parts of freeboard deck are to be in accordance with the requirements in Rule Pt 10, Ch 19.
3. Where the barge has an unusually large freeboard, the requirements in this chapter may be reduced subject to the approval by the Society.

102. Weathertightness

Hatchways and other openings on the decks are to have weathertight covers.

103. Position of Exposed Deck Openings

For the purpose of this chapter, two positions of exposed deck openings are defined as follows:

Position I : Upon exposed freeboard deck and raised quarter decks and exposed superstructure decks within the forward $0.25L_f$.

Position II : Upon exposed superstructure decks abaft the forward $0.25L_f$.

Section 2 Hatchways

201. Height of hatchway coamings

The height of coamings above the upper surface of deck is to be at least 600 mm in Position I and 450 mm in Position II. But, for barges of less than 30 m in length, the height of coamings may be as given in Table 17.1.

Table 17.1 Height of coamings for barges of less than 30 m in length (mm)

	Area of hatchways of 1.5 m ² and under	Others
Position I	380	450
Position II	230	300

202. Construction of hatchway coamings

1. The thickness of hatchway coamings is not to be less than obtained from the following formula, but neednot exceed 11 mm.

$$t = 0.05L + 6.0 \quad (\text{mm})$$

2. On the hatchway coamings, horizontal stiffeners are to be provided at an appropriate position, and the upper edges of the hatchway coamings are to be stiffened by half round bars or other suitable means.
3. The hatchway coamings are to be stiffened with efficient brackets or stays fixed with the horizontal stiffeners specified in Par 2 and the deck at an interval of not greater than 3.0 m.

- Where hatch covers of sliding type are provided, the hatchway coamings are to be suitably strengthened according to the weight of hatch covers.

Section 3 Hatch Covers

301. Hatch covers

- The thickness of steel hatch covers is not to be less than 0.01 times of the spacing of stiffeners or 6 mm, whichever is the greater.
- Stiffeners in steel hatch covers are to be provided at an interval of not more than 750 mm and to be of section modulus not less than obtained from the following formula;

$$Z = CSl^2 \quad (\text{cm}^3)$$

where :

S = Spacing of stiffeners (m)

l = Length of stiffeners (m)

C = Coefficient obtained from the following formula

$$C = 0.15L + 12$$

- Stiffeners are to be provided around the edges of steel hatch cover, so as to ensure sufficient rigidity to withstand deformation while handling.
- The scantlings of portable beams are to comply with the requirements in **Par 2**. However, S is to be taken as the spacing of portable beams, l as the length of portable beams. The thickness of wooden hatch covers is not to be less than obtained from the following formula, however, in no case is it to be less than 60 mm.

$$t = 40S \quad (\text{mm})$$

where:

S = Spacing of portable beam (m)

302. Miscellaneous

- The depth of portable beams and the width of face bars are to be suitably designed, taking into consideration their tripping and deflection.
- The parts supporting hatch covers and portable beams are to be effectively strengthened.
- The carriers for portable beams are to be of steel, with the bearing surface of not less than 75 mm wide and not less than 12.5 mm thick.
- The carriers on the side coamings are to be provided with appropriate devices to prevent the portable beams from falling off.

Section 4 Companion-ways and Other Deck Openings

401. Manholes and flush scuttles

Manholes and flush scuttles in exposed positions on the freeboard deck or superstructure deck or within superstructures other than enclosed superstructures are to be closed by steel coves capable of being made watertight.

402. Companion-ways

The height of sills of doorways above the upper surface of the deck is not to be less than given in the following **Table 17.2**. ⚓

Table 17.2 Height of sills of doorways (mm)

Position \ L	$L \geq 30 \text{ m}$	$L < 30 \text{ m}$
I	450	300
II	300	150

CHAPTER 18 BULWARKS, FREEING PORTS, VENTILATORS AND PERMANENT GANGWAYS

Section 1 General

101. Application

1. The requirements of this chapter are to apply to the barges specified in **Ch 17, 101. 1.**
2. The barges specified in **Ch 17, 101. 2** are to be in accordance with the requirements in **Pt 4, Ch 4** of the **Rules**.

Section 2 Bulwarks and Guardrails

201. General [See Guidance]

Efficient guardrails or bulwarks are to be provided on all exposed parts of the freeboard and superstructure deck and the top of similar deckhouses.

202. Dimensions

The height of bulwarks or guardrails specified in **201.** is to be at least 1 m from the upper surface of deck. However, a less height than this may be accepted where this height would interfere with the normal operation of the barge, provided that other adequate protection means are provided to the satisfaction of the Society.

203. Construction of bulwarks

1. The bulwarks are to be strongly constructed and effectively stiffened on their upper edge.
2. The thickness of bulwarks on the freeboard decks is not to be less than 6 mm.
3. Bulwarks are to be supported by strong stays attached to deck in way of the beams and spaced not more than 1.8 m apart on freeboard deck.
4. Bulwarks on the decks which are designed to carry timber deck cargoes are to be supported by specially strong stays spaced not more than 1.5 m apart.

Section 3 Freeing Ports

301. Freeing arrangements [See Guidance]

On the weather parts of freeboard or superstructure deck, freeing arrangements are to be provided with in accordance with the requirements in **Pt 4, Ch 4** of the **Rules**.

Section 4 Ventilators

401. Height of ventilator coamings

The height of ventilator coamings above the upper surface of the deck is not to be less than given in the following **Table 18.1** corresponding L and the position specified in **Ch 17, 103**. However, a lower height may be accepted where the barge has an specially large freeboard or where the ventilator serves the spaces within unenclosed superstructures.

402. Thickness of coamings

The thickness of ventilator coamings is to be in accordance with the discretion of the Society.

Table 18.1 Height of ventilator coamings (mm)

Position \ L	$L \geq 30 \text{ m}$	$L < 30 \text{ m}$
I	900	760
II	760	450

Section 5 Permanent Gangways**501. General**

Satisfactory means are to be provided on the weather decks for the protection of the crew in getting to and from their quarters and other parts. ⚓

CHAPTER 19 EQUIPMENT NUMBER AND EQUIPMENT

Section 1 General

101. General (2020)

1. Equipment number and Equipment are to be in accordance with the **Pt 4, Ch 8** of the **Rules**.
2. For barges having 205 or below in equipment number, the wire ropes may be used in lieu of chain cables.

102. Unmanned barges (2020)

Notwithstanding the requirements in **101.**, for the unmanned barges the following requirements are applied:

- (1) The number of anchors may be one of the unit mass in **Pt 4, Table 4.8.1** of the **Rules**.
- (2) The length of anchor chains may be half of length in **Pt 4, Table 4.8.1** of the **Rules**.
- (3) Except where specified in (1) and (2), the **Pt 4, Table 4.8.1** of the **Rules** is applied.

Section 2 Equipment Number

201. Equipment number (2020)

As specified in **Pt 4, Ch 8, Sec 2** of the **Rules**.

202. Mass of anchors (2020)

As specified in **Pt 4, Ch 8, Sec 2** of the **Rules**. ⚓

CHAPTER 20 MACHINERY

Section 1 General

101. General

1. The machinery is to be capable of operating satisfactorily, under the service conditions and environmental conditions on board.
2. The rotating, reciprocating and high temperature parts of machinery and live parts of electrical apparatus for which the operators or other persons are liable to inadvertently touch to, are to be arranged with suitable protections from becoming injured.
3. It is recommended that no unhealthy gases or dangerous gases which may cause fire, leak from the machinery. Where it is unpracticable, the machinery is to be situated in well ventilated spaces and to be capable of discharging such gases.
4. The machinery is to be so constructed and installed as to be capable of maintenance easily.
5. The machinery used for important system is to be capable of operating easily and certainly, and to be capable of operating satisfactorily except the mooring system, when the barge inclined from the normal at any angle up to 15 deg transversely and 10 deg longitudinally, and when rolling up to 22.5 deg from the vertical.
6. Power transmission systems, shaft couplings and gearing systems used for important system are to be so designed and manufactured as to have sufficient strength withstanding the maximum working stress under normal operating conditions.

Section 2 Internal Combustion Engines

201. General construction

1. The frames and bedplates are to be of rigid and oiltight construction and bedplates are to be fixed securely to the engine seatings.
2. Ventilation of crankcase and any arrangement which could produce a flow of external air within the crankcase, is forbidden except case of (1) and (2).
 - (1) Where vent pipes are provided to crankcase: In this case, the diameters of these pipes are to be as small as practicable.
 - (2) Where a forced extraction of the gases from the crankcase is provided: In this case, the vacuum in the crankcase is not to exceed 25 mm of water head.
3. Crankcase and its doors are to have sufficient strength, and the doors are to be securely fastened, so that they will not be readily displaced by an explosion.

202. Safety devices [See Guidance]

1. Where risk from over-speeding of machinery exists, means are to be provided to ensure that the safe speed is not exceeded.
2. Engines having cylinder of large bore size are to be provided with a relief valve or warning device of an approved type for prevention of overpressure in the cylinder, and also to be provided with crankcase explosive relief valve of an approved type.

203. Installation

1. Where the structures above engines and their surroundings are constructed with combustible materials, adequate measures are to be taken in protection against fire.
2. Engines located on the weather deck are to be provided with ventilated metal hoods or to be installed in well ventilated deckhouses of steel.

204. Exhaust gas pipe arrangement

1. Exhaust gas pipes and silencers are to be water cooled or are to be effectively insulated.
2. Silencers are to be so arranged that they may be easily cleaned.
3. In principle, exhaust gas pipes of several engines are not to be connected together.
4. Exhaust gas pipe is to extend not less than 2.4 m above deck on barge intended to carry liquid cargo having a flash point 60 °C or below and to be provided with a suitable spark arrestor.

Section 3 Boiler and Pressure Vessels**301. General**

Boilers prescribed in **Pt 5, Ch 5** of the **Rules** and pressure vessels belonging to Group 1 or Group 2 prescribed in **Pt 5, Ch 5** of the **Rules** are generally to comply with the requirements in **Pt 5, Ch 5** of the **Rules**. Single system of fuel oil burning and feed water may be acceptable for boiler which is not used for the heating of special cargoes.

Section 4 Auxiliaries and Piping Arrangement**401. Pressure pipes and pipe connections [See Guidance]**

1. Pipes, flanges, valves and pipe fittings and their joints subject to internal pressure are to have an adequate strength conforming to the service conditions.
2. Sleeve threaded joints are generally not to be used for the joints of direct connection of pipe length and flange-pipe connections which pipings are used for fuel oil, lubricating oil or other inflammable oil systems.

402. Piping arrangement

Piping arrangements are to comply with the requirements in **Pt 5, Ch 6** of the **Rules for the Classification of Steel Ships**. However, slip joints maybe acceptable subject to the approval of the Society.

403. Sea suction Valves and overboard discharge valves

Sea suction valves and overboard discharge valves are to be constructed and installed in accordance with the requirements in **Pt 5, Ch 6, Sec 3** of the **Rules for the Classification of Steel Ships**.

404. Pneumatic system

1. Air reservoirs are to be provided with a sufficient drainage system.
2. Air compressors are to be provided with a relief valve to prevent the pressure from rising more than 0.01 times above the maximum pressure in the cylinders.
3. In the case of water cooled air compressor, and where water jacket of compressors and coolers might be subjected to dangerous excessive pressure due to leakage into them from air pressure parts, safety device for overpressure is to be provided at their cooling space .
4. Where air reservoirs can be isolated from the relief valves prescribed in **Par 2** or air reservoirs are charged by hand air compressor only, they are to be provided with a pressure relief device to release the pressure automatically in the event of fire.
5. Starting air piping systems for internal combustion engines are to be provided with non-return valves or other equivalent devices.

405. Fuel oil systems and lubricating oil systems

1. Arrangements for the storage, distribution and utilization of fuel oil and lubricating oil are to be such as to ensure the safety of the barge and persons on board.
2. Machinery spaces in which oil vapour is likely to accumulate, are to be adequately ventilated.
3. Fuel oil systems are to be so arranged that defects and leakage can readily be observed, and the spaces in which the systems are installed are to be adequately illuminated.
4. Materials used for pipes, valves and other fittings of fuel oil systems and lubricating oil systems are to be of the fire resisting metals.
5. Tanks used for the storage of the fuel oil or lubricating oil and oil strainers are not to be installed above hot parts.
6. Fuel oil tanks which do not form part of the barge's structure are to be of steel and to be of rigid construction.
7. Provision is to be made to prevent overpressure in any part of the fuel oil system and lubricating oil system. Any relief valves are to be discharged to a safe position.
8. Coamings or other arrangements are to be provided at each oil tank, oil pump and oil strainer, and suitable means are to be provided for disposing of fuel oil drains.
9. The suction pipes from all tanks, except double bottom tanks, are to be provided with stop valves or cocks secured to the tank walls.
10. Valves, cocks or other fittings fitted on tanks are to be located in safe positions as to protect them from the external damage.
11. Main suction valves of all fuel oil tanks except for double bottom tanks are to be capable of being closed from a remote position which will always be accessible. This requirement, however, may not be applied to tanks for which the Society specially approved considering the arrangement or the capacity of the tanks.
12. Fuel oil pipings are to be entirely separated from other pipings. Where, however, it is unavoidable to interconnect to any other pipings, effective means are to be provided to prevent the accidental contamination with other liquids while in operation.
13. Lubricating oil pipings are to be entirely separated from other pipings, unless specially approved by the Society.
14. As for the systems of fuel oil having a flash point below 60 °C are to comply with the requirements in **Pt 5, Ch 6, Sec 9** of the **Rules**.

406. Air pipes, overflow pipes and sounding devices [See Guidance]

1. Air pipes, overflow pipes and sounding devices are to comply with the requirements in **Pt 5, Ch 6, Sec 2** of the **Rules** except the following requirements for the inside diameter of the air and overflow pipes and for the arrangements of overflow pipes.
2. Air pipes fitted to tanks which do not form part of the barge's structure are to be in accordance with the discretion of the Society for the capacity and service conditions of the tanks.
3. Overflow pipes are to be provided to settling tank and service tank for fuel oil which can be pumped up, or to other tanks having any openings below the open end of air pipes.
4. The overflow pipes are to have sufficient area for pump capacity to prevent overflow from other opening of the tanks while liquid is filled.
5. For unmanned barges, if it is recognized that the safety of the barge is not impaired, the air pipes and sounding devices may be dispensed with for particular compartments except tanks, irrespective of the provision in **1**.

407. Bilge systems [See Guidance]

1. An efficient bilge pumping system is to be provided in all barges capable of pumping from and draining each watertight compartment when the barge is on an even keel and either upright or listed 5 deg. If the Society is satisfied that the safety of the barge is not impaired, the bilge system may be dispensed with for particular compartment.
2. Where common bilge main connected with branch bilge suction from each compartment is provided, at least two independent power bilge pumps are to be provided. Each pump is to be connected to the bilge main, and is to be capable of discharging the bilge effectively even where the one pump gets out of order. These pumps may be substituted by bilge ejectors in combination with sea water pump.
3. The power bilge pumps prescribed in **Par 2** are to be in accordance with the discretion of the Society. Area and length of the bilge suction pipes and the bilge main are to be such that the capability of the bilge pumps is not impaired.
4. Where any source of power is not available on board, such means as manual bilge pumps are to be provided to drain each watertight compartment.
5. Where centrifugal pumps are employed in bilge drainage, they are to be of the self-priming or the equivalent type.
6. The manual pumps prescribed in **Par 4** are to be located above the upper deck, or at the high convenient level which is easily accessible, and they are to be capable of operating effectively.
7. Special bilge systems are to be subjected to the approval of the Society.
8. Bilge suction pipes are to be entirely separated from pipes used for filling or emptying spaces carrying water ballast or all.
9. Non-return valve or cock which does not permit the communication between bilge and ballast water tanks, fresh water tanks or fuel oil tanks is to be provided to bilge suction pipes connected to any pump having a seawater or fuel oil suction in order to prevent the possibility of water or fuel oil passing into the water-tight compartments from the sea, fuel oil tanks or water tanks or bilge passing from one compartment to another through the bilge pipes.
10. Valves and cocks which are connected to bilge system are to be located at an easily accessible position.
11. Branch pipes of each bilge suction are to be led to mud boxes or rose boxes which are to be arranged for easy cleaning without disconnecting any joint of the pipe.
12. For barges which are intended to carry oil having a flash point 60 °C or below as cargo, bilge in a pump room and compartments which are adjoining to cargo oil tanks is not to be led to compartments which do not adjoin to the cargo tanks. Further, bilge pipes in a cargo oil pump room and compartments which are adjoining to cargo oil tanks are to be entirely separated from the bilge pipes in other compartments not adjoining to the cargo tanks.
13. For unmanned barges, in general, portable pumps or other suitable drainage means are to be provided.

408. Scuppers [See Guidance]

1. Scuppers sufficient in number and size to provide effective drainage are to be provided in the freeboard deck.
2. Scuppers draining weather decks and spaces within superstructures and deckhouses of which access openings are not provided with closing means complying with the requirements in **Pt 5, Ch 6, Sec 3** of the **Rules**, are to be led overboard.
3. Scuppers from spaces below the freeboard deck or spaces within enclosed superstructures or enclosed deckhouses on the freeboard deck are to be led to the bilges. Alternatively, scuppers provided with valves may be led overboard, where the Society is satisfied that the pipes are provided with adequate protection to prevent from flooding into the board.

4. Scuppers originating at any level and penetrating the shell plating either more than 450 mm below the freeboard deck or less than 600 mm above the summer load waterline, are to be provided with an automatic non-return valve at the shell plating. This valve, unless required by **Par 3**, may be omitted provided that the pipe thickness is in accordance with the **Pt 5, Ch 6, Table 5.6.2.** of the **Rules**.
5. Scupper pipes passing through the shell plating below the freeboard deck are to be of steel or other approved materials. Valves and shell fittings for scuppers passing through the shell plating below the freeboard deck are to be of steel, bronze or other approved ductile materials.

Section 5 General Requirements of Electrical Equipment

501. General

1. The design and installation of electrical equipment are to be such as to minimize the risk of fire or other electrical accidents due to its failure.
2. Electrical equipment is to be suitable construction for marine use and provided with effective protective enclosure for environmental conditions in which the equipment is installed.
3. Insulating materials and windings of electrical equipment are to have sufficient resistance for moisture, sea air and oil vapour.

502. System voltage [See Guidance]

System voltages are to comply with the requirements in **Pt 6, Ch 1, 201. 5** of the **Rules**.

503. Clearance and creepage

1. The clearances and creepages between live parts and between live parts and earthed metals are to be adequate for the working voltage having regard to the nature of the insulating materials and operating conditions.
2. The clearances and creepages inside the terminal box of rotating machinery, switchboard bussbar and the controlling equipment, etc. are to comply with the requirements in **Pt 6, Ch 1, 201. 1, 202., 301., 403., 701. and 706** of the **Rules**.

504. Limits of temperature rise

1. Ambient temperature

For all electrical equipment, the following ambient temperatures are recognized as standard:

- (1) For all equipment located in compartment where the boilers are installed and on weather decks: 45 °C (for rotating machinery 50 °C).
- (2) For all equipment located in other spaces than specified in **Par 1**: 40 °C

2. Limits of temperature rise

The limits of temperature rise of generators, motors, switchboards, transformers and starters for motors are to comply with the requirements in **Pt 6, Ch 1** of the **Rules**.

Section 6 Earthing

601. Earthing of electrical equipment

Non-current-carrying metallic parts of fixed electrically equipment and portable electrical apparatus having the rated voltage of 100 V and over are to be effectively earthed.

602. Earthing of cables

Metallic coverings of cables are to be electrically continuous throughout their length and to be effectively earthed at both ends, except that in final sub-circuits earthing may be at the supply end only.

603. Exemption in application **[See Guidance]**

Notwithstanding the requirements in **601.**, the earthing of non-current-carrying metallic parts may be dispensed with for double insulated portable apparatuses.

Section 7 Protective Devices of Electrical Equipment

701. General

1. Electrical equipment is to be protected against accidental overcurrents including short-circuit. The protective devices are to be capable of continuously servicing other circuits which are used for the electrical source and/or other important feeder circuit as far as practicable by breaking fault circuit and to be capable of eliminating damage to the systems and hazard off fire.
2. Circuit-breakers and fuses used for the protective devices are to comply with the requirements in **Pt 6, Ch 1, Sec 8** of the **Rules** or equivalent thereto. **[See Guidance]**

702. Protection against short-circuit

1. Short-circuit protection is to be provided in each live pole of a direct-current system and in each phase of an alternating current system.
2. Circuit breakers and fuses for used by protective device are to comply with the requirements in **Pt 6, Ch 1, Sec 8** of the **Rules** or the equivalent above. **[See Guidance]**

703. Protection against overload

1. Overload protection is to be provided in the following line or phase;
 - (1) Two-wire *D.C.* or single-phase *A.C.* system—at least one line or phase.
 - (2) Three-wire *D.C.* system—both outer lines.
 - (3) Three-phase *A.C.* system—at least two phase.
2. Tripping characteristics of overload protective devices (blowing out characteristics for fuse) are to be adequate for the thermal capacity of the electrical equipment and wirings protected.

704. Protection of generators

1. Generators are to be protected against short-circuit and overcurrent by a multipole circuit-breaker arranged to open simultaneously all insulated poles. In the case of generators less than 50 kW and not arranged to operate in parallel, they may be protected by a multipole linked switch with fuses or a circuit breaker in each insulated pole.
2. In the case of generators arranged to operate in parallel, they are to be provided with reverse power protection for *A.C.* system or reverse current protection for *D.C.* system.

705. Protection of motors

Each motor used for important system is to be protected from short-circuit and overload. protective device of motor is to have a delay characteristic to enable the motor to start.

Section 8 Source of Electrical Power

801. Generator [See Guidance]

1. Aggregate capacity of generators used for important system is to be sufficient to supply the total necessary electrical power for the barge. In *A.C.* generators, they are to have sufficient capacity to permit the starting of the largest motor in the barge during normal operation satisfactorily.
2. Generators used for important system are to withstand any load fluctuation in normal operating condition and always be capable of supplying stable electrical power.
3. Prime movers for generators used for important system are to be provided with speed regulators which will maintain the speed withstanding the load fluctuation of generators.

802. Switch boards [See Guidance]

1. Switchboards are to be constructed and installed in accordance with the requirements in **Pt 6, Ch 1, Sec 4** and **8** of the **Rules** in general.
2. Switchboards used for important system are to be provided with the instruments prescribed in **Pt 6, Ch 1, Sec 4** of the **Rules**, as far as applicable. Where two or more generators are provided but not arranged to operate in parallel, the instruments of switchboard are to be in accordance with the discretion of the Society.

803. Section boards and distribution boards

Section boards and distribution boards are to be constructed in accordance with the requirements in **Pt 6, Ch 1, Sec 4** of the **Rules**.

804. Transformers for lighting and power

1. Transformers for lighting and power are to be constructed in accordance with the requirements in **Pt 6, Ch 1, Sec 6** of the **Rules**.
2. Transformers are to withstand any load fluctuation in normal operating condition and always be capable of supplying stable electrical voltage.

805. Storage batteries [See Guidance]

1. Batteries and their charging facilities are to comply with the requirements in **Pt 6, Ch 1, Sec 13** of the **Rules**.
2. In the case of barge whose navigation lights are solely operated by electrical power, and where the power source is batteries without means of charging during normal navigation, the batteries are to have sufficient capacity for operating hours of navigation lights and operating conditions of themselves.
3. Batteries prescribed in **Par 2** may be used for starting the internal combustion engines unless this does not give any insecure effect to the function of these batteries.

806. Reserve source of electrical power

1. The barges whose navigation lights are solely operated electrical power except those for which the electrical power is supplied from pusher are to be provided with at least one set of independent reserve source of electrical power device which has the capacity to supply the power to the navigation lights at least 16 hours continuously. This device is to be available immediately in stead of main source of electrical power, in the event of failure of the main source of electrical power.
2. In the case of unmanned barge, arrangements are to be made to ensure that reserve source of electrical power will automatically come into operation in the event of failure of the main source of electrical power.
3. For barge which has two or more generators, one of them may be regarded as a reserve source of

electrical power. In this case, all generators are to be so arranged as to be available for the source of electrical power for the navigation lights.

4. Notwithstanding with the requirements in **Par 1** the reserve source of electrical power system may be omitted where the navigation lights having own batteries approved by the Society are used.

Section 9 Cables

901. General

1. Construction, application and current carrying capacity of cable are to be in accordance with the requirements in **Pt 6, Ch 1, Sec 5 of the Rules for the Classification of Steel Ships**.
2. In the case of barge whose electrical power is supplied from the pusher, these feeder cables are to be avoided from having a direct effect of tension on the cables regardless of the connecting method of the pusher and barge.

902. Installation of cables [See Guidance]

1. Cable are to be so installed as to avoid damages due to deflection of the hull.
2. When installing cables, the minimum internal radius of bend is to be of adequate to prevent the cables from damage.
3. Where cables having different insulating materials each other are bunched together, considerations are to be given to the maximum rated conductor temperatures of each cable.
4. Where cables pass through watertight or airtight bulkheads or decks, considerations are to be given to maintain the watertightness or airtightness of these bulkheads or decks.

903. Mechanical protection of cables [See Guidance]

Cables fitted in locations, such as cargo holds, where they are likely to suffer mechanical damage, are to be suitably protected by pipes or ducts.

904. Cable pipes and ducts

1. Cable pipes and ducts are to have suitable drainage.
2. Metallic pipes and ducts are to be efficiently protected against corrosion and to be earthed effectively. Nonmetallic pipes and ducts are to be of flame-retardant materials.

905. Securing of cables [See Guidance]

Cables are to be effectively supported and secured by supports and clips which are of corrosion-resistant metallic materials or those protected against corrosion or of flame-retardant non-metallic materials taking account of kind of cable, electrical magnetic force caused by short circuit current, vibration and their installing condition except cables which are portable cords or installed in pipes.

906. Cable joint and branch

Cables is to be jointed or branched in a suitable box with terminals, except where method of connection has no risk of deteriorating water-proof characteristics, flame retardant, mechanical strength or electrical characteristics of cables.

Section 10 Distribution

1001. Shore connections

1. A connection box is to be provided in a suitable position where arrangements are made for the supply of electrical power from a source on shore except those prescribed in **Par 4**.
2. The connection box is to contain terminals of suitable size and a circuit-breaker or an isolating switch with fuses. Means are to be provided for checking the phase sequence for the phase alternating current system or checking the polarity for direct current system.
3. The cables between the connection box and the switchboard are to be permanently fixed and a pilot lamp for source and a switch or circuit-breaker are to be provided on the switchboard.
4. The switchboard may be used for a shore connection box. In this case, the fittings described in **Par 2** and **3** are to be provided on this switchboard.
5. Where the electrical power source on board is a generator, interlocking device is to be provided on the switchboard to prevent parallel operation of the generator on board with the shore main.

1002. Navigation light circuits

1. Each navigation light is to be connected independently to the navigation light control panel.
2. Each navigation light is to be controlled and protected in each pole by a switch with fuses or a circuit-breaker fitted on the navigation light control panel.
3. The navigation light control panel is to be served by independent circuit fed from the switchboard or other electrical power source panel for navigation lights.
4. Switches and fuses are not to be provided on the feeder circuits of navigation lights, except on the switchboard or on the control panel. However, automatic control devices for the navigation lights may be provided to them.
5. Navigation light control panel is to be installed at the suitable manned place except for unmanned barges.

Section 11 Control Gears

1101. Starters [See Guidance]

Starters for motors are to be constructed in accordance with the requirements in **Pt 6, Ch 1, Sec 7** of the **Rules**.

Section 12 Explosion-Protected Electrical Equipment

1201. General

Explosion-protected electrical equipment is to be in accordance with the requirements in **Pt 6, Ch 1, Sec 9** of the **Rules**.

Section 13 Emergency Stopping Device

1301. Emergency stopping ventilators

Mechanical ventilating fans for machinery space or cargo space and boiler fans are to be capable of being stopped from an easily accessible position outside the machinery space, as well as from another position.

1302. Emergency stopping of fuel oil pumps

Fuel oil pumps except those having small capacity are to be capable of being stopped from an easily accessible position outside the machinery space, as well as from another position.

Section 14 Machinery and Electrical Equipment of Tank Barges

1401. General

Machinery and electrical equipment of barges intended to carry crude oil or petroleum products having the vapour pressure (in gauge) less than 0.2 MPa at 38 °C in bulk are to comply with the requirements in **Pt 7, Ch 1, Sec 10 to 11** of the **Rules** to the exclusion of the requirements for arrangements of cargo pumps and for bilge arrangements as well as the requirements in **Sec 1 to 13** of this Chapter.

Section 15 Spare Parts

1501. Spare parts for internal combustion engines and boilers

The Society may require to carry necessary spare parts for internal combustion engines used for important system or boilers which supply steam as power source of important system or heat source of special cargoes.

Section 16 Tests

1601. Tests at the manufacturer's work [See Guidance]

1. Boilers and pressure vessels are to be tested in accordance with the requirements in **Pt 5, Ch 5** of the **Rules**.
2. Pipes, valves and other fittings used for compressed air piping having a maximum working pressure exceeding 2 MPa are to be tested with hydrostatic pressure of 1.5 times the maximum working pressure after completion of welding, bending or machining.
3. Valves, cocks and casting distance pieces fitted to the shell plating of the barge below the load water line are, after finished, to be tested with hydrostatic pressure of 0.5 MPa.
4. Fuel oil tanks with their fittings which do not form a part of the ship's structure are to be tested with a hydrostatic pressure corresponding to a head of water not less than 2.5 m above the top plates.
5. Generators, switchboards, motors and their starters and transformers used for important system are to be tested in accordance with the requirements in relevant Chapter of **Pt 6** of the **Rules**. Voltage regulation of generators and transformers at load characteristics test is to be in accordance with the discretion of the Society.
6. Cables are to be tested in accordance with the requirements in **Pt 6, Ch 1, Sec 5** of the **Rules**.
7. Explosion-protected electrical equipment is to be subjected to the tests prescribed in **Pt 6, Ch 1, 103. 1. (2)** of the **Rules**.

1602. On board tests

1. Popping test and accumulation test for safety valve of boiler are to be carried out in accordance with the requirements in **Pt 5, Ch 5, 124.** of the **Rules**.
2. Piping systems including pumps, strainers and heaters for fuel oil, lubricating oil, cargo oil and others used for inflammable oil are to be subjected to test, after installed on board, with hydrostatic pressure of 1.5 times the maximum working pressure. The pressure test of the pipings connected to the pumps which have been subjected to hydrostatic test before assembled on board, may be omitted except for fuel oil piping systems, provided that the leakage tests are carried out at operating conditions.
3. Other piping systems together with fittings are, after installed on board, to be subjected to trial.
4. Important systems are, after installed on board, to be subjected to performance test synthetically.
5. Electrical equipment is, after installed on board, to be subjected to insulation resistance test in accordance with requirements in **Pt 6, Ch 1, 1701.** of the **Rules**.
6. Various safety devices prescribed in each Paragraph are, after installed on board, to be subjected to performance test.

1603. Additional tests

The Society may require, where considered necessary, other tests than those prescribed in this Chapter. ⚴

CHAPTER 21 PONTOON BARGES

Section 1 General

101. Application

1. The requirements in this chapter apply to steel pontoon barges with longitudinal framing intended for carriage of cargoes on the freeboard deck only.
2. The relevant chapters in these rule are to apply, unless otherwise specified in this chapter.

Section 2 Construction

201. General

Special consideration is to be given, such as the provision of longitudinal bulkheads at the center line or similar strengthened constructions.

202. Arrangement

Bottom transverses, side transverses and deck trans-verses are to be provided at an interval of less than about 3.5 m in one plane.

203. Bottom Longitudinals

The section modulus of bottom longitudinals is not to be less than obtained from the following formula:

$$Z = 9.5 S D l^2 \quad (\text{cm}^3)$$

where :

S = Spacing of longitudinals (m)

l = Span measured between the adjacent supports of longitudinals (m)

204. Bottom Transverses

The scantlings of bottom transverses are not to be less than obtained from the following formula:

$$\text{Section modulus : } Z = 7.4 S D l^2 \quad (\text{cm}^3), \quad \text{Thickness of web : } t = 0.01 d_0 + 1.5 \quad (\text{mm})$$

where:

S = Spacing of transverses (m)

l = Span measured between the adjacent supports of transverses (m)

d_0 = Depth of web (mm)

205. Side Longitudinals

The section modulus of side longitudinals is not to be less than obtained from the following formula.

$$Z = 9.5 S h l^2 \quad (\text{cm}^3)$$

where:

S = Spacing of longitudinals (m)

l = Span measured between the adjacent supports of longitudinals (m)

h = Vertical distance from the longitudinals to a point of D above the top of keel (m), but to be taken as $0.3\sqrt{L}$ (m), where the distance is less than $0.3\sqrt{L}$ (m)

206. Side Transverses

The scantlings of side transverses are not to be less than obtained from the following formula:

$$\text{Section modules : } Z = 8Shl^2 \quad (\text{cm}^3), \quad \text{Thickness of web : } t = 0.01d_0 + 1.5 \quad (\text{mm})$$

where :

S = Spacing of transverses (m)

l = Span measured between the adjacent supports of transverses (m)

h = Vertical distance from the centre of l to a point of D above the top of keel (m), but to be taken as $0.3\sqrt{L}$ (m), where the distance is less than $0.3\sqrt{L}$ (m)

d_0 = Depth of web (mm)

207. Longitudinal beams

1. The section modules of longitudinal beams for the midship part is not to be less than obtained from the following formula:

$$Z = 1.14Shl^2 \quad (\text{cm}^3)$$

where:

S = Spacing of longitudinal beams (m)

l = Span measured between the adjacent supports of longitudinal beams (m)

h = Deck load specified in **Ch 10, 201.** (kN/m²)

2. Beyond the midship part, the section modules of longitudinal beams may be gradually reduced, but the section modules is not to be less than obtained from the following formula:

$$Z = 0.43Shl^2 \quad (\text{cm}^3)$$

where :

S , h and l = As specified in **Par 1.**

208. Deck transverses

The scantlings of deck transverses are not to be less than obtained from the following formula:

$$\text{Section modules: } Z = 0.484Shl^2 \quad (\text{cm}^3), \quad \text{Thickness of web: } t = 0.01d_0 + 1.5 \quad (\text{mm})$$

where:

S = Spacing of deck transverses (m)

l = Span measured between the supports of deck transverses (m)

h = Deck load specified in **Ch 10, 201.** (kN/m²)

d_0 = Depth of web (mm)

Section 3 Peak Construction

301. Application

1. The bottom and the side constructions off both end parts are to be in accordance with the provisions in **Ch 13**.
2. The fore peaks and after peaks to be used for deep tanks are to be as required in **Ch 15**. ⚴

CHAPTER 22 TANK BARGES

Section 1 General

101. Application

1. The construction and equipment of the tank barges are to be in accordance with the requirements in this chapter, where "tank barge" means a barge intended to carry crude oil, petroleum products having a vapour pressure(in gauge) less than 0.2 MPa at 38 °C, or other similar liquid cargoes in bulk.
2. The construction and scantlings of tank barges are to be in accordance with the relevant chapters in addition to this chapter.

102. Cofferdams

1. In tank barges intended to carry oils having a flash-point 60 °C and below, cofferdams are to be provided between cargo oil spaces and other spaces such as accommodation spaces, general cargo holds under freeboard decks and machinery spaces being regarded as source of ignition, etc.
2. The cofferdams prescribed in **Par 1** may be concurrently used as pump rooms.
3. Fuel oil or ballast water tanks may be concurrently used as cofferdams prescribed in **Par 1** subject to the approval by the Society.

103. Airtight bulkheads

Airtight bulkheads are to be provided for the isolation of cargo oil(flashpoint 60 °C and below) pumps and pipings from electric installations or machinery where source of ignition is normally present.

104. Ventilation

1. Efficient ventilation is to be provided in spaces adjacent to cargo oil tanks. Air holes are to be cut in every part of the structure where there might be a chance of gases being "pocketed".
2. Efficient means are to be provided for clearing oil tanks and pump rooms of dangerous vapours by means of mechanical ventilation or by steam.
3. Ventilation systems in pump rooms are to be of mechanical extraction type capable of circulating sufficient air to give at least 20 air changes per hour for the total volume of the pump room to prevent accumulation of cargo vapours. Wire mesh screen with mesh of size suitable are to be fitted at the exhaust ducts, whose outlets are to be led to the safe position above the weather deck. The ventilation fan is to be of non-sparking construction. The ducts are to be arranged to permit ventilation from the vicinity of the pump room bilge, immediately above the transverse floor plate or bottom longitudinals. An emergency intake located 2 m above the pump room lower grating is to be arranged to the trunks, and this emergency intake is to have a damper which is capable of being opened or closed from the weather deck and lower grating level.
4. In tankers carrying oils having a flashpoint above 60 °C, the capacity of ventilation in the pump rooms specified in **Par 3** may be modified.
5. The requirements in **Par 3** are applied to the ventilation fans and wire mesh screens for the spaces adjacent to the cargo oil tank specified in **Par 1**.

Section 2 Structural Members in Cargo Oil Spaces

201. Longitudinal strength

The section modulus of the hull for the midship part of the tank barges is not to be less than that specified in **Ch 4, 201.** increased by 3 percent.

202. Thickness of members

The thickness of structural members in cargo oil spaces is to be in accordance with the following:

- (1) The thickness of shell plating is to be as required in **Ch 5.** But the thickness of shell plating obtained from the formula in **302., 304. and 402.** is to be increased by 0.5 mm above that.
- (2) The thickness of upper deck plating is to be as required in **Ch 6.** But the thickness of upper deck plating obtained from the formula in **301.** is to be increased by 0.5 mm above that.
- (3) The thickness of webs of girders is to be increased by 1 mm above that obtained from the relevant formula.
- (4) The thickness of bulkhead platings is to comply with the requirements in **Ch 15.** However, in no case are the requirements in **Ch 15, 205.** to be applied.

203. Scantlings of members

The section modulus of bottom longitudinals, side longitudinals, longitudinal beams, transverse girders, bulkhead stiffeners and longitudinal girders in cargo oil spaces are not to be less than 1.1 times that of obtained from the formula in **Ch 21.** ↓

CHAPTER 23 BARGES INTENDED TO BE CLASSIFIED AS RESTRICTED SERVICES

Section 1 General

101. Application

1. The requirements of this chapter are applicable to the barges intended to be classified as restricted services.
2. The relevant chapters are to apply, unless otherwise specified in this chapter.

Section 2 Barges Intended to be classified as Coastal Service

201. Application

The requirements in this section are applicable to the barges intended to be classified as coastal service.

202. Reductions of scantlings of members

1. The scantlings of structural members may be reduced by the ratios given in **Table 23.1** in relation to the requirements in the relevant chapters, but in no cases are they to be less than each minimum scantling in the same table.
2. Reduction of scantlings of members other than given in **Table 23.1** may be made at the discretion of the Society.

Table 23.1 Reductions of scantlings of members and minimum scantlings

Items	Coastal	Smooth water	Minimum scantlings
Longitudinal strength	5 %	10 %	–
Shell platings (including plate keels)	5 %	10 %	6 mm, except superstructures
Minimum thickness of deck platings	1 mm	1 mm	5 mm
Section modulus of frames (including bottom longitudinals)	10 %	20 %	30 cm ³
Section modulus of beams	15 %	15 %	–
Section modulus of deck girders	15 %	15 %	–
Thickness of plates of double bottom members	1 mm	1 mm	5.5 mm
Thickness of plates of single bottom members	0.5 mm	10 % or 1 mm whichever is the smaller.	–
Plate thickness and section modulus of superstructure end bulkhead	10 %	10 %	–

3. The scantlings of the structural members of deck beams supporting deck cargoes, inner bottom plates and longitudinals supporting heavy cargoes and deep tanks are not to be reduced from the values specified in the relevant chapters, notwithstanding the provisions in **Par 1** and **2**.

203. Equipment

1. Equipments given in **Table 19.1** are to be provided according to their equipment numbers obtained from the formula in **Ch 19**. However, the mass of one of the two anchors may be reduced to 85% of the mass given in the **Table 19.1**.
2. The mass of an anchor required to be provided with for unmanned barges, is not to be less than given in **Table 19.1**.
3. For unmanned barges which are not engaged in the international voyage, the requirements for equipment specified in **Ch 19** may be omitted at the request of owner when considered appropriate by the Society. **[See Guidance]**

204. Bilge discharge systems

In bilge discharge systems, the number of two bilge suction pumps specified in **Ch 20, 407. 2** may be reduced to one.

Section 3 Barges Intended to be classified as Smooth Water Service

301. Application

The requirements in this section are applicable to the barges intended to be classified as smooth water service.

302. Reduction of scantlings of members

1. The scantlings of structural members may be reduced by the ratios given in **Table 23.1** in relation to the requirements in the relevant chapters, however, in no case are to be less than minimum scantlings given in **Table 23.1**.
2. Reduction of scantlings of other members than given in **Table 23.1** is to be in accordance with the discretion of the Society .
3. In no case the scantlings of structural members such as deck beams Supporting roads, inner bottom platings and inner bottom longitudinals supporting heavy loads and members of deep tanks are to be less than obtained from the requirements in relevant chapters, irrespective of the requirements in **Par 1** and **2**.

303. Height of hatchway coamings, etc.

Height of hatchway coamings, sills of doors, etc. is not to be less than the heights specified in **Table 23.2**.

Table 23.2 Height of hatchway coamings, sills of doors, etc. (mm)

Coamings Position	General hatchways	Small hatchways (Area of hatchways 1.5 m ² and under)	Companionways	Doors of superstructure end bulk-head	Ventilators
I	450	380	300	300	760
II	300	230	100	100	450

304. Hatch covers

1. The hatch covers may be of shelter type.
2. The thickness of steel hatch cover, on which cargoes are not carried, may be 4.5 mm.
3. Stiffeners are provided at suitable intervals in the steel hatch covers, and the section modulus of stiffeners, on which cargoes are not carried, may be obtained from the formula in **Ch 17, 301. 2** taking C as **1.7**.

305. Equipment

1. Equipment given in **Table 19.1** (1) may be provided by reducing one rank according to their equipment numbers obtained from the formula in **Ch 19**.
2. The mass of one of the two anchors is to be of the mass specified in **Par 1** and another may be reduced to 85 % of the mass specified in **Par 1**. However, in unmanned barges, the number of anchors may be one of the mass specified in **Par 1**.
3. For unmanned barges which are not engaged in the international voyage, the requirements for equipment specified in **Ch 19** may be omitted at the request of owner when considered appropriate by the Society. **[See Guidance]**

306. Air pipes

Where air pipes extend above the exposed parts of the freeboard decks, the height between deck and open end and the closing means at open end are to be in accordance with the discretion of the Society.

307. Bilge discharge systems

In bilge discharge systems, the number of two bilge suction pumps specified in **Ch 20, 407. 2** may be reduced to one. ⚴



2021

Guidance Relating to
the Rules for the Classification of
Steel Barges

APPLICATION OF THE GUIDANCE RELATING TO THE RULES

This "Guidance relating to rules for the survey and construction of Steel Barges" (hereafter called as the Guidance Relating to the Rules) is prepared with the intent of giving details as to the treatment of the various provisions for items required the unified interpretations and items not specified in the Rules, and the requirements specified in the Guidance Relating to the Rules are to be applied, in principle, in addition to the various provisions in the Rules.

As to any technical modifications which can be regarded as equivalent to any requirements in the Guidance Relating to the Rules, their flexible application will be properly considered.

APPLICATION OF "GUIDANCES RELATING TO RULES FOR THE CLASSIFICATION OF STEEL BARGES"

1. Unless expressly specified otherwise, the requirements in the Guidance apply to Steel Barges for which contracts for construction are signed on or after 1 July 2019.
2. The amendments to the Guidances for 2017 edition and their effective date are as follows;

Effective Date 1 July 2020

〈 No revision〉

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CHAPTER 1 GENERAL

Section 1 Definitions

114. Important system 【See Rules】

1. System necessary for safety of life and barge are as follows:
 - (1) Bilge discharge system
 - (2) Anchoring system
 - (3) Mooring system
 - (4) Ballast system for tank barge and barge designed to load and unload by submerging or inclining itself
 - (5) Lighting System(except for unmanned barge)
 - (6) Electric power source supplying electric power to any one of the systems listed above (1) to (5) or navigation light or signal light.

Section 2 General

201. Application 【See Rules】

1. The requirements not specified in this guidance are to be in accordance with "Guidance relating to the Rules for the Classification of Steel Ship".
2. The barge intended to be registered as pusher-barge are to be in accordance with the Appendix 1 "Special requirements for pusher-barges".

204. Barges of unusual form or construction 【See Rules】

If the barge built for loading or unloading cargo by submerging the cargo deck engaged in international voyage, relevant requirements of stability are to comply with **Ch 4, 4200.** of the **Guidance relating to the Rules for the Classification of Floating Docks.** ⤵

CHAPTER 4 LONGITUDINAL STRENGTH

Section 1 General

101. Loading manual [See Rules]

1. For chemical barges, gas barges with L_f less than 65 m, other barges with L_f less than 100 m and the ships engaged in under the coastal service, loading manual are not required. But precautions for loading such as design max. cargo load are to be recorded in adequate document like as stability material.
2. The loading manual to be approved by the Society according to 101. of the rules, are to be prepared in accordance with **Pt 3, Annex 3-1** "Guidance for Survey and Composition of Loading Manual" of "Guidance Relating to the Rules for the Classification of Steel Ships". They are to be written with a language easily understood by the shipmaster and if it is not English, English version is to be attached. ⚓

CHAPTER 5 SHELL PLATING

Section 4 Shell Plating for End Parts

401. Shell plating for end parts [See Rules]

1. The thickness of shell plating in the curved portions for $0.3L$ from each end of barge may be calculated using the spacing, S , equal to the vertical or horizontal spacing of frames multiplied by 1.1. (See Fig 5.1)
2. The tapering of the thickness of shell plating is to be as per shown in Fig 5.2. The thickness of each plating is not to be less than the shown in Fig 5.2 approximately at the longitudinal center of the plating.

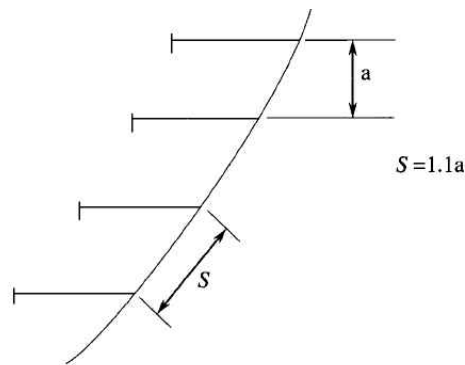
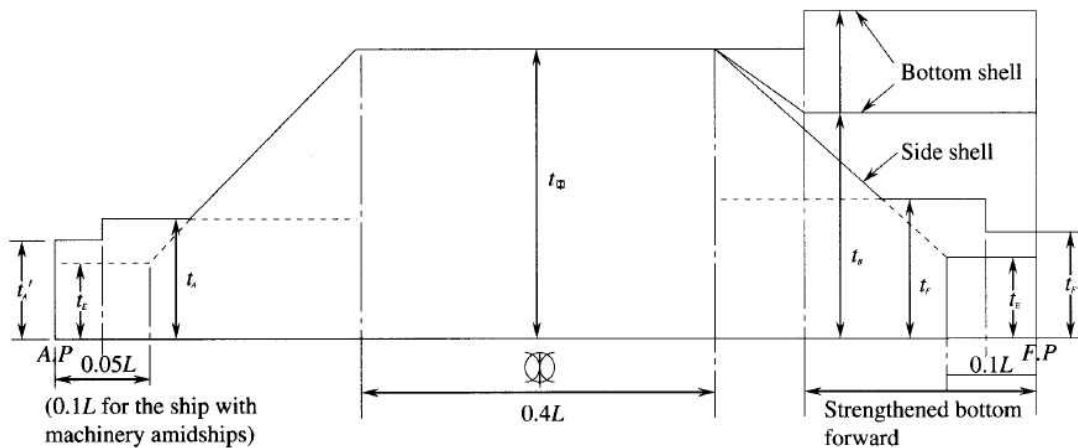


Fig 5.1 Modification of spacing, S , for the parts beyond the midship part



- t_m = The required thickness of shell plating for the midship part (Where the thickness is increased more than the required thickness for the longitudinal strength, the actual thickness is to be taken.)
- t_e = The required thickness of end parts of shell plating ($4.6 + 0.044L$)
- $t_f(t_f')$ = The required thickness of shell plating for $0.3L$ fore end part ($1.34S\sqrt{L} + t_c$)
- $t_a(t_a')$ = The required thickness of shell plating for $0.3L$ aft part ($1.20S\sqrt{L} + t_c$)
- t_b = The required thickness of shell plating in way of strengthened bottom forward

Fig 5.2 The tapering of the thickness of shell plating

Section 6 Local Compensation of Shell Plating

602. Shell plating framed transversely 【See Rules】

Where both deck and side structures are transversely framed, the buckling strength is to be calculated. ⚓

CHAPTER 10 BEAMS

Section 2 Deck Load

201. Value of h 【See Rules】

h for second tier superstructure deck above the freeboard deck is not to be less than obtained from the following formula in **Table 10.1**.

Table 10.1 Minimum value of h

Position of deck	h	C			
		Deck plating	Beams		Transverses, Longitudinal deck girders and pillars
			$L < 90\text{m}$	$90\text{ m} \leq L \leq 150\text{ m}$	
Second tier superstructure deck above the freeboard deck	$C\sqrt{L}$	1.95	1.28	$9.81/100(0.11 L + 3.2)$	0.69



CHAPTER 14 WATERTIGHT BULKHEADS

Section 1 Arrangement

101. Collision bulkheads [See Rules]

For submersible barges, the requirement of **101.** of the rules may be waived when the arrangement is accepted by the Society on the basis that an application is submitted together with calculations verifying that the final water line after flooding is below the maximum sinking draft even when the compartment forward of collision bulkhead corresponding to the length of transverse extent of damage $(1/3 [L^{2/3}] \text{ or } 14.5 \text{ m, whichever is the lesser})$ is flooded (However, if the result of a lesser extent cause a more severe condition than the result of a maximum extent, such a lesser extent shall be assumed.) under the loading condition corresponding to the maximum immersion water line. ⚓

CHAPTER 18 BULWARKS, FREEING PORTS, VENTILATORS AND PERMANENT GANGWAYS

Section 2 Bulwarks and Guardrails

201. General [See Rules]

For unmanned barges, guardrails or bulwarks may be omitted.

Section 3 Freeing Ports (2019)

301. Freeing arrangements [See Rule]

1. General

Where coamings or other structures are to be provided for retaining deck cargo in pontoon barges, adequate freeing ports are to be provided in accordance with **Par 2**.

2. Freeing port area

(1) Basic area

The basic freeing port area is to be in accordance with **Pt 4, Ch 4** of the **Rules**, but a sheer correction need not be applied.

(2) Beam Correction

The freeing port area as determined by (1), above, may then be reduced by the factor f_b expressed by:

$$f_b = (b/B)^2/0.85$$

b = transverse distance between the coamings (m)

B = breadth of the barge (m)

(3) Height Correction

Where the height, h_b , of the coaming sides is greater than standard height h_s , the freeing port area as determined by (1), above, may be reduced by the factor f_h , given in table below. ↓

h_b/h_s	f_h
1.0	1.00
2.0	0.66
3.0	0.44
Values of f_h for intermediate values of h_b/h_s are to be obtained by linear interpolation.	

h_b = height of the coaming sides (m)

$h_s = 0.01L + 1.05$ (m, $75 \leq L \leq 125$)

L = length of the barge (m)

CHAPTER 20 MACHINERY

Section 2 Internal Combustion Engines

202. Safety devices [See Rules]

1. Internal combustion engine to drive a generator having a maximum continuous output of not less than 220 kW, is to be provided with a overspeed protective device so adjusted the engine speed from being exceeded by more than 15% of the maximum continuous revolutions.
2. Internal combustion engine having a cylinder diameter of not less than 230 mm is to be provided with relief valves or warning devices specified in **Pt 5, Ch 2, 203. 3 of Rules for the Classification of Steel Ships**. Internal combustion engine having a cylinder diameter of not less than 200 mm or total volume of crankcase of not less than 0.6 m³ is to be provided with relief valves at the crankcases specified in **Pt 5, Ch 2, 203. 5 of Rules for the Classification of Steel Ships**.

Section 4 Auxiliaries and Piping Arrangement

401. Pressure pipes and pipe connections [See Rules]

1. Strength of the pipes subjected to the internal pressure is to be in accordance with the requirements in **Pt 5, Ch 6, 102. 6 of Rules for the Classification of Steel Ships**. Direct connection of pipe lengths and connection of pipes with flanges are to be in accordance with the requirement in **Pt 5, Ch 6, 104. 1, 2 and 3 of Rules for the Classification of Steel Ships**.
2. **Pt 5, Ch 6, 102. 6 of Rules for the Classification of Steel Ships**, minimum wall thickness for steel pipe (only for scupper pipes and exposed portions of air pipes which terminate above the freeboard deck or superstructure deck), are to be applied to the barges complying with **ILLC(Internal Load Line Convention)**.

406. Air pipes, overflow pipes and sounding devices [See Rules]

1. The requirements in **401. 2** of the Guidance apply to the minimum thickness of air pipes of barges complying with **ICLL**.
2. The "particular compartment" referred to in **406. 5** of the rules is small watertight compartment where a manhole is provided at an easily accessible position on the upper deck or other similar decks, or each watertight compartment where a manhole is provided at an easily accessible position on the upper deck or other similar decks for pontoon type cargo barges which are divided into many watertight compartments.

407. Bilge systems [See Rules]

1. The "particular compartment" referred to in **407. 1** of the rules is compartment referred to in **406. 2** of the Guidance.
2. The capacity of the power bilge pumps specified in **407. 3** of Rules is not to be less than Q obtained from the following formula, even where one of the pumps becomes out of use.

$$Q = 5.66d^2 \times 10^{-3} \quad (\text{m}^3/\text{h})$$

$$d = 1.68 \sqrt{L(B+D)} + 25 \quad (\text{mm})$$

3. The diameter of the bucket cylinder of the manual bilge pump is not to be less than d' obtained

from the following formula.

$$d' = \frac{lBD}{142} + 100 \text{ (mm)}$$

d' : The diameter of the bucket cylinder (mm)

l : Length of the compartment to be drained by the manual pump (m)

4. The compartment referred to in the above 1 may be considered as being provided with suitable drainage means specified in **407. 13** of the rules.

408. Scuppers [See Rules]

The requirements in **401. 2** of the guidance are applied to the minimum thickness of scuppers of barges complying with **ICLL**.

Section 5 General Requirements of Electrical Equipment

502. System voltage [See Rules]

1. Where the electric power of which voltage exceeds the value specified in **502. 1** of the rules is intended to be used data of construction, installation, testing method, etc. for the electrical equipment and cables are to be submitted to the Society.
2. Electrical equipment of which system voltage exceeds 500 V is to comply with the requirements **Pt 6, Ch 1, Sec 15** of **Rules for the Classification of Steel Ships**.

Section 6 Earthing

603. Exception in application [See Rules]

1. In general, the earthing of the following may not be required;
 - (1) Non-current carrying metal which are not liable to be touched by personnel in use.
 - (2) Lamp cap
 - (3) Shades, reflectors and guards supported on lamp holders or luminaries constructed of, or shrouded in, non-conducting material.
 - (4) Bolts, metal penetrations and moulded metal parts isolated by insulations from live parts and earthed metal parts.
 - (5) Housings of bearings insulated to prevent a circulating current
 - (6) Clips of fluorescent lighting tube
 - (7) Electrical appliance supplied at safe voltage
 - (8) Cable clips

Section 7 Protective Devices of Electrical Equipment

701. General

1. "The requirements equivalent thereto" prescribed in **701. 2** of the rules means KS, IEC or other national or authorized standards. However, in this case fuses are to be of enclosed type (tube type or plug type). **[See Rules]**

Section 8 Source of Electrical Power

801. Generator [See Rules]

Characteristics of the speed governors for the prime movers to drive generators are to comply with the requirement in **Pt 6, Ch 1, 302. of Rules for the Classification of Steel Ships.**

802. Switchboards [See Rules]

Switchboards used for the source of electrical power in which two or more generators are provided but not arranged to operate in parallel may be provided with only one ammeter, voltmeter and wattmeter (where the alternating current) which can be used in common for each generators.

805. Storage batteries [See Rules]

In the case of unmanned barge provided with means of turning off the navigation lights in the day time, the capacity of the storage batteries is to be determined based on the assumption that the duration of the supply of the electrical power to the navigation light is 12 hours in a day.

Section 9 Cables

902. Installation of cables [See Rules]

- Where cables are installed with loops for expansion, the internal radius of the loops is at least not to be less than 12 times the external diameter of the cables.
- When installing cables, the minimum inside radius of bend is to be in accordance with the following:
 - 6 d for rubber and PVC insulated cables with metallic covering (d = overall diameter of cable);
 - 4 d for rubber and PVC insulated cables without metallic covering; and
 - 4 d for mineral insulated cables
- Where cables with different maximum-rated conductor temperatures are bunched together, the current rating of the cables is to be determined based on the lowest temperature-rated cables in the group.

903. Mechanical protection of cables [See Rules]

The protection pipes and casings for cables in cargo holds are to be of metallic. Where non-metallic pipes or casings are used, details of materials, strength, installation method, etc. are to be submitted to the Society for approval.

905. Securing of cables [See Rules]

The distance between cable clips or supports is not be more than the value given in **Table 20.1.**

Table 20.1 Distance between cable supports

Installation method of cables	Distance between supports(mm)
In case of horizontal run by clips	300
In case of vertical run by clips	400
In case of horizontal run by supports	900
(NOTE) Where cables are installed on the weather deck, distance between supports is to be 300 mm.	

Section 11 Control Gears

1101. Starters [See Rules]

Electromagnetic contractors for starters complying with KS, IEC or such national or authorized standards may be used, not only those complying with the requirement in **Pt 6, Ch 1. 8** of **Rules for the Classification of Steel Ships**.

Section 16 Tests

1601. Tests at the manufacturer's work [See Rules]

The voltage regulation of generators and transformers is to be in accordance with the requirements specified in **Pt 6, Ch 1, 305. 4, 306. 2 and 604.** of **Rules for the Classification of Steel Ships**. ↕

CHAPTER 23 BARGES INTENDED TO BE CLASSIFIED AS RESTRICTED SERVICES

Section 2 Barges Intended to be classified as Coastal Service

203. Equipment 【See Rules】

For the ships not engaging in the international service, the equipments may be omitted as follows:

- (1) Where owner requests omitting anchors and anchor chains, an application for omitting that specified the reason of operating only pier mooring, etc. is to be submitted to the Society.
- (2) Where owner requests omitting mooring lines, an application for omitting that specified the reason of arranging adequate mooring lines at mooring point etc. is to be submitted to the Society.

Section 3 Barges Intended to be classified as Smooth Water Service

305. Equipment 【See Rules】

For the ships not engaging the international service, the equipments may be omitted as follows:

- (1) Where owner requests omitting anchors and anchor chains, an application for omitting that specified the reason of operating only pier mooring, etc. is to be submitted to the Society.
- (2) Where owner requests omitting mooring lines, an application for omitting that specified the reason of arranging adequate mooring lines at mooring point etc. is to be submitted to the Society.

↓

ANNEX 1 SPECIAL REQUIREMENTS FOR PUSHER-BARGES

1. Application

- (1) The requirements of this Annex apply to the barges intended to be classed as pusher-barges which are barges connected to pusher that are operated by the pushing of pusher.
- (2) For items not specified in this Annex, the requirements of Rules for Classification Steel Barges and Guidance relating to Rules for Classification Steel Barges are to be applied.
- (3) Alternative hull, connection construction and equipment will be accepted by the Society, provided that the Society is satisfied that such hull, connection construction and equipment are equivalent to or above those required in this requirements.

2. Definition

- (1) Hard connection : Hard connection is a combination method where a barge and pusher is connected to behave as a one unit during a voyage without relative motion between the two.
- (2) Soft connection : Soft connection is a combination method where a barge and pusher is connected to allow relative motion with one or more degree(s) of freedom during a voyage. Pusher-barge connected by this method is to engage in coastal services.
- (3) Length of connection L_c : Length of connection L_c is distance in *meters* along the load line which is from inside face of side plate or forward side of fore part structure to after side of rudder post or the centre of the rudder stock under the hard connection condition.
- (4) If the connection is based on hydraulic operation, the mechanical locking devices are to be fitted to hold locking condition even if the hydraulic system is failed in locking condition.
- (5) Hydraulic system and drawings relating to the connection are to be submitted.
- (6) Operational procedure for connection system is to be provided onboard, and its copy is to be submitted to the Society.

3. Longitudinal strength

- (1) Calculation of longitudinal strength
 - (A) Longitudinal strength of pusher-barge with hard connection is calculated accordance with **Ch 4** of the rules using length of connection L_c .
 - (B) Longitudinal strength of pusher-barge with soft connection is calculated accordance with **Ch 4** of the rules using length of connection L .
- (2) Still water bending moment and shear force
 - (A) Still water bending moment and shear force of hard connection are calculated for connected unit of barge and pusher.
 - (B) Still water bending moment and shear force of soft connection are calculated for barge only.
- (3) Loading manual
The requirements of **Ch 4, 101.** of Guidance are to be complied with according to length of connection L_c

4. Calculation of scantlings

- (1) Scantlings of pusher
Scantlings of pusher are to comply with the "Rules for the Classification of Steel Ship" using length of pusher only. In case of pusher-barge with hard connection, scantlings of the pusher's hull structure(deck, shell, frame, superstructures, deckhouses, etc.) which will be exposed to wave loading when the pusher is acting as part of the combined unit(pusher + barge) should be designed using L_c . In this case, the scantlings are to be not less than the scantlings complying with the pusher's length only.
- (2) Scantlings of barges :
In calculating the scantlings of each member, length of connection L_c is to be used for hard connection barge and length of barge L for soft connection barge.
- (3) Position of forepeak bulkhead
Forepeak bulkhead of barge is to be located between $0.05L_c$ and $0.08L_c$. However, when the length of connection is less than 90 m, forepeak bulkhead may be located between $0.05L_c$ and $0.13L_c$.

5. Equipment number and equipment

Equipment number and equipments are to comply with **Ch 19** of the rules using L_c .

6. Type of pusher-barges

Pusher-barges are classified into two types and are to comply with **Table 1**.

Table 1 Type and Application of Pusher-Barge

Kind	Type A	Type B	
Definition	Permanent connection	Disconnection (A verification as to whether disconnection can be made within the harbour by one person within 5 minutes. And after disconnection in the open sea, the pusher shall be able to tow the barge.)	
	Hard connection	Hard connection	Soft connection
	No relative motion between the pusher and the barge	No relative motion between the pusher and the barge	Relative motion between the pusher and the barge with one or more degree(s) of freedom
Stability	Satisfactory under connected condition	Satisfactory under connected condition (also as a unconnected pusher)	
Freeboard	Greatest freeboard out of; - pusher - barge - combination	Pusher and barge each as an individual ship	
Longitudinal Strength	Connected condition	Connected condition	Pusher and barge each as an individual ship
Scantling	Connected condition	Connected condition	Pusher and barge each as an individual ship
Safety Equipment	Connected condition (conventional certificates corresponding to connected condition to be issued for ocean-going services)	Pusher and barge each as an individual ship (conventional certificates to be issued for individual ships for ocean going services)	
Navigation limit area	Ocean-going	Ocean-going	Costal service

7. Connection structure of pusher-barge

- (1) For the stress assessment of all strength members related with connection of pusher and barge, direct calculation is to be carried out.
 - (A) Where deemed necessary by the Society, the wave hull girder loads and the forces transmitted through the connection are to be calculated from a direct calculation of the pusher-barge combination motion and acceleration in irregular waves, unless such data are available from similar ships.
 - (B) These loads are to be obtained as the most probable that the pusher-barge combination may experience during its operating life for a probability level of 10^{-8} . For this calculation, the wave statistics relevant to the area of navigation and weather condition are to be taken into account.
 - (C) When the difference between the pusher and the barge depths is considered to be not negligible by the Society, its effects are to be considered in evaluating the buoyancy force distributions and the corresponding hull girder loads on the pusher structures immediately aft of the connection section, for the different wave encountering conditions.
- (2) Permissible stresses in the connection are :

Normal stress : $225 f_1 \text{ N/mm}^2$

Shearing stress : $120 f_1 \text{ N/mm}^2$

$$f_1 = \left(\frac{\sigma_y}{235} \right)^{0.75}$$

σ_y : yield stress of materials

- (3) Data for direct calculation according to (1) and (2) are to be submitted to the Society for reference. ⚡

**RULES AND GUIDANCES FOR THE
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