RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

Part CS Hull Construction and Equipment of Small Ships

Rules for the Survey and Construction of Steel Ships
Part CS 2023 AMENDMENT NO.1
Guidance for the Survey and Construction of Steel Ships
Part CS 2023 AMENDMENT NO.1

Rule No.29 / Notice No.28 30 June 2023
Resolved by Technical Committee on 25 January 2023

ClassNK
NIPPON KAIJI KYOKAI

An asterisk (*) after the title of a requirement indicates that there is also relevant information in the corresponding Guidance.

RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

RULES

Part CS Hull Construction and Equipment of Small Ships

2023 AMENDMENT NO.1

Rule No.29 30 June 2023

Resolved by Technical Committee on 25 January 2023

An asterisk (*) after the title of a requirement indicates that there is also relevant information in the corresponding Guidance.

Rule No.29 30 June 2023
AMENDMENT TO THE RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

"Rules for the survey and construction of steel ships" has been partly amended as follows:

Part CS HULL CONSTRUCTION AND EQUIPMENT OF SMALL SHIPS

Chapter 1 GENERAL

1.1 Application and Equivalency

1.1.1 Application*

Sub-paragraphs -4 and -5 have been amended as follows.

1 This part applies to steel ships of normal form and proportions of less than 90 *m* in length to be classed for unrestricted service.
2 Hull construction, equipment and scantlings of ships to be classed for restricted service may be appropriately modified according to the condition of service in addition to the requirements in **Chapter 27**.
3 In the application of relevant provisions in this Part to ships to which the requirements in **Part V** do not apply, L_f is to be read as *L* and B_f as *B*.
4 Cargo vessels engaged in international voyages and that are not less than 500 gross tonnage are to comply with the requirements in ~~**Chapter 33 of**~~ **2.3.4, Part 1,** **Part C**.
Note: For the construction of ships flying the Japanese flag, alternative arrangements are to be made.
5 Where deemed necessary by the Society, ships coming under the definition of bulk carrier as specified in ~~**31A.1.2(1),**~~ **An1.2.1(1), Annex 1.1, Part 2-2,** **Part C**, may be applicable to relevant requirements of **Part C**.

1.3 Materials, Scantlings, Welding and End Connections

1.3.1 Materials

Sub-paragraph -7 has been amended as follows.

7 The steels used for hull structures are to be in accordance with the requirements of ~~**1.1.11** and **1.1.12**~~ **3.2.2, Part 1, Part C**. However, the steel grades shown in **Table CS1.1** and **Table CS1.2** may be used in lieu of ~~**Table C1.1** and **Table C1.2,**~~ **Table 3.2.2-1** and **Table 3.2.2-2, Part 1, Part C**. Where stainless clad steel specified in **Chapter 3, Part K of the Rules** is used for hull construction, the thickness of the base steel is to be used as the thickness of the plate in ~~**Table C1.1** and **Table C1.2**~~ **Table 3.2.2-1** and **3.2.2-2, Part 1, Part C.**

Paragraph 1.3.3 has been amended as follows.

1.3.3 Welding

Welding to be used in hull construction and important equipment is to be in accordance with the requirements in **Chapter 12, Part 1, Part C** and **Part M**.

Paragraph 1.3.9 has been deleted, and Paragraph 1.3.10 has been renumbered to Paragraph 1.3.9.

~~**1.3.9 Approved Corrosion Control**~~

~~**1** Where an approved measure of corrosion control is applied to tanks, the required scantlings of structural members in the tanks may be reduced at the discretion of the Society.~~

~~**2** Where the scantlings are reduced in accordance with **-1**, the notation "*CoC*" will be entered in the Classification Register.~~

Paragraph 1.3.10 has been amended as follows.

1.3.~~10~~9 Ship Identification Number

For cargo ships not less than 300 *gross tonnage* engaged on international voyages, the ship's identification number is to be permanently marked in accordance with ~~**1.1.24**~~**14.2, Part 1, Part C** ~~**of the Rules**~~.

Chapter 6 DOUBLE BOTTOMS

6.6 Longitudinals

6.6.3 Vertical Struts

Sub-paragraph -2 has been amended as follows.

2 The sectional area of the above-mentioned vertical struts is not to be less than that obtained from the following formula:

~~*2.2SPh*~~ *2.2Sbh* (cm^2)

Where:

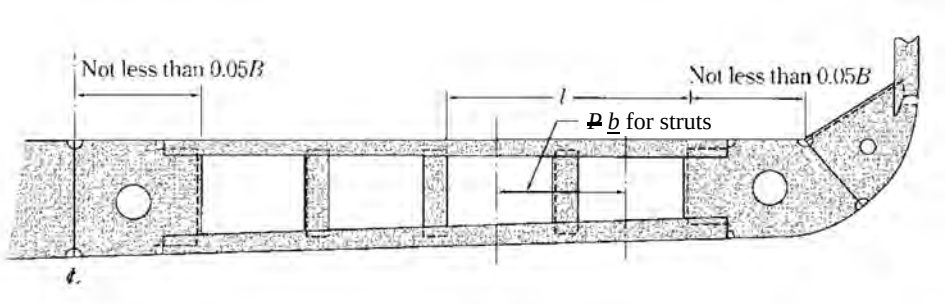
S: Spacing (*m*) of longitudinals

~~*P*~~ *b*: Breadth (*m*) of the area supported by the strut (*See* **Fig. CS6.1**)

h: As specified in **6.6.2-1**

Fig. CS6.1 has been amended as follows.

Fig. CS6.1 Open Floors



Chapter 13 WATERTIGHT BULKHEADS

13.2 Construction of Watertight Bulkheads

Paragraph 13.2.9 has been amended as follows.

13.2.9 Corrugated Bulkhead

~~Construction of corrugated bulkheads is to be in accordance with the requirements given in **13.2.4, Part C** of the Rules.~~

1 The plate thickness of corrugated bulkheads is not to be less than that obtained from the following formula:

$3.4CS_1\sqrt{h} + 2.5 \ (mm)$

Where:

h: As specified in **13.2.1**

S_1: Breadth (m) of face part or web part indicated as *a* or *b*, respectively, in **Fig. CS13.2**

C: Coefficient given below:

Face part: $\dfrac{1.5}{\sqrt{1+\left(\frac{t_w}{t_f}\right)^2}}$

Web part: 1.0

t_f and t_w: Thickness (mm) of plates of face part and web part, respectively

2 The section modulus per half pitch of corrugated bulkheads is not to be less than that obtained from the following formula:

$3.6CShl^2 \ (cm^3)$

Where:

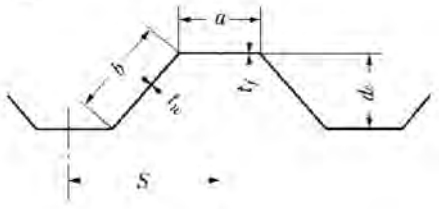
S: Half pitch length (m) of the corrugation (*See* **Fig. CS13.2**)

h: As specified in **13.2.3**

l: Length (m) between the supports, as indicated in **Fig. CS13.3**

C: Coefficient given in **Table CS13.3**, according to the type of end connection

Fig. CS13.2 Measurement of *S*



S_1 = *a* or *b*.
S = Half pitch length.

Fig. CS13.3 Measurement of l

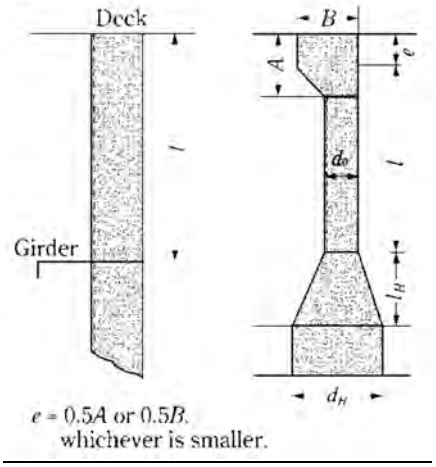


Table CS13.3 Values of C (For Corrugated Bulkheads)

The other end of bulkhead		One end of bulkhead		
		Supported by horizontal or vertical girders	Upper end welded directly to deck	Upper end welded to stool efficiently supported by ship structure
(1)	Supported by horizontal or vertical girders or lower end of bulkhead welded directly to decks or inner bottoms	$\frac{4}{2+\frac{Z_1}{Z_0}+\frac{Z_2}{Z_0}}$	$\frac{4}{2.2+\frac{Z_2}{Z_0}}$	$\frac{4}{2.6+\frac{Z_2}{Z_0}}$
(2)	Lower end of bulkhead welded to stool efficiently supported by ship structure	$\frac{4.8(1+\frac{l_H}{l})^2}{2+\frac{Z_1}{Z_0}+\frac{d_H}{d_0}}$	$\frac{4.8(1+\frac{l_H}{l})^2}{2.2+\frac{d_H}{d_0}}$	$\frac{4.8(1+\frac{l_H}{l})^2}{2.6+\frac{d_H}{d_0}}$
		The value of C is not to be less than that obtained from **(1)**		

Notes:

Z_0: Minimum section modulus (cm^3) per half pitch of mid part for 0.6l of the corrugated bulkhead

Z_1 and Z_2: Section modulus (cm^3) per half pitch of end part

For vertical corrugation, Z_1 is the section modulus of the upper end part and Z_2 is that of the lower end part. Where the plate thickness is increased in accordance with **13.2.9-5** the section modulus is to be that for the plate thickness reduced by the increment.

l_H: Height (m) of stool measured from inner bottom plating

d_H: Breadth (m) of stool measured on inner bottom plating

d_0: Depth (m) of corrugation

3 Where the end connection of corrugated bulkheads is remarkably effective, the value of C specified in **-2** may be adequately reduced.

4 The thickness of plates at end parts for 0.2l in line with l is not to be less than that obtained from the following formulae respectively:

Web part:

$$0.0417\frac{CShl}{d_0}+2.5 \ (mm)$$

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

$1.74 \cdot \sqrt[3]{\frac{CShlb^2}{d_0}} + 2.5 \ (mm)$

Face part, except the upper end part of vertically corrugated bulkheads:
$12a + 2.5 \ (mm)$
Where:
S, h, l and d_0: As specified in **-2**.
a and b: Breadth (m) of face part and web part, respectively
C: Coefficient given in **Table CS13.4**
Where the vertically corrugated bulkheads are constructed with a single span, the value of C may be taken as the value for the uppermost span in the Table.

Table CS13.4 Value of C

Position		Upper end	Lower end
Vertically corrugated bulkhead	Uppermost span	0.4	1.6
	Other spans	0.9	1.1
Both ends of horizontally corrugated bulkhead		1.0	

5 The thickness of the plates specified in **-1** and **-4** is to be in accordance with **13.2.2**.
6 The actual section modulus per half pitch of corrugated bulkheads is to be calculated by the following formula:

$\frac{at_f d_0}{0.002} + \frac{bt_w d_0}{0.006} \ (cm^3)$

Where:
a and b: Breadth (m) of face part and web part respectively
t_f and t_w: Thickness (mm) of plates of face part and web part respectively
d_0: Depth (m) of corrugation

13.3 Watertight Doors

Paragraph 13.3.6 has been amended as follows.

13.3.6 Alarms*
1 Failure of the normal power supply of alarms required to be installed by **13.3.6-2** and **13.3.6-3** is to be indicated by an audible and visual alarm. This alarm is to be located on the bridge.
2 Watertight doors which are capable of being remotely closed are to be provided with an audible alarm which will sound at the door position whenever such a door is remotely closed.
3 All watertight doors (including sliding doors) operated by hydraulic door actuators, irrespective of whether their control positions are a central hydraulic unit or local operating position, are to be provided with either a low fluid level alarm, a low gas pressure alarm or some other means as applicable for monitoring the loss of stored energy in the hydraulic accumulators. Such alarms are to be both audible and visible and located on the bridge

Chapter 14 DEEP TANKS

14.2 Deep Tank Bulkheads

Paragraph 14.2.8 has been amended as follows.

14.2.8 Corrugated Bulkhead

~~Construction of corrugated bulkheads is to be in accordance with the requirements given in **14.2.4, Part C** of the Rules.~~

1 The thickness of plates of corrugated bulkheads is not to be less than that obtained from the following formula:

$3.6CS_1\sqrt{h} + 3.5$ (mm)

Where:

S_1: As specified in **13.2.9-1**

h: As specified in **14.2.2**

C: Coefficient given below:

For face part: $\frac{1.4}{\sqrt{1+(\frac{t_w}{t_f})^2}}$

For web part: 1.0

t_f and t_w: As specified in **13.2.9-1**

2 The section modulus per half pitch of corrugated bulkheads is not to be less than that obtained from the following formula:

$7CShl^2$ (cm^3)

Where:

S: As specified in **13.2.9-2**

h: As specified in **14.2.3**

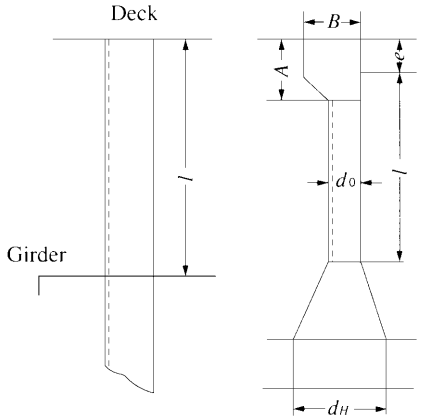
l: Length (m) between the supports, as indicated in **Fig. CS14.1**

C: Coefficient given in **Table CS14.3**, according to the type of end connection

For bulkheads with lower stools of which the width in the longitudinal direction at the lower end, d_H, is less than 2.5 times the web depth of the bulkhead, d_0 (*See* **Fig. CS14.1**), the measurement of l and the values of C are to be at the discretion of the Society.

For vertically corrugated bulkheads, the section modulus per half pitch of the upper part of a corrugated bulkhead which is located above one third of the span measured between the upper deck and the supporting point may not be less than 75% of that obtained by the above formula.

Fig. CS14.1 Measurement of l



$$e = A - \frac{d_0}{2B}A$$

Table CS14.3 Values of C

Column	Lower end	Upper end		
		Supported by Girders	Welded directly to deck	Welded to stool efficiently supported by ship structure
(1)	Supported by girders or welded directly to decks or inner bottoms	1.00	1.50	1.35
(2)	Welded to stool efficiently supported by ship structure	1.50	1.20	1.00

3 The thickness of plates at end parts for 0.2 l in line with l is not to be less than that obtained from the following formulae:

Thickness of web part:

$$0.0417\frac{CShl}{d_0} + 3.5 \ (mm)$$

Not to be less than that obtained from the following formula:

$$1.74 \cdot \sqrt[3]{\frac{CShlb^2}{d_0}} + 3.5 \ (mm)$$

Thickness of the face part except the upper end part of vertically corrugated bulkheads:

$12a + 3.5 \ (mm)$

Where:

h: As specified in **14.2.3**

C, S, d_0, a and b: As specified in **13.2.9-4**

l: As specified in **-2**

Chapter 19 HATCHWAYS, MACHINERY SPACE OPENINGS AND OTHER DECK OPENINGS

19.2 Hatchways

19.2.3 Net Scantling Approach

Sub-paragraph -4 has been amended as follows.

4 The corrosion addition t_c is to be taken as specified in **Table CS19.1** according to ship type, the type of structure and structural members of steel hatchway covers, steel pontoon covers and steel weathertight covers (hereinafter referred to as "steel hatch covers"). However, the corrosion additions for structural members that make up hatchway coamings are to be as deemed appropriate by the Society when their t_c values are not specified in **Table CS19.1.**

Paragraph 19.2.13 has been amended as follows.

19.2.13 Additional Requirement for Small Hatches Fitted on Exposed Fore Deck

For ships of 80 *m* or more in length ~~L_1~~ L_C, specified in ~~**15.2.1-1,**~~ **1.4.3.1-1, Part 1, Part C**, **s**mall hatches located on exposed decks forward of 0.25 ~~L_1~~L_C are to be of sufficient strength and weathertightness to resist green sea force if the height of the exposed deck in way of those hatches is less than 0.1 ~~L_1~~ L_C or 22 *m* above the designed maximum load line, whichever is smaller.

Chapter 23 EQUIPMENT

23.2 Towing and Mooring Fittings

23.2.2 Tow Lines

Sub-paragraph (2) has been amended as follows.

Where ships are provided with tow lines, it is advised that such two lines are to be in accordance with the following **(1)** and **(2)**.

(1) Wire ropes and fibre ropes used as tow lines are to be comply with the requirements in **Chapter 4** and **Chapter 5, Part L of the Rules**, respectively. The specifications of tow lines (e.g. breaking load, length) and the number of tow lines are to be in accordance with **Table CS23.1** according to ship equipment numbers. However, when calculating the equipment number, the effect of deck cargoes at the ship nominal capacity condition is to be considered with respect to the side-projected area *A*.

(2) Fibre ropes used as tow lines are to be not less than 20 *mm* in diameter in consideration of rope age degradation and wear. Therefore, the line design break force for such ropes is to be in accordance with the following **(a)** or **(b)**:
   (a) Polyamide ropes: *LDBF* $\geq$ 120 % of the minimum breaking load specified in **Table CS23.1** according to equipment number.
   (b) Other synthetic ropes: *LDBF* $\geq$ 110 % of the minimum breaking load specified in **Table CS23.1** according to equipment number.

Chapter 27 SHIPS TO BE CLASSED FOR RESTRICTED SERVICE

27.2 Ships to be Classed for *Coasting Service*

Paragraph 27.2.2 has been amended as follows.

27.2.2 Reductions of Scantlings of Members

1 The scantlings of structural members may be reduced by the ratios given in **Table CS27.1** 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.

Table CS27.1 Reductions of Scantlings of Members and Minimum Scantlings

Item	*Coasting*	*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 smaller	-
Plate thickness and section modulus of superstructure end bulkhead	10%	10%	-

2 Reductions of scantlings of members other than given in **Table CS27.1** may be made at the discretion of the Society.

3 The scantlings of the structural members of deck beams supporting deck cargoes, inner bottom plates and longitudinals supporting heavy cargoes and deep tanks and those required in accordance with the provisions of ~~**Chapter 31A**~~ **Annex 1.1, Part 2-2, Part C** are not to be reduced from the values specified in the relevant Chapters, notwithstanding the provisions in **-1**. and **-2**.

4 The design pressure P_e given in **21.3.4-1(1)** and **Table CS21.3** may be multiplied by 0.8.

5 The design pressure of rectangular windows *P* given in **21.5.8-1** may be multiplied by 0.9.

~~**6 Ships not engaged on international voyages need not apply the provisions of Chapter 31A and 34.2, Part C.**~~

Paragraph 27.2.3 has been amended as follows.

27.2.3 Equipment

1 Equipment is to be in accordance with the requirements of **Chapter 23**.

2 Notwithstanding the provision in **-1**, the mass of one of the two anchors may be reduced to 85% of the mass required in the **Table CS23.1**.

3 Notwithstanding the provision in **-1**, for ships not engaged on international voyage Emergency Towing Procedures specified in ~~**27.4, Part C** and~~ **23.3, ~~Part CS~~** are not required.

Paragraph 27.2.6 has been amended as follows.

27.2.6 Means of Embarkation and Disembarkation

For ships not engaged on international voyages, the means of embarkation and disembarkation specified in ~~**23.8, Part C** and~~ **21.8, ~~Part CS~~** are not required.

27.3 Ships to be Classed for *Smooth Water Service*

Paragraph 27.3.2 has been amended as follows.

27.3.2 Reductions of Scantlings of Members

1 The scantlings of structural members may be reduced by the ratios given in **Table CS27.1** 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 Reductions of scantlings of members other than given in **Table CS27.1** may be made at the discretion of the Society.

3 The scantlings of the structural members of deck beams supporting deck cargoes, inner bottom plates and longitudinals supporting heavy cargoes and deep tanks and those required in accordance with the provisions of ~~**Chapter 31A**~~ **Annex 1.1, Part 2-2, Part C** are not to be reduced from the values specified in the relevant Chapters, notwithstanding the provisions in **-1** and **-2**.

4 The design pressure P_e given in **21.3.4-1(1)** and **Table CS21.3** may be multiplied by 0.5.

5 The design pressure of rectangular windows *P* given in **21.5.8-1** may be multiplied by 0.9.

~~**6 Ships not engaged on international voyages need not to apply the provisions of Chapter 31A and 34.2, Part C.**~~

Paragraph 27.3.7 has been amended as follows.

27.3.7 Means of Embarkation and Disembarkation

For ships not engaged on international voyages, the means of embarkation and disembarkation specified in ~~**23.8, Part C** and~~ **21.8~~, Part CS~~** are not required.

27.4 Ships Not Engaged On International Voyages

Paragraph 27.4.1 has been amended as follows.

27.4.1 Relaxation to Ships Not Engaged On International Voyages

~~**1 Ships not engaged on international voyages need not to apply the provisions of 34.2.2, Part C. Where deemed appropriate by the Society taking account of various conditions of such ships related to the navigation, the requirements of 34.2, Part C need not to be applied to.**~~

~~**2 Bulk carriers not engaged on international voyages need not to apply the provisions of 35.2, Part C.**~~

3 For non-conventional ships, the requirements in ~~**27.2, Part C** and~~ **23.2** need not to be applied.

4 Ships not engaged on international voyages need not apply the provisions of ~~**23.8, Part C** and~~ **21.8~~, Part CS~~**.

5 Ships not engaged on international voyages need not to apply the provisions of ~~**27.4, Part C** and~~ **23.3~~, Part CS~~**.

EFFECTIVE DATE AND APPLICATION

1. The effective date of the amendments is 1 July 2023.

2. Notwithstanding the amendments to the Rules, the current requirements apply to the following ships:
   (1) ships for which the date of contract for construction is before the effective date; or
   (2) sister ships of ships subject to the current requirements for which the date of contract for construction is before 1 January 2025.

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE

Part CS Hull Construction and Equipment of Small Ships

2023 AMENDMENT NO.1

Notice No.28 30 June 2023
Resolved by Technical Committee on 25 January 2023

Notice No.28 30 June 2023
AMENDMENT TO THE GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

"Guidance for the survey and construction of steel ships" has been partly amended as follows:

Part CS HULL CONSTRUCTION AND EQUIPMENT OF SMALL SHIPS

CS1 GENERAL

CS1.1 Application and Equivalency

CS1.1.1 Application

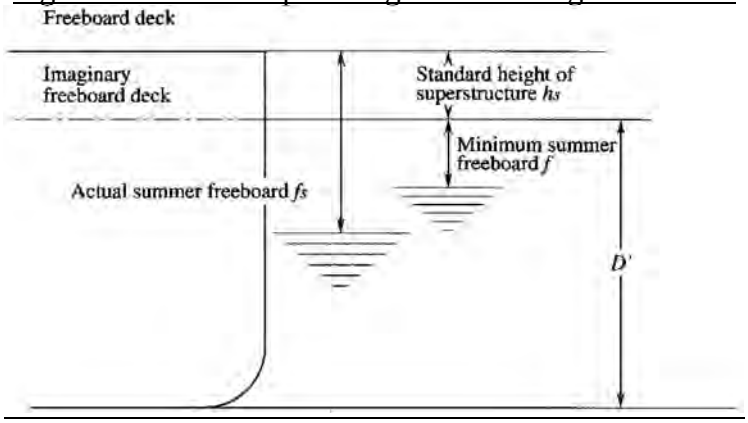
Sub-paragraph -3 has been amended as follows.

1 Even where a ship is intended to be classified for restricted services, the provisions in **27.2.4**, **27.3.3** and **27.3.4, Part CS** of the Rules cannot be applied as far as the "International Convention on Load Lines, 1966" (as may be amended) is to apply to the ship.
2 In cases where a ship is engaged in international voyages and is not subject to the "International Convention on Load Lines, 1966" (as may be amended), the Society may require the ship comply with provisions equivalent to those of the "International Convention on Load Lines, 1966" (as may be amended).
3 With respect to the provisions of **1.1.1-5, Part CS** of the Rules, bulk carriers as defined in ~~**31A.1.2-1(2)**~~ **An1.2.1(2), Annex 1.1, Part 2-2, Part C** of the Rules, of 500 *gross tonnage* and above, are to apply the provisions of ~~**31A.6.1-3** and **34.2.1-3**~~**3.3.5.2-2, Part 1, 3.2.1.1, Part 2-2** and **An6.1.1-3, Annex 1.1, Part 2-2, Part C** of the Rules ~~and **C25.2.1-2**~~. In this case, for the application to ships of less than 65 *m* in length L_f, loading manuals as specified in ~~**C31A.1.2**~~ **An1.2.1(1), Annex 1.1, Part 2-2, Part C** of the Rules are to read as stability information booklets as required in **1.2.1-1, Part U** of the Rules. The provisions of ~~**34.2.1-3**~~**3.2.1.1, Part 2-2, Part C** of the Rules need not apply to such ships. Notwithstanding the above, such ships not engaged on international voyages need not to apply the provisions of ~~**C25.2.1-2**~~ **3.3.5.2-2, Part 1, Part C** of the Rules.

Paragraph CS1.1.3 has been added as follows.

CS1.1.3 Ships of Unusual Form or Proportion, or Intended for Carriage of Special Cargoes
1 Ships Having Unusually Large Freeboards
(1) "Ships having unusually large freeboards" are the ships having freeboards that comply with following formula.
$f_s \geq h_s + f$
f_s : Actual summer freeboard (*mm*) assigned by the requirements in **V2.2.1**
h_s: Standard height (*mm*) of superstructure determined by the requirements in **V2.2.1**
f : Minimum summer freeboard (*mm*) determined by the requirements in **Part V of the Rules** on the basis of an assumed freeboard deck which is measured down from the actual freeboard deck by h_s

Fig. CS1.1.3-1 Ship Having Unusual Large Freeboard



(2) Ships having unusually large freeboards may be treated as follows where the requirements in **Part CS of the Rules** apply. However, the undermentioned treatment is not to apply to ships whose assigned freeboards are "*B*-60" or "*B*-100" type specified in **Part V of the Rules**.

(a) In the provision of "*h*" specified in **5.4.3, Part CS of the Rules**, "*D*" may be replaced with "*D'*" which is the vertical distance from the top of the keel to an assumed freeboard deck.

(b) The requirements in **7.5.2-1, Part CS of the Rules** may be applied to tween deck frames above an assumed freeboard deck even if they are located below the actual freeboard deck.

(c) In the provision of "*h*" specified in **17.1.1-2, Part CS of the Rules**, a weather deck may be regarded as follows in relation to H_D which is the vertical distance from an assumed freeboard deck to the weather deck at side. The same may be applied to other chapters in **Part CS of the Rules** where "*h*" is used.

$h_s \leq H_D < 2h_s$: Superstructure deck of first tier above the freeboard deck

$2h_s \leq H_D < 3h_s$: Superstructure deck of second tier above the freeboard deck

$3h_s \leq H_D$: Superstructure deck of third tier above the freeboard deck

(d) The thickness of side shell plating located above the imaginary freeboard deck is to be obtained according to the following.

i) The thickness of side shell plating from the imaginary freeboard deck to a height of $2h_s$ above the imaginary freeboard deck is to be obtained from the formulae in **16.3.2, Part CS** of the Rules, where $(d + 0.04L)$ in the first term may be replaced by $(d + 0.04L)D/(D + 2h_s)$

Where

h_s: Standard height of superstructures specified in **V2.2.1**

ii) The thickness of superstructure side plating from a height equal to twice h_s (as per **i)**) above the freeboard deck to the strength deck is not to be less than that obtained from the following formula:

$0.7\sqrt{(L + 50)}$ (*mm*)

iii) The thickness of superstructure side plating from the freeboard deck to a height h_s (as per **i)**) above the freeboard deck forward of $0.25L_f$ aft of F.P. is not to be less than that obtained from **i)** above or **16.5.2, Part CS** of the Rules, whichever is greater.

(e) The interpretation of **(c)** above may be applied to the provision of "*h*" specified in **18.2.1-1, Part CS of the Rules**.

(f)

i) The interpretation of **(c)** above may be applied to the provision of "Position of Exposed Deck Openings" in **19.1.2, Part CS of the Rules**. The same may be applied to other chapters in **Part CS** and **Part D of the Rules** where this provision is used.

ii) In Note(*3) of **Table CS19.2**, **Part CS of the Rules**, "freeboard deck" may read as "assumed freeboard deck".

(g) In the application of the requirements in **21.1**, **21.2** and **21.5, Part CS of the Rules**, "freeboard deck" may be read as "assumed freeboard deck" and the interpretation of **(c)** above may be applied when determining the position of the deck. However, side scuttles for spaces below the actual freeboard deck or spaces considered as buoyancy in stability calculations are to be class *A* side scuttles, class *B* side scuttles, or equivalent thereto. In such cases, the deadlight is not to be omitted.

(h) In **13.5.3**, **Part D,** D' may be used in place of *D* in determining the diameters of bilge suction pipes.

2 Ships Having Unusually Reduced Freeboards

"Ships having unusually reduced freeboards" are ships whose freeboards are of the "*A*", "*B*-60" or "*B*-100" type, assigned in accordance with the requirements in **Part V of the Rules**.

Paragraph CS1.3.1 has been added as follows.

CS1.3.1 Materials

1 Where high tensile steel are used, the construction and scantlings are to be determined in accordance with **Annex CS1.3.1-1** "**GUIDANCE FOR HULL CONSTRUCTION CONTAINING HIGH TENSILE STEEL MEMBERS**".

2 Where the requirements in **1.3.1-2(3), Part CS of the Rules** are applied, data corresponding to the standard of steels used (extent of their use, location of structural members, section rigidity, fatigue strength, minimum thickness, etc.) is to be submitted to the Society and approved.

3 When the requirements in **1.3.1-4(1), Part CS of the Rules** are applied, data corresponding to the standard of steels used (e.g., extent of use, location of structural members, section rigidity, buckling strength, minimum thickness, etc.) is to be submitted to the Society for approval when deemed necessary.

4 The requirements of **1.3.1-4 (2), Part CS of the Rules** apply to members which do not come in contact with sea water, and the values in **(1)** and **(2)** may be deducted from the scantlings required by relevant requirements.

(1) For stainless steel

(a) Where the scantling is determined by the thickness of the plate: 1.0 *mm*

(b) Where the scantling is determined by the section modulus: 5%

(2) For stainless clad steel

Where the scantling is determined by the thickness of plate: 0.5*mm*

5 "Areas of anticipated stress concentration" specified in **1.3.1-4 (3) Part CS of the Rules** refers to, for example, the connections of the lower corner parts of corrugated bulkheads and inner bottom plates or the top plate of the lower stools, the connections of inner bottom plates and bilge hopper plates or lower stools, etc.

6 "Where deemed appropriate by the Society" specified in **1.3.1-4(3) Part CS of the Rules** refers to cases such as where fatigue strength assessments based upon hot spot stresses obtained using the finite element method are carried out and the results are submitted to the Society for approval.

7 In cases where it has been deemed appropriate by the Society, fiber reinforced plastic (FRP)

may be used for equipment specified in this Part. In this case, such usage is subject to the requirements given in **Annex 3.2, Part 1, Part C of the Rules**.

Chapter CS2 has been added as follows.

CS2 STEMS AND STERN FRAMES

CS2.1 Stems

CS2.1.1 Plate Stems

1 The thickness of plate stems may be the same as that of side shell plating at the level of the freeboard deck and the same as that of the forecastle-side shell in the range of the forecastle.

2 Where the plate stem with a large radius of curvature at its fore end is not fitted with a centreline stiffener or is not reinforced by using thicker plate in accordance with **2.1.1-1, Part CS** of the Rules, horizontal breasthooks are to be provided at a space not exceeding 600 *mm* apart for reinforcement.

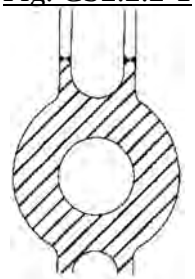
CS2.2 Stern Frames

CS2.2.2 Propeller Posts

1 Connection of cast steel boss and plate parts of built-up stern frame

The connection of a cast steel boss and built-up stern frame is to be well grooved and welded with full penetrations at the root as shown in **Fig. CS2.2.2-1**. A cast steel boss having a shape different from that shown in **Fig. CS2.2.2-1** may be used if enough consideration is paid to workmanship, at the discretion of the Society.

Fig. CS2.2.2-1



2 Length of shaft hole of propeller boss

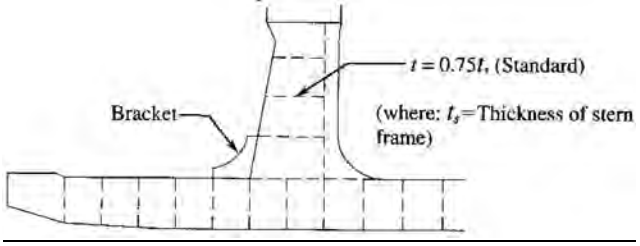
The length of the shaft hole of the propeller boss is to be greater than 1.25 *times* the inside diameter of the boss hole. Where the length of the shaft hole is less than the length of the bearing prescribed in **6.2.10, Part D** of the Rules, it is recommended that the length of the shaft hole be adjusted to match that of the bearing.

3 Round bars used for built-up stern frame

Where a round bar is used as the aft edge of a built-up stern frame, the standard radius of the round bar is at least 70% of $R(0.40L + 16)$ prescribed in **2.2.2, Part CS** of the Rules. At the connection of the round bar to the cast steel part or at the connection of round bars, the depth of the bevel for welding is to be at least 1/3 the diameter of the round bar.

4 The standard thickness of ribs fitted to the stern frame is 75% of the stern frame plate. (*See* **Fig. CS2.2.3-1**)

Fig. CS2.2.3-1



CS2.2.3 Shoe Pieces

1 Connection of shoe pieces and propeller posts

The top plate of the shoe piece is to be extended forward beyond the aft end of the propeller post. A bracket of the same thickness as the stern frame is to be fitted at the connection of the shoe piece and the aft end of the propeller post to keep a sufficient continuity of strength. (*See* **Fig. CS2.2.3-1**)

2 Steel bolts for fixing zinc slabs to the shoe piece must not be directly screwed into the shoe piece. They are to be directly welded to the shoe piece or screwed into steel plates welded to the shoe piece.

3 Shoe pieces of built-up construction are to be made watertight and the inside coated with effective coating material. Where no coating is applied to the inside of the built-up shoe piece, the thickness of the shoe piece is to be increased by 1.5 *mm*.

4 Refer to **CS2.2.2-4** above.

CS2.2.4 Heel Pieces

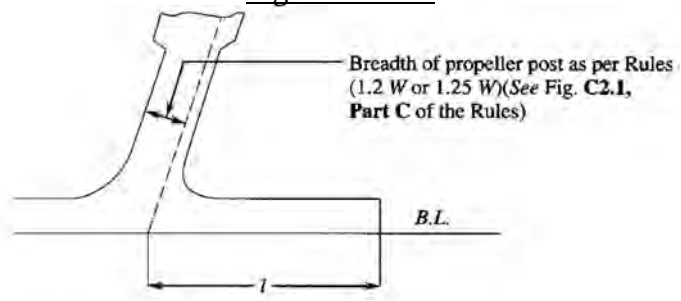
Determination of length of heel pieces

(1) In built-up stern frames, the length of heel pieces may be equal to twice the frame spacing at the position of the heel pieces providing that the thickness of flat keels connected to the heel pieces is increased by 5 *mm*.

(2) The length of heel pieces is to be measured as shown in **Fig. CS2.2.4-1**.

(3) Refer to **CS2.2.2-4** also.

Fig. CS2.2.4-1



CS3 RUDDERS

CS3.1 General

Paragraph CS3.1.1 has been amended as follows.

CS3.1.1 Application

1 For Mariner-type rudders (*See* **Fig. ~~C3.1~~ 13.2.1-1** (*D*) and (*E*), **Chapter 13, Part 1, Part C** of the Rules), the scantling of rudders is to be determined in accordance with the requirements in **Chapter 13, Part 1, Part C** of the Rules.

2 The scantling of each member of rudders having three or more pintles is to be determined in accordance with the requirements in **Chapter 3, Part CS** of the Rules. However, the moment and force acting on each member are to be determined by the direct calculation method, in accordance with the requirements in **CS3.4**.

3 Rudders having a special shape or sectional form are to be in accordance with following **(1)** and **(2)**.

(1) The scantling of each member of nozzle rudders is to be determined in accordance with the requirements in **Chapter 3, Part CS** of the Rules, unless the rudder force and rudder torque are required to be determined by tests or detailed theoretical calculation. In applying the Rules, the total rudder area and the rudder area ahead of the centreline of the rudder stock are to be calculated as follows:

Total rudder area *A*:

$2h(b_1 + b_2) + h'(a_1 + a_2)$ (m^2)

Rudder area ahead of the centreline of the rudder stock A_f:

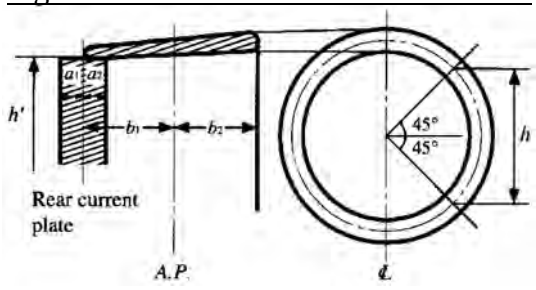
$2hb_2$ (m^2)

Where:

a_1, a_2, b_1, b_2, h and h': Refer to **Fig. CS3.1.1-1**

(2) In other rudders, the scantling of each member is to be determined by obtaining the rudder force and rudder torque through tests or detailed theoretical calculations, and correspondingly applying the requirements in **Chapter 3, Part CS** of the Rules. Results of tests or theoretical calculations are to be submitted to the Society.

Fig. CS3.1.1-1 Area of Nozzle Rudder



4 The scantling of each member of rudders designed for helm angles exceeding 35° is to be determined in accordance with the requirements in **Chapter 3, Part CS** of the Rules, on the basis of the rudder force and rudder torque obtained through tests or detailed theoretical calculations. The results of tests and theoretical calculations are to be submitted to the Society.

Paragraph CS3.1.2 has been added as follows.

CS3.1.2 Materials

1 If the diameter of the rudder stock is small, cast carbon steel is not to be used.

2 Rolled bar steel (*KSFR*45) may be treated in the same way as *KSF*45.

Paragraph CS3.1.4 has been added as follows.

CS3.1.4 Equivalence

Where steel castings with a yield stress of less than 205 N/mm^2 are used for rudder main pieces according to the provisions of **3.1.4**, **Part CS of the Rules**, the Society may require that consideration be given to the yield stress of such castings with respect to the application of the allowable stress of rudder main pieces in way of the recesses specified in **3.6.3-3(2)**, **Part CS of the Rules**.

Section CS3.4 has been added as follows.

CS3.4 Rudder Strength Calculation

CS3.4.1 Rudder Strength Calculation

1 General

The bending moment, shear force, and supporting force acting on the rudder and rudder stock may be evaluated using the basic rudder models shown in **Fig. CS3.4.1-1** to **Fig. CS3.4.1-4**.

2 Moments and forces to be evaluated

The bending moment M_R and the shear force Q_1 acting on the rudder body, the bending moment M_b acting on the bearing, and the bending moment M_s acting on the coupling between the rudder stock and the rudder main piece and the supporting forces B_1, B_2, B_3 are to be obtained. These moments and forces are to be used for analyzing the stresses in accordance with the requirements in **Chapter 3, Part CS** of the Rules.

3 Method of evaluating moments and forces

The method of evaluating moments and forces is to be as in the following **(1)** to **(3)** below.

(1) General data

Data on the basic rudder models shown in **Fig. CS3.4.1-1** to **Fig. CS3.4.1-4** is as follows:

$l_{10}\sim l_{50}$: Lengths (*m*) of individual girders of the system

$I_{10}\sim I_{50}$: Moments (cm^4) of inertia of these girders

For rudders supported by a shoe piece, the length l_{20} is the distance between the lower edge of the rudder body and the centre of the shoe piece and I_{20} is the moment of inertia of the pintle in the shoe piece.

h_c is the vertical distance (*m*) from the mid-point of the length of that pintle to the centroid of the rudder area.

(2) Direct calculation

The standard data to be used for direct calculation are as follows:

Load acting on rudder body (Type *B* rudder)

$$P_R = \frac{F_R}{1000 l_{10}} \ (kN/m)$$

Load acting on rudder body (Type *C* rudder)

$$P_R = \frac{F_R}{1000 l_{10}} \ (kN/m)$$

Notwithstanding the above, the value is as follows for rudders with rudder trunks supporting rudder stocks.

$$P_R = \frac{F_R}{1000(l_{10}+l_{20})} \ (kN/m)$$

Load acting on rudder body (Type *A* rudder)

$$P_{R10} = \frac{F_{R2}}{1000 l_{10}} \ (kN/m)$$

$$P_{R20} = \frac{F_{R1}}{1000 l_{30}} \ (kN/m)$$

Where:

F_R, F_{R1}, F_{R2}: As specified in **3.2** and **3.3, Part CS** of the Rules

k: Spring constant of the supporting point of the shoe piece or rudder horn respectively, as shown below

For the supporting point of the shoe piece:

$$k = \frac{6.18 I_{50}}{{l_{50}}^3} \ (kN/m)$$

(*See* **Fig. CS3.4.1-1** and **Fig. CS3.4.1-2**)

Where:

I_{50}: The moment (cm^4) of inertia of shoe piece around the Z-axis

l_{50}: Effective length (m) of shoe piece

For the supporting point of rudder horn:

$$k = \frac{1}{f_b + f_t} \ (kN/m)$$

(*See* **Fig. CS3.4.1-1**)

Where:

f_b: Unit displacement of rudder horn due to a unit force of 1 *kN* acting in the centre of support as shown below.

$$f_b = 1.3 \frac{d^3}{6.18 I_n} \ (m/kN)$$

Where:

I_n: The moment (cm^4) of inertia of rudder horn around the *X*-axis

f_t: Unit displacement due to torsion, as shown below.

$$f_t = \frac{dc^2 \Sigma u_i/t_i}{3.14 {F_T}^2} \times 10^{-8} \ (m/kN)$$

F_T: Mean sectional area (m^2) of the rudder horn

u_i: Breadth (mm) of the individual plates forming the mean sectional area of the rudder horn

t_i: Plate thickness (mm) within the individual breadth u_i

(3) Simplified method

The moments and forces for rudders of each type may be obtained from the following formulae.

(a) Type *A* rudders

$$M_R = \frac{{B_1}^2 (l_{10}+l_{30})}{2F_R} \ (N\text{-}m)$$

$$M_b = \frac{B_3 (l_{30}+l_{40}) (l_{10}+l_{30})^2}{l_{10}^2} \ (N\text{-}m)$$

$$M_s = B_3 l_{40} \ (N\text{-}m)$$

$$B_1 = \frac{F_R h_c}{l_{10}} \ (N)$$

$$B_2 = F_R - 0.8B_1 + B_3 \ (N)$$

$$B_3 = \frac{F_R {l_{10}}^2}{8l_{40}(l_{10}+l_{30}+l_{40})} \ (N)$$

(b) Type *B* rudders

$$M_R = \frac{{B_1}^2 l_{10}}{2F_R} \ (N\text{-}m)$$

$$M_b = B_3 l_{40} \ (N\text{-}m)$$

$$M_s = \frac{3M_R l_{30}}{l_{10}+l_{30}} \ (N\text{-}m)$$

$$B_1 = \frac{F_R h_c}{l_{10}+l_{30}} \ (N)$$

$$B_2 = F_R - 0.8B_1 + B_3$$

$$B_3 = \frac{F_R (l_{10}+l_{30})^2}{8l_{40}(l_{10}+l_{30}+l_{40})} \ (N)$$

(c) Type *C* rudders

$$M_b = F_R h_c \ (N\text{-}m)$$

$$B_2 = F_R + B_3 \ (N)$$

$$B_3 = \frac{M_b}{l_{40}} \ (N)$$

Notwithstanding the above, the value is as follow, for rudders with rudder trunks supporting rudder stocks.

M_R is the greatest of the following values:

$M_{FR1} = F_{R1} (CG_{1Z} - \ell_{10})$

$M_{FR2} = F_{R2} (\ell_{10} - CG_{2Z})$

where A_1 and A_2 are the rudder blade area which are above the lower bearing and below respectively and symbols are as follows (*See* **Fig. CS3.4.1-4**)

F_{R1} : Rudder force over the rudder blade area A_1

F_{R2} : Rudder force over the rudder blade area A_2

CG_{1Z}: Vertical position of the centre of gravity of the rudder blade area A_1 from base

CG_{2Z}: Vertical position of the centre of gravity of the rudder blade area A_2 from base

$F_R = F_{R1} + F_{R2}$

$B_2 = F_R + B_3$

$$B_3 = \frac{M_{FR2} - M_{FR1}}{\ell_{20} + \ell_{40}}$$

Fig. CS3.4.1-1 Type *A* Rudder

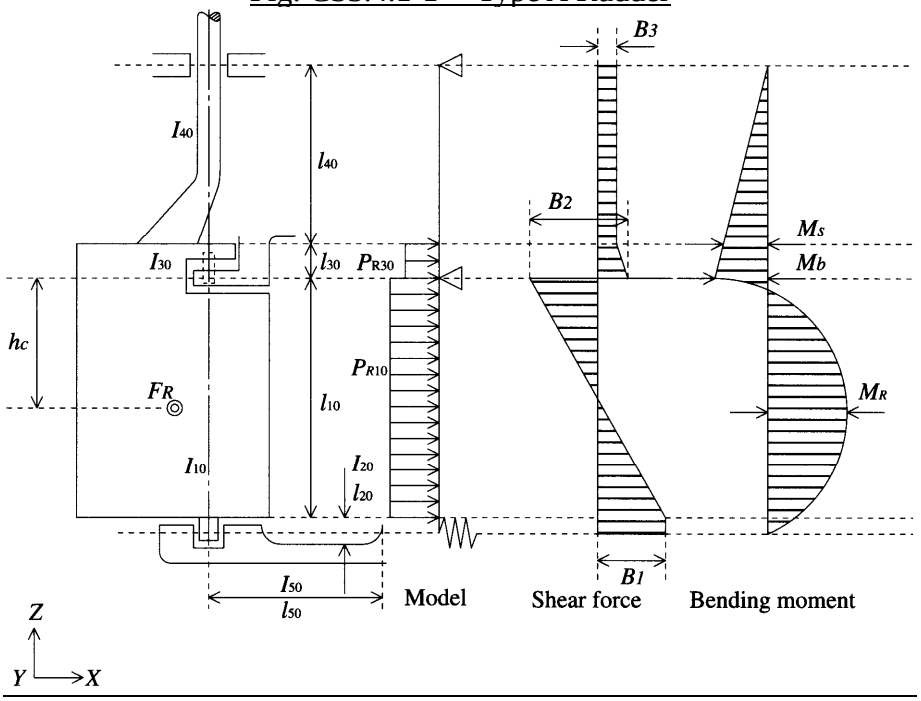


Fig. CS3.4.1-2 Type *B* Rudder

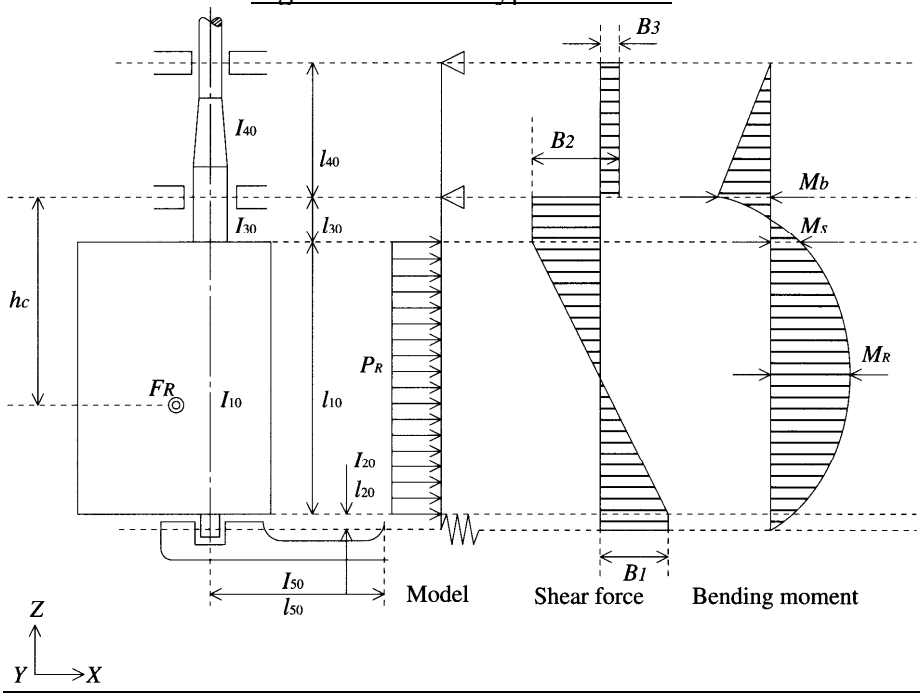


Fig. CS3.4.1-3 Type *C* Rudder

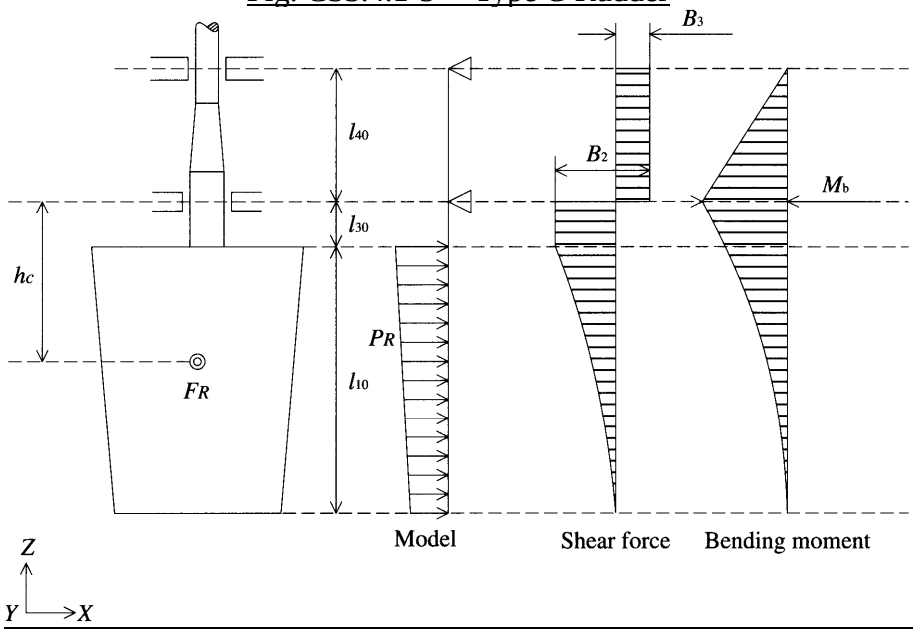
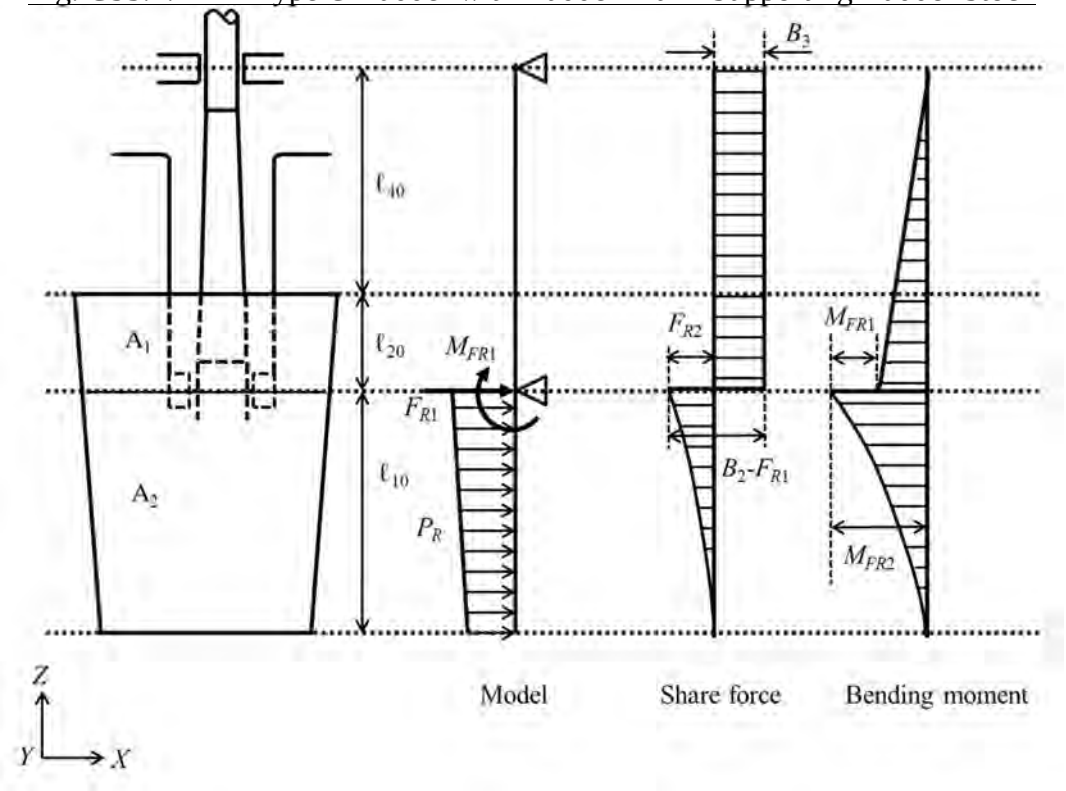


Fig. CS3.4.1-4 Type *C* Rudder with Rudder Trunk Supporting Rudder Stock



Section CS3.5 has been added as follows.

CS3.5 Rudder Stocks

CS3.5.1 Upper Stocks

1 Taper of upper stock at joint with tiller

Where the upper stocks are tapered for fitting the tiller, the taper is not to exceed 1/25 of the radius or 1/12.5 of the diameter.

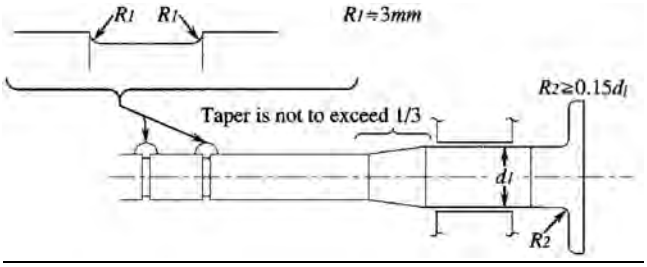
2 Keyways

(1) The depth of the keyway may be neglected in determining the diameter of the rudder stock.

(2) All corners of keyways are to be properly rounded.

3 Each part of the rudder stocks of Type *B* and *C* rudders specified in **3.5, Part CS** of the Rules is to be so constructed as shown below.

Fig. CS3.5.1-1 Rudder Stock of Type *B* and *C* Rudder



Section CS3.6 has been added as follows.

CS3.6 Rudder Plates, Rudder Frames and Rudder Main Pieces of Double Plate Rudders

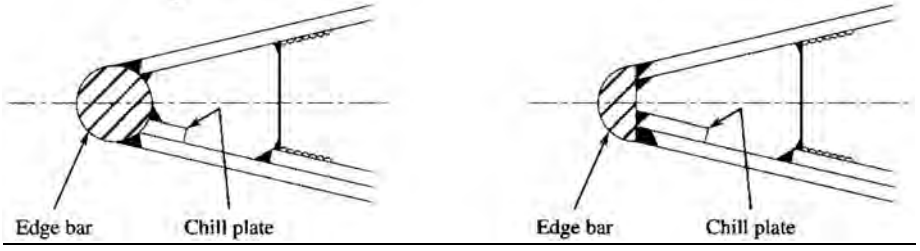
CS3.6.3 Rudder Main Pieces

Material factor K_m is to be for the lowest strength material among the materials used in the section considered.

CS3.6.4 Connections

In principle, edge bars are to be fitted to the aft end of the rudder. However, considering the size and form of the rudder, weldability, etc., edge bars and/or chill plates may be omitted. (*See* **Fig. CS3.6.4-1**)

Fig. CS3.6.4-1 Aft end Construction of Rudder



Section CS3.9 has been added as follows.

CS3.9 Couplings between Rudder Stocks and Main Pieces

CS3.9.1 Horizontal Flange Couplings

1 Diameters of coupling bolts in Type *A* rudder

In the application of **3.9.1-1, Part CS** of the Rules, the diameter of the coupling bolt d_l in Type *A* rudder is to be determined in accordance with the requirements in **3.5.2, Part CS** of the Rules, assuming that the lower stock is cylindrical.

2 Locking device for nuts of coupling bolts

The nuts of coupling bolts are to have locking devices. They may be split pins.

CS3.9.2 Vertical Flange Couplings

1 Diameter of coupling bolts in Type *A* rudder

In the application of **3.9.2-1, Part C** of the Rules, the diameter of the coupling bolt d_l in Type *A* rudder is to be determined in accordance with **3.5.2, Part CS** of the Rules, assuming that the lower stock is cylindrical.

2 Locking devices for nuts of coupling bolts

The nuts of coupling bolts are to have locking devices. They may be split pins.

CS3.9.3 Cone Couplings with Key

1 General

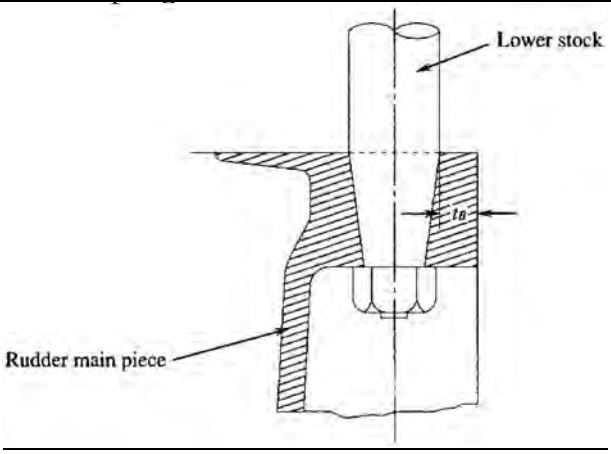
(1) The lower stock is to be securely connected to the rudder body with slugging nuts or hydraulic arrangements. Shipbuilders are to submit data on this connection to the Society.

(2) Special attention is to be paid to corrosion of the lower stock.

(3) The thickness t_B of the cast steel part of the rudder body (*See* **Fig. CS3.9.3-1**) is not to be less than 0.25 *times* the required diameter of the lower stock.

(4) In the application of **3.9.3-1** to **-3, Part CS** of the Rules, actual values are to be used for d_0, d_g and d_e.

Fig. CS3.9.3-1 Coupling Between Lower Stock and Rudder Main Piece



2 In the application of **3.9.3-5**, the scantlings of the key are as follows in cases where all rudder torque is considered to be transmitted by the key at the couplings.

(1) The shear area A_k of keys is not to be less than:

$$A_k = \frac{30 T_R K_k}{d_k} \ (mm^2)$$

Where:

d_k: Rudder stock diameter (*mm*) at the mid-point of length of the key

K_k: Material factor for the key as given in **3.1.2, Part CS** of the Rules

T_R: Rudder torque obtained from **3.3, Part CS** of the Rules

(2) The abutting surface area A_c between the key and rudder stock or between the key and rudder body, respectively, is not to be less than:

$$A_c = \frac{10 T_R K_{\max}}{d_k} \ (mm^2)$$

Where:

$K_{\max}$: The greater of the material factors (given in **3.1.2, Part CS** of the Rules) between the rudder stock and the key it is in contact with or the greater of the material factors between the rudder body and the key it is in contact with

d_k and T_R: As specified in **(1)**

CS3.9.4 Cone Couplings with Special Arrangements for Mounting and Dismounting the Couplings

The outer diameter of gudgeon (d_a) is recommended to be taken at the same plane in which the mean cone diameter (d_m).

Section CS3.10 has been added as follows.

CS3.10 Pintles

CS3.10.2 Construction of Pintles

1 Locking device for pintle nut

Split pins are not recommendable as the locking device for pintle nuts. Locking rings or other equivalent devices are to be used, as shown in **Fig. CS3.10.2-1**.

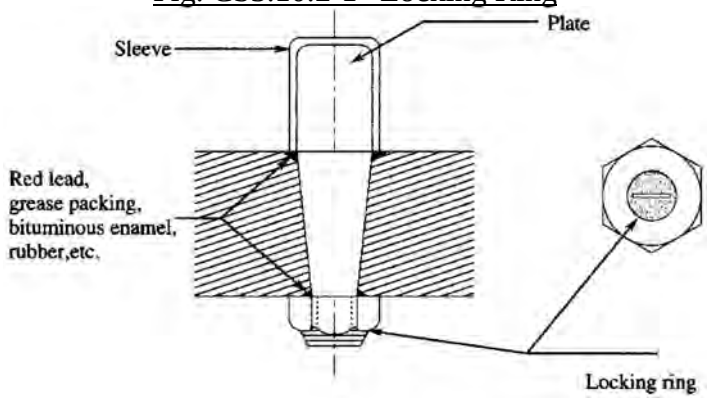
2 Preventing corrosion of pintles

To prevent corrosion of pintles, the end of the sleeve is to be filled with red lead, grease packing, bituminous enamel, rubber, etc. as shown in **Fig. CS3.10.2-1**.

3 Combination of pintle and rudder frame in monoblock

In ships exceeding 80 *m* in length, combining the pintle and rudder frame into a monoblock is not recommended.

Fig. CS3.10.2-1 Locking Ring



Section CS3.11 has been added as follows.

CS3.11 Bearings of Rudder Stocks and Pintles

CS3.11.1 Minimum Bearing Surface

1 Where a metal bush is used, the sleeve is to be of a different material from the bush (for example, sleeve of *BC*3 and bush of *BC*2).

2 "The type as deemed appropriate by the Society" stipulated in **Table CS3.3, Part CS** of the Rules means that approval is to be made in accordance with the requirements of **Chapter 5, Part 4 of Guidance for the Approval and Type Approval of Materials and Equipment for Marine Use**.

CS3.11.3 Bearing Clearances

Where a bush is non-metal, the standard bearing clearance is to be 1.5~2.0 *mm* in diameter.

Section CS3.12 has been added as follows.

CS3.12 Rudder Accessories

CS3.12.1 Rudder Carriers

1 Materials of rudder carriers and intermediate bearings

Rudder carriers and intermediate bearings are to be of steel. They are not to be of cast iron.

2 Thrust bearing of rudder carrier

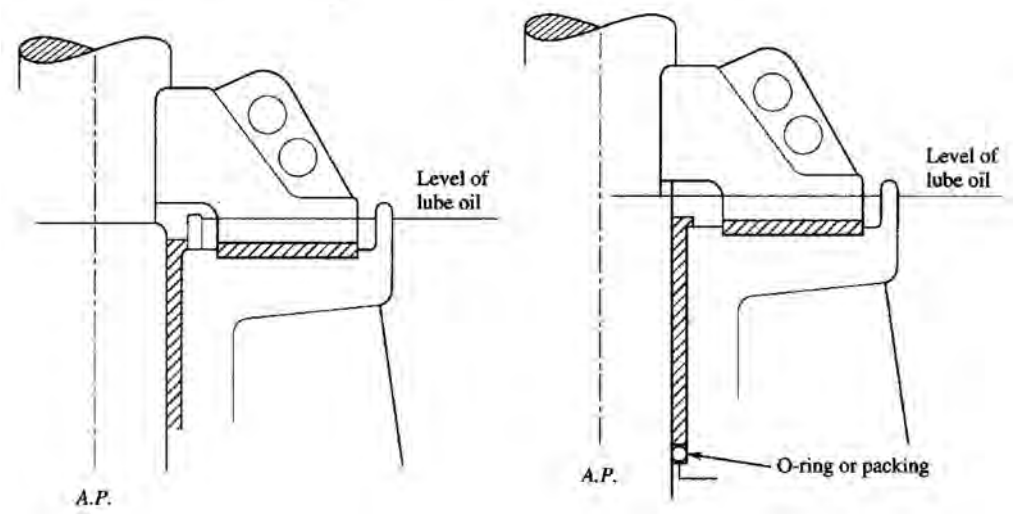
(1) The bearing is to be provided with a bearing disc made of bronze or other equivalent materials.

(2) The calculated bearing pressure is not to exceed 0.98 *MPa* as a standard. In calculating the weight of the rudder, its buoyancy is to be neglected.

(3) The bearing part is to be well lubricated by dripping oil, automatic grease feeding, or a similar method.

(4) The bearing is to be designed to be structurally below the level of lubricating oil at all times. (*See* **Fig.CS3.12.1-1**)

Fig. CS3.12.1-1 Rudder Carrier



3 Watertightness of rudder carrier part

(1) In rudder trunks which are open to the sea, a seal or stuffing box is to be fitted above the deepest load waterline to prevent water from entering the steering gear compartment and the lubricant from being washed away from the rudder carrier. If the top of the rudder trunk is below the deepest waterline two separate stuffing boxes are to be provided.

(2) It is recommended that the packing gland in the stuffing box have an appropriate clearance from the rudder stock corresponding to the position of the stuffing box. The standard clearance is to be 4 *mm* for the stuffing box provided at the neck or intermediate bearing, and 2 *mm* for the stuffing box at the upper stock bearing.

4 Assembly of rudder carriers

In split type rudder carriers, at least two bolts are to be used on each side of the rudder for assembly.

5 Installation of rudder carriers

(1) In ships exceeding 80 *m* in length, it is recommended that the rudder carrier is directly installed on the seat on the deck.

(2) A spigot type seat is not recommended to be installed on the deck.

(3) The hull construction in way of the rudder carrier is to be suitably reinforced.

6 Bolts securing rudder carriers and intermediate bearing

(1) At least one half of the bolts securing the rudder carrier and the intermediate bearing are to be reamer bolts. If stoppers for preventing the rudder carrier from moving are to be fitted on the deck, all bolts may be ordinary bolts. In using chocks as stoppers, they are to be carefully arranged so that they are not driven in, in the same direction. (*See* **Fig CS3.12.1-2**)

(2)

(a) In ships provided with electrohydraulic steering gears, the total sectional area of the bolts securing the rudder carriers or the bearing just under the tiller to the deck is not to be less than that obtained from the following formula:

$0.1d_u^2$ (mm^2)

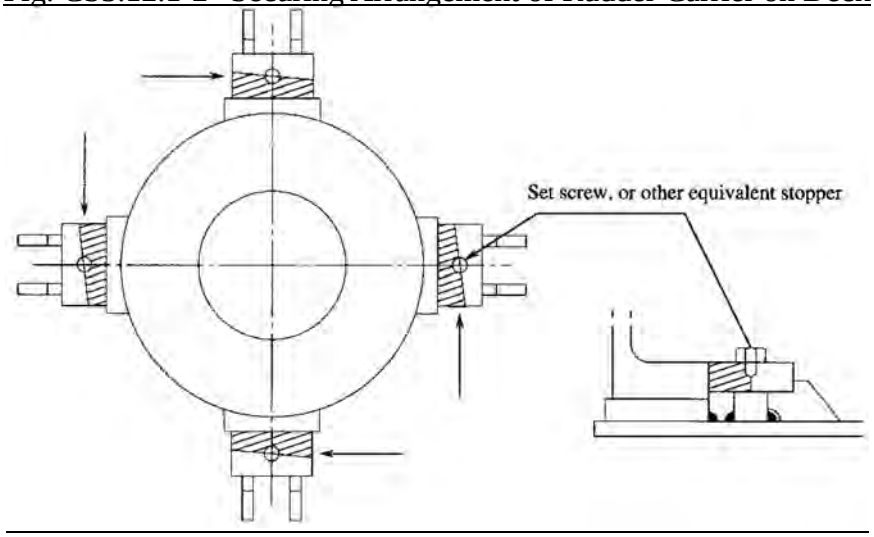
Where:

d_u: Required diameter of upper stock (*mm*)

(b) Where the arrangement of the steering gear is such that each of the two tiller arms is connected with an actuator and two actuators function simultaneously, or is of any other type where the rudder stock is free from horizontal force, the total sectional area of bolts securing the rudder carrier to the deck may be reduced to 60% of the area required in **(a)**.

(c) Where all the bolts securing the rudder carrier to the deck are reamer bolts, the total sectional area of bolts may be reduced to 80% of the area required by **(a)** and **(b)**.

Fig. CS3.12.1-2 Securing Arrangement of Rudder Carrier on Deck



C3.12.2 Prevention of Jumping

A 2 *mm* clearance between the jumping stopper and its contact surface is deemed as standard.

Chapter CS4 has been added as follows.

CS4 SUBDIVISIONS

CS4.1 General

CS4.1.1 Application

"Those ships specifically approved by the Society" refers to the following.

(1) Bulk carriers having freeboards of type *B*-60 or *B*-100 as specified in the requirements of **Part V** of the Rules; however, when carrying deck cargoes, the requirements of **Chapter 4, Part CS** of the Rules apply

(2) Special purpose ships complying with the requirements of *IMO Resolution MSC*.266(84)

CS4.1.2 Definitions

1 "Light service draught" stated in **4.1.2(4), Part CS** of the Rules corresponds, in general, to the ballast arrival condition with 10 % consumables.

2 "Deck or decks limiting the vertical extent of flooding" stated in **4.1.2(6), Part CS** of the Rules refers to the weather deck. However, when the ship has multiple decks above d_s + 12.5 (*m*) at the deepest subdivision draught, the deck just above d_s + 12.5 (*m*) is implied.

3 The wording "specifically accepted by the Society" stated in **4.1.2(13), Part CS** of the Rules means the carriage of timber and wood chip in cargo holds. Figures specified in **Table CS4.1.2** may be used as the permeability of compartment.

4 With respect to the provisions of **4.1.2(13), Part CS** of the Rules, the volume of spaces under consideration is to be taken as the moulded volume.

Table CS4.1.2 Permeability of Compartment Regarding Timber Cargo

Space for	Permeability at draught d_s	Permeability at draught d_p	Permeability at draught d_l
Timber cargo in holds	0.35	0.70	0.95
Wood chip cargo	0.60	0.70	0.95

CS4.2 Subdivision Index

CS4.2.1 Subdivision Index

1 If pipes, ducts or tunnels are provided within an assumed damaged compartment or group of compartments, they are to be arranged in such a way as to prevent flooding progressing to other compartments, or they are to be fitted with devices which can easily control the progress of flooding to other compartments. However, where the attained subdivision index takes into account flooding to other compartment through the pipes, ducts or tunnels, and satisfies the requirements in **4.2, Part CS** of the Rules, these requirements need not apply.

2 Notwithstanding the provisions of **-1** above, minor progressive flooding may be permitted if it is demonstrated that the effects of progressive flooding of other compartments through these pipes, ducts or tunnels can be easily controlled and the safety of the ship is not impaired. However, for ships up to L_f = 150 *m* the provision for allowing "minor progressive flooding" is to be limited to pipes penetrating a watertight subdivision with a total cross-sectional area of not more than 710 mm^2 between any two watertight compartments. For ships of L_f = 150 *m* and upwards the total cross-sectional area of pipes is not to exceed the cross-sectional area of one pipe with a diameter of L_f/5000 *m*.

3 Where penetrations for piping, ventilation, electrical cables, etc. are provided in bulkheads, decks and shells forming a compartment, the watertight integrity of the penetrations are to be at least equivalent to the parts they penetrate.

4 With the same intent as wing tanks, the summation of the attained index *A* is to reflect effects caused by all watertight bulkheads and flooding boundaries within the damaged zone. It is not correct to assume damage only to one half of the ship's breadth (*B*′) and ignore changes in subdivision that would reflect lesser contributions.

5 In the forward and aft ends of the ship where the sectional breadth is less than the ship's breadth (*B*') specified in **4.1.2(11), Part CS** of the Rules, transverse damage penetration may extend beyond the centreline bulkhead.

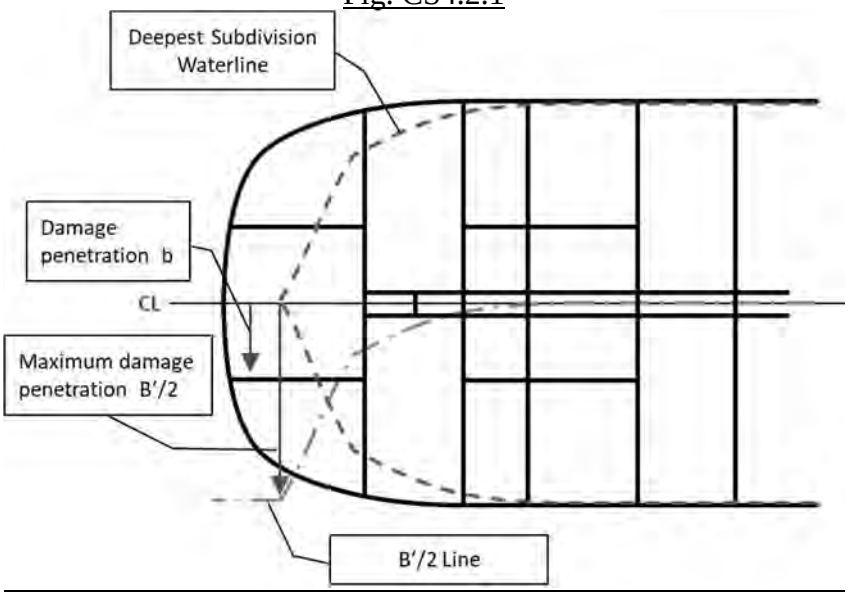
6 Where, at the extreme ends of the ship, the subdivision exceeds the waterline at the deepest subdivision draught, the damage penetration b or *B*′/2 is to be taken from centreline. **Fig. CS4.2.1** illustrates the shape of the *B*′/2 line.

7 Where longitudinal corrugated bulkheads are fitted in wing compartments or on the centreline, they may be treated as equivalent plane bulkheads provided the corrugation depth is of the same order as the stiffening structure. The same principle may also be applied to transverse corrugated bulkheads.

8 Pipes and valves directly adjacent or situated as close as practicable to a bulkhead or to a deck can be considered to be part of the bulkhead or deck, provided the separation distance on either side of the bulkhead or deck is of the same order as the bulkhead or deck stiffening structure. The same applies for small recesses, drain wells, etc.

9 In setting the trim and G_0M used to calculate the subdivision index, reference is also to be made to **1.3.10-11** and **-12**, **Annex U1.2.1 "GUIDANCE FOR STABILITY INFORMATION FOR MASTER", Part U of the Guidance**.

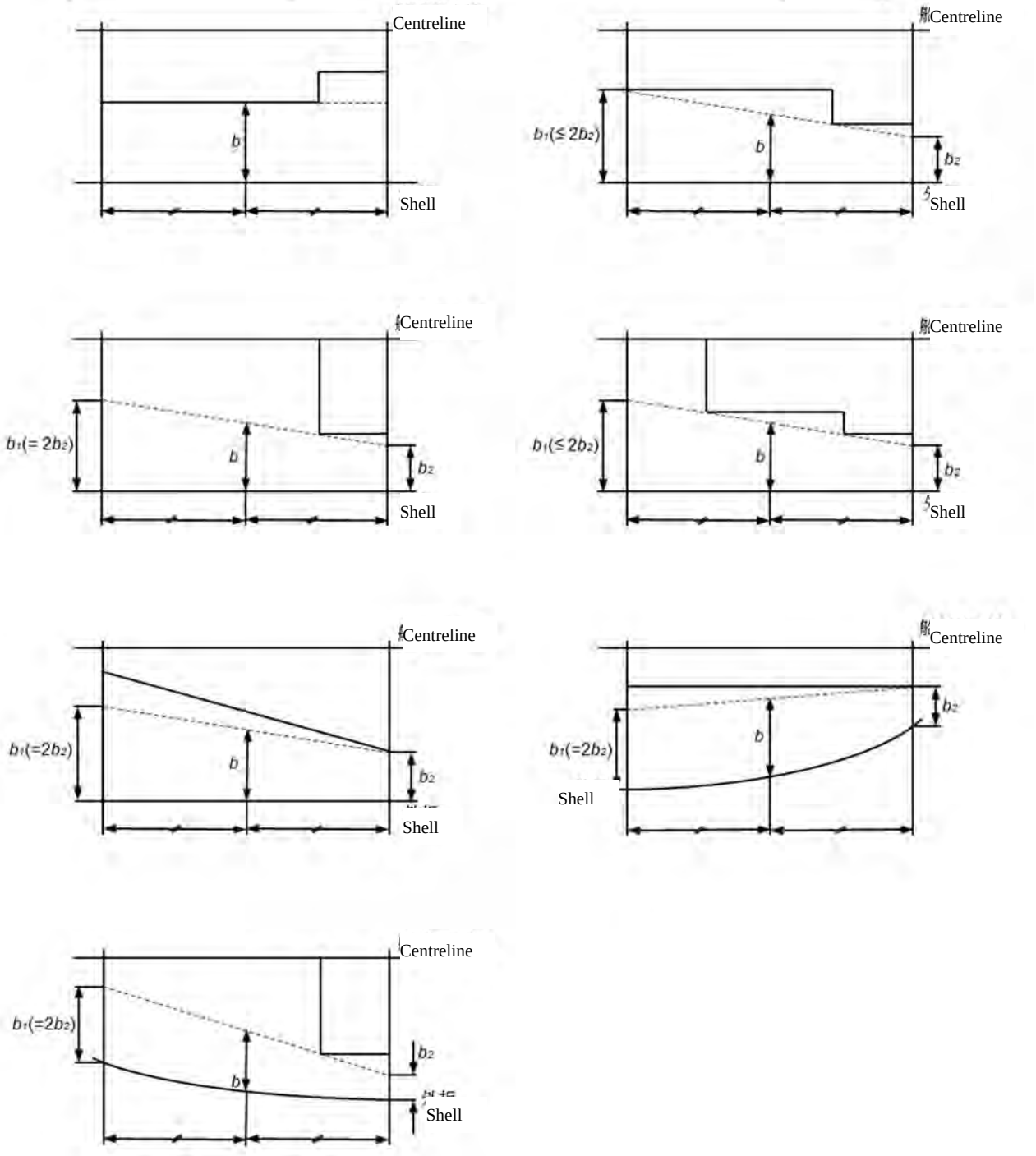
Fig. CS4.2.1



CS4.2.2 Compartment Flooding Probability (p_i)

In application of the requirement of **4.2.2-1, Part CS** of the Rules, in case where the longitudinal bulkhead is not paralleled to the side shell plating, the assumed vertical plane which is considered in the determination of transverse distance (*b*) between longitudinal bulkhead and side shell plating is to be refer to a example specified in **Fig.CS4.2.2**.

Fig.CS4.2.2 Examples of Assumed Vertical Plane (In case of Single Damage Zone)



CS4.2.3 Probability of Survival (s_i)

1 Openings (e.g., access openings provided in the end bulkhead of the superstructure and cargo hatchways), air pipes, and ventilators which are provided only with the weathertight closing apparatus specified in **Part CS** of the Rules are to be treated as allowing progress of flooding when the water line at the final equilibrium state immerses their lower edge.

2 In applying θ_v, specified in **4.2.3-1, Part CS of the Rules**, an "opening incapable of being closed weathertight" includes ventilators provided with weathertight closing appliances in accordance with the requirements of **21.6.5-2, Part CS of the Rules** that for operational reasons have to remain open to supply air to the engine room, emergency generator room or closed ro-ro and vehicle spaces (if the same is considered buoyant in the stability calculation or protecting openings leading below) for the effective operation of the ship. Where it is not technically feasible to treat some closed ro-ro and vehicle space ventilators as unprotected openings, an alternative arrangement that provides an equivalent level of safety may be used provided that it is deemed appropriate by the Administration.

3 The calculation of the probability of survival (s_i) in **4.2.3-10, Part CS of the Rules** is to be treated as follows.

(1) Where the buoyancy of the timber deck cargo is taken into account, the cargo is to be in compliance with the following **(a)** to **(d)**:

(a) The timber deck cargo is to be stowed in accordance with the requirements of **Section 2.9**, **Part A** of the *Code of Safe Practice for Ships Carrying Timber Deck Cargoes, 2011* (*IMO* resolution *A*.1048(27)).

(b) The timber deck cargo is to be secured by lashings, uprights or both.

(c) Lashings and uprights are to comply with the requirements of **Section 2.10**, **Part A** of the *Code of Safe Practice for Ships Carrying Timber Deck Cargoes, 2011* (*IMO* resolution *A*.1048(27)).

(d) The height and extent of the timber deck cargo is to be in accordance with **Section 3.3.2** of **Chapter 3**, **Part A** of the *International Code on Intact Stability, 2008 (2008 IS Code)* and is to be at least stowed to the standard height of one superstructure.

(2) The permeability of the timber deck cargo is not to be less than 25 % of the volume occupied by the cargo up to one standard superstructure height.

(3) When the buoyancy of any timber deck cargo is taken into account, the timber deck cargo in way of a damaged zone is deemed ineffective to all areas in an athwartships direction. However, when the vertical extent of the damage stops at the upper deck and the coefficient (v_m) from **4.2.3-4, Part CS** of the Rules is used in the calculations, the buoyancy of the timber deck cargo may be taken into account in accordance with **(2)** above even if it is directly above the damaged area.

4 Tanks and compartments taking part in such equalization is to be fitted with air pipes or equivalent means of sufficient cross-section to ensure that the flow of water into the equalization compartments is not delayed.

5 In applying the requirements specified in **4.2.3-9(2), Part CS of the Rules**, with respect to equalization devices, reference is to be made to the *IMO Res. MSC*.362(92) "*Revised Recommendation on a standard method for evaluating cross-flooding arrangements*", as amended.

6 If the final waterline immerses the lower edge of any opening through which progressive flooding takes place, the factor "s" may be recalculated taking such flooding into account. However, in this case the *s* value is also to be calculated without taking into account progressive flooding and corresponding opening. The smallest *s* value is to be retained for the contribution to the attained index.

CS4.3 Openings

CS4.3.1 Internal Openings

1 "Watertight" stated in **4.3.1-1, Part CS** of the Rules means watertight integrity that is sufficient against a water head corresponding to the opening in question at the final equilibrium state and intermediate waterline.

2 With respect to the provisions of **4.3.1-2, Part CS** of the Rules, watertight closing appliances are categorized as in the following **(1)** to **(3)** corresponding to their purpose and frequency of use.

(1) Watertight closing appliances which are to be *permanently closed* at sea:
Such appliances are open in port and closed before the ship leaves port. The time of opening/closing such doors is to be recorded in the log-book.

(2) Watertight closing appliances which are to be *normally closed* at sea:
Such appliances are kept closed at sea but may be used if authorized by the officer of the watch and to be closed again after use.

(3) Watertight closing appliances which are *used* at sea:
Such appliances are used regularly and may be left open provided they are ready to be immediately closed.

3 General requirements of **4.3.1-2, Part CS** of the Rules are shown in **Table CS4.3.1-1**.

4 Details of functions, specifications, etc. for the power, controls, indicators, alarms, notices for watertight closing appliances specified in **4.3.1-2, Part CS** of the Rules are to be in accordance with **13.3, Part CS** of the Rules.

5 With respect to the provisions of **4.3.1-2, Part CS** of the Rules, watertight closing appliances above the bulkhead deck are also to comply with the requirements for doors provided for means of escape specified in **Chapter 13, Part R** of the Rules.

CS4.3.2 External Openings

1 General requirements of closing appliances specified in **4.3.2, Part CS** of the Rules are show in **Table CS4.3.1-2**.

2 Details of indicators for the watertight closing appliances specified in **4.3.2, Part CS** of the Rules are to be in accordance with **13.3.5, Part CS** of the Rules.

3 "Bridge" stated in **4.3.2-2, Part CS** of the Rules means the place where the watch officer is always present and normally implies the navigation bridge deckhouse.

Table CS4.3.1-1 Requirements for Closing Devices for Internal Openings

Position relative to bulkhead or freeboard deck	Referenced requirement in **Part CS** of the Rules	Frequency of use	Type of closing appliance	Remote closure	Open/close indicators	Audible or visual alarms	Notices	Notes
Below	**4.3.1-2(2), 13.3.4-2 13.3.5, 13.3.6**	Used	POS	Yes	Yes	Yes (Local)	No	---
	4.3.1-2(3), 13.3.5-1 13.3.8-1	Norm. Closed	S or H	No	Yes	No	Yes	*1, 6
	4.3.1-2(4), 13.3.4-3 13.3.8-2	Perm. Closed (cargo spaces)	S or H	Prohibited	No	No	Yes	*3, 4, 7
	4.3.1-2(5), 13.3.8-2	Perm. Closed (others)						
At or above	**4.3.1-2(2), 13.3.4-2 13.3.5, 13.3.6**	Used	POS	Yes	Yes	Yes (Local)	No	*2, 5
	4.3.1-2(3), 13.3.5-1 13.3.8-1	Norm. Closed	S or H	No	Yes	No	Yes	*1, 6
	4.3.1-2(4), 13.3.8-2	Perm. Closed	S or H	Prohibited	No	No	Yes	*3, 4, 7

Notes:

*1 : If hinged, this door is to be of single-action type.

*2 : Under the “International Convention on Load Lines, 1966”, doors separating a main machinery space from a steering gear compartment may be hinged single-action types provided the lower sill of such doors is above the Summer Load Line and the doors remain closed at sea whilst not in use.

*3 : The time of opening such doors in port and closing them before the ship leaves port is to be entered into the logbook in the case of doors in watertight bulkheads subdividing cargo spaces.

*4 : Doors are to be fitted with devices which prevent unauthorized opening.

*5 : Under *MARPOL*, hinged watertight doors may be acceptable in watertight bulkheads of the superstructure.

*6 : Notices are to state “Kept closed at sea”.

*7 : Notices are to state “Not to be opened at sea”.

Table CS4.3.1-2 Requirements for Closing Devices for External Openings

Position relative to bulkhead or freeboard deck	Referenced requirement in **Part CS** of the Rules	Frequency of use	Type of closing appliance	Remote closure	Open/close indicators	Audible or visual alarms	Notices	Notes
Below	**4.3.2-2, 4.3.2-3 13.3.8-2**	Perm. Closed	S or H	No	Yes	No	Yes	*2, 3, 5
At or above	**13.3.5-1, 13.3.8-1**	Norm. Closed	S or H	No	Yes	No	Yes	*1, 4
	4.3.2-2, 13.3.8-2	Perm. Closed	S or H	No	Yes	No	Yes	*2, 3, 5

Notes:

*1 : If hinged, this door is to be of single-action type.

*2 : The time of opening such doors in port and closing them before the ship leaves port is to be entered into the logbook in the case of doors in watertight bulkheads subdividing cargo spaces.

*3 : Doors are to be fitted with devices which prevent unauthorized opening.

*4 : Notices are to state “Kept closed at sea”.

*5 : Notices are to state “Not to be opened at sea”.

CS5 has been added as follows.

CS5 SINGLE BOTTOMS

CS5.4 Floor Plates

CS5.4.3 Scantlings

In ships which have L and C_b not more than 150 m and 0.7 respectively, and $V/\sqrt{L}$ not less than 1.4, it is recommended that the face plates of floors in way of strengthened bottom forward required in **CS6.9.1-2(1)** are to be plated. The thickness of floors is to comply with the requirements in **CS6.9.1-2(3)**.

CS6 DOUBLE BOTTOMS

CS6.1 General

CS6.1.1 Application

Table CS6.1.1-1 has been amended as follows.

Table CS6.1.1-1 Assumed Extent of Damage

	For 0.3*L* from the forward perpendicular of the ship	Any other part of the ship
Longitudinal extent	$1/3\ L_f^{2/3}$ or 14.5*m*, whichever is less	$1/3\ L_f^{2/3}$ or 14.5*m*, whichever is less
Transverse extent	*B*'/6 or 10*m*, whichever is less	*B*'/6 or 5*m*, whichever is less
Vertical extent, measured from the keel line	*B*'/20, to be taken not less than 0.76 *m* and not more than 2 *m*	*B*'/20, to be taken not less than 0.76 *m* and not more than 2 *m*

Notes:
1. Keel line is to be in accordance with **2.1.48, Part A** of the Rules.
2. Ship breadth (*B*') is to be in accordance with **4.1.2(11), Part CS** of the Rules.

Section CS6.6 has been added as follows.

CS6.6 Longitudinals

CS6.6.2 Scantlings

1 For longitudinal stiffeners in double bottoms, where both ends of those stiffeners are fixed to vertical stiffeners on solid floors, horizontal stiffeners on vertical webs or struts, the section modulus required for those stiffeners may be multiplied by the value obtained from the following formula:

$$\left(1-\frac{a}{l}\right)^2\left(1-\frac{b}{l}\right)$$

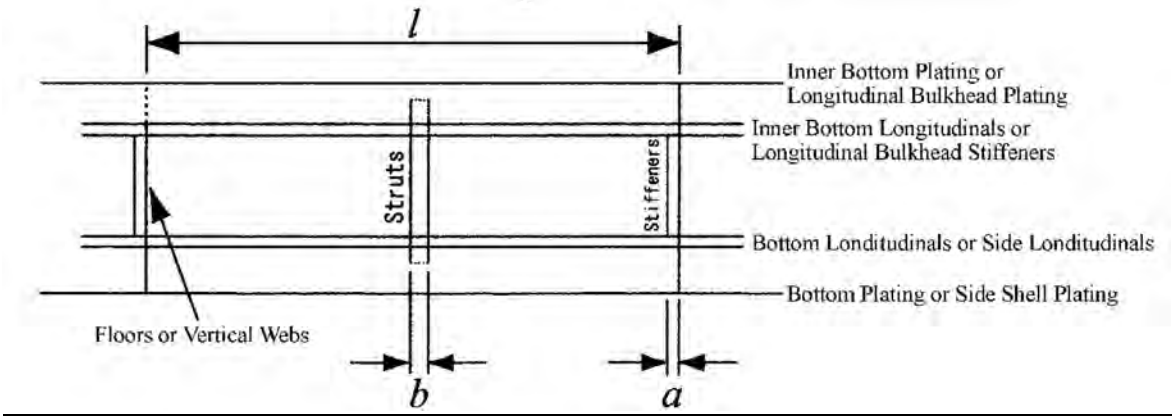
l : Distance (m) between floors or vertical webs

a : Width (m) of stiffeners of floors or vertical webs (a is zero if the stiffeners are not secured to longitudinals or other stiffeners by means of a lug connection)

b : Width of struts (m)

(*See* **Fig. CS6.6.2-1**)

Fig. CS6.6.2-1



Section CS6.7 has been added as follows.

CS6.7 Inner Bottom Plating and Margin Plates

CS6.7.1 Thickness of Inner Bottom Plating

1 Where the height of the centre girder is less than *B*/16, the thicknesses of the inner bottom plating and bottom shell plating are to be increased so that the moment of inertia of the double bottom obtained from the following formula may be equivalent to that corresponding to when the centre girder has the required height.

$$I = 1.23\frac{t_1 t_2}{t_1 + t_2} d_0^2$$

Where:

d_0: Height (m) of centre girder

t_1 : Thickness (mm) of bottom shell plating

t_2 : Thickness (mm) of inner bottom plating

2 Where fork-lift trucks are used for handling cargoes, **CS17.3.5** is to be applied for determining the thickness of the inner bottom plating.

Section CS6.9 has been added as follows.

CS6.9 Construction and Strengthening of the Bottom Forward

CS6.9.1 Application

1 Here, "ballast condition" means the ordinary ballast condition where only ballast tanks such as clean ballast tanks, segregated ballast tanks and ballast holds are ballasted. This ballast condition excludes exceptional cases where cargo tanks are ballasted in heavy weather conditions to ensure the safety of the ship.

2 In ships of which C_b is not more than 0.7 and $V/\sqrt{L}$ is not less than 1.4, the construction of the bottom forward is to be as required in the following **(1)**, **(2)** and **(3)**.

(1) Construction

The construction of the strengthened bottom forward is to be in accordance with **6.9.3, Part CS** of the Rules. However, the vertical stiffeners for the solid floors specified in **6.9.3-3, Part CS** of the Rules are to be provided on all shell stiffeners. Where the bottom longitudinals or

longitudinal shell stiffeners are extended through the solid floors, slots are to be reinforced with collar plates.

(2) Scantlings of longitudinal shell stiffeners or bottom longitudinals

(a) In ships having a bow draught of not more than $0.025L$ in ballast condition, the section modulus of longitudinal shell stiffeners or bottom longitudinals in way of the strengthened bottom forward is not to be less than that obtained from the following formula:

$0.53P\lambda l^2 \ \ (cm^3)$

Where:

l : Spacing (m) of solid floors

λ : $0.774l$.

However, where the spacing of longitudinal shell stiffeners or bottom longitudinals is not more than $0.774l$, λ is to be taken as the spacing (m).

P : Slamming impact pressure (kPa) obtained from the following formula:

$$2.48\frac{LC_1C_2C_3}{\beta} \ (kPa)$$

C_1: Coefficient given in **Table CS6.9.1-1**. For intermediate values of $V/\sqrt{L}, C_1$ is to be obtained by linear interpolation.

C_2: Coefficient obtained from following formula:

Where $\frac{V}{\sqrt{L}}$ is 1.0 and under: 0.4

Where $\frac{V}{\sqrt{L}}$ is over 1.0, but less than 1.3: $0.667\frac{V}{\sqrt{L}} - 0.267$

Where $\frac{V}{\sqrt{L}}$ is 1.3 and over: $1.5\frac{V}{\sqrt{L}} - 1.35$

β: Slope of the ship's bottom obtained from the following formula, but C_2/β need not be taken as greater than 11.43:

$$\frac{0.0025L}{b}$$

b : Horizontal distance (m) measured at the station $0.2L$ from the stem, from the centre line of the ship to the intersection of the horizontal line $0.0025L$ above the top of the keel with the shell plating (*See* **Fig. CS6.9.1-1**)

C_3: Coefficient obtained from the following formula:

$$C_3 = 1.9 - 0.9\left(\frac{d_f}{0.025L}\right)$$

Where:

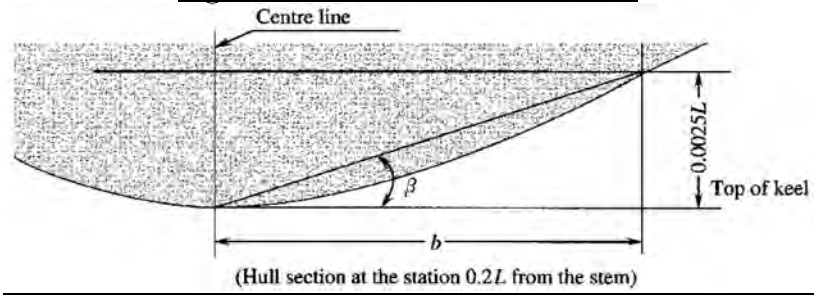
d_f: Minimum bow draught in ballast condition

(b) In ships having a bow draught of more than $0.025L$ but less than $0.037L$ in ballast condition, the section modulus of longitudinal shell stiffeners or bottom longitudinals in way of the strengthened bottom forward is to be obtained by linear interpolation from the values given by the requirements in **(a)** and **6.6, Part CS** of the Rules.

Table CS6.9.1-1 Value of C_1

$V/\sqrt{L}$	1.4	1.5	1.6	1.7	1.8
C_1	0.31	0.33	0.36	0.38	0.40

Fig. CS6.9.1-1 Measurement of b



(3) Thickness of solid floors

The thickness of solid floors in way of the strengthened bottom forward is obtained from the following requirements **(a)** and **(b)**, whichever is greater:

(a) The thickness obtained from the following formula.

$$\frac{PSb_1}{196(b_1-d_1)} + 2.5 \ (mm)$$

P : Slamming impact pressure given by **(2)(a)**. In ships having a bow draught of more than $0.025L$ but less than $0.037L$ in ballast condition, this requirement is to be applied using the actual bow draught in ballast condition.

S : Spacing (m) of solid floors

b_1: Breadth (m) of solid floor panel between the midpoints of the spaces on either side of a bottom longitudinal (excluding longitudinal shell stiffeners provided in between bottom longitudinals)
(*See* **Fig. CS6.9.1-2**)

d_1: Total breadth (m) of openings (lightening holes, slots, etc.) at the level of the floor in question ($d_1 = d_2 + d_3$)
Where, the openings are reinforced with doubling plates, the sectional area may be considered.

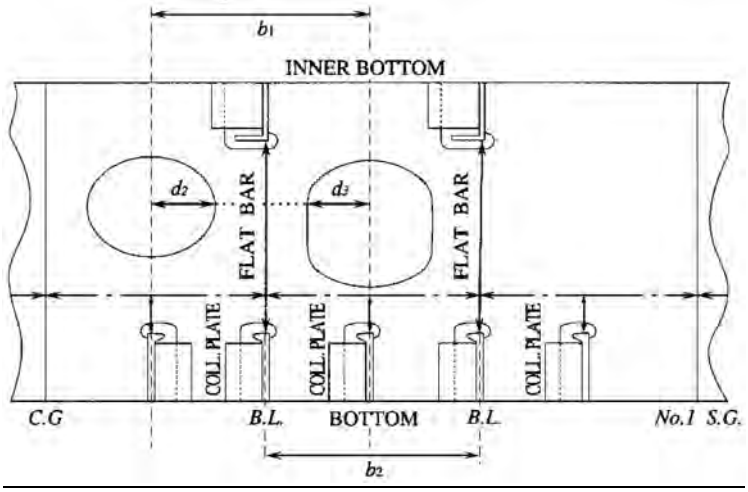
(b) The thickness obtained from the following formula.

$$1.1 \cdot \sqrt[3]{PSb_2{}^2} + 2.5 \ (mm)$$

P and S: As specified in **(a)**.

b_2: Spacing (m) of bottom longitudinals (*See* **Fig. CS6.9.1-2**)

Fig. CS6.9.1-2 Solid Floor



3 In way of the strengthened bottom forward, structural arrangements other than those specified in **6.9.3**, **Part CS** of the Rules may be adopted subject to the following **(1)** to **(3)**.

(1) Solid floors of a longitudinal stiffened system and girders in a transverse stiffened system are to comply with the provisions of **CS6.9.1-2(3)**. The slamming impact pressure P acting on the solid floors of a longitudinal stiffened system may be corrected by multiplying the coefficient C_9 specified in **(3)** below.

(2) The thickness of solid floors and girders is to be in accordance with the value obtained by the following.

$$t_1 = K \cdot \frac{C_8 \cdot P \cdot S \cdot l}{226 \cdot (d_0 - d_1)} + 2.5 \ (mm)$$

K: As specified in **1.2.1-2(2)** of **Annex CS1.3.1-1** "**GUIDANCE FOR HULL CONSTRUCTION CONTAINING HIGH TENSILE STEEL MEMBERS**"

P: The applicable slamming impact pressure as specified in **6.9.4-1, Part CS** of the Rules, or **CS6.9.1-2.**

In ships having a bow draught of more than $0.025L'$ but less than $0.037L'$ in ballast condition, the slamming impact pressure of when the bow draught is $0.037L'$ is to be obtained by linear interpolation from the following formula. The slamming impact pressure is not to be less than the value obtained by the following formula.

$P = 1.015L$ (kPa)

C_8: As given by the following formula

This value is not to be less than 0.1 and not to be greater than 1.

$$C_8 = \frac{3}{A}$$

A: Area (m^2) considered in the strength examination, as given by the following formula

$A = S \times l$

S: Spacing (m) of solid floors (or girders) when solid floors (or girders) are under consideration

l: Spacing (m) of girders (or solid floors) when solid floors (or girders) are under consideration

d_0: Depth (m) of floors or girders at the considered position

d_1: Depth (m) of openings in the floors or girders at the considered position

(3) In the calculation of the section modulus of longitudinal shell stiffeners and bottom

longitudinals, the slamming impact pressure P may be corrected by multiplying by the coefficient C_9 as given by the following formula. The coefficient C_9 is not to be less than 0.1 and not to be greater than 1.

$$C_9 = \frac{3}{l}$$

l: As given in **6.9.4-1**, **Part CS** of the Rules

CS6.9.2 Strengthened Bottom Forward

In ships of which C_b is less than 0.7 and the bow draught is less than $0.025L$ in ballast condition, the area of the strengthened bottom forward of the ship is to be expanded as follows. However, ships that carry a certain amount of cargo regularly such as Container Ships need not comply.

(1) The after end of the strengthened area is to be extended the distance a afterwards from the position required in **6.9.2-1 of Part CS**.

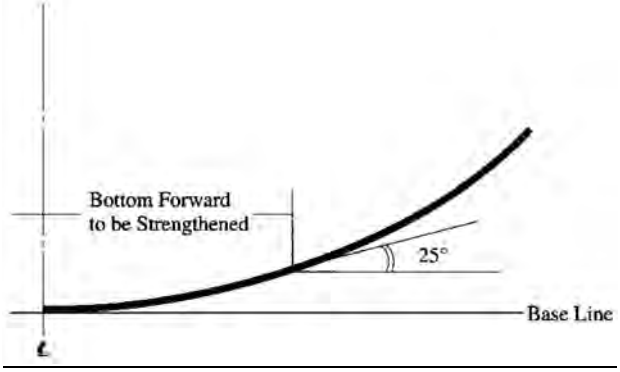
$a = 0 \quad (C_b = 0.7)$

$a = 0.05L \quad (C_b \leq 0.6)$

For intermediate values of C_b, a is to be obtained by linear interpolation.

(2) In addition to **(1)** above, bottom areas whose tangential slope to the base line is less than 25 *degrees* are required to be strengthened. (*See* **Fig. CS6.9.2-1**)

Fig. C6.9.2-1 Transverse Area of Bottom Forward to be Strengthened



Chapter CS7 has been added as follows.

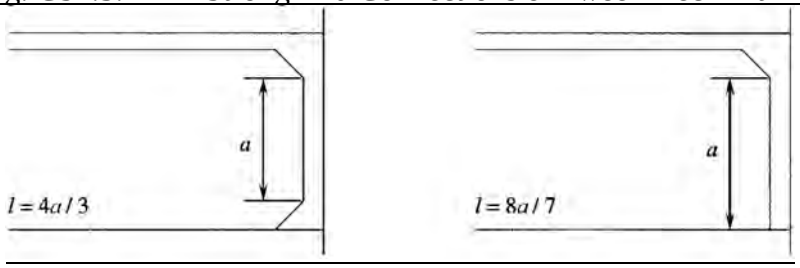
CS7 FRAMES

CS7.5 Tween Deck Frames

CS7.5.2 Scantlings of Tween Deck Frames

Where ends of tween deck frames are connected with brackets that have an arm length longer than *l*/8, the requirements of **7.5.2, Part CS** of the Rules may be applied in the manner shown in **Fig. CS7.5.2-1**.

Fig. CS7.5.2-1 Strong End Connections of Tween Deck Frames



CS7.5.3 Special Precautions Regarding Tween Deck Frames

In ships with multiple decks such as pure car carriers that have freeboards shorter than the length given in **Table CS7.5.3-1**, the tween deck frames above the freeboard deck are to be generally reinforced according to the ship's length as follows.

(1) Range of reinforcement is at least up to the tween deck frames of the first tier above the freeboard deck.

(2) The section modulus of tween deck frames is to be determined applying the requirements of **7.5.2-1, Part CS** of the Rules. However, the coefficient *C* is to be obtained from **Table CS7.5.3-2**, according to the description of the tween deck frames. The section modulus of parts forward of the collision bulkhead and abaft the after peak bulkhead is not to be less than the values determined applying the requirements in **7.6.1** and **7.6.3, Part CS** of the Rules.

Table CS7.5.3-1 Standard Value of Freeboard

Length of Ship: *L* (*m*)	75>*L*	75 ≤ *L* < 90
Freeboard (*m*)	0.36	0.40

Table CS7.5.3-2 Coefficient *C*

Description of tween deck frames	*C*
Superstructure frames for 0.125*L* from fore end and cant frames at stern	0.89
Superstructure frames for 0.125*L* from aft end	0.74
Superstructure frames excluding above	0.54

Chapter CS8 has been added as follows.

CS8 CANTILEVER BEAM CONSTRUCTION

CS8.3 Connection of Cantilever Beams to Web Frames

1 To prevent the buckling of end brackets of cantilever beams connected to web frames, stiffeners are to be fitted to the brackets, with suitable spacing, in order to keep their panels small as shown in **Fig. CS8.3-1**.

2 Within the range of 1/2 of the throat depth of the end bracket from the side of the face plate, stiffeners such as inverted angles are to be arranged in the direction of compression at the spacing obtained from the following formula. This spacing is deemed as the standard.

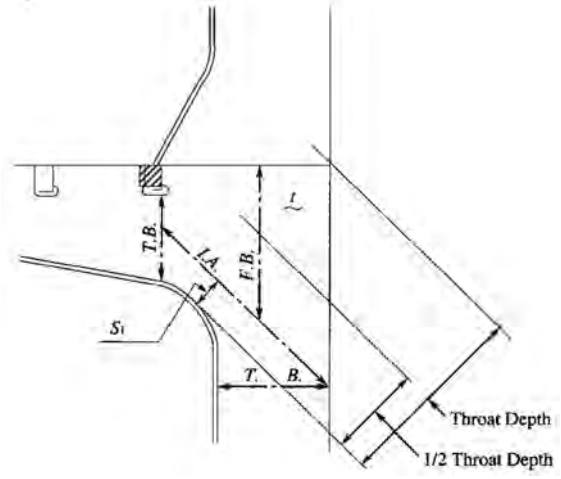
$S_1 = 35(t - 2.5)$

Where:

S_1: Spacing (*mm*) of stiffeners (*See* **Fig. CS8.3-1**)

t : Thickness (*mm*) of bracket

Fig. CS8.3-1 Reinforcement of Brackets



CS9 ARRANGEMENTS TO RESIST PANTING

Section CS9.1 has been added as follows.

CS9.1 General

CS9.1.2 Swash Plates

The scantlings of swash plates in fore and aft peak tanks used as deep tanks are to comply with **9.2.2-5, Part CS** of the Rules.

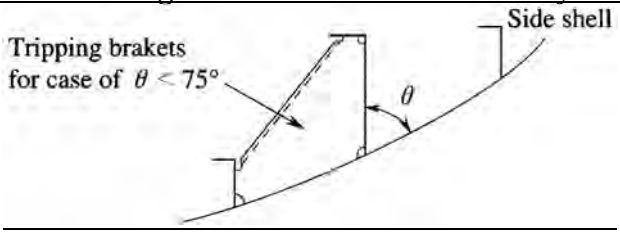
CS9.1.3 Stringers Fitted to Shell at Extremely Small Angles

Where the angle between the web of stringers and the shell plating is smaller than 75°, the stringer is to be treated as follows unless approved otherwise by the Society (*See* **Fig. CS9.1.3-1**). In general, even where stringers and girders attach to the shell at an angle, the actual section modulus is to be calculated against a neutral axis parallel to the shell plating.

(1) Face plates are to be fitted on the side of open bevels.

(2) Tripping brackets are to be fitted spaced suitably.

Fig. CS9.1.3-1 Stringers Fitted to Shell at Extremely Small Angles



Chapter CS10 has been added as follows.

CS10 BEAMS

CS10.1 General

CS10.1.2 Connections of Ends of Beams

1 The connection method of the ends of longitudinal beams shown in **Fig. CS10.1.2-1** is standard.

2 The connection method of transverse beams by means of brackets shown in **Fig. CS10.1.2-2** is standard.

Fig. CS10.1.2-1

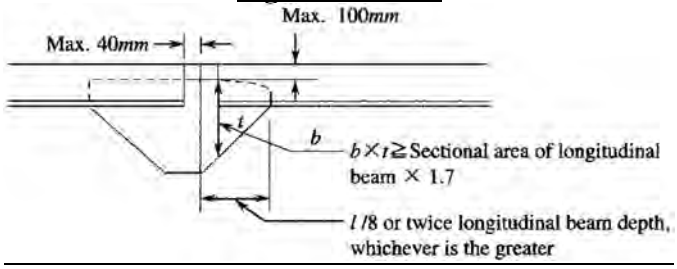
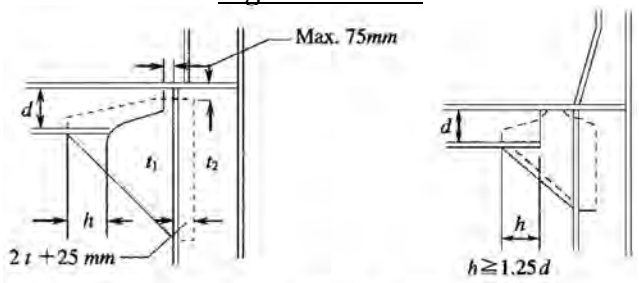


Fig. CS10.1.2-2



CS10.2 Longitudinal Beams

CS10.2.3 Section Modulus of Longitudinal Beams

The section modulus of longitudinal beams outside the line of hatchway openings of the strength deck fore and aft of the midship part may be determined by interpolation between the requirements of **10.2.3-1** and **10.2.3-2, Part CS** of the Rules. Interpolation may be performed at the middle of each building block in the direction of the ship's length. However, where the length of the block is over 15 *metres*, the block is to be subdivided into appropriate lengths.

CS10.3 Transverse Beams

CS10.3.2 Proportion

Where the span/depth ratio of transverse beams exceeds 30 in strength decks or 40 in effective

decks and superstructure decks, the section moduli of these beams are to be increased by the corresponding ratios.

CS10.7 Deck Beams Supporting Vehicles

CS10.7.1 Section Modulus of Beams

1 The section modulus of beams of decks loaded with wheeled vehicles (hereinafter referred to as "car decks") is not to be less than that obtained from the following formula. Where the span length or moment of inertia changes along the continuous beam, the scantlings of the beam are to be determined by direct strength calculation as specified in **-2**.

$C_1 C_2 M \ (cm^3)$

Where:

C_1 : Coefficient determined as follows:

C_1 : 1.0 for $b/S \leq 0.8$

C_1 : 1.25-0.31 b/S for b/S >0.8

Where:

S : Beam spacing (m)

b : Length (m) of wheel print measured at right angle to beams (*See* **Fig. CS10.7.1-1**)

For vehicles with ordinary pneumatic tires, values in **Table CS10.7.1-1** may be used.

C_2 : Coefficient determined from **Table CS10.7.1-2**

M : M_1, M_2 and M_{3j} obtained from the following formulae, whichever is the greatest ($kN \cdot m$):

$$M_1 = \frac{1}{15}\left[\sum_{i=1}^{N_I} 4P_{Ii}\alpha_{Ii}\left\{1-\left(\frac{\alpha_{Ii}}{l}\right)^2\right\} + \sum_{j=1}^{N_{II}} P_{IIj}\alpha_{IIj}\left(1-\frac{\alpha_{IIj}}{l}\right)\left(7-5\frac{\alpha_{IIj}}{l}\right) - \sum_{k=1}^{N_{III}} P_{IIIk}(l-\alpha_{IIIk})\left\{1-\left(\frac{l-\alpha_{IIIk}}{l}\right)^2\right\}\right]$$

$$M_2 = \frac{1}{15}\left[-\sum_{i=1}^{N_I} P_{Ii}\alpha_{Ii}\left\{1-\left(\frac{\alpha_{Ii}}{l}\right)^2\right\} + \sum_{j=1}^{N_{II}} P_{IIj}\alpha_{IIj}\left(1-\frac{\alpha_{IIj}}{l}\right)\left(2+5\frac{\alpha_{IIj}}{l}\right) + \sum_{k=1}^{N_{III}} 4P_{IIIk}(l-\alpha_{IIIk})\left\{1-\left(\frac{l-\alpha_{IIIk}}{l}\right)^2\right\}\right]$$

$$M_{3j} = \left|R_{II}\alpha_{IIj} - \sum_{r=0}^{j-1} P_{IIr}(\alpha_{IIj}-\alpha_{IIr}) - \left(\frac{M_2-M_1}{l}\right)\alpha_{IIj} - M_1\right|$$

Where:

$P_{II0} = 0,\ \alpha_{II0} = 0$

l: Span (m) of beam between support points

P_{Ii}, P_{IIj} and P_{IIIk}: Maximum design wheel load (kN) between support points

Where the maximum design wheel loads between support points are given in tons, the values of P_{Ii}, P_{IIj} and P_{IIIk} should be multiplied by 9.81 to convert them into kN. Subscript "I_i" means the ith load point from left end of the Ith beam. Subscript "II_j (or II_r)" means the jth (or rth) load point from left end of the IIth beam. Subscript "III_k" means the kth load point from left end of the IIIth beam. (*See* **Fig. CS10.7.1-2**)

$\alpha_{Ii}, \alpha_{IIj}$ and α_{IIIk}: Distance (m) from each support point to the point of action of wheel load (*See* **Fig. CS10.7.1-2**), when wheels are so arranged that M may be at its maximum value

N_I, N_{II} and N_{III} : Number of wheel loads between each span

R_{II}: The value obtained from following the formula

$$R_{II} = \frac{1}{l}\sum_{j=1}^{N_{II}} P_{IIj}(l - \alpha_{IIj})$$

Fig. CS10.7.1-1 Measurement of Wheel Print Length

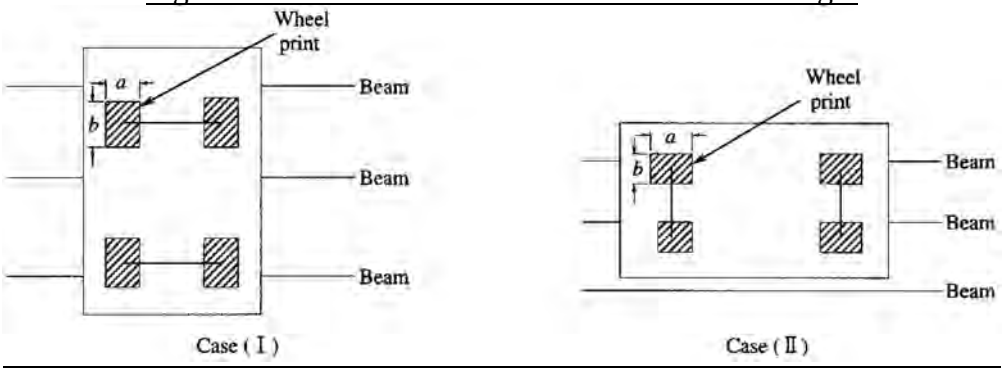


Fig. CS10.7.1-2 Measurement of P_{Ii}, α_{Ii}, l etc.

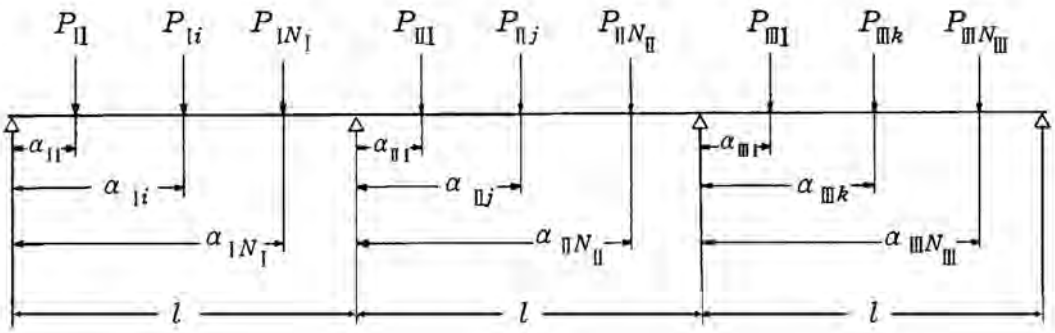


Table CS10.7.1-1 Wheel Print Length (Pneumatic Tires)

	Wheel print length parallel to axle in **Fig.CS10.7.1-1**, *a* in Case (I), *b* in Case(II)	Wheel print length right angles to axle in **Fig.CS10.7.1-1**, *b* in Case (I), *a* in Case (II)
Single tire	Tire width	$\sqrt{P}/20$
Double tire	2×Tire width. Gap between tires, if any, may be added	$9\sqrt{P}/250$

Note:

P: Maximum design wheel load (*kN*). Where the maximum design wheel load is given in tons, the value of *P* should be multiplied by 9.81 to convert it into *kN*.

TableCS10.7.1-2. Value of C_2

		Vehicles exclusively used for cargo handing	Other vehicles
Longitudinal beams of strength decks in mid ship region	Decks where vehicles are exclusively loaded (except weather deck)	$\frac{5.6K}{1-0.34f_{DH}K}$	$\frac{7.0K}{1-0.64f_{DH}K}$
	Elsewhere	$\frac{6.1K}{1-0.34f_{DH}K}$	$\frac{7.7K}{1-0.64f_{DH}K}$
Elsewhere	Decks where vehicles are exclusively loaded (except weather deck)	5.6*K*	7.0*K*
	Elsewhere	6.1*K*	7.7*K*

Notes

f_{DH}: Ratio of the section modulus of transverse section of hull at deck according to the requirements in **Chapter 15, Part CS** of the Rules when mild steel is used to the actual section modulus of hull at strength deck. Where the ratio is less than 0.79/*K*, f_{DH} is to be assumed as 0.79/*K*

K: Coefficient corresponding to the material, as specified in **1.3.1-2, Part CS** of the Rules

2 Scantlings of beams of car decks may be determined by the direct calculation methods shown below.

(1) The model of structures and the method of calculation are to be those approved by the Society.

(2) Loads are to be assumed as follows:

(a) 1.5×maximum design wheel load for loaded condition with vehicles on car decks

(b) 1.2×maximum design wheel load for vehicles used for cargo handling only (fork-lifts or similar vehicles used for handling cargo in ports only)

(3) The allowable stresses for calculation of the section modulus are to be as shown in **Table CS10.7.1-3**.

(4) To take into account the effects of corrosion and similar wear, the section moduli obtained in **(1)**, **(2)** and **(3)** above are to be multiplied by 1.1 for decks exclusively loaded with vehicles (except the weather deck) and 1.2 for other decks.

Table CS10.7.1-3 Permissible Stress (N/mm^2)

Members	Vehicles used for cargo handling only	Other vehicles
Longitudinal beams of strength decks in midship region	$\frac{235}{K}-80f_{DH}$	$\frac{235}{K}-150f_{DH}$
Elsewhere	$\frac{235}{K}$	$\frac{235}{K}$

CS11 has been added as follows.

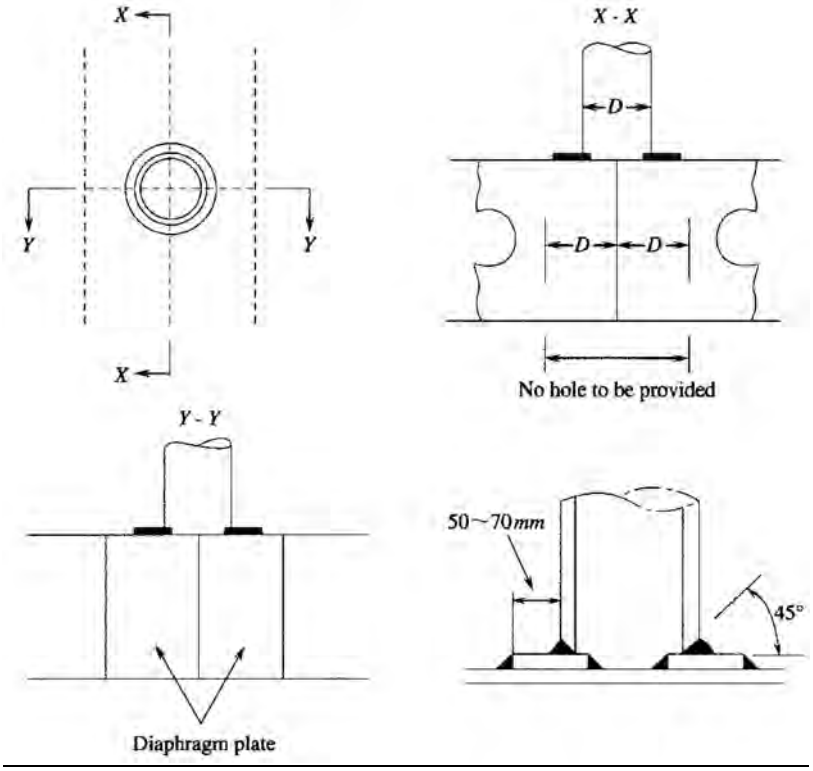
CS11 ILLARS

CS11.1 General

CS11.1.2 Pillars in Holds

The reinforcement under pillars is to be as shown below.

Fig. CS11.1.2-1



CS11.2 Scantlings

CS11.2.1 Sectional Area of Pillars

The sectional area of pillars which can be regarded as fixed at both ends may be obtained from the following formula:

$$\frac{0.223w}{2.72-\frac{0.5l}{k_0}} \ (cm^2)$$

CS12 has been added as follows.

CS12 DECK GIRDERS

CS12.1 General

CS12.1.3 Construction

1 At the upper and lower ends of pillars and other places where concentrated loads are expected, girders are to be fitted with tripping brackets and slots in the girders are to be fitted with collars. Under the end bulkheads of superstructures, only collars are required. Collars are also to be fitted at the slots near the toes of end brackets.

2 Butt joints of girder webs are to be away from slots. Butt joints of face plates are to be away from knuckled parts. The depth of slots is not to exceed $0.4d_G$. If this limit is exceeded, collars are to be fitted. This depth is not to exceed $0.5d_G$. These requirements may be suitably modified for superstructures.

3 Sizes of lightening holes are to be as follows:

Girder with slot: $d \leq \frac{d_G}{4}$

Girder without slot: $d \leq \frac{d_G}{3}$

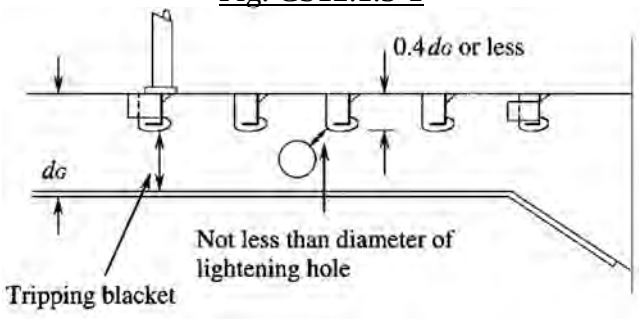
Where:

d_G: Depth of girder

d : Diameter of lightening hole

No lightening hole is to be provided near the toes of brackets or under pillars where shearing force is augmented. The distance between the lightening hole and slot is not to be less than the diameter of the lightening hole. (*See* **Fig. CS12.1.3-1**)

Fig. CS12.1.3-1



4 In ships such as RO-RO ships, the scantlings of girders may be determined by direct calculation of strength.

5 Where the value obtained from the following formula is not less than 1.6, special consideration is to be given to the beams on the shell side or bulkhead side around the mid-span of girders because of added stress due to forced deflection.

$$\frac{I_b l^4}{I_g S b^3}$$

Where:

I_b and I_g: Actual moment of inertia (cm^4) of beam and girder, respectively

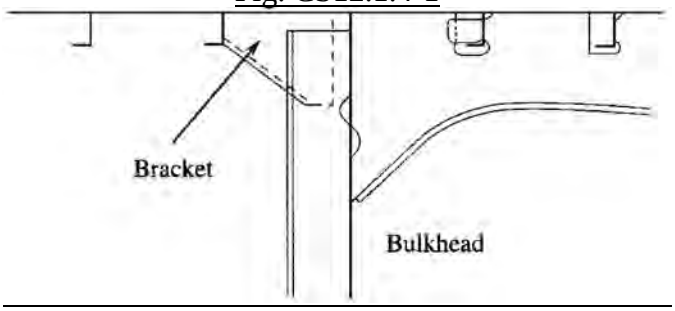
b and l : Span (m) of beam and girder, respectively

S : Beam spacing (m).

CS12.1.4 End Connection

1 Where a girder stops at a bulkhead, a bracket is to be fitted on the reverse side. (*See* **Fig. CS12.1.4-1**)

Fig. CS12.1.4-1



2 Continuity of Deck Girders

(1) The standard depth of a bracket is twice the depth of a web. If the depth of the bracket is smaller than this standard, suitable equivalent means, such as attaching a gusset plate, is to be provided. (*See* **Fig. CS12.1.4-2**)

(2) The girder included in the calculation of the section modulus is to completely penetrate the bulkhead (including the web and face plate) or is to be connected in a way that ensures an equivalently secure bond. (*See* **Fig. CS12.1.4-3**)

(3) Where deck girders are discontinuous, they are to be sufficiently overlapped. (*See* **Fig. CS12.1.4-4**)

Fig. CS12.1.4-2

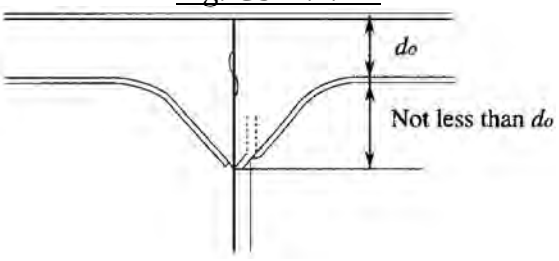


Fig. CS12.1.4-3

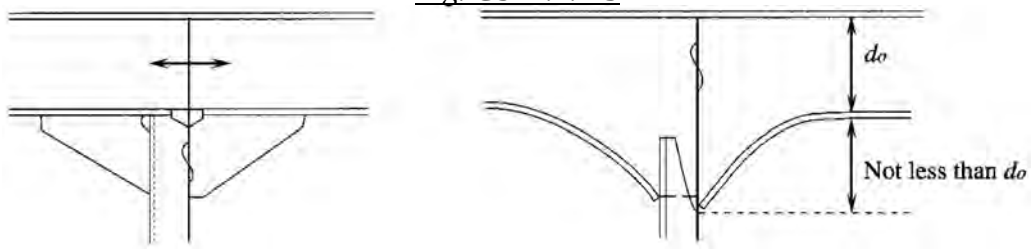
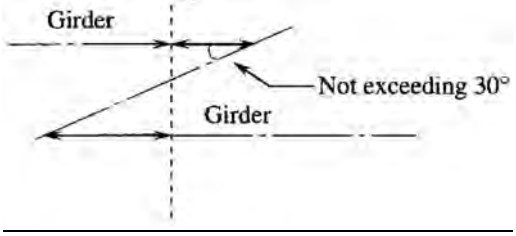


Fig. CS12.1.4-4



CS12.2 Longitudinal Deck Girders

CS12.2.1 Section Modulus of Girders

The section modulus of longitudinal deck girders outside the line of hatchway openings of the strength deck fore and aft of the midship part is generally determined by interpolation as stipulated in **12.2.1-1** and **12.2.1-2, Part CS** of the Rules. Interpolation is to be performed at the centre of the girder's span. However, this may be modified when taking into consideration factors such as the length of building blocks.

CS13 WATERTIGHT BULKHEADS

CS13.1 Arrangement of Watertight Bulkheads

Paragraph CS13.1.1 has been amended as follows.

CS13.1.1 Collision Bulkheads

1 ~~When the position of the collision bulkhead is determined, refer to the provisions of **C13.1.1-1, Part C** of the Guidance.~~ The position of the collision bulkhead is to be determined as shown below.

(1) In case of a Bulbous Bow (*See* **Fig. CS13.1.1-1**)
(When the stem has a hollowed part over the waterline at 85% of the least moulded depth measured from the top of the keel)

(2) In case of a Collision Bulkhead with a Step or Recess (*See* **Fig. CS13.1.1-2**)

Fig. CS13.1.1-1

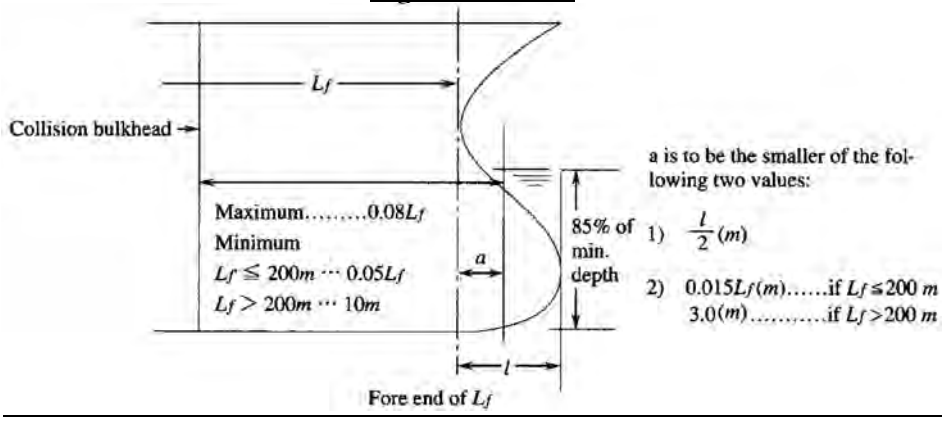
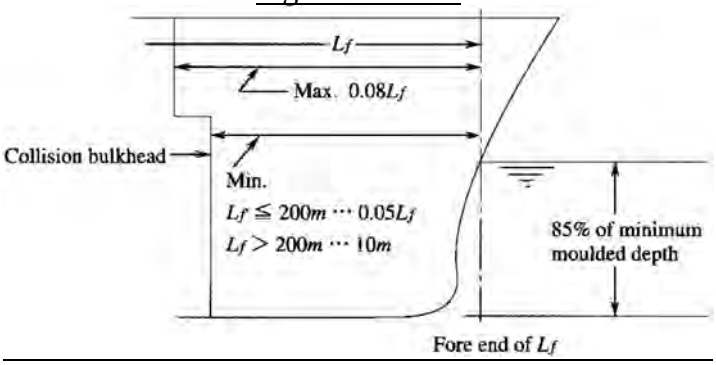


Fig. CS13.1.1-2



2 In ships with bow doors, the collision bulkhead under the deck just above the freeboard deck is to comply with the requirements mentioned in **13.1.1-1** and **-2** and **13.1.5(2), Part CS** of the Rules.

3 "Special structural reasons which are approved by the Society" in **13.1.1-1, Part CS** of the Rules are reasons approved on the basis that an application is submitted together with calculations verifying that no part of the bulkhead deck will be immersed even when the compartment forward of the collision bulkhead is flooded under loaded conditions (without trim) corresponding to the load line.

Paragraph CS13.1.2 has been added as follows.

CS13.1.2 After Peak Bulkheads

Measures to minimize the danger of water penetrating into the ship in case of damage to stern tube arrangements are to be taken.

Paragraph CS13.1.4 has been added as follows.

CS13.1.4 Hold Bulkheads

1 Where the distance between two neighbouring bulkheads is less than $0.7\sqrt{L}$ *m*, these two bulkheads are not counted as two bulkheads.

2 Where the number of watertight bulkheads is smaller than that specified in **13.1.4-1, Part CS** of the Rules, due attention is to be paid to the transverse strength of the hull in accordance with the requirements of **13.1.4-2, Part CS** of the Rules, and the number of watertight bulkheads may be in accordance to one of the following **(1)** to **(3).** Where the number of watertight bulkheads is decreased from that required according to the following **(2)**, an application for the omission of bulkheads stating the reasons for such omission is to be submitted by the shipowner to the Society.

(1) The number of bulkheads arranged in accordance with the following **(a)** and **(b)**.

(a) The ships has sufficient transverse strength of hull

(b) The final waterline does not exceed the upper surface of the bulkhead deck at the side of the ship even after any compartment, except the machinery space, has been flooded under the loading condition corresponding to the summer load water line. The permeability used in flooding calculations is to be in accordance with **Table CS13.1.4-1** and **Table CS13.1.4-2**. However, the following ships are exempted from this calculation.

(i) Tankers in compliance with the requirements of **3.2.2, Part 3 of the Rules for Marine Pollution Prevention Systems**

(ii) Ships carrying liquefied gases in bulk or ships carrying dangerous chemicals in bulk

(iii) Ships in compliance with the requirements of **Chapter 4, Part CS** of the Rules (including ships specified in **CS4.1.1**)

Table CS13.1.4-1 Permeability of Cargo Spaces

Cargo spaces	Permeability
empty	0.95
loaded with general cargo	0.60
loaded with timber	0.55
loaded with ore	0.50
loaded with cars or containers	$0.95 - 0.35 \times \frac{V_C}{V_0}$

Notes:

V_C: Volume (m^3) occupied by cars and/or containers

V_0: Moulded volume (m^3) of the compartment

Table CS13.1.4.-2 Permeability of Deep Tanks

Cargo condition	Permeability
empty	0.95
filled	0

Note:

For spaces loaded with special kinds of cargo, a suitable permeability is used depending on the kind of cargo.

(2) For ships of special types, the number is in accordance with **(a)**, **(b)** or **(c)**

(a) Ships carrying long cargoes (rails, sheet piles or similar long cargoes), train ferries, and car carriers, may omit one bulkhead where the required number is 5 or less, and 2 bulkheads where the required number is 6 or more

(b) Ships having conveyor systems for handling cargoes may omit all the hold bulkheads, if necessary

(c) Ships other than those specified above are, as a rule, not regarded as special type ships

(3) Where special consideration is given for improving safety of ships by means such as that of a double hull, the arrangement of watertight bulkheads may be different from that required in the Rules.

Section CS13.2 has been added as follows.

CS13.2 Construction of Watertight Bulkheads

CS13.2.3 Stiffeners

1 Scantlings of bulkhead stiffeners just under deck girders

The scantlings of bulkhead stiffeners supporting under-deck girders are to comply with the following formula:

$$C\frac{Z_0}{Z}+\frac{W}{A}\leq C$$

Z_0: Required section modulus (cm^3) of stiffener

Z : Actual section modulus (cm^3)

C : 17.7

A : Sectional area (cm^2) of stiffener (may include attached plate)

W: Axial load (kN) of stiffener obtained from the following formula:

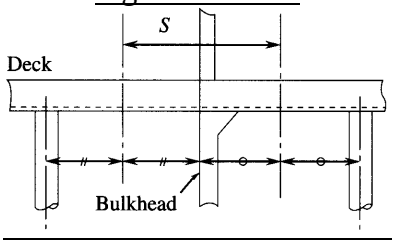
Sbh

S : Distance (m) between mid-spaces of adjacent girders supported by stiffeners (*See* **Fig. CS13.2.3-1**)

b and h : As specified in **12.2.1, Part CS** of the Rules.

In ships having two or more decks, W for the upper tier deck need not be taken into consideration.

Fig. CS13.2.3-1



2 Scantlings of bulkhead stiffeners just under cargo gears and deck girders

The scantlings of bulkhead stiffeners just under cargo gears and deck girders are to comply with **-1** above using the value obtained from following formula as the axial load on the stiffener. Where the stiffeners support only tare weight of cargo gears, the first term in the formula may be zero.

$Sbh + P$ (kN)

S, b and h : As specified in above **-1**

P : Tare weight of cargo gears (kN)

For derrick systems, it may be acceptable to use the value shown in **Table CS13.2.3-1** according to the type of derrick system and the arrangement of derrick booms.

Table CS13.2.3-1 Tare Weight of Derrick Systems (kN)

Arrangement of Derrick Booms	Type of Derrick Post	
	Independent type	Gate type
Booms arranged only on fore or aft side	2.0w	2.3w
Booms arranged on both sides	2.7w	3.0w

Note:

Where, W : Safe working load (kN) of each boom

For booms arranged on both sides, the average value is to be taken.

3 Dimensions of brackets of bulkhead stiffeners

The dimensions of brackets of bulkhead stiffeners are to be as indicated in **Fig. CS13.2.3-2**.

4 Support of stiffeners at decks

Where a deck terminates at the bulkhead, the stiffeners are to have ribs at the level of the deck. (*See* **Fig.CS13.2.3-3**)

Fig. CS13.2.3-2

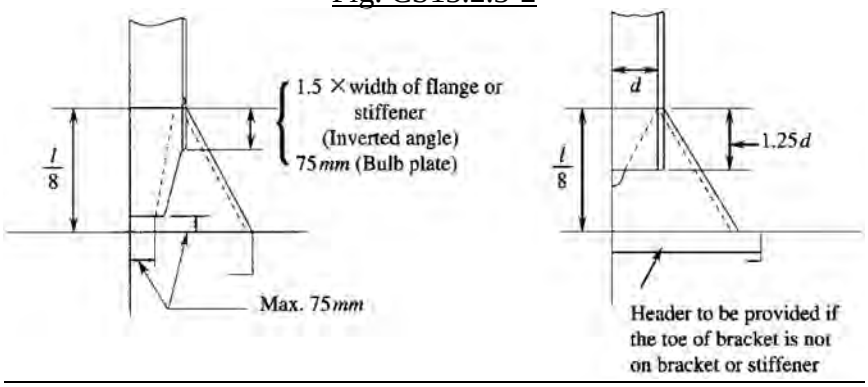
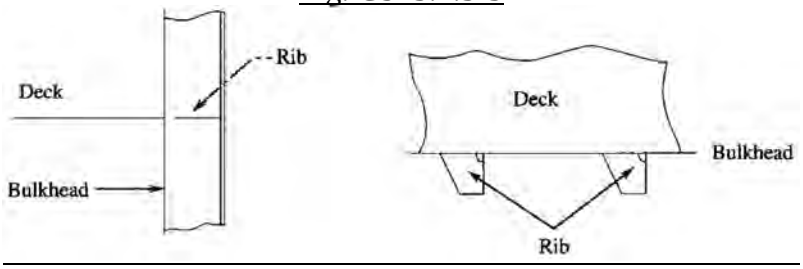


Fig. CS13.2.3-3



CS13.2.9 Corrugated Bulkheads

1 Section modulus of corrugated bulkheads

Where the end connection of corrugated bulkheads is remarkably effective, the coefficient C in **13.2.9-2, Part CS** of the Rules may be the value taken from **Table CS13.2.9-1** in calculating the section modulus per half pitch. "Remarkably effective" means the following:

(1) The value of m_1 specified in **Table CS13.2.9-1.** is greater than 0.2 for the connection of the upper end of the corrugated bulkhead to the deck

(2) The value of m_2 specified in **Table CS13.2.9-1.** is greater than 0.6 for the connection of the upper end of the corrugated bulkhead to the stools

(3) The plate thickness of lower stools is not less than half the thickness of the face plates of the corrugated bulkhead for the connection of the lower end of the corrugated bulkhead to the stools

2 Construction of corrugated bulkheads

(1) Stiffeners are to be provided at the ends of under-deck girders.

(2) Where brackets are fixed to bulkhead plates, pads or headers are to be fitted at the bracket toe.

(3) The angle of corrugation is to be not less than 45°.

(4) Girders fitted to corrugated bulkheads are to be balanced girders, except where the strength of such girders is at least equivalent to that of girders fitted to flat bulkheads. In calculating the actual section modulus of the girder, the depth of the girder is to be taken as shown in **Fig. CS13.2.9-3**. The bulkhead plate of corrugated bulkheads is not to be included into the section modulus of the girder as an effective attached plate.

(5) The lower end of the corrugated bulkhead is to be constructed as shown in **Fig. CS13.2.9-4** (A) or (B). The construction of the upper end is recommended to follow the construction of the lower end.

Table CS13.2.9-1 oefficient *C*

Col.	Other ends	*C*		
		One end of bulkhead		
		Supported by horizontal or vertical girders	Upper end welded directly to deck	Upper end welded to stool efficiently supported by ship structure
1	Supported by horizontal or vertical girders or lower end of bulkhead welded directly to decks or inner bottoms	As per the Rules	$\frac{4}{2+m_1+\frac{Z_2}{Z_0}}$	$\frac{4}{2+m_2+\frac{Z_2}{Z_0}}$
2	Lower end of bulkhead welded to stool efficiently supported by ship structure	$\frac{4.8\left(1+\frac{l_H}{l}\right)^2}{2+\frac{Z_1}{Z_0}+\frac{Z_H}{Z_0}}$	$\frac{4.8\left(1+\frac{l_H}{l}\right)^2}{2+m_1+\frac{Z_H}{Z_0}}$	$\frac{4.8\left(1+\frac{l_H}{l}\right)^2}{2+m_2+\frac{Z_H}{Z_0}}$
		Not to be less than value of Column 1		

Notes:

In the above table, Z_0, Z_1, Z_2, l_H and l are to be as per the Rules.

m_1 is to be obtained from the following formula for the upper end but it need not exceed Z_1/Z_0.

$$\frac{1}{Z_0}\left[Z_S+\left(\frac{l_L+d_0}{l_L-d_0}+1.0\right)Z_L\right]$$

Z_S is the section modulus (cm^3) of the continuous stiffener at the upper end (*See* **Fig. CS13.2.9-1**).

l_L and Z_L are the span (m) and section modulus (cm^3) of the longitudinal member connected to the upper end. (*See* **Fig. CS13.2.9-1)**

d_0 is as per the Rules.

m_2 is to be obtained from the following formulae, whichever is smaller.

$$\frac{1}{Z_0}\times\frac{1050At}{n}$$

$$\frac{3.6\left(\frac{l}{l_0}\right)^2-3}{}$$

A : Area (m^2) enclosed by periphery upper stool (*See* **Fig. CS13.2.9-2**)

t : Average plate thickness (*mm*) of upper stool (*See* **Fig. CS13.2.9-2**)

n : Number of pitches of corrugation supported by upper stool (*See* **Fig. CS13.2.9-2**)

l_0 : Distance (*m*) between insides of upper and lower stools (*See* **Fig. CS13.2.9-2**)

Z_H: Section modulus (cm^3) per half pitch of lower end of lower stool (*See* **Fig. CS13.2.9-2**)

Fig. CS13.2.9-1

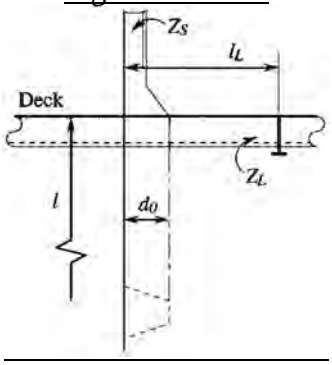


Fig. CS13.2.9-2

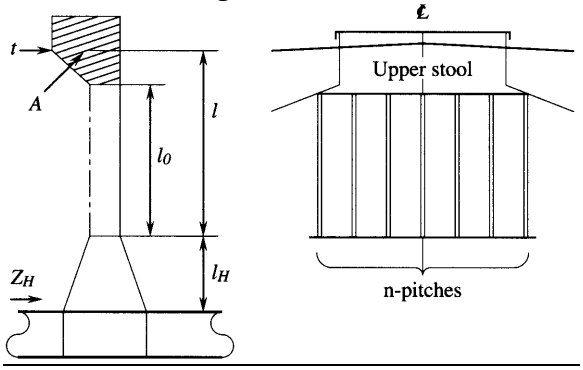


Fig. CS13.2.9-3. Depth of Girder

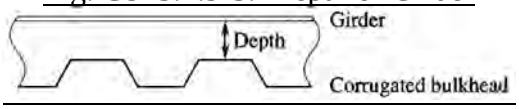
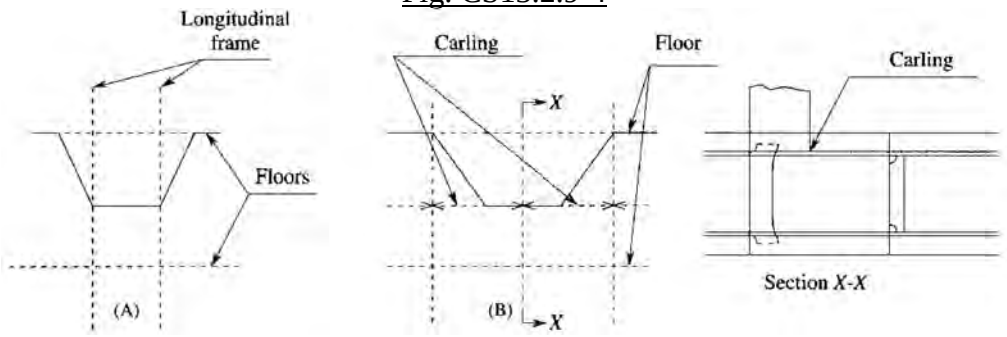


Fig. CS13.2.9-4



Section CS13.3 has been amended as follows.

CS13.3 Watertight Doors

CS13.3.1 General

1 With respect to the provisions of **13.3, Part CS** of the Rules, watertight doors are categorized as the following **(1)** to **(3)** corresponding to their purpose and frequency of use.

(1) Watertight doors which are to be permanently closed at sea

Such doors are open in port and closed before the ship leaves port (*e.g.* bulkhead doors for loading/unloading). The time of opening/closing such doors is to be entered in the log-book.

(2) Watertight doors which are to be normally closed at sea

Such doors are kept closed at sea but may be used if authorized by the officer of the watch and to be closed again after use.

(3) Watertight doors which are used at sea

Kept closed, but may be opened during navigation when authorized by the Administration to permit the passage of passengers or crew, or when work in the immediate vicinity of the door necessitates it being opened. The door, however, is to be immediately closed after use.

2 The requirements of **13.3, Part CS** of the Rules apply to watertight doors required by other regulations regarding damage stability requirements. Watertight doors located above the bulkhead deck are to also comply with the requirements for doors provided for means of escape specified in **Chapter 13, Part R** of the Rules.

3 With respect to the provisions of **13.3**, **Part CS** of the Rules, **Table CS4.3.1-1** and **Table CS4.3.1-2** are also referenced as general requirements for watertight doors.

CS13.3.2 Types of Watertight Doors

Watertight doors provided in watertight bulkheads are to be of a sliding type as far as is practicable. If hinged doors are used, they are to be accessible at any time.

CS13.3.3 Strength and Watertightness

1 "Where deemed necessary by the Society" in **13.3.3-1, Part CS** of the Rules refer to cases other than those specified in the following **(1)** to **(3)**.

(1) The prototype of such doors has been tested by design water pressure

(2) The design of such doors has been verified to have enough strength and watertightness by direct structural analysis

Where watertight doors utilize gasket seals, a prototype pressure test to confirm that the compression of the gasket material is capable of accommodating any deflection is to be carried out.

(3) Such doors are complying with a standard deemed appropriate by the Society

2 Hydrostatic tests specified in **13.3.3-1, Part CS** of the Rules are to be carried out as follows:

(1) The head of water used for the hydrostatic test is to correspond at least to the head measured from the lower edge of the door opening (at the location in which the door is to be fitted in the ship) to 1 *m* above the freeboard deck. However, for watertight doors subject to **4.3.1, Part CS** of the Rules, the head is not to be less than the height of the final damage waterline or the intermediate waterline, whichever is greater.

(2) The acceptable leakage rate at the test is not to be greater than the following values.

(a) Doors with gaskets: No leakage

(b) Doors with metallic sealing: 1 *l/min*

(3) Notwithstanding **(2)** above, the following leakage rate may be accepted for hydrostatic tests on large doors located in cargo spaces employing gasket seals or guillotine doors located in conveyor tunnels.

(a) For doors of design head exceeding 6.10 *m*:

$$\frac{(P+4.572)\cdot h^3}{6568}\ (l/min)$$

P: Perimeter of door opening (*m*)
h: Test head of water (*m*)

(b) For doors with a design head not exceeding 6.10 *m*, the acceptable leakage rate is the value calculated by the formula specified in **(a)** above or 0.375 *l/min*, whichever is greater.

CS13.3.4 Control

1 Where it is necessary to start the power unit for remote operation of the watertight door required by **13.3.4, Part CS** of the Rules, means to start the power unit is also to be provided at remote control stations.

2 Remote controls required by **13.3.4, Part CS** of the Rules, are to be in accordance with the following.

(1) The operating console at the navigation bridge is to have a "master mode" switch with the following two modes of control. This switch is normally to be in the "local control" mode. The "doors closed" mode is only used in an emergency or for testing purposes. Special consideration is to be given to the reliability of the "master mode" switch.

(a) "Local control" mode
This mode is to allow any door to be locally opened and locally closed after use without automatic closure.

(b) "Doors closed" mode
This mode is to permit doors to be opened locally and automatically reclose the doors upon release of the local control mechanism.

(2) The operating console at the navigation bridge is to be provided with a diagram showing the location of each door, with visual indicators to show whether each door is open or closed. A red light is to indicate that a door is fully open and a green light is to indicate that a door is fully closed. When the door is closed remotely, the red light is to indicate the intermediate position by flashing. The indicating circuit is to be independent of the control circuit for each door.

3 Where remote control is required by **13.3.4, Part CS** of the Rules, signboard/instructions are to be placed in way of the door advising how to act when the door is in the "doors closed" mode.

4 With respect to the provisions of **13.3.4, Part CS** of the Rules, where a watertight door is located adjacent to a fire door, both doors are to be capable of independent operation, remotely if required and from both sides of each door.

5 "Navigation bridge" stated in **13.3.4, Part CS** of the Rules means the place where the watch officer is always present and normally implies the navigation bridge deckhouse.

6 With respect to the provisions of **13.3.4-1, Part CS** of the Rules, operation capability with the ship listed at 30 *degrees* to either side is to be verified by tests such as the prototype test.

7 With respect to the provisions of **13.3.4-1, Part CS** of the Rules, power operated doors are also to be capable of being opened and closed by power, in addition to by hand.

CS13.3.5 Indication

1 For watertight doors with dogs/cleats for securing watertightness, position indicators required by **13.3.5, Part CS** of the Rules are to be provided to show whether all dogs/cleats are fully and properly engaged or not.

2 With respect to the provisions of **13.3.5, Part CS** of the Rules, a position indicator may not be required for doors which are designed to confirm easily whether the doors are open or closed from

either side and, if applicable, all dogs/cleats are fully and properly engaged or not.

3 The door position indicating system required by **13.3.5, Part CS** of the Rules is to be of a self-monitoring type and the means for testing it are to be provided at the position where the indicators are fitted.

4 "Position indicators on the bridge showing whether the doors are open or closed" required by **13.3.5, Part CS** of the Rules is to be in accordance with **CS13.3.4-2(2)**.

5 "Those permanently closed at sea" stated in **13.3.5**, **Part CS** of the Rules means "other closing appliances which are kept permanently closed at sea" stated in **4.3.1-2(4)**, **Part CS** of the Rules.

CS13.3.6 Alarms

~~All watertight doors (including sliding doors) operated by hydraulic door actuators, irrespective of whether their control positions are a central hydraulic unit or local operating position, are to be provided with either a low fluid level alarm, a low gas pressure alarm or some other means as applicable for monitoring the loss of stored energy in the hydraulic accumulators. Such alarms are to be both audible and visible and located on the bridge.~~

An audible alarm required by **13.3.6-2, Part CS** of the Rules is to have a sound distinctive from any other alarms in the area, which will sound whenever the door is remotely closed.

CS13.3.7 Source of Power

~~Failure of the normal power supply of alarms required to be installed by **13.3.6, Part CS of the Rules** and by **CS13.3.6** is to be indicated by an audible and visual alarm. This alarm is to be located on the bridge.~~

"Electrical installations for devices specifies in **-1**" stated in **13.3.7-2, Part CS** of the Rules refers to electrical motors for opening and closing the doors and their control components; indicators that show whether the doors are opened or closed; audible alarms; and limit switches for ensuring the door position and their associated cables.

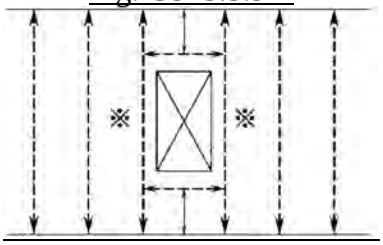
CS13.3.8 Notices

"A device which prevents unauthorized opening" stipulated in **13.3.8-2, Part CS** of the Rules can be a lock that prevents access to closing and/or operating apparatus.

CS13.3.9 Sliding Doors

The section moduli of stiffeners adjacent to both sides of sliding doors (indicated with an asterisk in **Fig. CS13.3.9-1**) are to be determined by the formula for stiffeners of deep tank bulkheads. The upper end of *h* in the formula is to be the bulkhead deck at the centreline of hull.

Fig. CS13.3.9-1



CS14 has been added as follows.

CS14 DEEP TANKS

CS14.1 General

CS14.1.3 Divisions in Tanks

1 Length of deep tanks

The length of deep tanks is not to exceed the following limits.

(1) Where no longitudinal bulkhead is provided or a longitudinal bulkhead is provided on the centreline only:

$0.15L_f$ (*m*) or 10 *m*, whichever is greater

(2) Where two or more longitudinal bulkheads are provided:

$0.2L_f$ (*m*) except that the limit is to be $0.15L_f$ (*m*) in the bow and stern parts of bulk carrier type ships

Further, where the breadth of the wing tank is less than $4L + 500$ (*mm*), the inner wall cannot be regarded as a longitudinal bulkhead.

2 Divisions

(1) Except in the bow and stern parts, deep tanks extending from side to side of the ship are to have longitudinal divisions in the ship's centreline. However, when it can be confirmed by the stability data that such bulkheads will be unnecessary, they might be omitted.

(2) In fresh water tanks extending from side to side of the ship, fuel oil tanks or other tanks which may not be kept completely full during navigation, wash plates or deep girders are to be provided on the centreline as well as in positions approximately *B*/4 distant from the ship's sides, except when it can be confirmed by the data on the rolling period of the ship and the inherent period of oscillation of water or oil in the tanks, that they will be unnecessary.

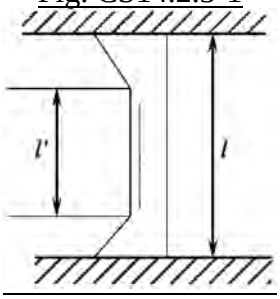
CS14.2 Deep Tank Bulkheads

CS14.2.3 Bulkhead Stiffeners

1 Span of stiffeners

For stiffeners having "Connection Type A," the span may be taken as $4l'/3$ if the arm length of brackets exceed $l/8$. For "Connection Type A," *see* **Fig. CS14.2.3-1**.

Fig. CS14.2.3-1



2 End connection of stiffeners at the top of deep tanks

Stiffeners of deep tank bulkheads, which are not in line with stiffeners of tween deck bulkheads at the top of the tank, are to have bracket ends.

3 Scantlings of bulkhead stiffeners supporting under-deck girders

The scantlings are to be calculated according to **CS13.2.3-1**, taking *C* as 9.81.

CS14.2.8 Corrugated Bulkheads

1 Upper and lower structures supporting corrugated bulkheads

(1) In cases where stools are not fitted with corrugated bulkheads, the standard upper and lower structures supporting the corrugated bulkheads are to be in accordance with **Table CS14.2.8-1**.

Table CS14.2.8-1 Upper and Lower Structures Supporting Corrugated Bulkheads

Type of corrugated bulkhead		Location	Supporting structure
Vertically corrugated bulkhead	Transverse	Lower	Floors with a thickness that is the same as that of the lower part of a corrugated bulkhead are to be arranged beneath both flanges of the corrugated bulkhead or a floor with a thickness that is the same as that of the lower part of a corrugated bulkhead is to be arranged beneath one flange of the corrugated bulkhead and a bracket with a web depth that is not less than 0.5 times the depth of the corrugation is to be arranged beneath the other side flange of the corrugated bulkhead. (See **Fig.CS14.2.8-1.**)
	Longitudinal	Upper	An on-deck longitudinal girder or an on-deck longitudinal with a web thickness of not less than 80% of the thickness of the upper part of a corrugated bulkhead is to be arranged above both flanges of the corrugated bulkhead.
		Lower	Girders (center girders or side girders) with a thickness that is the same as that of the lower part of a corrugated bulkhead are to be arranged beneath both flanges of the corrugated bulkhead or a girder with a thickness that is the same as that of the lower part of a corrugated bulkhead is to be arranged beneath one flange of the corrugated bulkhead and an inner bottom longitudinal with a web depth that is not less than 0.5 times the depth of the corrugation or an equivalent stiffener is to be arranged beneath the other side flange of the corrugated bulkhead.
Horizontally corrugated bulkhead	Transverse	Lower	A floor with a thickness that is the same as that of the lower part of a corrugated bulkhead is to be arranged beneath the web of the corrugated bulkhead.
	Longitudinal	Upper	An on-deck longitudinal girder with a web thickness that is not less than 80% of the thickness of the upper part of a corrugated bulkhead is to be arranged above the web of the corrugated bulkhead.
		Lower	A girder (center girder or side girder) with a thickness that is the same as that of the lower part of a corrugated bulkhead is to be arranged beneath the web of the corrugated bulkhead.

(2) In cases where a stool is fitted with a corrugated bulkhead, the standard lower stool and structures supporting such a lower stool are to be in accordance with the following **(a)** and **(b)**:

(a) The thickness of the top plate and the uppermost part of the side plating of the lower stool is to be the same as that of the lower part of the corrugated bulkhead.

(b) At the bottom of a lower stool, floors in a double bottom are to be arranged beneath the side plating of the lower stools for transverse corrugated bulkheads and girders (center girders or side girders) are to be arranged beneath the side plating of the lower stools for longitudinal corrugated bulkheads. In addition, the thickness of the upper part of floors and girders are to be the same as that of the side plating of the lower stool.

(3) In cases **(1)** and **(2)** above, any openings such as slots or scallops providing penetration for stiffeners to a floor, web of transverses or girders are to be eliminated or covered by collar plates.

2 Section modulus of corrugated bulkheads

Where the width d_H in the direction of the ship's length of the lower stool of the corrugated bulkhead at the inner bottom is less than 2.5 *times* the web depth d_0 of the corrugated bulkhead, the span l between supports is to be measured as shown in **Fig. CS14.2.8-2**. Further, the section modulus per half pitch of the corrugated bulkhead and the section modulus of the lower stool at the inner bottom are to be obtained from the formulae in **14.2.8-2, Part CS of the Rules**, using the

value of *C* in **Table CS14.2.8-2**.

3 Construction of corrugated bulkheads

The corrugation angle, ϕ, of a corrugated bulkhead is not to be less than 55 degrees. (See **Fig. CS14.2.8-3.**)

4 In evaluating the corrugated bulkheads of compartments intended to carry liquid cargoes with specific gravity, ρ, more than 1.0, the scantlings of the corrugated bulkheads are to be calculated by multiplying *h* by ρ before using the formulae specified in **14.2.8-1** to **-3, Part CS of the Rules**.

Fig. CS14.2.8-1 Example of Structures Supporting Vertically Corrugated Bulkheads (Transverse Bulkheads)

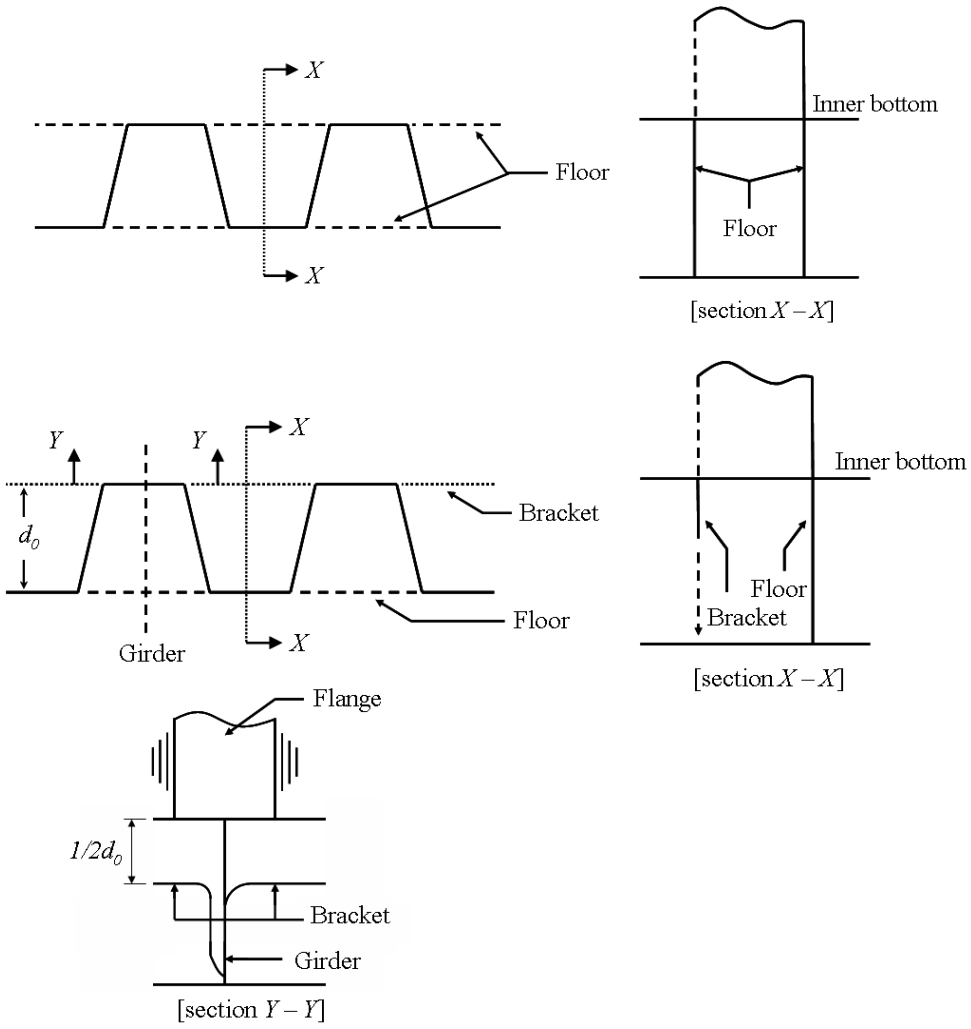


Fig. CS14.2.8-2. Measurement of l where $d_H/d_0<2.5$

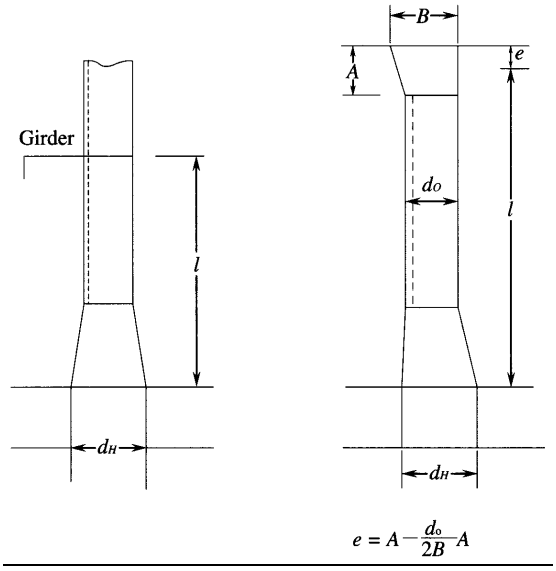


Fig. CS14.2.8-3. Definition of the Corrugation Angle of a Corrugated Bulkhead

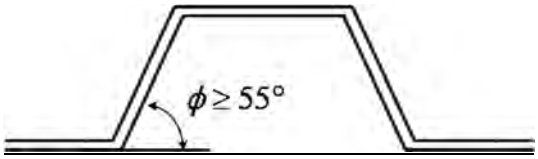


Table CS14.2.8-2 Coefficient C

Upper end support	Supported by girder	Connected to deck	Connected to stool
Section modulus of corrugated bulkhead	1.00	0.85	0.78
Section modulus of stool at bottom	1.00	1.50	1.35

CS15 has been added as follows.

CS15 LONGITUDINAL STRENGTH

C15.1 General

C15.1.1 Special Cases in Application

The ships stated in **15.1.1, Part CS** of the Rules are to be treated as follows.

(1) Ships of unusual proportion

For ships that have L/B<5 or B/D_s>2.5, adequate consideration is to be given regarding overall strength of the ships in addition to the requirements in **Chapter 15, Part CS** of the Rules.

(2) Ships with especially large hatches

Ships that have hatches with a breadth exceeding 0.7B in the midship part are to have their torsional strength examined.

(3) Ships with especially small C_b

Where C_b' specified in **15.2.1-1, Part CS** of the Rules is less than 0.65, Z_σ specified in **15.2.1-1, Part CS** of the Rules is to be obtained by multiplying by the following coefficient according to the value of C_b'.

$C_b' \leq 0.60$: 1.05

$0.60 < C_b' < 0.65$: 1.65-C_b'

(4) Ships with large flares and high ship speed

According to the values of K_v and K_f obtained from the following formulae, M_w specified in **15.2.1-1, Part CS** of the Rules is to be increased in accordance with the requirements in **(a)** and **(b)**.

$K_v = 0.2V/\sqrt{L_1}$

$K_f = (A_d - A_W)/L_1 h_B$

Where:

A_d: Area (m^2) projected onto a horizontal plane of exposed deck forward of 0.2L_1 aft of the fore end (including the part forward of the fore end)

Where a forecastle is provided, the horizontal project area of the forecastle overlaps the aforementioned area.

A_w: Water plane area (m^2) corresponding to the designed maximum load line within the forward 0.2L_1

h_B : Vertical distance (m) from designed maximum load line to exposed deck at the side of fore end

(a) Where K_v exceeds 0.28

C_2 specified in **15.2.1-1, Part CS** of the Rules is to be replaced with the value given in **Table CS15.1.1-1** according to the values of K_v and x which is the distance (m) from aft end of L to the position of the considered hull transverse section. For intermediate values of K_v and/or x, the value is to be determined by interpolation.

(b) Where ($K_v + K_f$) exceeds 0.40

C_2 specified in **15.2.1-1, Part CS** of the Rules is to be replaced with the value given in **Table CS15.1.1-2** according to the values of (K_v+K_f) and x only under sagging conditions. For intermediate values of (K_v+K_f) and/or x, the value is to be determined by interpolation.

Table CS15.1.1-1 Modified Value of C_2

K_v	X		
	$0.65L_1$	$0.75L_1$	$1.0L_1$
0.28	1.0	5/7	0
0.32 and over	1.0	0.8	0

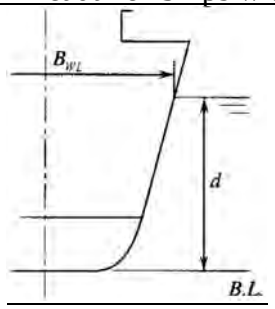
Table CS15.1.1-2 Modified Value of C_2

$K_v + K_f$	X		
	$0.65L_1$	$0.75L_1$	$1.0L_1$
0.40	1.0	5/7	0
0.50 and over	1.0	0.8	0

(5) Other ships

Where the requirements in **15.2.1, Part CS** of the Rules apply, B may be replaced with B_{WL} which is the moulded breadth corresponding to the designed maximum load line at the widest section of the ship. (*See* **Fig. CS15.1.1**)

Fig. CS15.1.1 Breadth of Ships with Inclined Sides



CS15.2 Bending Strength

CS15.2.1 Bending Strength at the Midship Part

1 With respect to the provisions of **15.2.1, Part CS of the Rules**, calculation of the longitudinal bending moment in still water is to be as follows.

(1) To perform the calculation of longitudinal bending moment in still water, the method of calculation used is to be submitted for prior approval by the Society.

(2) For ships intended to be built under Classification survey, calculation sheets for longitudinal strength in still water corresponding to the actual loading plans and the data necessary for the calculations are to be submitted to the Society.

(3) In the Classification Survey, longitudinal strength calculations in still water are to be performed at the time of completion of the ship on each type of operating condition, and the necessary data and results of these calculations are to be included in the loading manual specified in **25.1.1, Part CS of the Rules**.

(4) Where ballast conditions in the actual loading plans (including intermediate conditions specified in **An1.3.1-2. in Annex 3.8, Part 1, Part C of the Rules**) involve partially filled ballast tanks, such conditions where such ballast tanks are assumed to be empty or full are to be included with the calculation sheets for longitudinal strength specified in **(2)** above. Where two or more ballast tanks are partially filled simultaneously at departure, arrival or during the intermediate conditions specified in **An1.3.1-2. in Annex 3.8, Part 1, Part C of the Rules**, all possible combinations with these ballast tanks empty or full are to be considered.

(5) In cargo loaded conditions, the requirements of **(4)** above are to apply to the peak tanks only.

(6) For large wing ballast tanks of ore carriers as defined in **1.3.1(13)(b), Part B of the Rules**, an examination for partially filled ballast tanks specified in **(4)** above, may be according to the following.

(a) Where the ship's trim exceeds one of the following conditions when one or two pairs of these tanks are empty or have full ballast water filling levels, it is sufficient to demonstrate compliance with maximum, minimum, and intended partial filling levels of these tanks such that the ship's condition does not exceed any of these trim limits.

i) Trim by stern of 3% of the ship's length (L_1)

ii) Trim by bow of 1.5% of ship's length (L_1)

iii) Any trim that cannot maintain propeller immersion (I/D) of not less than 25%, where:

I = the distance from propeller centreline to the waterline

D = propeller diameter

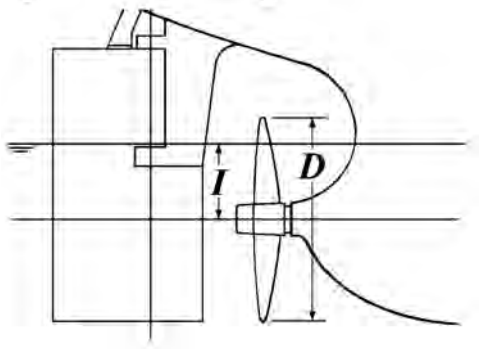
(b) In the application of the provisions of **(a)** above, where two or more pairs of these tanks are intended to be partially filled, filling levels of all other wing ballast tanks are to be considered between empty and full.

(c) In the application of the provisions of **(a)** above, the maximum and minimum filling levels of the above mentioned pairs of side ballast tanks are to be indicated in the loading manual specified in **25.2.1, Part CS of the Rules**.

(7) The provisions of **(4)** to **(6)** above need not apply to ballast water exchange using the sequential method. However, bending moment and shear force calculations for each de-ballasting or ballasting stage in the ballast water exchange sequence are to be included in the loading manual or ballast water management plan of any vessel that intends to employ the sequential ballast water exchange method.

(8) For the application of the provisions of **(4)** to **(6)** above, reference is to be made to **Annex 4.3, Part 1, Part C of the Rules**.

Fig. CS15.2.1-1 Propeller Immersion



CS15.2.3 Calculation of Section Modulus of Transverse Section of Hull

1 Unit of section modulus of transverse section of hull

The section modulus Z (cm^3) is to have five significant figures.

2 Members included in longitudinal strength

The ratio of inclusion of members effective for longitudinal strength is to be as follows.

(1) All intercostal plates may be included if the fillet welding complies with **12.2.1.3-2, Part 1, Part C of the Rules**.

(2) All doubling plates may be included if fitted during ship construction or 90% if fitted during conversion or addition.

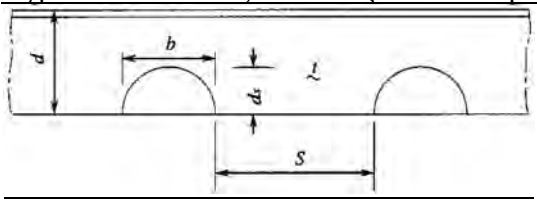
(3) For side stringers, slots for frames are to be deducted.

(4) Scallops complying with the following conditions need not be deducted from the sectional area. (*See* **Fig. CS15.2.3-1**)

(a) d_s not exceeding $d/4$ nor exceeding $7t$, maximum 75 *mm*

(b) S more than $5b$ and more than $10d_s$

Fig. CS15.2.3-1 S, b and d_s of Scallops



(5) As for the longitudinal continuous decks between hatchways of ships having 2 or 3 rows of cargo hatches, the ratio of sectional area to be included in the calculation of the section modulus is to be obtained from **Table CS15.2.3-1**. For intermediate values of ξ and l/L, linear interpolation is to be applied.

Table CS15.2.3-1 Ratio of Inclusion of Sectional Area

ξ	Hatches in 2 rows			Hatches in 3 or more rows		
	l/L					
	0.10	0.20	0.30	0.10	0.15	0.20
0	0.96	0.85	0.70	0.96	0.91	0.85
0.5	0.65	0.57	0.48	0.89	0.80	0.69
1.0	0.48	0.43	0.36	0.83	0.73	0.62
2.0	0.32	0.29	0.25	0.73	0.63	0.53
3.0	0.24	0.22	0.18	0.65	0.57	0.47

Notes:

ξ = Values obtained from the following formula:

$$\frac{ab^3}{lI_c}\left\{\frac{1+2\mu}{6(2+\mu)}\times 10^4 + 2.6\frac{I_c}{a_c b^2}\right\}$$

Where:

I_c : Moment of inertia (cm^4) of deck between hatches, including hatch coamings

a_c: Effective shear area (cm^2) of deck between hatches

a : Sectional area (cm^2) of continuous deck between hatches (port or starboard side half)

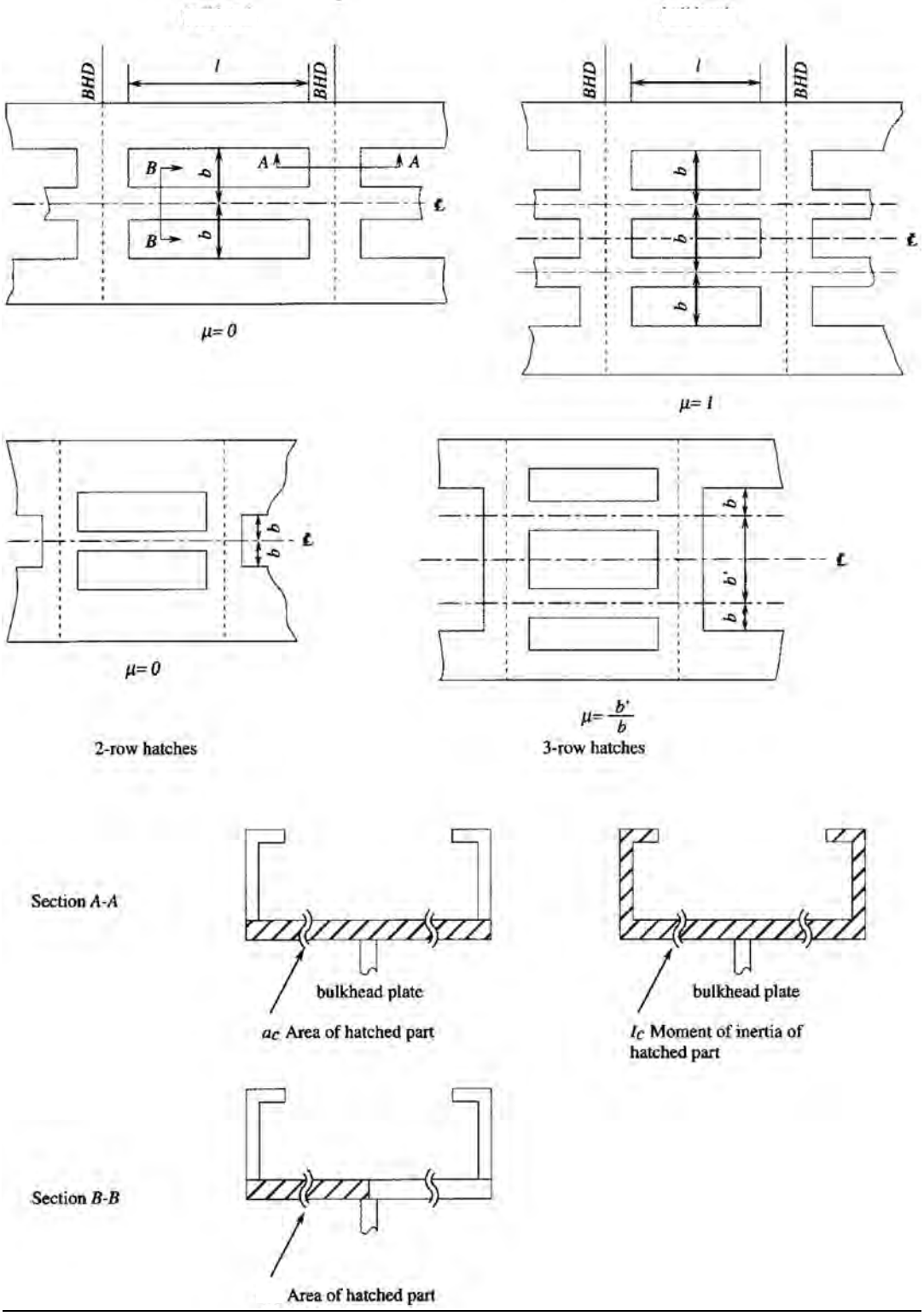
l : Length (*m*) of hatch

μ , b : As per **Fig. CS15.2.3-2** (*m*)

(6) Where the sectional area of longitudinals, which are unable to be continued due to factors such as the arrangement of small hatch openings are compensated by adjacent ones, they may be included in the calculation of the section modulus of the transverse section.

(7) Where the car deck plating of exclusive car carriers are intermittently welded in lap joints, they are not to be included in the calculation of the section modulus of the transverse section.

Fig. CS15.2.3-2. l, b and μ



3 Openings in strength decks

Openings in strength decks outside the line of hatch openings are to be treated as mentioned below.

(1) Where the shape and dimensions do not meet the conditions in **Table CS15.2.3-3**, reinforcement by means of rings, thicker plates, etc. is required (*See* **Fig. CS15.2.3-3** and **Fig. CS15.2.3-4**)

(2) Where the intervals between centres of holes *e* do not meet the conditions in **Fig. CS15.2.3-5**, reinforcement as per **(1)** above is needed.

Table CS15.2.3-3

	Elliptic holes	Circular holes
Oil tankers	$\frac{a}{b} \le \frac{1}{2}, a \le 0.06B$ $(a_{max} = 900\ mm)$	$a \le 0.03B$ $(a_{max} = 450\ mm)$
Cargo ships	$\frac{a}{b} \le \frac{1}{2}, a \le 0.03(B - b_H)$ $(a_{max} = 450\ mm)$	$a \le 0.015(B - b_H)$ $(a_{max} = 200\ mm)$

Fig. CS15.2.3-3 Where Elliptic Hole and Circular Hole are in Same Cross-section

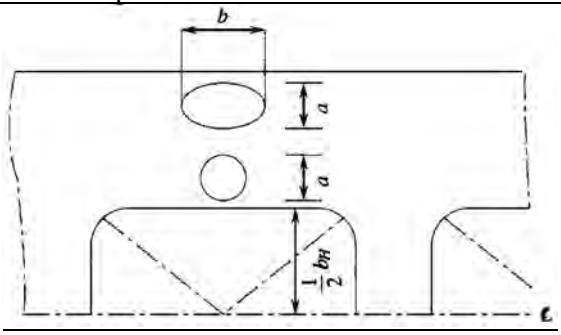


Fig. CS15.2.3-4 Reinforcement by Means of Ring

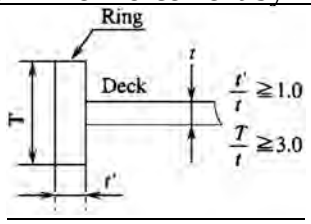
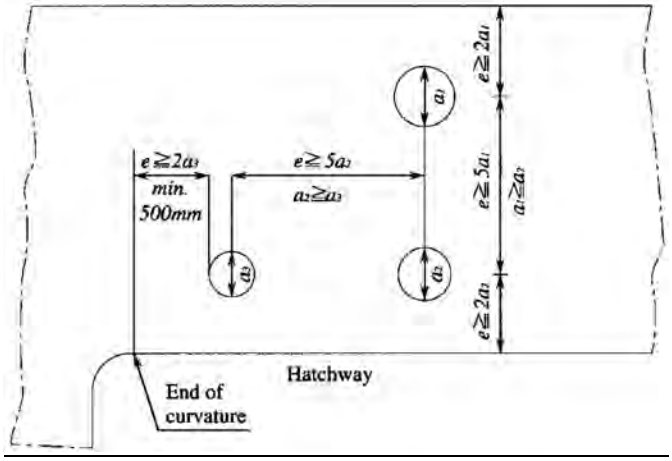


Fig. CS15.2.3-5 Intervals between Centres of Holes



CS16 PLATE KEELS AND SHELL PLATING

Section CS16.3 has been added as follows.

CS16.3 Shell Plating for Midship Part of Ship

CS16.3.3 Sheer Strakes

Precautions regarding sheer strakes

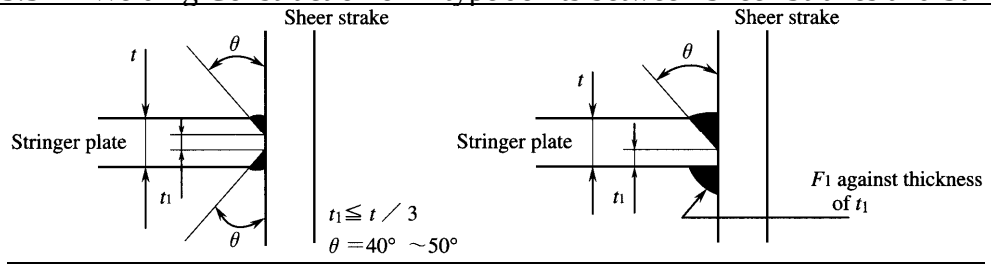
(1) The upper edges of sheer strakes are to be properly smoothed.

(2) Bulwarks are not to be directly welded to sheer strakes in the range of 0.6*L* amidships. Furthermore, fixtures such as eye plates are not to be directly welded on to the upper edge of sheer strakes, except in the fore and aft end parts.

(3) Special care should be taken where fixtures, gutter bar ends, etc. are directly welded on to the curved parts of round gunwales.

(4) At least for 0.6*L* amidships, the standard manner of welding construction of T-type joints between sheer strakes and stringer plates of the strength deck is to be as shown in **Fig. CS16.3.3-1**. However, where the thickness of stringer plates is less than 13 *mm*, fillet welds of F_1 grade may be acceptable without edge preparation.

Fig. CS16.3.3-1 Welding Construction of T-type Joints between Sheer Strakes and Stringer Plates



CS16.4 Special Requirements for Shell Plating

Paragraph CS16.4.4 has been added as follows.

CS16.4.4 Shell Plating of Bottom Forward

1 In ships of which C_b is not more than 0.7 and $V/\sqrt{L}$ is not less than 1.4, the thickness of shell plating at the strengthened bottom forward specified in **CS6.9.2** is to be determined in accordance with **16.4.4, Part CS** of the Rules using *P* in **CS6.9.1-2(2)(a)**.

Section CS16.5 has been added as follows.

CS16.5 Side Plating in way of Superstructure

CS16.5.3 Compensation at Ends of Superstructure

The manner of construction at the ends of superstructures is to be as shown in **Fig. CS16.5.3-1** or **Fig. CS16.5.3-2**.

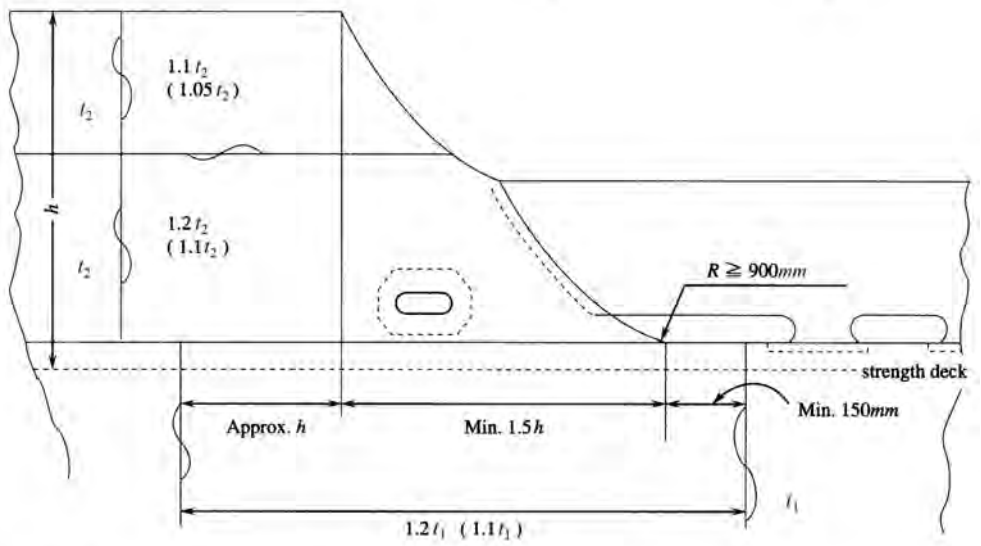
(1) The side shell plating of the superstructure is to be well extended beyond the end of the superstructure to terminate with an ample radius ($R \geq 900$ *mm*).

(2) Butt welding joints of sheer strakes at the strength deck is to be off by at least 150 *mm* from the *R*-end.

(3) The rate of thickening of shell plating in the region of 0.4*L* amidships is to be as shown in **Fig. CS16.5.3-1** and **Fig. CS16.5.3-2** (even when an expansion joint is not provided, the rate of thickening is to be the same). The rate of thickening is to be zero in the region 0.2*L* from the fore and aft ends of the ship. At intermediate points, the rate is to be determined by linear interpolation.

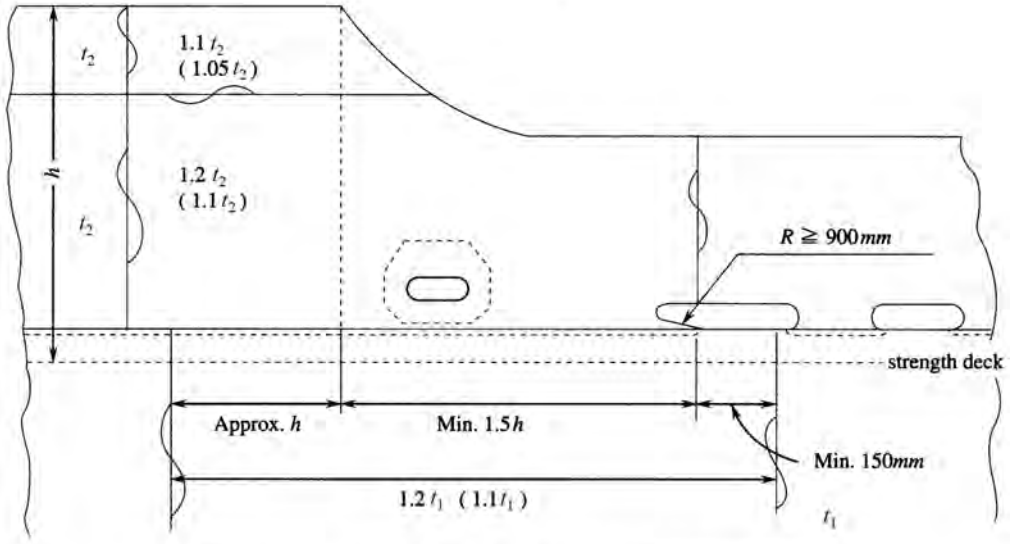
(4) Where the superstructure is set in, no thickening of shell plating is needed.

Fig. CS16.5.3-1 Construction at the End of Superstructure (With Expansion Joint)



Notes: 1. t_1 = Thickness of sheer strake
2. t_2 = Thickness of superstructure side plating
3. Figures without brackets ( ) show the case where the superstructure deck is regarded as the strength deck.
4. Figures in brackets ( ) show the case where the superstructure deck is not the strength deck.

Fig. CS16.5.3-2 Construction at the End of Superstructure (Without Expansion Joint)



Notes: For symbols, the **Notes** to **Fig. C16.6.1-1** are to be referred to.

Section CS16.6 has been added as follows.

CS16.6 Local Compensation of Shell Plating

CS16.6.1 Openings in Shell

Compensation for openings

(1) Openings in shell plating of 300 *mm* or more in size are to be compensated by doubling plate or by thickening of the plate.

(2) In the end parts of the hull, proper modifications may be accepted in regards to the compensation for openings.

(3) The radius at the corners of openings is to be at least 100 *mm*.

CS16.6.2 Recesses

Refer to **CS16.6.1** for compensation of openings.

CS17 has been added as follows.

CS17 DECKS

CS17.1 Value of Deck Load *h*

CS17.1.1 Value of *h*

Suitable documents which specify values of the deck load h (kN/m^2) prescribed in **17.1.1-1, Part CS** of the Rules (e.g. Loading Manual) are to be provided on board to aid the ship's master.

CS17.2 General

CS17.2.1 Steel Deck Plating

1 Decks which are not fully plated

(1) Stringer plates

Decks not fully plated are to have stringer plates of an appropriate breadth and of a thickness not less than that determined for deck plating in accordance with the requirements in **17.4, Part CS** of the Rules for the positions concerned. The stringer plates of effective decks are to be effectively connected to the shell plating.

(2) Tie plates

Tie plates are to be provided along hatch sides, in way of pillars, on the under-deck girders and under deckhouse coamings. These tie plates are to have an appropriate breadth and a thickness not less than that determined for deck plating in accordance with the requirements in **17.4, Part CS** of the Rules for the positions concerned.

(3) In way of transverse bulkheads and at the ends of deck openings

In way of transverse bulkheads and at the ends of deck openings, the deck is to be suitably plated with steel plates.

2 Wooden decks

(1) Materials

(a) The materials of wooden deck planking are to be of a good quality well seasoned and without rots, saps, cracks and defective knots.

(b) The term "hard wood" means materials such as teak, and the term "soft wood" those such as cedar.

(2) Scantlings of wooden deck planking

Deck planks are to be effectively arranged and fixed, and their thickness is not to be less than 63 *mm* for soft wood and 50 *mm* for hard wood. The thickness may be suitably reduced in spaces appropriated for living accommodation and navigation works only.

CS17.2.2 Watertightness of Decks

1 Where the rudder stock penetrates the deck lower than 1.5 *m* above the load line, special attention is to be given to the watertightness at the penetration.

2 With respect to the provisions of **17.2.2-2, Part CS** of the Rules, decks required to be watertight are to be in accordance with following **(1)** and **(2)**.

(1) Deck structures are to comply with related provisions of **Chapter 13, Part CS** of the Rules for the pressure due to head of water in the most severe conditions at the intermediate or final stages of flooding specified in **Chapter 4, Part CS** of the Rules. In this case, such decks are to be regarded as the part of the deck which forms bulkhead recesses.

(2) Where the trunks and other constructions penetrating watertight deck are provided, such trunks are to be capable of withstanding the pressure due to a head of water up to the

bulkhead deck and head of water in the most severe conditions at the intermediate or final stages of flooding specified in **Chapter 4, Part CS** of the Rules.

CS17.2.4 Compensation for Openings

1 All corners of openings in decks, such as hatchways, are to be well rounded, properly smoothed and reinforced, as necessary, by thickening the deck plating or by means of doubling plates.

(1) Regions where thicker plating or doubling plates are required

Strength deck: Within 0.75*L* from ⌀

Effective 2nd deck: Within 0.6*L* from ⌀

3rd deck and lower decks: No doubling needed, as a rule

Superstructures and long deckhouse:

Doubling within 0.6*L* from ⌀ for decks immediately above the strength deck

(2) Plate thickening and doubling plates may be properly reduced depending upon their locations. (*See* **Fig. CS17.2.4-1**)

(3) The dimensions and thickness of doubling plates or ranges of thickening are to be determined considering the degree of stress concentration around the openings.

(4) The minimum radii at the corners are to be as follows:

Within 0.5*L* from ⌀ of strength deck: 250 *mm*

Elsewhere: 200 *mm*

The radius may be suitably reduced for small openings. For companionways and similar small openings, the radius at the corners may be 150 *mm* in the strength deck outside the line of openings and 75 *mm* or so elsewhere.

(5) For corners of openings having a radius not less than 600 *mm* or having a parabolic or similar shape, neither doubling plates nor thickening of the plating is required. The recommended corner shape is as shown in **Fig. CS17.2.4-2**.

(6) No welded joints are permitted at the corners of openings in the strength deck. The welded joints are to be properly off the end of the curvature. (*See* **Fig. CS17.2.4-3**)

Fig. CS17.2.4-1

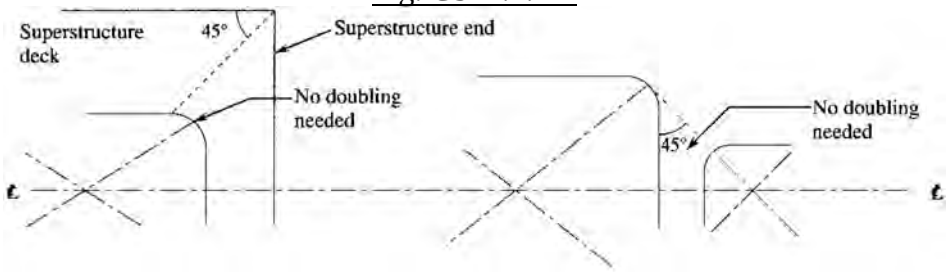


Fig. CS17.2.4-2

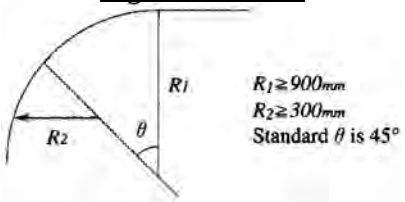
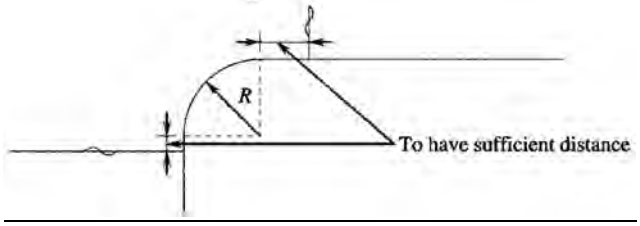
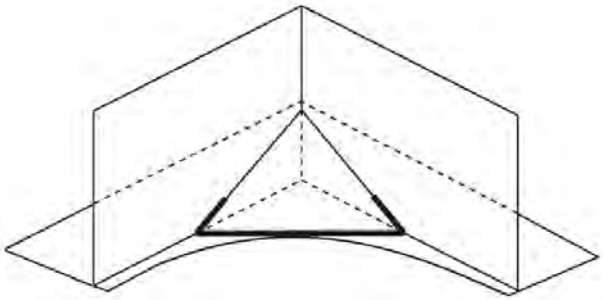


Fig. CS17.2.4-3



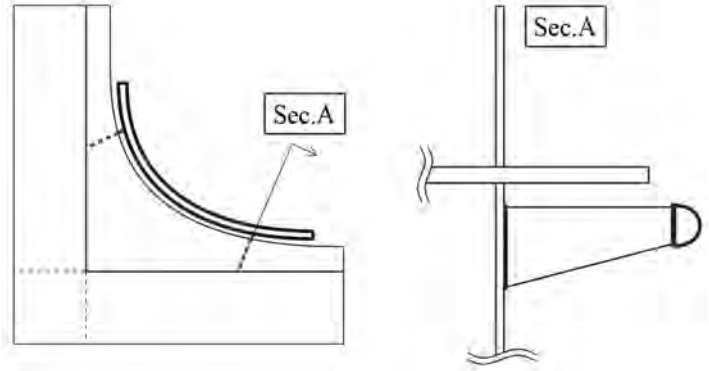
2 Where attachments such as slant plates or protective means are provided as stated in **17.2.4-2, Part CS of the Rules**, such attachments are to be provided as referred to the method shown in **Fig. CS17.2.4-4** or **Fig. CS17.2.4-5**.

Fig. CS17.2.4-4 Example of the Method for Providing Slant Plates



Note:
The connections between slant plates and strength deck (indicated in the bold line) are not to be welded.

Fig. CS17.2.4-5 Example of the Method for Providing Protective Means



Note:
Protective means (i.e. half round bars) are to be provided on hatch side girders and hatch end beams.

CS17.2.5 Rounded Gunwales

Where rounded gunwales are made of steel plate of Grade *D* or Grade *E*, the inner radius of the curvature is not to be less than 20 *times* the thickness of the gunwale plate. However, where the width of the sheer strake that is bent to form the rounded gunwale is not less than 500 *mm* plus the plate width of the strake prescribed in **3.2.2.1-4, Part 1, Part C of the Rules** or the method of bending work is especially approved by the Society, the radius may be reduced down to 15 *times* the plate thickness.

CS17.3 Effective Sectional Area of Strength Deck

CS17.3.2 Effective Sectional Area of Strength Deck

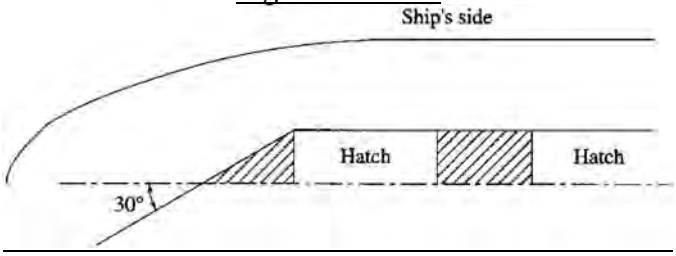
1 Members to be included in the calculation of the actual sectional area of strength deck

In addition to the deck plating, members attached to the deck plating, such as stringer angles and longitudinal beams, which are included as longitudinal strength members are to be included in the calculation of the actual sectional area. The shaded areas in the figure below are not to be included in the calculation. *(See* **Fig. CS17.3.2-1**)

2 Where round gunwales are provided, the sectional area is to be calculated assuming that the plate of the round gunwale is horizontally extended to the ship's side.

3 In the requirements of **17.3.2-3, Part CS** of the Rules, "the value approved by the Society" means the value obtained by applying the provisions of **15.2.1-1, Part C of the Rules** by using the coefficient C_2 obtained from the dotted line in **Fig. CS15.1, Part C of the Rules**.

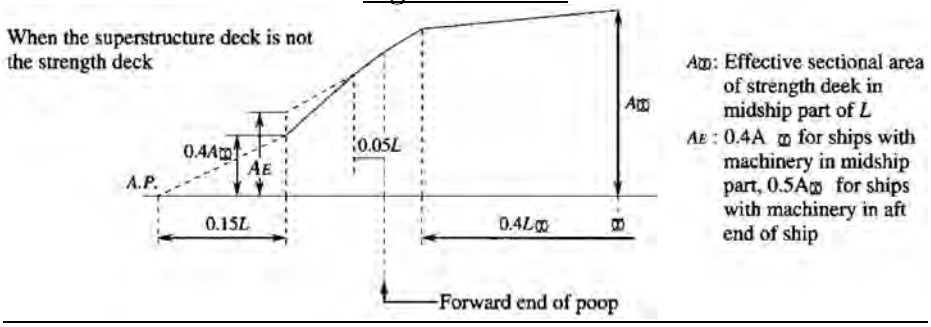
Fig. CS17.3.2-1



CS17.3.4 Effective Sectional Area of Strength Deck within Long Poop

When the superstructure deck is not the strength deck (*See* **Fig. CS17.3.4-1**)

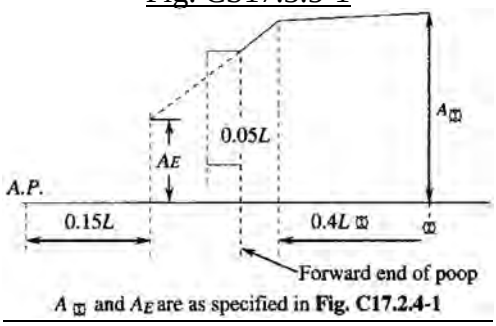
Fig. CS17.3.4-1



CS17.3.5 Deck within Superstructure where Superstructure Deck is Designed as Strength Deck

In case of poop deck (*See* **Fig. C17.3.5-1**)

Fig. CS17.3.5-1



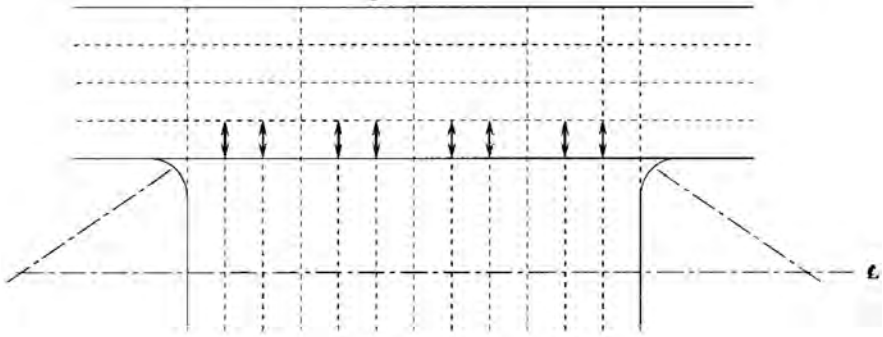
$A_{\text{箱}}$ and A_E are as specified in **Fig. C17.2.4-1**

CS17.4 Deck Plating

CS17.4.1 Thickness of Deck Plating

For prevention of deck buckling, the deck within the line of openings is recommended to be constructed using the transverse framing system. (*See* **Fig. C17.4.1-1**)

Fig. CS17.4.1-1



CS17.4.5 Thickness of Deck Plating Loaded with Wheeled Vehicles

The thickness of deck plating loaded with wheeled vehicles is to be determined according to **(1)** or **(2)** below. The thickness of plating of the weather deck is to be 1 *mm* thicker than that obtained from these formulae.

(1) Where the distance between the centres of wheel prints in a panel is not less than ($2S + a$):

$$C\sqrt{\frac{2S-b'}{2S+a}\cdot\frac{P}{9.81}}+1.5 \quad (mm)$$

Where:

C: Coefficient obtained from **Table CS17.4.5-1**

S : Beam spacing (m)

P: Maximum designed wheel load (kN), or, if $b > S$, a value equal to the maximum designed wheel load multiplied by the value of S/b

Where the maximum designed wheel load is given in tons, the value of P should be multiplied by 9.81 to convert it into kN.

b' : b or S, whichever is the smaller

a and b : Dimensions of wheel print as shown in **Fig. CS10.7.1-1**

However, for vehicles with ordinary pneumatic tires, values of a and b in **Table CS10.7.1-1** may be used.

(2) Where the distance between centres of wheel prints in a panel is less than ($2S + a$) (*See* **Fig. CS17.4.5-1**):

$$C\sqrt{\frac{2S-b'}{2S+a+e}\cdot\frac{nP}{9.81}}+1.5\ (mm)$$

Where:

C, S, a, b' and P: As specified in **(1)** above

e: Sum of distances (m) between centres of wheel prints where wheels are placed side by side at a spacing of less than ($2S + a$) in one panel (*See* **Fig. CS17.4.5-1**)

n: Number of wheel loads in the range of e

Table CS17.4.5-1 Values of C

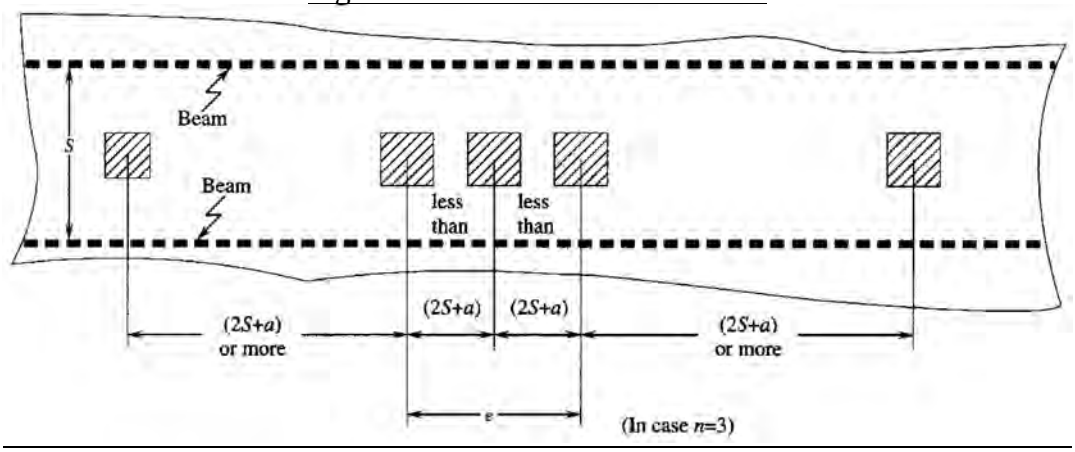
		Vehicles exclusively used for cargo handling	Other vehicles
Midship part of strength deck	Longitudinal framing	$4.6\sqrt{K}$	$\frac{3.64\sqrt{K}}{\sqrt{1-0.64f_{DH}K}}$
	Transverse framing	$4.9\sqrt{K}$	$\frac{5.15\sqrt{K}}{\sqrt{1-0.41{f_{DH}}^2K^2}}$
Elsewhere		$4.6\sqrt{K}$	$5.2\sqrt{K}$

Note:

f_{DH}: Value as specified in **CS10.7.1-1**

In longitudinal framing system, f_{DH} is not to be less than 0.79/K.

Fig. CS17.4.5-1 Measurement of e



CS18 has been added as follows.

CS18 SUPERSTRUCTURES AND DECKHOUSES

CS18.1 General

CS18.1.1 Application

With respect to the provisions of **Chapter 18, Part CS of the Rules**, the determination of the position of tiers above the freeboard deck may be treated in the same manner as the provisions of **CS1.1.3-2(2)(c)**.

CS18.3 Closing Means for Access Openings in Superstructure End Bulkheads

CS18.3.1 Closing Means for Access Openings

Where the sill of an access opening is liable to hinder the passage of heavy spare parts or similar, a portable sill may be used subject to approval by the Society under the following conditions.

(1) Portable sills are to be installed before the ship leaves port.

(2) Portable sills are to be gasketed and fastened by closely spaced through-bolts.

(3) Whenever sills are replaced after removal, the weathertightness of the sills and relevant doors is to be verified by hose testing. The dates of removal, replacement and hose testing are to be recorded in the ship's log-book.

CS18.4 Additional Requirements for Bulk Carriers, Ore Carriers and Combination Carriers, etc.

If this requirement hinders hatch cover operation, the aft bulkhead of the forecastle may be fitted forward of the forward bulkhead of the foremost cargo hold provided the forecastle length is not less than 7% of the length for freeboard defined in **Part A 2.1.3.**

CS19 HATCHWAYS, MACHINERY SPACE OPENINGS AND OTHER DECK OPENINGS

Section CS19.1 has been added as follows.

CS19.1 General

CS19.1.2 Position of Exposed Deck Openings

1 In the application of the requirements of **19.1.2, Part CS** of the Rules, "superstructure decks" include top decks of superstructures, deckhouses, companionways and other similar deck structures.

2 "Exposed raised quarter decks" in the definition of Position I specified in **19.1.2, Part CS** of the Rules refers to exposed superstructure decks lower than h_S specified in **V2.2.1** above the freeboard deck.

3 "Exposed superstructure decks" in the definition of Position I specified in **19.1.2, Part CS** of the Rules refers to exposed superstructure decks lower than $2h_S$ specified in **V2.2.1** above the freeboard deck.

4 "Exposed superstructure decks located at least one standard height of superstructure above the freeboard deck" in the definition of Position II specified in **19.1.2, Part CS** of the Rules refers to exposed superstructure decks located at least h_S specified in **V2.2.1** above the freeboard deck and lower than $2h_S$ specified in **V2.2.1** above the freeboard deck.

5 "Exposed superstructure decks located at least two standard heights of superstructure above the freeboard deck" in the definition of Position II specified in **19.1.2, Part CS** of the Rules refers to exposed superstructure decks located at least $2h_S$ specified in **V2.2.1** above the freeboard deck and lower than $3h_S$ specified in **V2.2.1** above the freeboard deck.

CS19.2 Hatchways

Paragraph CS19.2.4 has been added as follows.

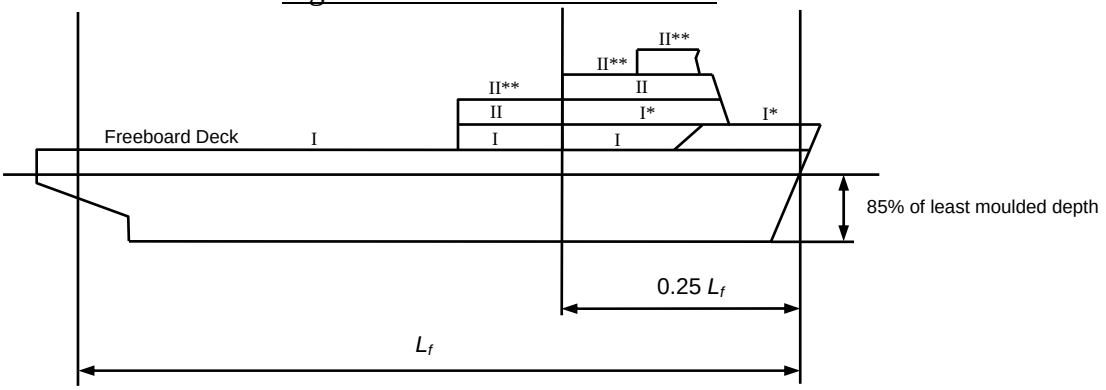
CS19.2.4 Design Loads for Steel Hatch Covers, Portable Beams and Hatchway Coamings

1 Design vertical wave load P_V as specified in **19.2.4(1), Part CS** of the Rules is to comply with the following requirements.

(1) Positions I and II may be determined in accordance with **Fig. CS19.2.4-1** and **-2**.

(2) Where an increased freeboard is assigned, the design load for hatch covers according to **19.2.4(1), Part CS** of the Rules on the actual freeboard deck may be as required for a superstructure deck, provided the summer freeboard is such that the resulting draught will not be greater than that corresponding to the minimum freeboard calculated from an assumed freeboard deck situated at a distance at least equal to one superstructure standard height (as per Regulation 33 of the "*International Convention on Load Lines*, 1966 *and Protocol of* 1988 *relating to the International Convention on Load Lines*, 1966") below the actual freeboard deck (see **Fig. CS19.2.4-2**).

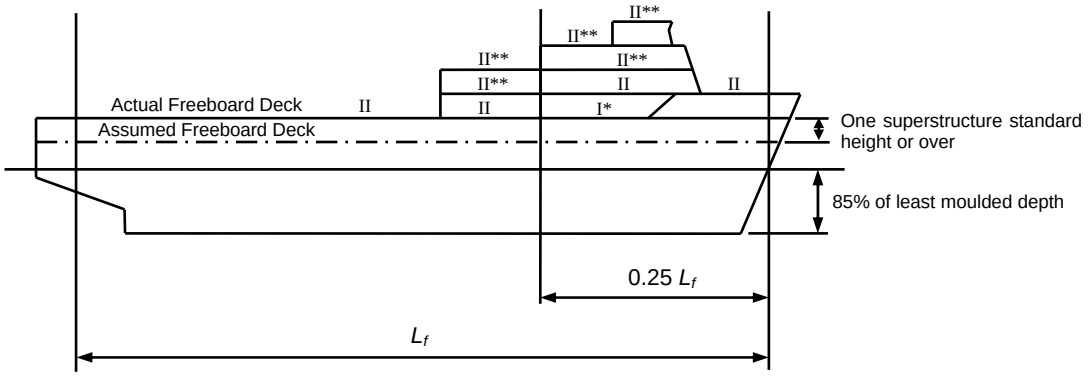
Fig. CS19.2.4-1 Position I and II



* Exposed superstructure decks located at least one superstructure standard height above the freeboard deck

** Exposed superstructure decks of vessels having length L_f of greater than 100*m* located at least one superstructure standard height above the lowest Position II deck

Fig. CS19.2.4-2 Position I and II for an Increased Freeboard

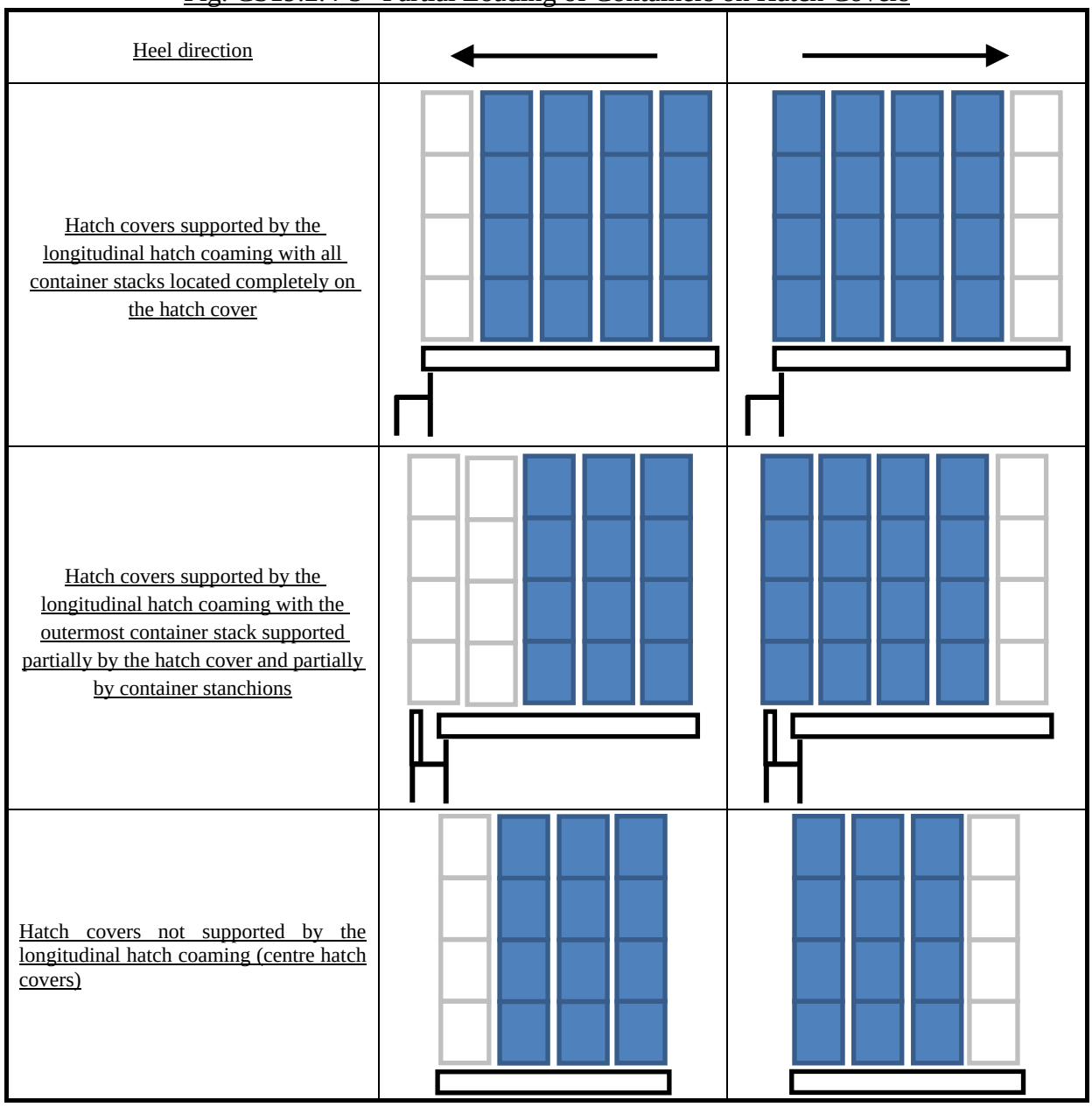


* Exposed superstructure decks located at least one superstructure standard height above the freeboard deck

** Exposed superstructure decks of ships having length L_f of greater than 100*m* located at least one superstructure standard height above the lowest Position II deck

2 In the application of the requirements of **19.2.4(4)(a)** and **(c)**, **Part CS** of the Rules, load cases with the partial loading of containers on hatch covers are to be considered (see **Fig. CS19.2.4-3**). However, where deemed necessary by the Society, load cases other than those specified in **Fig. CS19.2.4-3** are to be separately considered.

Fig. CS19.2.4-3 Partial Loading of Containers on Hatch Covers



3 The partial load cases specified in **Fig. CS19.2.4-3** may not cover all partial load cases critical for the hatch cover lifting specified in **19.2.10-2, Part CS of the Rules**.

4 In the case of mixed stowage (e.g., 20-*foot* + 40-*foot* container combined stacks), the foot point forces at the fore and aft ends of the hatch cover are not to be higher than those resulting from the design stack weight for the 40-*foot* containers, and the foot point forces at the middle of the cover are not to be higher than those resulting from the design stack weight for the 20-*foot* containers.

Paragraph CS19.2.5 has been added as follows.

CS19.2.5 Strength Criteria of Steel Hatch Covers and Hatch Beams

1 Where scantlings of structural members of steel hatch covers are determined based upon direct calculations, the following requirements are to be applied. Those not specified in this paragraph are to comply with the requirements in **Chapter 8, Part 1, Part C of the Rules.**

(1) Loads

The design wave loads imposed on steel hatch covers are to be P_V specified in **19.2.4(1), Part CS** of the Rules.

(2) Modelling of structures

(a) The structural model is to be able to reproduce the behaviour of the structure with the highest possible fidelity. Stiffeners and primary supporting members subject to pressure loads are to be included in the modelling. However, buckling stiffeners may be disregarded for stress calculation.

(b) Net scantlings which do not include corrosion additions are to be used for modelling.

(c) In no case is element width to be larger than stiffener spacing. The ratio of element length to width is not to exceed 4. The element height of the webs of primary supporting members is not to exceed one-third of the web height.

(d) The structural model is to be supported by pads. If the arrangement of pads differs from the arrangement of stiffeners, the edge elements of steel hatch covers are also to be modelled.

(3) Permissible value

When the loads specified in **(1)** act on the structural model specified in **(2)**, the net scantlings are to be determined so that the stress and deflection generated in each structural member satisfy the allowable values specified in **19.2.5-1**, **Part CS** of the Rules.

(4) Miscellaneous

(a) The thickness of the top plating of steel hatch covers is to comply with the requirements in **19.2.5-2**, **Part CS** of the Rules.

(b) The scantlings of the secondary stiffeners of steel hatch covers are to comply with the requirements in **19.2.5-3**, **Part CS** of the Rules.

(c) The buckling strength for the structural members forming steel hatch covers is to comply with the requirements in **19.2.5-6**, **Part CS** of the Rules.

Paragraph CS19.2.6 has been added as follows.

CS19.2.6 Additional Requirements for Steel Hatch Covers Carrying Cargoes

1 "Direct calculations deemed appropriate by the Society" in **19.2.6-1**, **Part CS** of the Rules refers to calculations that comply with the following requirements. Those not specified in this paragraph are to comply with the requirements in **Chapter 8, Part 1, Part C of the Rules.**.

(1) Loads

(a) The loads acting on steel hatch covers are to be according to **19.2.4, Part CS** of the Rules based on the type of load and loading condition. Except as deemed necessary by the Society, no loads are to be assumed to act jointly.

(b) No dynamic loads due to ship motion are to be assumed as the wheel loads from wheeled vehicles only used for loading/unloading while in port.

(2) Modelling of Structures

(a) The structural model is to be able to reproduce the behaviour of the structure with the highest possible fidelity. Stiffeners and primary supporting members subject to pressure loads are to be included in the modelling. However, buckling stiffeners may be disregarded for stress calculation.

(b) Net scantlings which do not include corrosion additions are to be used for modelling.

(c) In no case is element width to be larger than stiffener spacing. The ratio of element length to width is not to exceed 4. The element height of the webs of primary supporting members is not to exceed one-third of the web height.

(d) The structural model is to be supported by pads. If the arrangement of pads differs from the arrangement of stiffeners, the edge elements of steel hatch covers are also to be

modelled.

(3) Permissible values

When the loads specified in **(1)** act on the structural model specified in **(2)**, the net scantlings are to be determined so that the stress and deflection generated in each structural member satisfy the allowable values specified in **19.2.5-1**, **Part CS** of the Rules.

2 The details for steel hatch covers carrying cargoes are to comply with the following **(1)** to **(4)**:

(1) To prevent damage to hatch covers and the ship structure, the location of stoppers is to be compatible with the relative movements between hatch covers and the ship structure.

(2) Hatchway covers and supporting structures are to be adequately stiffened to accommodate the load from hatch covers.

(3) At the cross-joints of multi-panel covers, vertical guides (male/female) are to be fitted to prevent excessive relative vertical deflections between loaded/unloaded panels.

(4) The construction and scantlings of hatchways on exposed parts or on the lower deck are to comply with the following requirements in addition to those of **19.2, Part CS** of the Rules.

(a) The loading arrangement is to be clearly shown in drawings submitted for approval. In the case of freight containers, the type and location are to be additionally described.

(b) Girders or stiffeners are to be provided for reinforcement beneath the corner fittings of freight containers.

(c) The top plates of hatch covers, upon which wheeled vehicles are loaded, are to comply with the following:

i) The thickness of hatch cover top plating may be determined by direct calculation or in accordance with **CS17.4.5**.

ii) The scantlings of the stiffeners of hatch covers may be determined by direct calculation or in accordance with **CS10.7.1**.

Paragraph CS19.2.10 has been added as follows.

CS19.2.10 Closing Arrangements

"At the discretion of the Society" prescribed in **19.2.10-2, Part CS** of the Rules refers to the following case:

(1) The case in which the height h_E (*mm*) of the transverse cover guides above the hatch cover supports is not less than that obtained from the following formula (see **Fig. CS19.2.10-1**):

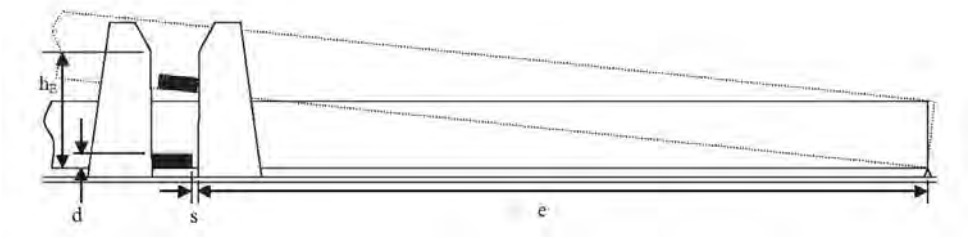
$h_E = 1.75\sqrt{2se + d^2} - 0.75d$, however, in no case is h_E to be less than the height of the cover edge plate plus 150 *mm*.

e: Largest distance (*mm*) from the inner edges of the transverse cover guides to the ends of the cover edge plate

s: Total clearance (*mm)* within the transverse cover guide, with $10 \leq s \leq 40$

d: Distance between the upper edge of transverse stopper and the hatch cover supports

Fig. CS19.2.10-1 Height of Transverse Cover Guides



Paragraph CS19.2.12 has been added as follows.

CS19.2.12 Steel Hatchway Covers for Container Carriers

1 In the application of the requirements of **19.2.12**, **Part CS** of the Rules, the height of coamings above the upper surface of the deck where the hatchway covers are fitted is to be at least 600 *mm* in Position II.

2 In the application of the requirements of **19.2.12-1, Part CS** of the Rules, the following requirements **(1)** through **(4)** are to be complied with:

(1) The hatchway covers concerned may be fitted to hatchways located on weatherdecks which are at least two standard superstructure heights (as per Regulation 33 of the "*International Convention on Load Lines*, 1966") above an actual freeboard deck or an assumed freeboard deck from which the freeboard can be calculated which will result in a draught not less than that corresponding to the freeboard actually assigned. Where any part of a hatchway is forward of a point located one quarter of the ship's length ($0.25L_f$) from the forward perpendicular, that hatchway is to be located on a weatherdeck at least three standard superstructure heights above the actual or assumed freeboard deck.

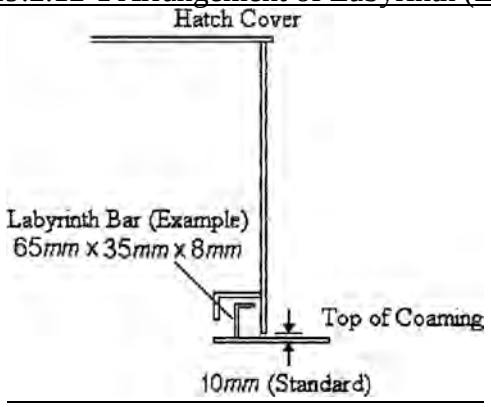
(2) The non-weathertight gaps between hatch cover panels are to be considered as unprotected openings in the application of **Part U** and **Chapter 4, Part CS** of the Rules. They are to be as small as possible commensurate with the capacity of the bilge system and expected water ingress, and the capacity and operational effectiveness of the fixed gas fire-extinguishing system required in **Part R** of the Rules, and are not to be more than 50 *mm*.

(3) Labyrinths, gutter bars, or other equivalent means are to be fitted close to the edges of each panel in way of the gaps to minimize the amount of water that can enter the container hold from the top surface of each panel. In general, the height of such means is not to be less than 65 *mm* from the top of the coaming and gutter bars or from the top of the panel, and the gaps between hatch covers and the top of the coaming are not to exceed 10 *mm*. (See **Fig. CS19.2.12-1**)

(4) Bilge alarms are to be provided in each hold fitted with non-weathertight covers.

3 In the application of **19.2.12-2**, **Part CS** of the Rules, relevant requirements specified in MSC/Circ.1087 may be applied.

Fig. CS19.2.12-1 Arrangement of Labyrinth (Example)



Paragraph CS19.2.13 has been added as follows.

CS19.2.13 Additional Requirement for Small Hatches Fitted on Exposed Fore Deck

1 General

(1) The strength of, and securing devices for, small hatchways fitted on the exposed fore deck in **19.2.13**, **Part CS** of the Rules are to comply with the requirements of this paragraph.

(2) Small hatchways in the context of this requirement are hatchways designed for access to spaces below the deck and are capable of being closed weathertight or watertight, as applicable. Their opening is normally 2.5 m^2 or less.

(3) Notwithstanding the provisions of **(1)** above, hatchways designed for emergency escape need not comply with the requirements of **-3(1)(a)**, **-3(1)(b)**, **-4(3)** and **-5**.

(4) The securing devices of the hatchways for emergency escape are to be of a quick-acting type (e.g., one action wheel handles are provided as central locking devices for latching/unlatching of hatch cover) operable from both sides of the hatch cover.

2 Strength

(1) For small rectangular steel hatch covers, plate thickness, stiffener arrangement and scantlings are to be in accordance with **Table CS19.2.13-1** and **Fig. CS19.2.13-1**. Stiffeners, where fitted, are to be aligned with the metal-to-metal contact points, required in **-4(1)**. Primary stiffeners are to be continuous. All stiffeners are to be welded to the inner edge stiffener. (See **Fig. CS19.2.13-2**)

(2) For rectangular hatchways, the upper edge of hatchway coamings is to be suitably reinforced by a horizontal section, normally not more than 170 to 190 *mm* from the upper edge of the coamings.

(3) For small hatch covers of a circular or similar shape, the cover plate thickness and reinforcement is to be according to the requirements of the Society.

(4) For small hatch covers constructed of materials other than steel, the required scantlings are to provide equivalent strength.

3 Primary Securing Devices

(1) Small hatchways located on an exposed fore deck subject to the application of this requirement are to be fitted with primary securing devices such that their hatch covers can be secured in place and weathertight by means of a mechanism employing any one of the following methods:

(a) Butterfly nuts tightening onto forks (clamps)

(b) Quick acting cleats

(c) Central locking device

(2) Dogs (twist tightening handles) with wedges are not acceptable.

4 Requirements for Primary Securing Devices

(1) Hatch covers are to be fitted with a gasket of elastic material. This is to be designed to allow metal-to-metal contact at a designed compression and to prevent over compression of the gasket by green sea forces that may cause the securing devices to be loosened or dislodged. (See item 9 of **Fig.CS19.2.13-2**) The metal-to-metal contacts are to be arranged close to each securing device in accordance with **Fig.CS19.2.13-1**, and of sufficient capacity to withstand the bearing force.

(2) The primary securing device is to be designed and manufactured such that the designed compression pressure is achieved by one person without the need of any tools.

(3) For a primary securing device that uses butterfly nuts, the forks (clamps) are to be of a robust design. They are to be designed to minimize the risk of the butterfly nuts being dislodged while in use; by means of curving the forks upward, a raised surface on the free end, or a similar method. The plate thickness of unstiffened steel forks is not to be less than 16 *mm*. An example arrangement is shown in **Fig.CS19.2.13-2**.

(4) For small hatch covers located on an exposed deck forward of the foremost cargo hatch, the hinges are to be fitted such that the predominant direction of green sea force will cause the cover to close, which means that the hinges are normally to be located on the fore edge.

(5) On small hatchways located between the main hatchways, for example between Nos. 1 and 2, the hinges are to be placed on the fore edge or outboard edge, whichever is practicable for

protection from green sea force in beam seas and bow quartering conditions.

5 Secondary Securing Device

Small hatchways on the fore deck are to be fitted with an independent secondary securing device (e.g. by means of a sliding bolt, a hasp or a backing bar of slack fit) which is capable of keeping the hatch cover in place, even in the event that the primary securing device becomes loosened or dislodged. It is to be fitted on the side opposite to the hatch cover hinges.

Table CS19.2.13-1 Scantlings for Small Steel Hatch Covers on the Fore Deck

Nominal size (*mm* × *mm*)	Cover plate thickness (*mm*)	Primary stiffeners	Secondary stiffeners
		Flat Bar (*mm* × *mm*); number	
630 × 630	8	-	-
630 × 830	8	100 × 8 ; 1	-
830 × 630	8	100 × 8 ; 1	-
830 × 830	8	100 × 10 ; 1	-
1030 × 1030	8	120 × 12 ; 1	80 × 8 ; 2
1330 × 1330	8	150 × 12 ; 2	100 × 10 ; 2

Fig. CS19.2.13-1 Arrangement of Stiffeners

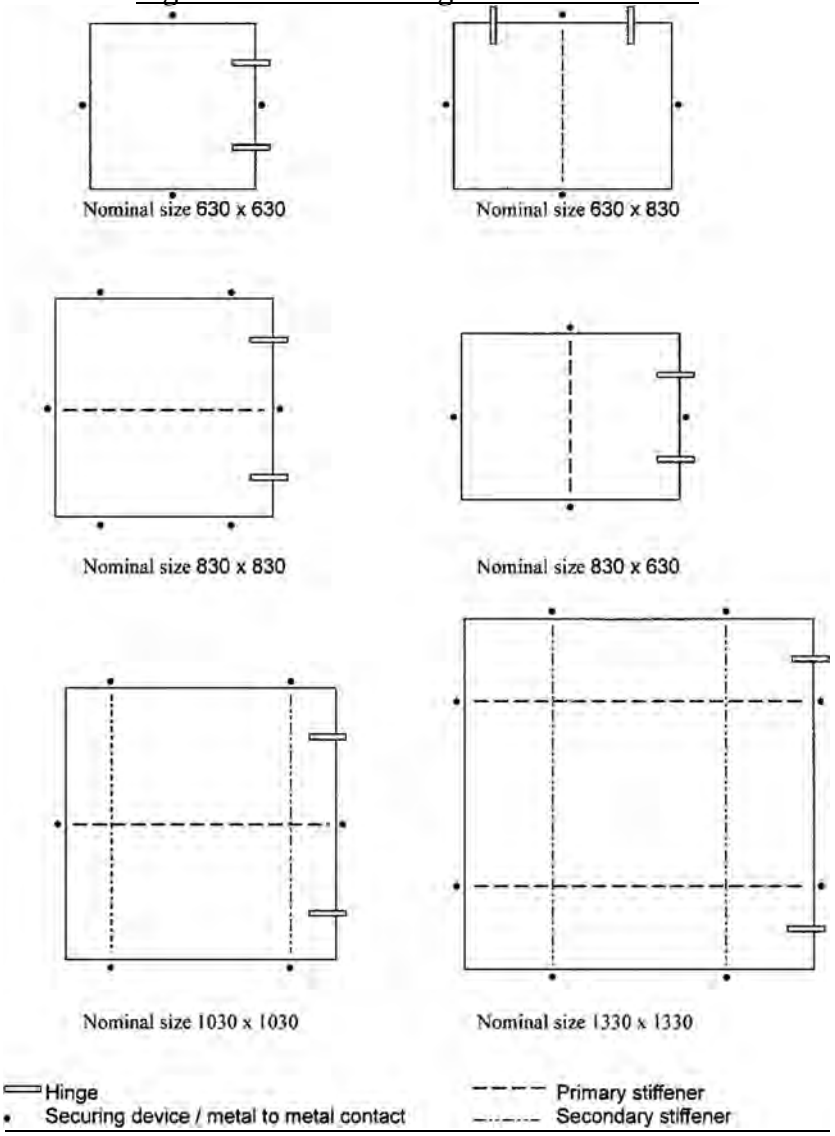
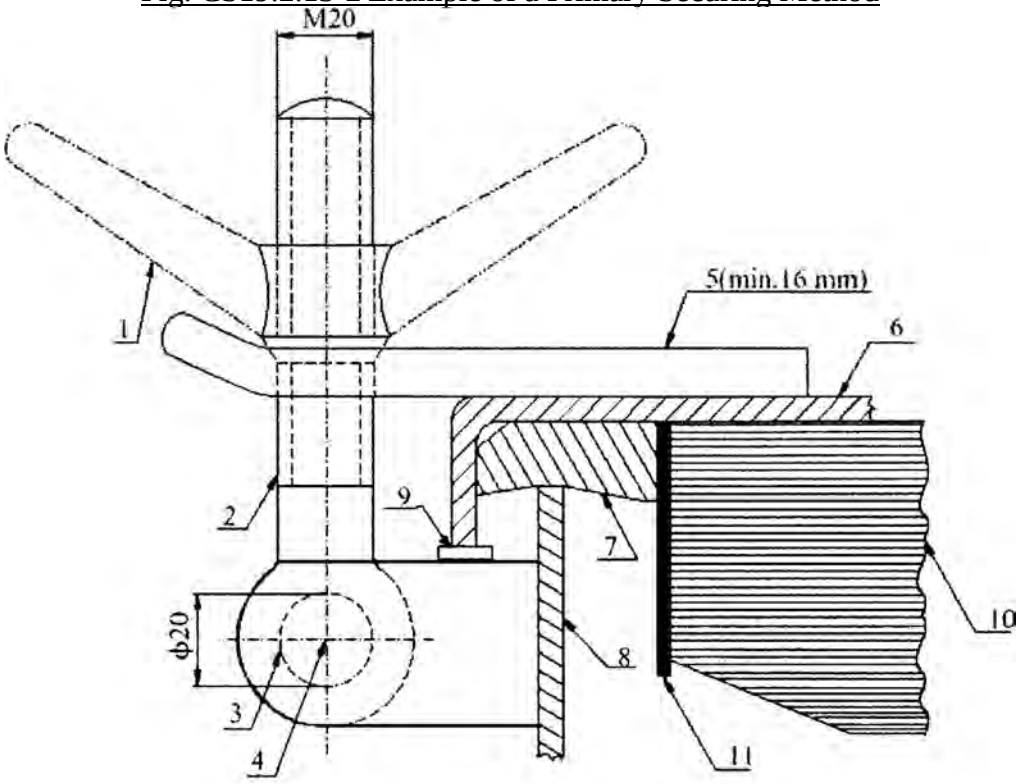


Fig. CS19.2.13-2 Example of a Primary Securing Method



(Note : Dimensions in millimeters)

1. Butterfly nut
2. Toggle Bolt
3. Toggle bolt pin
4. Center of toggle bolt pin
5. Fork(clamp) plate
6. Hatch cover
7. Gasket
8. Hatch coaming
9. Bearing pad welded on the bracket of a toggle bolt for metal to metal contact
10. Stiffener
11. Inner edge stiffener

Section CS19.3 has been added as follows.

CS19.3 Machinery Space Openings

CS19.3.5 Miscellaneous Openings in Machinery Casings

In applying the requirements of **19.3.5-1, Part CS** of the Rules, the ventilator coamings above the upper surface of the deck is to extend more than 4.5*m* above the surface of the deck in Position I, and more than 2.3*m* above the surface of the deck in Position II specified in **19.1.2, Part CS** of the Rules. Ventilator openings are not to be fitted with weathertight closing appliances. However, ventilator openings are to be fitted with closing means specified in **19.3.5-3, Part CS** of the Rules.

Section CS19.4 has been added as follows.

CS19.4 Companionways and Other Deck Openings

CS19.4.2 Companionways

Grouping into deckhouse and companion

(1) A structure is regarded as a deckhouse where its inside is always accessible through access openings provided on the top of the structure or through under-deck passageways, even when all access openings in the boundary walls are closed.

(2) A structure is regarded as a companion where its inside is not accessible through any other way, when all access openings in the boundary walls are closed.

CS20 MACHINERY SPACES, BOILER ROOMS AND TUNNEL RECESSES

CS20.2 Main Engine Foundations

Paragraph CS20.2.2 has been added as follows.

CS20.2.2 Ships with Double Bottoms

1 The following method for determining scantlings of double bottom construction in engine rooms is standard. Other methods approved by the Society may be acceptable.

(1) Thickness of centre girders is not to be less than the value obtained from the following formula.

$5.7 + 0.056L \ (mm)$

(2) Thickness of side girders and solid floors is not to be less than the value obtained from the following formula.

When the ship is over 100 *m* in length:

$6.5 + 0.035L \ (mm)$

When the ship is not over 100 *m* in length:

$0.6\sqrt{L} + 4.0 \ (mm)$

2 Girder plates beneath seat plates of the main engine are generally to penetrate inner bottom plates. Where they are unable to penetrate, the inner bottom plates are to be suitably thicker than required and rider plates are to be welded with edge preparation.

If man holes are provided in girder plates, their number is to be minimized as far as possible.

3 Where main engines are directly installed on to inner bottom plates, the compartments beneath main engines are recommended to be cofferdams. Where they are used as deep tanks, cap nuts, packing, etc. are to be fitted to the foundation bolts in order to keep water/oil-tightness.

CS21 has been added as follows.

CS21 BULWARKS, GUARDRAILS, FREEING ARRANGEMENTS, CARGO PORTS AND OTHER SIMILAR OPENINGS, SIDE SCUTTLES, RECTANGULAR WINDOWS, VENTILATORS AND GANGWAYS

CS21.1 Bulwarks and Guardrails

CS21.1.1 General

In **21.1.1-2(2)**, **Part CS of the Rules**, "measures deemed appropriate by the Society" implies that **(1)** and **(2)** below need to be satisfied.

(1) Stanchions are to be of increased breadth as in **(a)** to **(c)** below, depending on their arrangement. The figure of these stanchions is given in **Fig.CS21.1.1-1**.

(a) At least every third stanchion is to be of increased breadth: $kb_s \geq 2.9b_s$

(b) At least every second stanchion is to be of increased breadth: $kb_s \geq 2.4b_s$

(c) Every stanchion is to be of increased breadth: $kb_s \geq 1.9b_s$

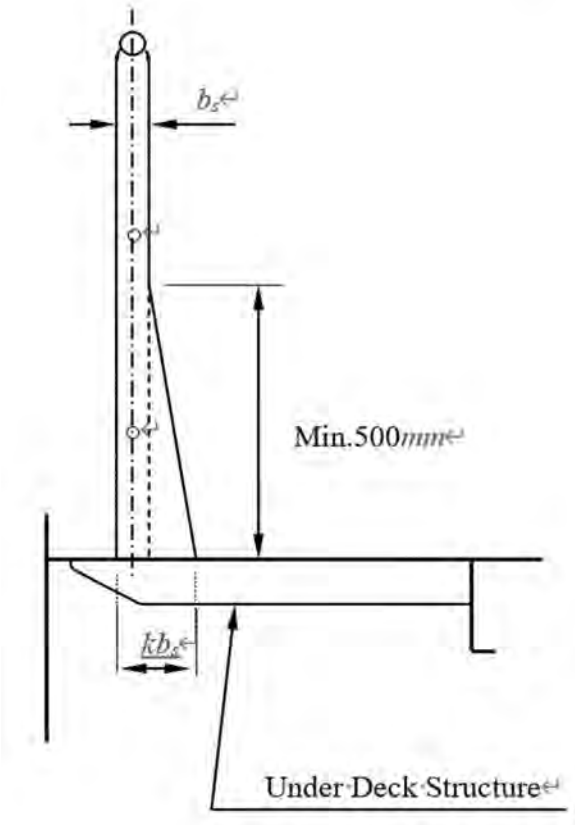
kb_s: increased breadth (*mm*) of stanchion

b_s: breadth (*mm*) of stanchion according to standards approved by the Society

Stanchions of increased breadth are to be welded to the deck with double continuous fillet welds and a minimum leg size of 7 *mm* or as specified by standards approved by the Society.

(2) Stanchions with increased breadth, as described in **(1)** above, are to be aligned with the members below the deck. These members are to be a minimum of 100×12 *mm* flat bar welded to the deck by double continuous fillet welds. The stanchions with increased breadth need not be aligned with under deck structures for deck plating exceeding 20 *mm*.

Fig.CS21.1.1-1 Guardrail Stanchion (Example)



CS21.1.2 Dimensions

Where bulwarks and/or guardrails specified in **21.1.2, Part CS** of the Rules interfere with the ship's normal operation due to their height, the height may be reduced on the condition that suitable alternative protection devices such as portable guardrails are provided.

CS21.1.3 Construction

In cases where the base of a bulwark stay adopts a gusset type, "special consideration" in **21.1.3-4, Part CS of the Rules** means the following **(1)** to **(3)**:

(1) The gusset plate is to be made of steel with the same yield stress as the steel of the upper deck to which the gusset plate is attached.

(2) The toes of gusset plates are to have a soft nose design.

(3) Pad plates are to be provided beneath the gusset plates. In addition, the breadth of such pad plates is to be as narrow as practicable. The pad plates are to be made of steel with the same yield stress as the steel of the upper deck to which the pad plate is attached.

C21.2 Freeing Arrangements

C21.2.1 General

1 The "adequate provisions for freeing the space within superstructures" referred to in **21.2.1-3, Part CS** of the Rules is subject to the following.

(1) The minimum freeing port area on each side of the ship for the open superstructure (A_s) is not to be less than that obtained from the following formula.

$$A_s = \frac{A_1 b_0 h_s}{2 l_t h_w}\left\{1 - \left(\frac{l_w}{l_t}\right)^2\right\} \ (m^2)$$

A_1: As given by the following formulae

Where l_t is not more than 20 m: $0.7 + 0.035 l_t \ (m^2)$

Where l_t is more than 20 m: $0.07 l_t \ (m^2)$

l_t : As given by the following formula:

$l_w + l_s \ (m)$

l_w : Length (m) of the open deck enclosed by bulwarks

l_s : Length (m) of the common space within the open superstructure

b_0 : Breadth (m) of the openings in the end bulkhead of the enclosed superstructure

h_s : One standard superstructure height (m) according to the requirement in **Part V**

h_w: The distance (m) of the well deck above the freeboard deck

(2) The minimum freeing port area on each side of the ship for the open well (A_w) is not to be less than that obtained from the following formula.

$$A_w = \frac{A_2 h_s}{2 h_w} \ (m^2)$$

A_2: As given by the following formulae

Where l_w is not more than 20 m: $0.7 + 0.035 l_w + a \ (m^2)$

Where l_w is more than 20 m: $0.07 l_w + a \ (m^2)$

a : As obtained from the following formulae

Where h is more than 1.2 m: $0.04 l_w (h - 1.2) \ (m^2)$

Where h is not more than 1.2 m, but not less than 0.9 m: 0 (m^2)

Where h is less than 0.9 m: $-0.04 l_w (0.9 - h) \ (m^2)$

h : Average height (m) of bulwarks above the deck

l_w, h_s and h_w: As specified in **(1)**

(3) In ships either without sheer or with less sheer than the standard, the minimum freeing port

area obtained from **(1)** and **(2)** above is to be multiplied by the factor obtained from the following formula.

$$1.5 - \frac{S}{2S_0}$$

S : Average of actual sheer (*mm*)

S_0: Average of the standard sheer (*mm*) according to the requirements in **Part V**

2 The requirements in **21.2.1-4, Part CS** of the Rules apply to type "*A*" or "*B*-100" ships with especially reduced freeboards.

3 The requirements in **21.2.2-4, Part CS** of the Rules apply to type "*A*" or "*B*-100" ships with especially reduced freeboards having trunks.

CS21.2.2 Freeing Port Area

1 A flush-decker having an effective deckhouse is to be considered to have two wells afore and abaft the deckhouse, and each of these wells is required to have a freeing port area as prescribed in **21.2.2, Part CS** of the Rules. The term "effective deckhouse" means a structure having a breadth not less than 80% of the breadth of ship and the width of passageways at its sides does not exceed 1.5 *m*.

2 Where a divisional bulkhead extending from side to side is provided at the forward end of deckhouse, the ship is to be considered to have two wells afore and abaft the bulkhead, irrespective of the breadth of deckhouse, and each of these wells is required to have the freeing port area prescribed in **21.2.2, Part CS** of the Rules.

3 In ships complying with the provisions of **CS21.2.1-2**, the guardrails installed on more than half the length of the exposed parts of the freeboard deck may be replaced by freeing ports in the lower parts of the bulwarks, for at least 33% of the total area of bulwarks. In ships complying with the provisions of **CS21.2.1-3**, the guardrails installed on half the length of trunks may be replaced by freeing ports in the lower parts of the bulwarks, for at least 33% of the total area of bulwarks.

4 In type "*B*-60" ships, freeing ports in the lower parts of bulwarks are to have an area not less than 25% of the total area of bulwarks.

5 Where freeing ports have rails or other fixtures that reduce the area of the opening, the projected area caused by these fixtures is to be deducted from the actual freeing port area during calculations.

6 Where a recess in the side shell or superstructure of a pure car carrier or similar ship forms a well, adequate freeing ports are to be provided in accordance with the requirements of **21.2.2-3, Part CS** of the Rules.

7

(1) "Where a ship is provided with a trunk or a hatch side coaming which is continuous or substantially continuous between detached superstructures" stipulated in **21.2.2-3, Part CS** of the Rules refers to the case where F_0 is not greater than F_1, and F_0 and F_1 are shown below.

F_0: Free flow area (m^2) through which water runs across the deck given by the following formula

$\sum(l_i h_i - a_i)$

l_i : Distance (*m*) between hatchways, and between hatchways and superstructures and deckhouses

h_i: Height (*m*) of bulwarks

a_i: Projected area (m^2) of structures which prevent free flow in $l_i h_i$

F_1: As specified in **21.2.2-1** and **-2, Part CS** of the Rules (m^2)

(2) Where F_0 is greater than F_1, but not greater than F_2, the freeing port area (F) is to be increased by the following formula. F_0 and F_1 are shown in **(1)** above, and F_2 is shown below.

$F = F_1 + F_2 - F_0$ (m^2)

F_2: As specified in **21.2.2-3, Part CS** of the Rules (m^2)

(3) Where F_0 is greater than F_2, F is to be equal to F_1. F_0, F_1 and F_2 are shown in **(1)** and **(2)** above.

CS21.2.3 Arrangement of Freeing Ports

In ships without sheer or having very small sheer, the area of freeing ports is to be distributed throughout the whole length of the well.

CS21.3 Bow Doors and Inner Doors

CS21.3.1 Application

1 "Bow doors" referred to in **21.3.1, Part CS** of the Rules mean the doors provided forward of the collision bulkhead.

2 The "securing device", "supporting device" and "locking device" referred to in **21.3, Part CS** of the Rules mean the following devices.

(1) Securing device: a device used to keep the door closed by preventing it from rotating about its hinges.

(2) Supporting device: a device used to transmit external or internal loads from the door to a securing device and from the securing device to the ship's structure, or a device other than a securing device, such as a hinge, stopper or other fixed device that transmits loads from the door to the ship's structure.

(3) Locking device: a device that locks the securing device in the closed position.

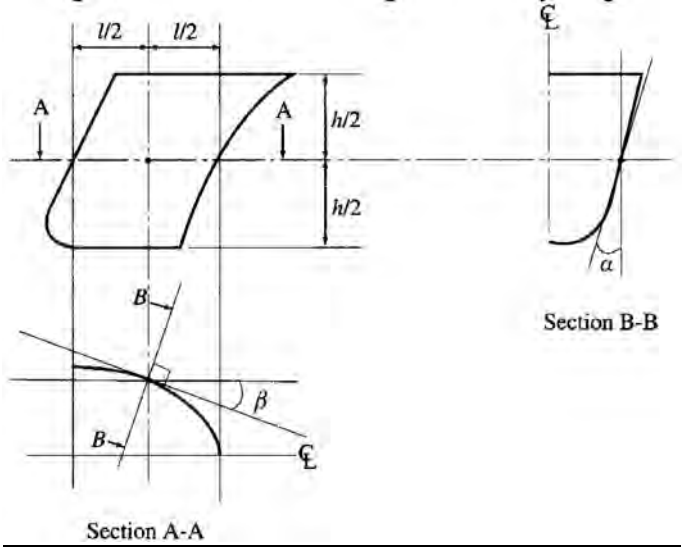
CS21.3.4 Design Loads

The "flare angle" and "entry angle" referred to in **21.3.4, Part CS** of the Rules mean the following angles. (*See*, **Fig. CS21.3.4-1**)

(1) Flare angle at the point to be considered is defined as the angle between a vertical line and the tangent to the side shell plating, measured in a vertical plane normal to the horizontal tangent to the shell plating.

(2) Entry angle at the point to be considered is defined as the angle between a longitudinal line parallel to the centreline and the tangent to the shell plating in a horizontal plane.

Fig. CS21.3.4-1 Flare Angle and Entry Angle



CS21.3.7 Securing and Supporting of Doors

"All load transmitting elements" referred to in **21.3.7-2(9), Part CS** of the Rules include pins, supporting brackets and back-up brackets.

CS21.3.8 Securing and Locking Arrangement

1 Making opening and closing systems as well as securing and locking devices "interlocked in such a way that they can only operate in the proper sequence" as stipulated in **21.3.8-1(3), Part CS** of the Rules means providing safeguards such as an interlocking system, where the doors can be closed only if securing and locking devices are released.

2 Making operating panels "inaccessible to unauthorized persons" as stipulated in **21.3.8-1(5), Part CS** of the Rules means providing safeguards such as installing a locking device on the operating panel.

3 In the application of **21.3.8-1(6), Part CS** of the Rules, if gravity or friction cannot maintain the door mechanically closed, securing devices such as mechanical pins are to be provided.

4 Indicator lights in the navigation bridge and on local operating panels specified in **21.3.8-2(1), Part CS** of the Rules are to indicate closing and securing conditions for each door. In addition, the required visual alarms are to indicate opening and lock-releasing conditions for each door. A common indicator can be used for both the securing and locking devices.

5 Visual and audible alarms specified in **21.3.8-2(1), Part CS** of the Rules are to be linked with the mode selection switch specified in **21.3.8-2(3), Part CS** of the Rules. The audible alarms may be equipped with a silence function switch.

6 Systems "designed on the fail safe principle" stipulated in **21.3.8-2(2)(a), Part CS** of the Rules means as follows.

(1) The indication panel is provided with:
   (a) A power failure alarm
   (b) A lamp test
   (c) A separate indication for door closed, door locked, door not closed, and door not locked

(2) Limit switches electrically close when the door is closed (when more limit switches are provided they may be connected in series)

(3) Limit switches electrically close when securing arrangements are in place (when more limit switches are provided they may be connected in series)

(4) Two electrical circuits (separate cables even if using multicore cable) with one for the indication of door closed/unclosed and the other for door locked/unlocked

(5) When the limit switches malfunction, an indication to show: unclosed, unlocked, and securing arrangement not in place - as appropriate

7 "A backup power source" referred to in **21.3.8-2(2)(c), Part CS** of the Rules may be regarded as a source of power (e.g., emergency generator with automatic start or electrical batteries) which is capable of supplying power within 45 *seconds* of a failure of the main source of power, or another secure supply of power (e.g., UPS) which is capable of supplying power for 18 *hours*.

8 In order to ensure that the sensors are "protected from water" as specified in **21.3.8-2(2)(d), Part CS** of the Rules, the sensors are required to have at least IP55 enclosures.

9 The "water leakage detection system" referred to in **21.3.8-2(4), Part CS** of the Rules is to be designed on the fail safe principle.

10 The "television surveillance system" referred to in **21.3.8-2(5), Part CS** of the Rules is to be designed on the fail safe principle.

11 The "audible alarm function" referred to in **21.3.8-2(6), Part CS** of the Rules is to be designed on the fail safe principle.

CS21.3.10 Operating and Maintenance Manual

The "Operating and Maintenance Manual" specified in **21.3.10-1 in Part CS** of the Rules is to include the following sentences.

The following recorded inspections of the door supporting and securing devices are to be carried out by the ship's staff;

(1) Inspections at monthly intervals

(2) Inspections following incidents that could result in damage, including heavy weather or contact in the region of doors

CS21.4 Side Shell Doors and Stern Doors

CS21.4.1 Application

1 "Side shell doors" and "stern doors" stipulated in **21.4.1, Part CS** of the Rules refer to the doors provided between the collision bulkhead and the after peak bulkhead and those provided after the after peak bulkhead.

2 The definitions of "securing device", "supporting device" and "locking device" referred to in **21.4, Part CS** of the Rules are to be as specified in **CS21.3.1**.

CS21.4.2 Arrangement of Doors

Shipside doors used for pilot transfer are to be in accordance with Regulation 23.5, Chapter V, SOLAS Convention.

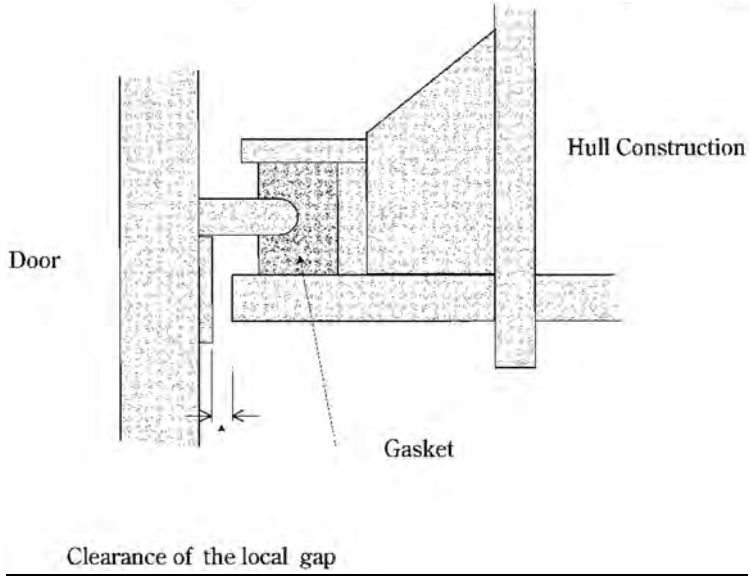
CS21.4.4 Design Loads

Where more than one securing and supporting devices are provided, vertical and horizontal forces may be considered as uniformly distributed between the devices.

CS21.4.6 Securing and Supporting of Doors

The "maximum design clearance between securing and supporting devices" stipulated in **21.4.6-1(4), Part CS** of the Rules refers to the permissible clearance of the local gap of the door in the secured condition. An example is shown in **Fig.CS21.4.6-1**. "All load transmitting elements" referred to in **21.4.6-2(4), Part CS** of the Rules includes pins, supporting brackets and back-up brackets.

Fig CS21.4.6-1 Maximum Design Clearance between Securing and Supporting Devices



CS21.4.7 Securing and Locking Arrangement

1 Making opening and closing systems as well as securing and locking devices "interlocked in such a way that they can only operate in the proper sequence" as stipulated in **21.4.7-1(3), Part CS** of the Rules means providing safeguards such as an interlocking system, where the doors can be closed only if securing and locking devices are released.

2 Making operating panels "inaccessible to unauthorized persons" as stipulated in **21.4.7-1(5), Part CS** of the Rules means providing safeguards such as installing a locking device on the operating panel.

3 In the application of **21.4.7-1(6), Part CS** of the Rules, if gravity or friction cannot maintain the door mechanically closed, securing devices such as mechanical pin are to be provided.

4 The "Ro-Ro spaces" referred in to **21.4.7-2, Part CS** of the Rules means spaces not normally subdivided in any way and extending to either a substantial length or the entire length of ship in which goods can be loaded and unloaded normally in a horizontal direction. (Refer to **3.2.41, Part R** of the Rules)

5 Indicator lights in the navigation bridge and on local operating panels specified in **21.4.7-2(2), Part CS** of the Rules are to indicate closing and securing conditions for each door. In addition, the required visual alarms are to indicate opening and lock-releasing conditions for each door. A common indicator can be used for both the securing and locking devices.

6 Visual and audible alarms specified in **21.4.7-2(2)(b), Part CS** of the Rules are to be linked with the mode selection switch specified in **21.4.7-2(4), Part CS** of the Rules. The audible alarms may be equipped with a silence function switch.

7 Systems "designed on the fail safe principle" stipulated in **21.4.7-2(3)(a), Part CS** of the Rules means as follows.

(1) The indication panel is provided with:
  (a) A power failure alarm
  (b) A lamp test
  (c) A separate indication for door closed, door locked, door not closed, and door not locked

(2) Limit switches electrically close when the door is closed (when more limit switches are provided they may be connected in series)

(3) Limit switches electrically close when securing arrangements are in place (when more limit switches are provided they may be connected in series)

(4) Two electrical circuits (separate cables even if using multicore cable) with one for the indication of door closed/unclosed and the other for door locked/unlocked

(5) Where the limit switches malfunction, an indication to show: unclosed, unlocked, and securing arrangement not in place - as appropriate

8 "A backup power source" referred to in **21.4.7-2(3)(c), Part CS** of the Rules may be regarded as a source of power, (e.g., emergency generator with automatic start or electrical batteries) which is capable of supplying power within 45 *seconds* of a failure of the main source of power, or another secure supply of power (e.g., UPS) which is capable of supplying power for 18 *hours*.

9 In order to ensure that the sensors are "protected from water" as specified in **21.4.7-2(3)(d), Part CS** of the Rules, the sensors are required to have at least IP55 enclosures.

CS21.4.9 Operating and Maintenance Manual

The "Operating and Maintenance Manual" specified in **21.4.9-1, Part CS** of the Rules is to include the following sentences.

The following recorded inspections of the door supporting and securing devices are to be carried out by the ship's staff;

(1) Inspections at monthly intervals

(2) Inspections following incidents that could result in damage, including heavy weather or

contact in the region of doors

CS21.5 Side Scuttles and Rectangular Windows

CS21.5.1 General Application

1 With respect to the provisions of **21.5, Part CS of the Rules**, side scuttles with round or oval openings having areas exceeding 0.16 m^2 are to be treated as windows.

2 With respect to the provisions of **21.5.1-1, Part CS** of the Rules, the design pressures of windows in the fore end bulkheads of superstructures and deckhouses above the third tier located above the freeboard deck and forward of 0.5*L* are not to be less than the minimum design pressures given in **Table CS21.5, Part CS** of the Rules. However, this requirement may be dispensed with if the height of the highest deck at the fore end is not less than 22 *m* above the designed maximum load line, or if cargo, etc. is regularly loaded onto exposed decks in front of the windows (e.g., container carriers).

3 With respect to the provisions of **21.5.1-2, Part CS** of the Rules, windows on the navigation bridge up to the third tier above the freeboard deck permitted to be rectangular according to the provisions of **21.5.6, Part CS** of the Rules may be other than those of Class *E* or Class *F* subject to the following **(1)** and **(2)**.

(1) The navigation bridge is to be separated from spaces below the freeboard deck and spaces within enclosed superstructures by the followings
   (a) Weathertight closing devices
   (b) Two or more cabin bulkheads or doors
   The height of the doorway sill to the navigation bridge is not to be less than that required for closing devices at the position of such a doorway.

(2) The design pressure of such windows is not to be less than the value specified in **21.5.8, Part CS** of the Rules. The frame of the window is to conform to Class *E* or Class *F* according to the location it is installed, and the window is to have appropriate weathertightness.

CS21.5.3 Application of Side Scuttles

The side scuttles "deemed appropriate by the Society" referred to in **21.5.3-5, Part CS** of the Rules are class *B* side scuttles or class *A* side scuttles without deadlights in cases where the height of superstructures and deckhouses specified in **21.5.3-5, Part CS of the Rules** is greater than standard quarterdeck height specified in **V2.2.1-1**.

CS21.5.5 Design Pressure and Maximum Allowable Pressure of Side Scuttles

With respect to the provisions of **21.5.5-1, Part CS** of the Rules, the value of coefficient "*a*" for side scuttles for spaces below the freeboard deck or spaces within superstructures may be determined using the formula for the first tier deckhouse in the provisions of **18.2.1-1, Part CS** of the Rules.

CS21.5.7 Application of Rectangular Windows

The rectangular windows "deemed appropriate by the Society" referred to in **21.5.7-3, Part CS** of the Rules are rectangular windows without shutters or deadlights. In such cases, deckhouses situated on the following spaces may be regarded as being in the second tier of the freeboard deck.

(1) A raised quarterdeck of a height equal to or greater than the standard quarterdeck height specified in **V2.2.1-1**.

(2) The deck of a superstructure of a height equal to or greater than the standard quarterdeck height specified in **V2.2.1-1**.

(3) The deck of a deckhouse of a height equal to or greater than the standard quarterdeck height specified in **V2.2.1-1**.

CS21.6 Ventilators

CS21.6.5 Closing Appliances

1 Closing appliances required in **21.6.5, Part CS of the Rules** are to be of steel or other equivalent materials. Furthermore, the closing appliances of the ventilators for machinery and cargo spaces required in **21.6.5-1, Part CS of the Rules** are to have inherent corrosion resistance properties or be provided with an adequate anticorrosion treatment.

2 With respect to the provisions of **21.6.5, Part CS of the Rules**, mechanical ventilation systems are to be provided with warning plates stating that the closing appliances of mechanical ventilation systems are generally to be closed after the ventilation system has been shut off, unless reinforced.

3 With respect to the provisions of **21.6.5-1, Part CS of the Rules**, in cases where internal checks of ventilators are impossible even if equipment installed on board is used, e.g. large ventilators that have cowls which cannot be easily removed or ventilators that have fans installed above, an inspection port at least 150 *mm* in diameter is to be installed in the coaming of the ventilator. In addition, such inspection ports are to be provided with suitable covers so as not to spoil the water tightness/weather tightness and fire resistance required for the coaming of ventilators.

CS21.6.7 Ventilators for Emergency Generator Room

1 Where it is not practicable for the height of ventilator coamings to comply with **21.6.7, Part CS** of the Rules, they are to comply with the following requirements **(1)** or **(2) instead**.

(1) Where the emergency generator room is located in an enclosed superstructure, the ventilators are to have coamings in compliance with **21.6.1, Part CS** of the Rules, and are to be fitted with weathertight closing appliances in combination with other suitable arrangements to ensure adequate ventilation.

(2) In cases other than **(1)** above, where the emergency generator room has no opening leading to a space below the freeboard deck, the height of coamings of ventilators to supply air to the emergency generator room, above the upper surface of the deck, is to be at least 900 *mm* above the surface of the deck in Position I or 760 *mm* above the surface of the deck in Position II specified in **19.1.2, Part CS** of the Rules. In addition, these ventilator openings are to be fitted with suitable protection devices such as louvers to prevent the intrusion of sea-water. Openings on the boundaries of the emergency generator room are to be treated in a similar manner.

2 The weathertight closing appliances and louvers specified in **-1** above are also to comply with requirements specified in **1.3.5-2, Part D of the Rules**.

CS21.6.8 Additional Requirement for Ventilators Fitted on Exposed Fore Deck

The strength of ventilators and their closing devices in **21.6.8, Part CS** of the Rules are to comply with the following requirements.

(1) Applied Loads

Forces acting in the horizontal direction on the pipe and its closing device are to be calculated by using the pressure (p) obtained from the following formula and the largest projected area of each component.

$p = 0.5\rho V_w^2 C_a C_s C_p$ *(kN/m²)*

ρ : Density of sea water (1.025 *t/m*^{3})

V_w: Velocity of water over the fore deck given by the following:

$13.5(m/sec)$: for $h_{ed} \leq 0.5h_t$

$13.5\sqrt{2\left(1-\frac{h_{ed}}{h_t}\right)}\,(m/sec)$: for $0.5h_t < h_{ed} < h_t$

h_{ed}: Distance from the designed maximum load line to exposed deck (m)

h_t : $0.1L_1$ or 22 m whichever is the lesser

C_d: Shape coefficient (0.5 for pipes and 1.3 for ventilator head in general, 0.8 for ventilator head of cylindrical form with its axis in the vertical direction)

C_s : Slamming coefficient (3.2)

C_p : Protection coefficient given by the following

(0.7): for pipes and ventilator heads located immediately behind a breakwater or forecastle

(1.0): elsewhere and immediately behind a bulwark

(2) Strength Requirements

(a) Bending moments and stresses in air and ventilator pipes are to be calculated at critical positions, such as at penetration pieces, at weld or flange connections, and at toes of supporting brackets. Bending stresses in the net section are not to exceed 0.8 times σ_y, where σ_y is the specified minimum yield stress or 0.2% proof stress of steel at room temperature. Irrespective of corrosion protection, a corrosion addition to the net section of 2.0 *mm* is then to be applied.

(b) For standard ventilators of 900 *mm* height closed by heads of not more than the tabulated projected area, pipe thickness standards are to be according to **Table CS21.6.8-1.** Where brackets are required, three or more radial brackets of a gross thickness of 8 *mm* or more, of a minimum length of 100 *mm*, and a height according to **Table CS21.6.8-1** are to be fitted; but they need not extend over the joint flange for the head. Bracket toes at the deck are to be suitably supported.

(c) For other configurations, loads according to **(1)** are to be applied, and means of support are to be determined in order to comply with the requirements of **(a)**. Brackets, where fitted, are to be of suitable thickness and length according to their height. Pipe thickness is not to be less than as indicated in column 1of **Table CS21.7, Part CS** of the Rules.

(d) All component parts and connections of the air pipe or ventilator are to be capable of withstanding the loads defined in **(1)**.

(e) Rotating type mushroom ventilator heads are deemed unsuitable.

Table CS21.6.8-1900 *mm* Ventilator Pipe Thickness and Bracket Standards

Nominal pipe diameter (*mm*)	Minimum fitted gross thickness (*mm*)	Maximum projected area of head (cm^2)	Height of brackets (*mm*)
80*A*	6.3	-	460
100*A*	7.0	-	380
150*A*	8.5	-	300
200*A*		550	-
250*A*		880	-
300*A*		1200	-
350*A*		2000	-
400*A*		2700	-
450*A*		3300	-
500*A*		4000	-

CS21.7 Gangways

CS21.7.1 General

1 In order to satisfy the provisions of **21.7.1, Part CS** of the Rules that require a means of protecting crew passageways on the exposed freeboard or raised quarterdeck, a means from **Table CS21.7.1-1** is to be provided according to the assigned freeboard or location onboard

2 In **Table CS21.7.1-1**, "**a**" to "**f**" refer to installations and **1)** to **5)** refer to locations onboard, as specified in the following **(1)** and **(2)**.

(1) Acceptable arrangements

a: A well lighted and ventilated under-deck passageway (clear opening 0.8 *m* wide, 2.0 *m* high) as close as practicable to the freeboard deck, connecting and providing access to the locations in question

b: A permanent and efficiently constructed gangway fitted at or above the level of the superstructure deck on or as near as practicable to the centre line of the ship, providing a continuous platform at least 0.6*m* in width and a non-slip surface, with guard rails extending on each side throughout its length

Guard rails shall be at least 1 *m* high with courses as required in **21.1.2-2** and **21.1.2-4**, **Part CS** of the Rules, and supported by stanchions spaced not more than 1.5 *m*, and with a foot-stop.

c: A permanent walkway at least 0.6 *m* in width fitted at freeboard deck level consisting of two rows of guard rails with stanchions spaced not more than 3 *m* apart

The number of courses of rails and their spacing are to be as required by **21.1.2-2** and **21.1.2-4**, **Part CS** of the Rules. On Type B ships, hatch coamings not less than 0.6 *m* in height may be regarded as forming one side of the walkway, provided that between the hatches two rows of guard rails are fitted.

d: A 10 *mm* minimum diameter wire rope lifeline supported by stanchions not more than 10 *m* apart, or a single hand rail or wire rope attached to hatch coamings, continued and adequately supported between hatches

e: A permanent and efficiently constructed gangway for tankers fitted at or above the level of the superstructure deck on or as near as practicable to the centre line of the ship:

- located so as not to hinder easy access across the working areas of the deck
- providing a continuous platform at least 1.0 *m* in width
- constructed of fire resistant and non-slip material
- fitted with guard rails extending on each side throughout its length; guard rails should be at least 1.0 *m* high with courses as required by **21.1.2-2** and **21.1.2-4**, **Part CS** of the Rules, and supported by stanchions spaced not more than 1.5 *m*
- provided with a foot stop on each side
- having openings (not more than 40 *m* apart) with ladders where appropriate, to and from the deck
- having shelters of substantial construction set in way of the gangway at intervals not exceeding 45 *m* if the length of the exposed deck to be traversed exceeds 70 *m*

  Every such shelter should be capable of accommodating at least one person (1×1×2 *m* in size as standard, and at least 0.6 *m* in width of entrance), be so constructed as to afford weather protection on the forward, port and starboard sides and the strength is to be in accordance with the requirements of **Chapter 18, Part CS** of the Rules.

f: A permanent and efficiently constructed walkway fitted at or above the level of the freeboard deck on or as near as practicable to the centre line of the ship having the same specifications as those for a permanent gangway listed in the arrangements "**e**" except for footstops

On type B ships (certified for the carriage of liquids in bulk), with a combined height of

hatch coamings and fitted hatch covers of together not less than 1 *m* in height, the hatch coamings may be regarded as forming one side of the walkway, provided that between the hatches two rows of guard rails are fitted.

(2) Alternative transverse locations for arrangements

1): At or near the centre line of the ship; or fitted on hatch covers at or near the centre line of the ship

2): Fitted on each side of the ship

3): Fitted on one side of the ship, provision being made for fitting on either side

4): Fitted on one side only

5): Fitted on each side of the hatches as near to the centre line as practicable

3 Precautions regarding arrangements specified in **-1** above

(1) Where wire ropes are fitted, turnbuckles are to be provided to ensure their tautness.

(2) Wire ropes may only be acceptable in lieu of guard rails in special circumstances and then only in limited lengths.

(3) Lengths of chain may only be acceptable in lieu of guard rails where fitted in between two fixed stanchions.

(4) Where stanchions are fitted, every third stanchion is to be supported by a bracket or stay.

(5) Removable or hinged stanchions shall be capable of being locked in the upright position.

(6) A means of passage over obstructions, if any, such as pipes or other fittings of a permanent nature, should be provided.

(7) Generally, the width of the gangway and deck-level walkway should not exceed 1.5 *m*.

4 Where a suitable passage facility is unable to be secured on or under the deck due to cargoes loaded on the exposed deck, life lines or guardrails are to be provided on the cargo on or near the centre line of the ship. Where a lumber freeboard is assigned, in addition to the above, life lines or guardrails, the height of which is at least 1.0 *m* and the clearance between courses is less than 350 *mm*, are to be fitted on both sides of the deck lumber.

Table CS21.7.1-1 Protection of Crew on Exposed Deck or Raised Quarter Deck

Locations of access in Ship	Assigned Summer Freeboard	Acceptable arrangements according to type of freeboard assigned:			
		Type A	Type B-100	Type B-60	Type B&B+
1.1 Access to Midship Quarters 1.1.1 Between poop and bridge,	≤ 3000 *mm*	A b e	a b e	a b c 1) e f 1)	a b c 1) c 2) c 4) d 1) d 2) d 3) e f 1) f 2) f 4)
1.1.2 Between poop and deckhouse containing living quarters or navigating equipment, or both.	> 3000 *mm*	A b e	a b e	a b c 1) c 2) e f 1) f 2)	
1.2 Access to Ends 1.2.1 Between poop and bow (if there is no bridge) 1.2.2 Between bridge and bow. 1.2.3 Between a deckhouse containing living quarters	≤ 3000 *mm*	A b c 1) e f 1)	a b c 1) c 2) e f 1) f 2)	a b c 1) c 2) e f 1) f 2)	
or navigating equipment, or both, and bow 1.2.4 In the case of a flush deck vessel, between crew accommodation and the forward and after ends of ship	> 3000 *mm*	a b c 1) d 1) e f 1)	a b c 1) c 2) d 1) d 2) e f 1) f 2)	a b c 1) c 2) c 4) d 1) d 2) d 3) e f 1) f 2) f 4)	

CS21.7.2 Tankers

1 Notwithstanding **CS21.7.1**, safe access to the bow is to be provided by at least one permanent arrangement noted in **Table CS21.7.2-1**.

2 Notations in **Table CS21.7.2-1** are as specified in **CS21.7.1-2**.

3 For tankers less than 100 *m* in length, the minimum width of the gangway platform or deck level walkway fitted in accordance with the arrangements "**e**" or "**f**", respectively, may be reduced to 0.6 *m*.

4 For gas carriers, where gangways are provided sufficiently high above the freeboard deck or where permanently constructed arrangements achieve an equivalent level of safety, the Society may approve modifications to the provisions of **-1** above. "Sufficiently high above the freeboard deck" means a vertical height of more than 3 times the standard superstructure height specified in **Table V2.2.1-1**.

Table CS21.7.2-1 Protection of Crew on Exposed Freeboard Deck or Raised Quarter Deck for Tankers

Location of access in Ship	Assigned Summer Freeboard	Acceptable arrangements according to type of freeboard assigned:
2.1 Access to Bow 2.1.1 Between poop and bow 2.1.2 Between a deckhouse containing living accommodation or navigating equipment or both, and bow 2.1.3 In the case of a flush deck vessel, between crew accommodation and the forward ends of ship	$\leq (Af + Hs)$*	a e f 1) f 5)
	$\geq (Af + Hs)$*	a e f 1) f 2)
2.2 Access to After End 2.2.1 In the case of a flush deck vessel, between crew accommodation and the after end of ship	As required in **1.2.4** of **Table CS21.7.1-1** for other types of ships	

Notes:

Af: Minimum summer freeboard calculated as type A ship regardless of the type of freeboard actually assigned

Hs: Standard height of superstructure as defined in **Table V2.2.1-1.**

CS21.8 Means of Embarkation and Disembarkation

CS21.8.1 General

1 The wording "specially approved by the Society" specified in **21.8.1, Part CS of the Rules** means those cases where a ship is engaged in voyages between designated ports where appropriate shore accommodation/embarkation ladders (platforms) are provided.

2 With respect to the requirements specified in **21.8.1, Part CS of the Rules**, the means of embarkation and disembarkation are to be in accordance with the following. However, ships that have small freeboards and are provided with boarding ramps needs not to be in accordance with the following:

(1) Accommodation ladders and gangways are to be constructed based on ISO 5488:1979 "*Shipbuilding - accommodation ladders*", ISO 7061:1993 "*Shipbuilding - aluminium shore gangways for seagoing vessels*" or standards where deemed appropriate by the Society. Accommodation ladder winches are to be constructed based on ISO 7364:1983 "*Shipbuilding and marine structures – deck machinery – accommodation ladder winches*" or standards where deemed appropriate by the Society or are to be the one pursuant to aforementioned standards.

(2) The structure of the accommodation ladders and gangways and their fittings and attachments are to be such as to allow regular inspection, maintenance of all parts and, if necessary, lubrication of their pivot pin. Special care is to be paid to welding connection.

(3) As far as practicable, the means of embarkation and disembarkation are to be sited clear of the working area and are not to be placed where cargo or other suspended loads may pass overhead. However, in cases where the Society recognizes unavoidable circumstances, the means of embarkation and disembarkation may be installed within the above mentioned areas or places, provided that safe passage is ensured through description in operation manuals, the installation of warning plates, and so on.

(4) Each accommodation ladder is to be of such a length to ensure that, at a maximum design operating angle of inclination, the lowest platform will be not more than 600 *mm* above the

waterline in the lightest seagoing condition (in this regard, trim is to be the condition resulting from the loading condition of the lightest seagoing condition), as defined in SOLAS Regulation III/3.13. However, in cases where the height of the embarkation/disembarkation deck exceeds 20 *m* above the waterline or is deemed appropriate by the Society, an alternative means of providing safe access to the ship or supplementary means of access to the bottom platform of the accommodation ladder may be accepted.

(5) The arrangement at the head of the accommodation ladder is to provide direct access between the ladder and the ship's deck by a platform securely guarded by handrails and handholds. The ladder is to be securely attached to the ship to prevent overturning.

(6) Each accommodation ladder or gangway is to be clearly marked at each end with a plate showing the restrictions on the safe operation and loading, including the maximum and minimum permitted design angles of inclination, design load, maximum load on bottom end plate, etc. Where the maximum operational load is less than the design load, it is also to be shown on the marking plate.

(7) Gangways are not to be used at an angle of inclination greater than 30 *degrees* from the horizontal and accommodation ladders are not to be used at an angle greater than 55 *degrees* from the horizontal, unless designed and constructed for use at angles greater than these and marked as such.

(8) Gangways are not to be secured to a ship's guardrails unless they have been designed for that purpose. If positioned through an open section of bulwark or railings, any remaining gaps are to be adequately fenced.

(9) Adequate lighting is to be provided to illuminate the means of embarkation and disembarkation, the position on deck where persons embark or disembark and the controls of the arrangement.

(10) A lifebuoy equipped with a self-igniting light and a buoyant lifeline is to be available for immediate use in the vicinity of the embarkation and disembarkation arrangement when in use. This lifebuoy is not to be taken into account when determining the minimum number and distribution of lifebuoys as required by *SOLAS* Reg. III/32.1.1.

(11) A safety net is to be mounted and arrangements that enable the installation of such net are to be provided to prevent falling accident in cases where it is possible that a person may fall from the means of embarkation and disembarkation or between the ship and quayside.

CS22 has been added as follows.

CS22 CEILINGS, SPARRINGS, CEMENTING AND PAINTING

CS22.2 Sparrings

CS22.2.1 Sparrings

1 The "equivalent arrangements … for the protection of framing" prescribed in **22.2.1-1, Part CS** of the Rules are to be in accordance with the following **(1)** and **(2)**.

(1) Hold frames are to be stiffened by one of the following:

(a) Longitudinal stiffeners or tripping brackets are to be fitted at intervals of about 2 *m*.

(b) Angle bars are to be fitted longitudinally at intervals of about 1.5 *m* on the flange surface of hold frames.

(c) Flat bars of about 150 *mm* wide 10 *mm* thick are to be fitted longitudinally at intervals of about 0.5 *m* on the flange surface of hold frames.

(2) Angle bars or flat bars (in case of flat bars, at least 2 tiers) are to be fitted longitudinally on the flange surface of tank side brackets or on the lower bracket of hold frames of bulk carrier type ships. However, the above requirements may be dispensed with where the thickness and breadth of the flange of hold frames of bulk carrier type ships are not less than that determined by the following.

(a) Thickness of bracket t = As determined by **Table CS1.4 of Part CS of the Rules** taking the arm length in **Fig. CS22.2.1-2** as the longer arm of the bracket

(b) Breadth of flange b = Value obtained from the following formula

$128\sqrt{d_0 l}$ (*mm*)

d_0: Depth of throat of bracket (*m*)

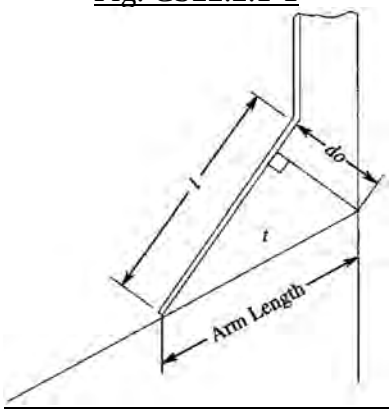
l: Length of flange of bracket (*m*)

2 For ships intended to carry timbers, the special protection of framing is to be in accordance with the following **(1)** and **(2)** in addition to the requirements of **-1** above,

(1) Where hold frames come right under hatchway at forward or after part of ship, the hold frames are to be stiffened further.

(2) Consideration is to be given on arrangement and size of tripping brackets for deep hold frames or other similar deep hull structural members.

Fig. CS22.2.1-1



CS22.4 Painting

CS22.4.1 General

1 Limitation of Using Aluminium Paint

Paints containing aluminium greater than 10 percent aluminium by weight in the dry film are not to be used in hazardous areas defined in **4.2.3-1** or **4.2.3-2, Part H** of the Rules in tankers and ships carrying dangerous chemicals in bulk intended to carry crude oil and petroleum products having a flashpoint not exceeding 60℃ and a Reid vapour pressure below atmospheric pressure or other liquid cargoes having similar fire hazards.

2 Cathodic Protection System

With respect to the provisions of **22.4, Part CS** of the Rules, where a cathodic protection system is adopted as a backup for coating or the omission of painting, the cargo tanks and their adjacent tanks in tankers and ships carrying dangerous chemicals in bulk, intended to carry crude oil and petroleum products having a flash point not exceeding 60˚C and Reid vapour pressure below atmospheric pressure or other liquid cargoes having similar fire hazards are to be in accordance with the following requirements.

(1) The anodes are to have steel cores and these are to be sufficiently rigid to avoid resonance in the anode support and be designed so that the anode does not come free when the surroundings become wasted.

(2) The anode is to be provided in accordance with **(a)** or **(b)**. When anode inserts and/or supports are welded to the structure, they are to be arranged so that the welds are clear of stress raisers. The supports at each end of an anode are not to be attached to separate structures which are likely to move independently.

(a) The steel inserts are to be attached to the structure by means of a continuous weld of adequate section.

(b) The steel inserts are to be attached to separate supports which are attached to the structure by means of a continuous weld of adequate section, by bolting, provided a minimum two bolts with locknuts are used or by appropriate mechanical means of clamping deemed as equivalent by the Society.

(3) Where anodes of aluminium or aluminium alloy are used, they are to meet the following requirements.

(a) Anodes are to be located such that their potential energy does not exceed 274.68*N-m*. The height of the anode is to be measured from the bottom of the tank to the centre of the anode, and its weight is to be taken as the weight of the anode as fitted, including the fitting devices and inserts. However, where anodes are located on horizontal surfaces not less than 1*m* wide and fitted with an upstanding flange or face flat projecting not less than 75*mm* above the horizontal surface, the height of the anode may be measured from this surface.

(b) Anodes are not to be located under tank hatches or butterworth openings, unless protected from any objects falling on the fitted anodes by an adjacent structure.

(4) Anodes of magnesium or magnesium alloy are not permitted.

CS22.4.2 Protective Coatings in Dedicated Seawater Ballast Tanks and Double-side Skin Spaces

1 The application of **22.4.2**, **Part CS** of the Rules with respect to coating system applications is to be in accordance with IACS Unified Interpretations SC223, as may be amended.

2 With respect to the provision of **22.4.2, Part CS of the Rules,** the following tanks are not considered to be dedicated seawater ballast tanks, provided the coatings applied in the tanks described in **(2)** below are confirmed by the coating manufacturer to be resistant to the media stored in the tanks, and are applied and maintained according to the coating manufacturer's procedures.

(1) Tanks identified as “Spaces included in Net Tonnage” in the International Convention on Tonnage Measurement of Ships, 1969

(2) Sea water ballast tanks in livestock carriers also designated for the carriage of the livestock dung

CS25.4.3 Corrosion Protection for Cargo Oil Tanks

1 “Crude oil tankers” in **22.4.3, Part CS of the Rules** refers to ships defined in **2.1.1(19), Part 1 of the Rules for Marine Pollution Prevention Systems**, and falling under items 1.11.1 or 1.11.4 of the Supplement to the International Oil Pollution Prevention Certificate (Form B).

2 The requirements of **22.4.3, Part CS of the Rules** need not be applied to “combination carrier” defined in **2.1.1(8), Part 1 of the Rules for Marine Pollution Prevention Systems** and “ships carrying dangerous chemicals in bulk” including ships certified to carry oil stipulated in **2.1.1(1), Part 1 of the Rules for Marine Pollution Prevention Systems**.

3 With respect to **22.4.3(1), Part CS of the Rules**, IACS Unified Interpretation SC259 as may be amended is to be applied.

4 With respect to **22.2.3(2), Part CS of the Rules**, IACS Unified Interpretation SC258 as may be amended is to be applied.

CS23 EQUIPMENT

CS23.1 Anchors, Chain and Ropes

Paragraphs CS23.1.1 and CS23.1.2 have been added as follows.

CS23.1.1 General

1 The "special consideration" referred to in **23.1.1-3, Part CS of the Rules** means the evaluation of the design effectiveness of anchors, chain cables and windlasses.

CS23.1.2 Equipment Numbers

1 Significant figures are to be taken as follows:

(1) Dimensions, such as length, height, and breadth are to be in metres rounded to two decimal places.

(2) The displacement W is to be measured in tons in whole numbers.

(3) Terms in the formula ($W^{2/3}$, $2.0(hB+S_{fun}$, $0.1A$) are to be rounded to the nearest whole number.

Example

$L_2 = 313.00\,m$ (Designed)

$= 313.06\,m$ (Scantling)

$B = 48.20\,m$

$D = 25.50\,m$

$d = 19.00\,m$ (Designed)

$d_s = 19.8\,m$ (Scantling)

$W = 253{,}800\,t$ (Scantling)

$f = 25.50 - 19.80 = 5.70$

$h' = 2.70 \times 4 + 2.80 \times 1 = 13.60$

$h = 5.70 + 13.60 = 19.30$

$f \times$ $= 5.70 \times 313.06 = 1{,}784.4$

(figures below 1st place of decimals omitted)

$(h'' \times l)$

Upper deck house $= 2.70 \times 40.85 = 110.2$

(figures below 1st place of decimal omitted)

A deckhouse $= 2.70 \times 40.85 = 110.2$ (〃)

B deckhouse $= 2.70 \times 34.85 = 94.0$ (〃)

+) C deckhouse $= 2.70 \times 34.85 = 94.0$ (〃)

$\sum(h'' \times l) = 408.4$

$A = 1{,}784.4 + 408.4 = 2{,}192$ (fraction omitted)

$W^{2/3} = 253{,}800^{2/3} = 4{,}009$

(whole number rounded to nearest)

$2.0\,hB = 2.0 \times 19.30 \times 48.20 = 1{,}861$ (〃)

+) $0.1A = 0.1 \times 2{,}192 = 219$ (〃)

Equipment number $= 6{,}089$

2 Measurement of breadth of structures for second term of the formula in **23.1.2, Part CS of the Rules**

(1) Structures are to be treated as separated above and below by a deck level. A continuous superstructure or deckhouse situated on one tier is to be treated as a single structure

irrespective of the mode of variation of their breadth and height, continuous or discontinuous, and the breadth is to be the largest one as shown in **Fig. CS23.1.2-1**.

(2) As for detached independent deckhouses on one tier, breadths of respective deckhouses are to be measured separately to determine whether they are to be included or not. (*See* **Fig. CS23.1.2-2**)

(3) Where a deckhouse having a breadth greater than *B*/4 is above a deckhouse with a breadth of *B*/4 or less, the narrow deckhouse may be ignored. (*See* **Fig. CS23.1.2-3**)

(4) When calculating *h*, sheer and trim are to be ignored. (*See* **Fig. CS23.1.2-4**)

3 Side projected area *A* may be in accordance with following **(1)** and **(2)**.

(1) The area of deck camber may disregarded when determining side projected area *A*.

(2) Side projected area *A* may be calculated using following formula.

(a) *A* is the value obtained from the following formula:

$aL_2 + \sum h''l$

$\Sigma h''l$: Sum of the products of the height h'' (*m*) and length l (*m*) of superstructures, deckhouses, trunks or funnels which are located above the uppermost continuous deck within L_2 and also have a breadth greater than *B*/4 and a height greater than 1.5 *m*

(b) Structures are to be treated as separated above and below by a deck level. A continuous superstructure or deckhouse situated on one tier is to be treated as a single structure irrespective of the mode of variation of their breadth and height, continuous or discontinuous. The length of the single structure is to be the value at the largest point. However, if the height is not more than 1.5 *m*, the part of the single structure is to be ignored. (See **Fig. CS23.1.2-5**)

(c) h'' is the height (*m*) at the centreline of each tier of deckhouses having a breadth greater than *B*/4.

4 Structures to be included in the third term of the formula in **23.1.2, Part CS of the Rules**

(1) The following items may be excluded from ship side projected area A:

(a) portions outside the fore and aft ends of *L*

(b) derrick posts, ventilators, etc. in continuation with superstructures or deckhouses

(c) cargoes loaded on decks

Fig. CS23.1.2-1

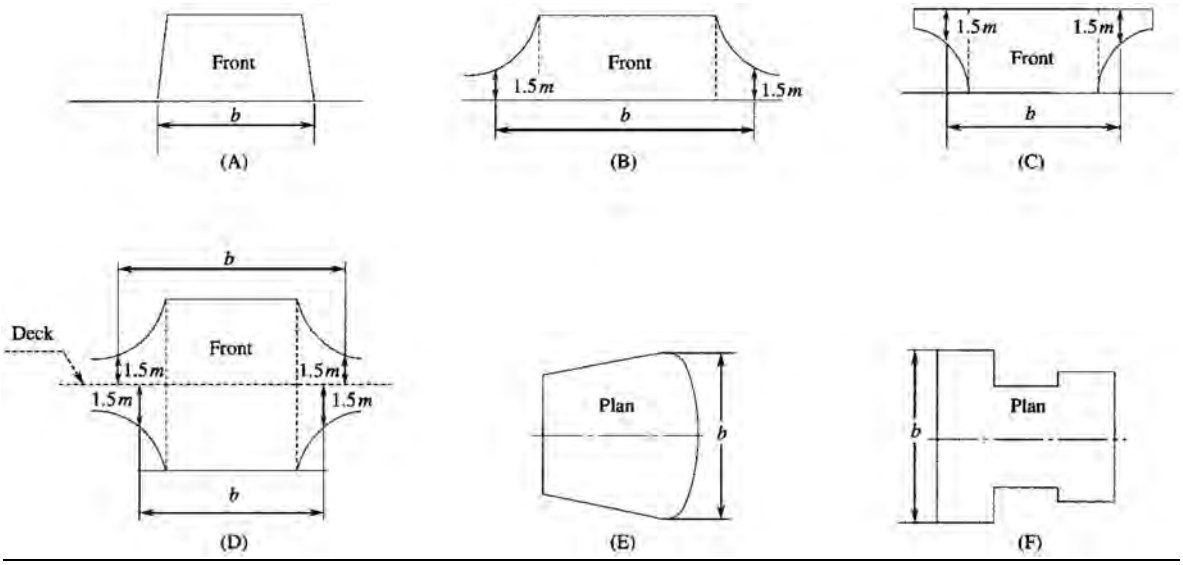
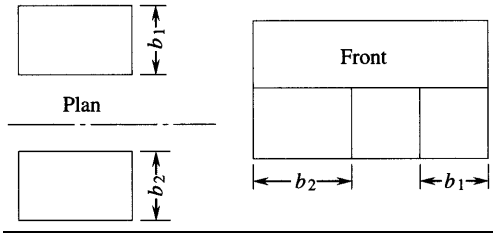


Fig. CS23.1.2-2



Note:

If both b_1 and b_2 are less than $B/4$, they are not to be included (irrespective of the sum b_1+b_2)

Fig. CS23.1.2-3

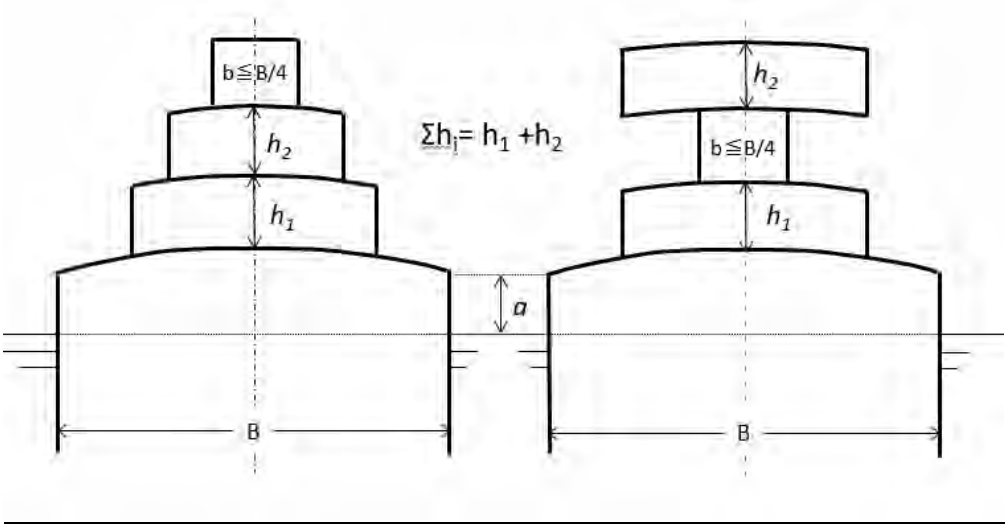


Fig. CS23.1.2-4

$\sum h' = h_1 + h_2 + h_3$

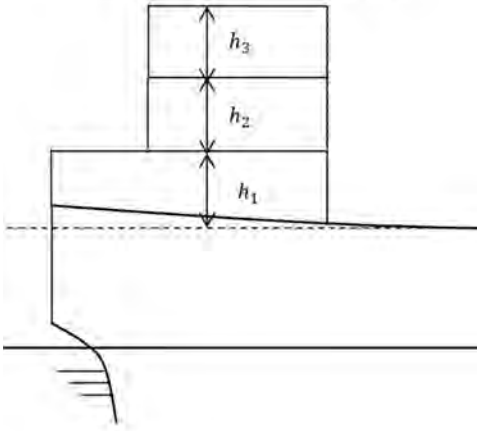
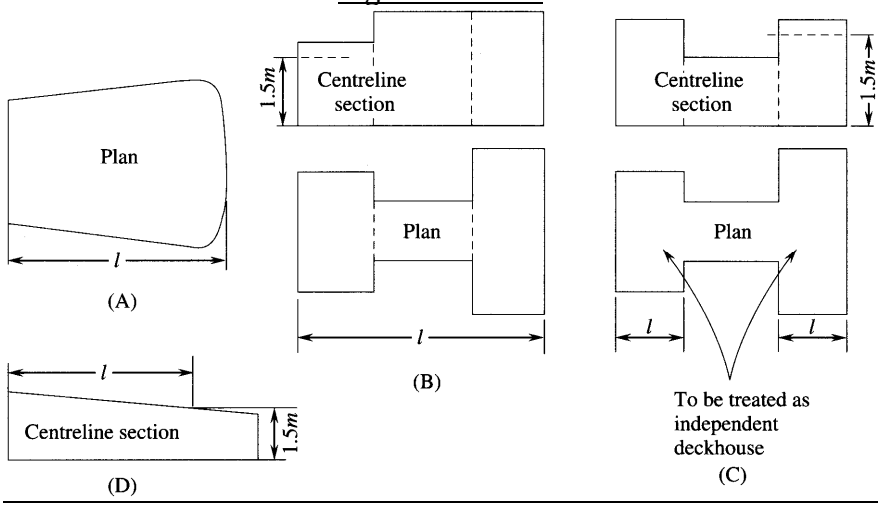


Fig. CS23.1.2-5



Paragraph CS23.1.5 has been added as follows.

CS23.1.5 Chain Lockers

The wording "the access cover and its securing arrangements to the satisfaction of the Society" in **23.1.5-5, Part CS of the Rules** means those which are in accordance with *JIS* F 2304, *JIS* F 2329, or *ISO* 5894:1999 or their equivalent.

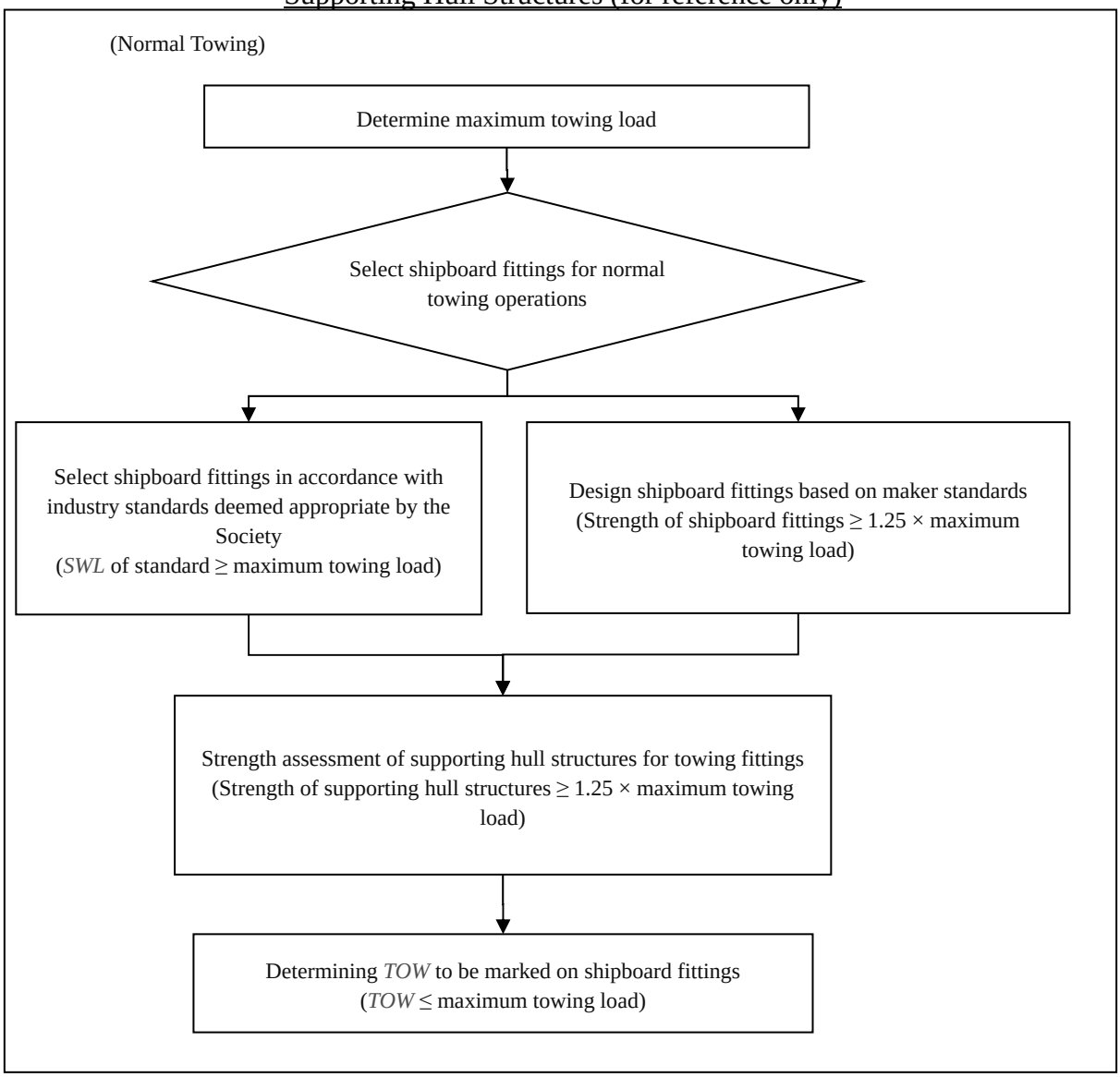
Section CS23.2 has been added as follows.

CS23.2 Towing and Mooring Fittings

CS23.2.1 General

With respect to the provisions of **23.2, Part CS of the Rules**, the flow charts shown in **Fig. CS23.2.1-1** and **Fig. CS23.2.1-2** are standard methods for the design processes of tow lines, mooring lines, shipboard fittings and their supporting hull structures.

Fig. CS23.2.1-1 Standard Design and Selection Process for Tow Lines, Towing Arrangements and Supporting Hull Structures (for reference only)



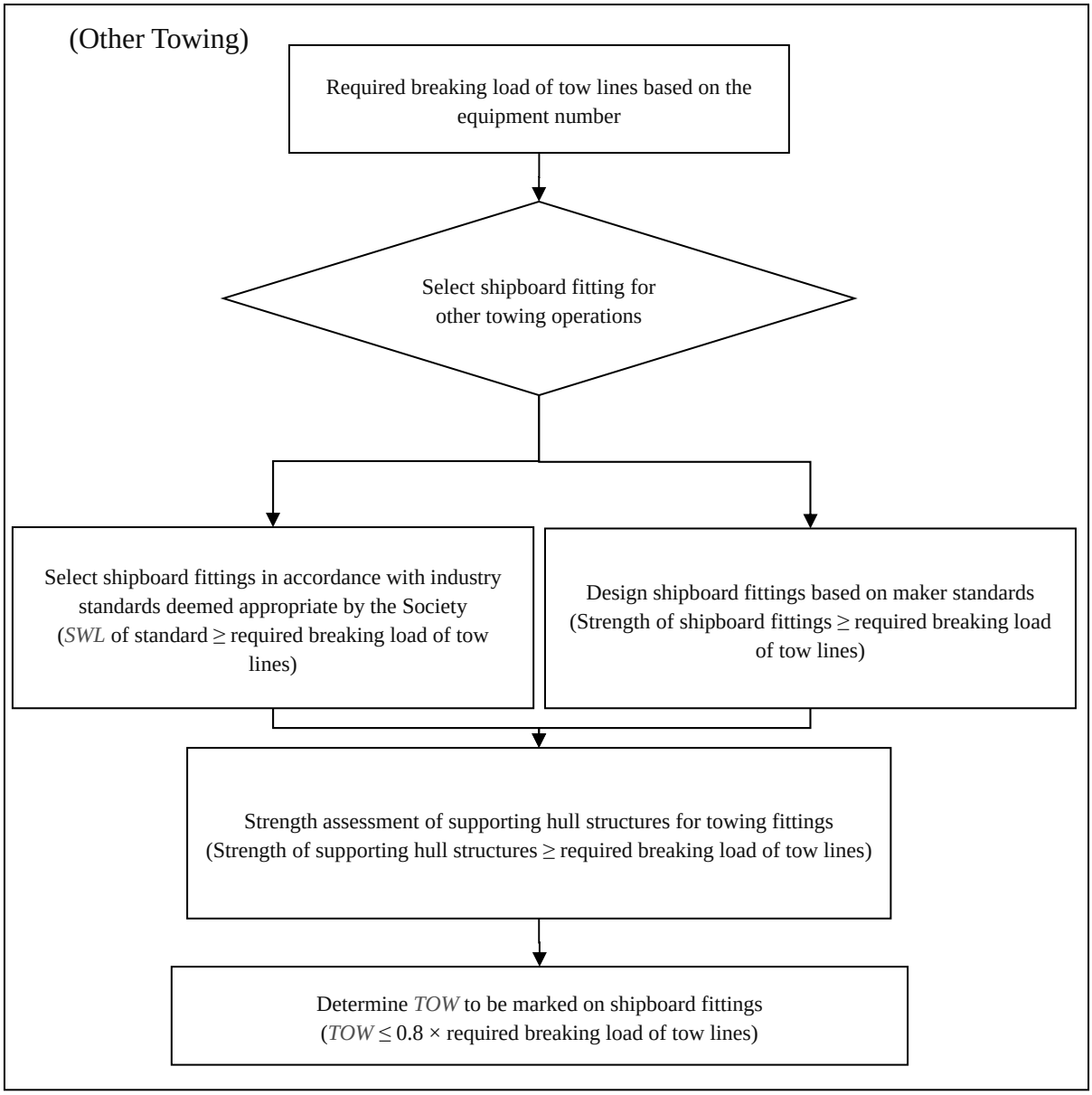
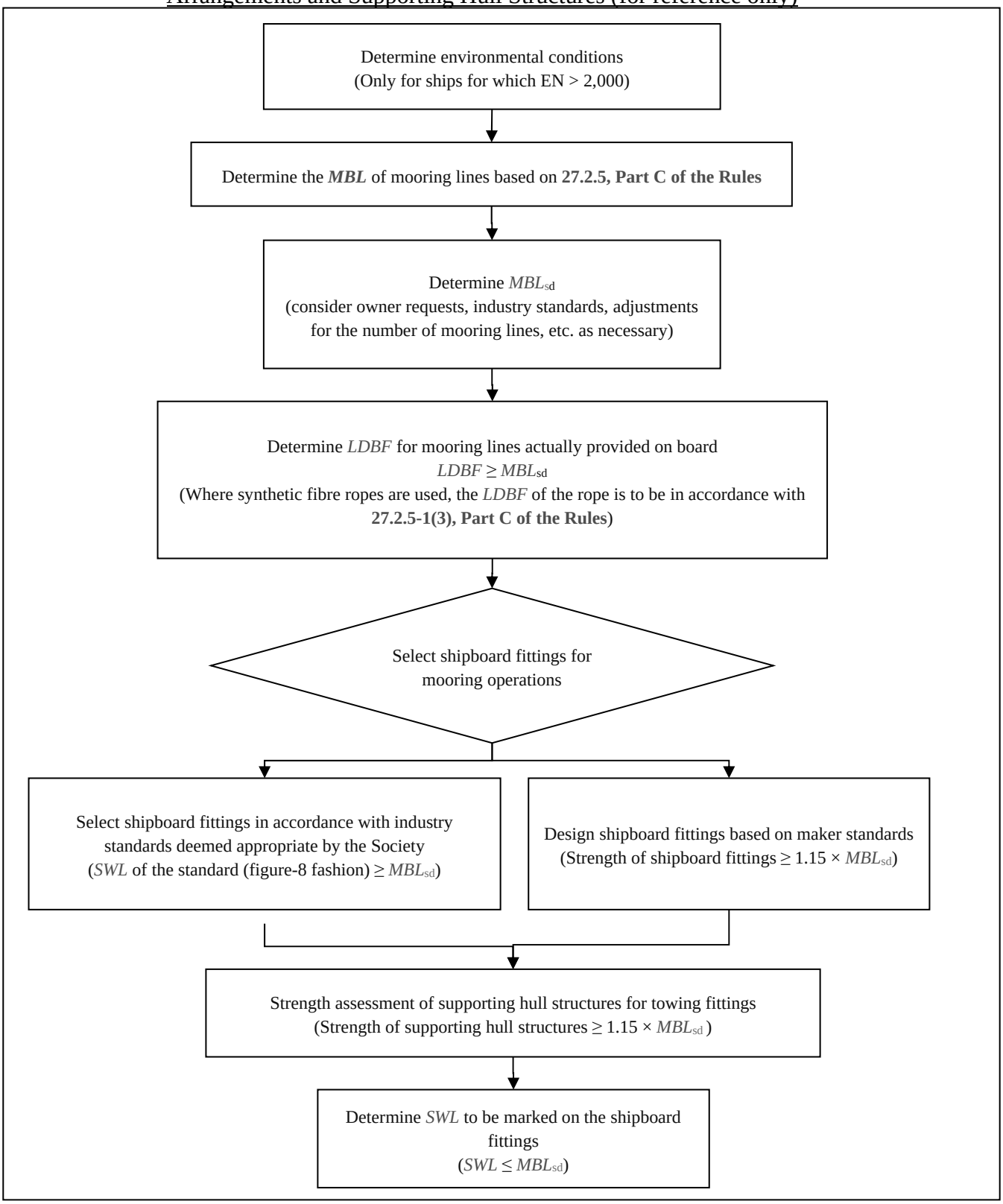

(Other Towing)
Required breaking load of tow lines based on the equipment number
Select shipboard fitting for other towing operations
Select shipboard fittings in accordance with industry standards deemed appropriate by the Society (*SWL* of standard ≥ required breaking load of tow lines)
Design shipboard fittings based on maker standards (Strength of shipboard fittings ≥ required breaking load of tow lines)
Strength assessment of supporting hull structures for towing fittings (Strength of supporting hull structures ≥ required breaking load of tow lines)
Determine *TOW* to be marked on shipboard fittings (*TOW* ≤ 0.8 × required breaking load of tow lines)

Fig. CS23.2.1-2 Standard Design and Selection Process for Mooring Lines, Mooring Arrangements and Supporting Hull Structures (for reference only)



CS23.2.3 Towing Fittings

1 "Industry standards deemed appropriate by the Society" as prescribed in **23.2.3-3(1), Part CS of the Rules**, means international standards or national standards such as *ISO*, *JIS F*, etc.

2 The provisions for the *TOW* specified in **23.2.3-6, Part CS of the Rules** are applied for the use of no more than one line. If not otherwise specified the *TOW* for towing bitts (double bollards) is the load limit for tow lines attached with eye splices.

3 Towing arrangements are recommended as follows.

(1) Tow lines are to be led through a closed chock. The use of open fairleads with rollers or closed roller fairleads is to be avoided.

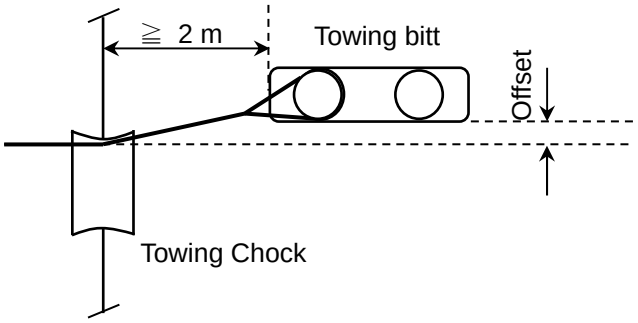
(2) It is recommended to provide at least one chock close to centreline of the ship forward and aft. It is beneficial to provide additional chocks on the port and starboard sides at the transom and at the bow.

(3) Tow lines are to have a straight lead from the towing bitt or bollard to the chock. Bitts or bollards serving chocks are to be located slightly offset and at a distance of at least 2 *m* away from the chock. (See **Fig. CS23.2.3-1**)

(4) Warping drums are to be positioned not more than 20 *m* away from chocks measured along the path of the line as far as practicable.

(5) Attention is to be given to the arrangement of the equipment for towing and mooring operations in order to prevent interference of mooring and tow lines as far as practicable.

Fig. CS23.2.3-1 Sample Arrangement of Towing Fittings



CS23.2.6 Mooring Fittings

1 The requirements in **23.2, Part CS of the Rules** also apply to additional mooring fittings as well as their supporting hull structures. However, MBL_{sd} specified in **23.2.6-3(1), Part CS of the Rules** and MBL_{sd} specified in **23.2.6-4, Part CS of the Rules** may be read as assumed values in consideration of the intended use. This information is to be incorporated into the towing and mooring arrangement plan specified in **23.2.9, Part CS of the Rules.**

2 The "industry standards deemed appropriate by the Society" referred to in **23.2.6-3(1), Part CS of the Rules** means international standards or national standards such as *ISO*, *JIS F*, etc.

3 The provisions for *SWL* specified in **23.2.6-6, Part CS of the Rules** apply only in cases where no more than one line is used.

4 Mooring arrangements are recommended to be as follows.

(1) As far as possible, a sufficient number of mooring winches is to be fitted to allow for all mooring lines to be belayed on winches. If the mooring arrangement is designed such that mooring lines are partly belayed on bitts or bollards, it is to be considered that these lines may not be as effective as the mooring lines belayed on winches. Mooring lines are to have as

straight a lead as is practicable from the mooring drum to the fairlead.

(2) At points of changes in direction, sufficiently large radii of the contact surface of a rope on a fitting is to be provided to minimize the wear experienced by mooring lines and as recommended by the rope manufacturer for the rope type intended to be used.

(3) Attention is to be given to the arrangement of the equipment for mooring operations in order to prevent interference of the mooring lines as far as practicable.

CS23.2.9 Towing and Mooring Arrangements Plan

1 It is recommended that the information related to safe towing and mooring operation in the towing and mooring arrangement plan specified in **23.2.9, Part CS of the Rules** is incorporated into the pilot card in order to provide pilots with relevant information on harbour or escort operations.

2 With respect to the provisions specified in **23.2.9-2(6), Part CS of the Rules**, the design condition related to **23.2.5-3(2), Part CS of the Rules** is to be described in this plan as a note.

CS24 has been added as follows

CS24 TANKERS

CS24.1 General

CS24.1.1 Application

1 With respect to the provisions of **24.1.1-2**, **Part CS** of the Rules, ships intended for the carriage of liquid cargoes having a vapour pressure less than 0.28 *MPa* at 37.8°C other than crude oil and oil petroleum products, are to be in accordance with the following.

(1) For tankers carrying liquid cargoes with a specific gravity ρ exceeding 1, the scantlings of structural members composing the cargo oil tank are to be the greater of the values obtained by the following two procedures.

(a) All scantlings calculated in accordance with the relevant requirements of the Rules

(b) Scantlings calculated by structural member type as follows

i) The scantlings of bulkhead plates, stiffeners attached to bulkhead plating, and girders attached to bulkhead plating are to be calculated by multiplying h by ρ before using the formulae specified in **24.3**, **24.4** and **24.7, Part CS** of the Rules.

ii) The scantlings of girders and floors in the double bottom and girders and transverses in the double side hull are to be calculated by multiplying h' by ρ before using the formulae specified in **24.6.3** and **24.6.4, Part CS** of the Rules. Where the load from the cargo oil tank is considered in determining h_i specified in **C24.5.1(1)**, the load is to be multiplied by ρ.

iii) The values of ρ are to be determined for respective cases unless shown in **Table CS24.1.1-1**.

(2) For tankers carrying dangerous chemicals in bulk, the requirements in **Part S** of the Rules are also to be applied.

Table CS24.1.1-1 Values of ρ

Cargo	ρ
Molasses	1.4
Asphalt	1.1
Concentrated sulphuric acid	1.85

2 Proposal of novel construction type

In the event that a novel construction type is proposed, scantlings are to be determined by carrying out comparative calculations with the standard structural model conforming to the requirements of the Rules. Submission of data covering the results of model experiments or real ship experiments may be requested by the Society as necessary.

CS24.1.2 Location and Separation of Spaces

1 Size and arrangement of cargo oil tanks and segregated ballast tanks.

The size and arrangement of cargo oil tanks and segregated ballast tanks are to comply with the requirements of **3.2.1, Part 3 of the Rules for Marine Pollution Prevention Systems**.

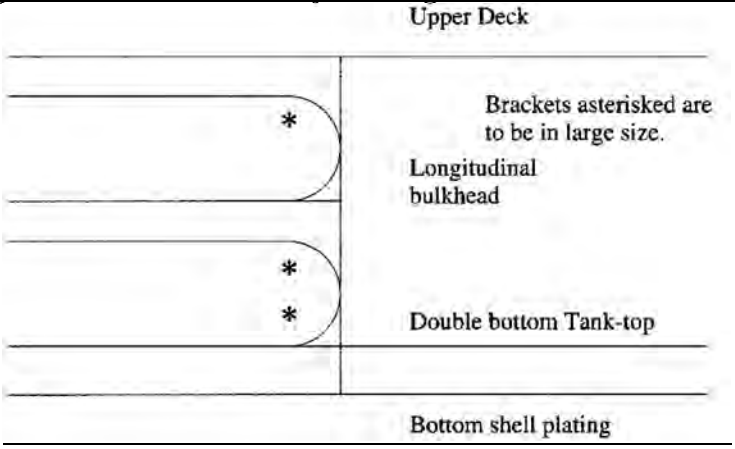
2 Restriction on arrangements of double hull structures and double bottom structures

Arrangements of double side hulls and double bottoms are to comply with the requirements of **3.2.4, Part 3 of the Rules for Marine Pollution Prevention Systems**.

3 Continuity of longitudinal bulkhead

At the forward and afterward ends of cargo oil tanks, precautions are to be taken to keep continuity between the ends of longitudinal bulkheads and the longitudinal members of the deck. (*See* **Fig. CS24.1.2-1**)

Fig. CS24.1.2-1 Continuity of Longitudinal Bulkhead at Ends



4 Cofferdams and bulkheads bounding cargo oil tanks

(1) "Cofferdam" referred to in **24.1.2-2, Part CS** of the Rules means an isolating void space between two adjacent steel bulkheads or decks. In case of the cofferdam between bulkheads, it is to be arranged to keep the minimum distance of 600 *mm* between bulkheads.

(2) Where a cargo oil tank is adjacent to the fore peak (fore peak tank), the collision bulkhead is to be free from openings. (*See* **14.3.2** and **14.3.3, Part D** of the Rules)

(3) Divisions between compartments defined as cofferdams and other compartments (except cargo oil tanks and fuel oil tanks) are not to have any openings with the exception of bolted watertight manholes provided in chain locker bulkheads, etc. (no watertight door is permitted).

(4) Electrical equipment is to be dealt with referring to the relevant requirements in **Chapter 4, Part H** of the Rules.

5 Airtight bulkheads

(1) Cofferdams which are not utilized as main or auxiliary pump rooms and compartments utilized as cofferdams under the freeboard deck are to meet the requirements for the strength of deep tanks. The bulkhead between the main pump room and engine room is to have structural scantlings of a watertight bulkhead in ships of not less than 100 *m* in length and of an airtight bulkhead in ships of less than 100 *m* in length.

(2) The following values are standard for scantlings of airtight bulkheads for which no hydrostatic tests are required. Airtightness tests may be replaced by hose tests. The plate thickness is not to be less than 6 *mm*, which may, however, be reduced to 4.5 *mm* in ships of less than 100 *m* in length. The section modulus of stiffeners and girders is to be 50% of the Rule requirements for watertight bulkheads. Where connected to the shell and decks, however, these stiffening members are to have the same effectiveness as frames and beams.

6 Superstructures and deckhouses

The deckhouse protecting the entrance to pump rooms is to be in accordance with the following requirements.

(1) The strength of the front wall is to be equivalent to that of the wall of the bridge.

(2) The strength of side walls and after wall are to be equivalent to that of the front wall of the poop.

(3) The height of doorway coamings is not to be less than 600 *mm* above the freeboard deck.

However, the height may be reduced to not less than 450 *mm* for ships with a class notation of *Coasting Service*.

CS24.4.2 Swash Bulkheads

1 Arrangements of swash bulkheads

Where the length or breadth of a cargo oil tank exceeds, 15 m or $0.1L$ (m), whichever is greater, swash bulkheads are to be provided in cargo oil tanks. However, this requirement may be dispensed with if special consideration is given to sloshing.

(1) The breadth and thickness of the uppermost and lowest strakes of the centreline swash bulkhead may be 90% of those required by the Rules for the uppermost and lowest strakes (respectively) of the longitudinal oiltight bulkhead.

(2) The "opening ratio" means the ratio of the sum of areas of openings (except slots and scallops) to the area of the bulkhead.

(3) The section modulus of stiffeners is to be obtained from the following formula.

It is not to be less than 2.0.

$CSh_s l^2$ (cm^3)

Where:

S: Spacing (m) of stiffeners

l : Span (m) of stiffener between supports

C : Coefficients given below:

Both ends effectively bracketed: 7.1

One end effectively bracketed and the other end supported by girder: 8.4

Both ends supported by girders: 10.0

h_s: Value obtained from the following formula

It is not to be less than 2.0.

$$\left(0.176 - \frac{0.025}{100}L\right)(1-\alpha)l_t$$

Where:

L: Length (m) of ship

α: Opening ratio of bulkhead plating

l_t: Length (m) of tank

(4) In applying the requirements of **24.7.1-1** to **24.7.1-3, Part CS** of the Rules, the scantlings of girders supporting stiffeners are to be obtained in such a way that values of h specified in the requirements under consideration referred to are not less than that obtained by substituting h with h_s specified in **(3)**.

CS24.9.4 Supporting Structures of Independent Prismatic Tanks

1 General

With respect to the provisions of **24.7.4, Part CS of the Rules,** the arrangement and scantlings of the supporting structures of the independent prismatic tanks are to comply with the requirements of this paragraph. However, other methods approved by the Society may be acceptable.

2 Strength Criteria

Compressive stress σ_a (N/mm^2) acting on each plate which composes the supporting structures, excluding top plate, is to comply with the following criteria:

$\sigma_a < \sigma_{cr}$

σ_a : The compressive stress acting on each plate which composes the supporting structures, excluding top plate, as given by the following:

$\sigma_a = \frac{F_a}{A_{\min}}$ (N/mm^2)

F_a : Load acting on the supporting structures as given by the following:

$F_a = 1000\rho V_t(1 + a_z)g$ (N)

ρ : Cargo density (ton/m^3)

V_t : Tank volume (m^3) supported by the supporting structure under consideration

a_z : Maximum dimensionless vertical acceleration (i.e. relative to the acceleration of gravity) acting on the centre of the cargo tank under consideration obtained from the following formula. a_z does not include the component due to the static weight.

$$a_z = \pm a_0 \sqrt{1 + \left(5.3 - \frac{45}{L}\right)^2 \left(\frac{x}{L} + 0.05\right)^2 \left(\frac{0.6}{C_b}\right)^{1.5}}$$

a_0: As obtained from the following formula:

$$a_0 = 0.2\frac{V}{\sqrt{L}} + \frac{34 - \frac{600}{L}}{L}$$

V : Ship speed (kt) as define in **2.1.8, Part A of the Rules**

x : Longitudinal distance (m) from amidships to the centre of gravity of the cargo tank; x is positive forward of amidships, negative aft of amidships

g: Acceleration due to gravity to be taken as 9.81 (m/s^2)

$A_{\min}$: Minimum horizontal sectional area (mm^2) which is obtained by subtracting 0.5 mm from all side of the plates (*See* **Fig.CS24.7.4-1**)

σ_{cr}: Allowable stress obtained by the following value, whichever is the lesser:

$\frac{\sigma_{yd}}{1.33}$ (N/mm^2)

$C_x\sigma_{yd}$ (N/mm^2)

σ_{yd}: Yield stress (N/mm^2) of the material used for the supporting structures

C_x : Reduction factor for each plate which composes the supporting structures, excluding top plate, as obtained by **Table CS24.7.4-1**. Assessed plate which is not rectangular may be approximated using **Table CS24.7.4-2**.

Fig. CS24.7.4-1 Example of Supporting Structure (Excluding Top Plate) and the Relevant Minimum Horizontal Sectional Area

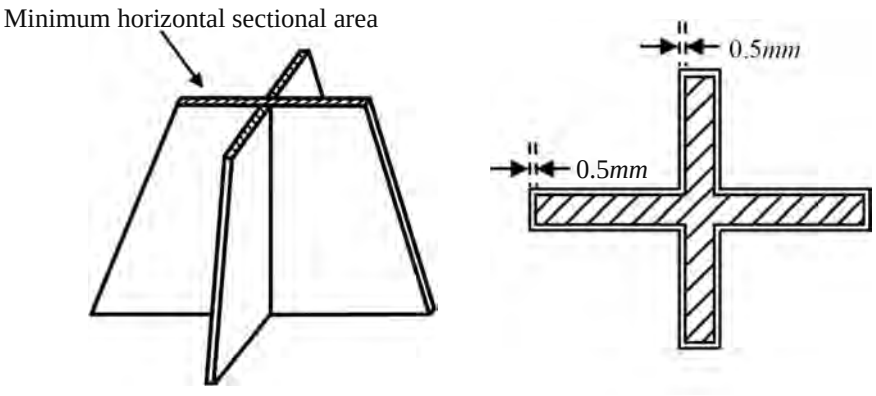
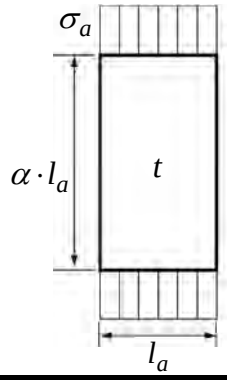
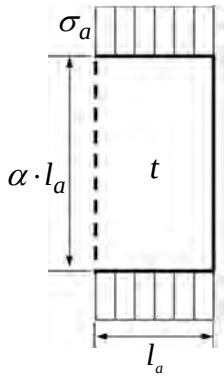


Table CS24.7.4-1 Reduction Factor for Plane Plate Panels

	Aspect ratio α	Buckling factor K	Reduction factor C_x
1  	$\alpha \geq 1$	$K = 4$	$C_x = 1$ for $\lambda \leq 0.8$ $C_x = 1.13\left(\frac{1}{\lambda} - \frac{0.22}{\lambda^2}\right)$ for $\lambda > 0.8$
2  	$\alpha > 0$	$K = 0.425 + \frac{1}{\alpha^2}$	$C_x = 1$ for $\lambda \leq 0.7$ $C_x = \frac{1}{\lambda^2 + 0.51}$ for $\lambda > 0.7$

Explanations for boundary conditions:

- - - - - plate edge free

——— plate edge simply supported

λ: Reference degree of slenderness, to be taken as:

$$\lambda = \sqrt{\frac{\sigma_{yd}}{K\sigma_E}}$$

σ_E: Reference stress (N/mm^2), to be taken as:

$$\sigma_E = 0.9E\left(\frac{t}{l_a}\right)^2$$

E: Modulus of elasticity, 206,000 (N/mm^2)

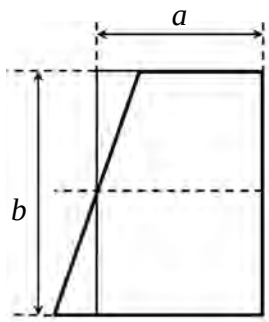
t: As obtained from the following formula

$$t = t_{as-built} - 1.0 \ (mm)$$

$t_{as-built}$: As-built thickness (mm)

l_a: Length of the side of the plate panel (mm)

Table CS24.7.4-2 Trapezoidal Panel Approximation

Shape	Approximation
	A rectangle is derived with *a* being the mean value of the bases and *b* being the height of the original panel.

CS24.11.5 Freeing Arrangement

1 Effective freeing arrangement

Open guardrails installed on more than half the length of the exposed parts of the freeboard deck may be replaced by freeing ports in the lower parts of the bulwarks, for at least 33% of the total area of bulwarks.

CS25 LOADING MANUAL

CS25.1 General

CS25.1.1 General

Sub-paragraph -1 has been amended as follows.

1 "Ships deemed appropriate by the Society" as stipulated in **25.1.1-2, Part CS** of the Rules, refers to the following types of ships when their maximum deadweight does not exceed 30 % of their maximum displacement.

(1) Ships with an arrangement that allows only small possibilities of variation in the distribution of cargo and ballast.

(2) Ships in regular service that perform standard loading. However, it is to be clearly stated either in the "Stability Information" as stipulated in **2.3.2-1, Part B** of the Rules, or in some other suitable document that no non-standard loading is to be performed.

(3) Ships other than those stipulated in ~~**34.1.1-2**~~**3.8.1.1-2, Part C** of the Rules.

Paragraph CS25.1.2 has been added as follows.

CS25.1.2 Loading Manual

1 The loading manual approved by the Society according to **25.1.2, Part CS of the Rules**, is to be prepared in compliance with **Annex3.8, Part 1, Part C of the Rules.** The manual is to be written with a language easily understood by the ship master. Where this language is not English, a translation into English is to be included.

2 The "standard loading conditions" specified in **25.1.2, Part CS of the Rules**, are the loading conditions specified for each ship type in **An1.3** of **Annex 3.8, Part 1, Part C of the Rules**.

CS26 MEANS OF ACCESS

Section CS26.1 has been added as follows.

CS26.1 General Rules

CS26.1.1 General

1 Means of access specified in **26.1.1**, **Part CS** of the Rules are arranged for the purpose of detecting disorders such as damage, corrosion, etc. which may occur on the boundaries of compartments and important internal structural members fitted thereon, such as transverse rings, web frames, girders, struts, etc. at an early stage. Accordingly, the arrangement is to be such that any one side of these members can be easily and safely inspected from within a distance of not more than 3 *m*. This distance may be properly modified, depending on the actual conditions, when easy access and/or ample illumination is available.

2 The means of access may be those permanently fixed to the hull, such as stagings, walkways, ladders, and steps (hereinafter, referred to as "permanent means of access") and those that are prepared for temporary use, such as inflatable rafts and portable ladders. Where structural members can be utilized as stagings or walkways, they can be regarded as permanent means of access.

CS26.1.2 Means of Access to Spaces

1 With respect to the provisions of **26.1.2**, **Part CS** of the Rules, permanent means of access where deemed as impracticable by the Society may be placed with portable ladders.

2 The openings of hatches or manholes for the means of access to the hold spaces for independent tanks are to be not less than those required by **g.** of **Table CS26.1.2**.

CS26.1.3 Means of Access within Spaces

1 With respect to the provisions of **26.1.3**, **Part CS** of the Rules, the following spaces and places are to be provided with permanent means of access.

(1) Fore peak tanks
(2) Aft peak tanks
(3) Cofferdams
(4) One side tank situated at or near the forward end of the parallel body of the hull and one or more tank(s) in other parts (water ballast tank if possible)
(5) Any one or more tank(s) from among centre tanks
(6) Watertight and oiltight bulkheads having horizontal girders
(7) Cargo holds with bilge hopper tanks whose height is over 3 *m* at side from the top of inner bottom plates to upper end of bilge hopper tanks

2 The permanent means of access in the spaces and places prescribed in **-1** above are to be arranged in accordance with the following:

(1) In side tanks, ladders or steps are to be so arranged that all corners and structural ends of one or more transverse ring(s) (preferably at mid-tank) can be inspected.
(2) In centre tanks, ladders or steps are to be so arranged that both ends of one or more bottom transverse(s) (preferably at mid-length of tank) can be inspected.
(3) For watertight and oiltight bulkheads with horizontal girders, ladders or steps are to be arranged for access to such girders.
(4) Ladders or steps for access to a height up to about 1.5 *m* above the bottom or a horizontal girder may be omitted where access is available by means of longitudinal frames, horizontal stiffeners, etc.
(5) On both sides of each cargo hold specified in **-1(7)** above at the forward, middle and aft parts,

ladders (or steps) and hand rails are to be available for inspection of lower parts of hold frames together with their end brackets. Hand rails are to be fitted within the spaces between three hold frames at least. However, a portable ladder may be acceptable instead of fixed ladders (or steps) and hand rails may be omitted subject to approval by the Society.

3 The clearances for inspections and means of access within the hold spaces for independent tanks is to be not less than those required by **a.** to **f.** of **Table CS26.1.2**.

Table CS26.1.2

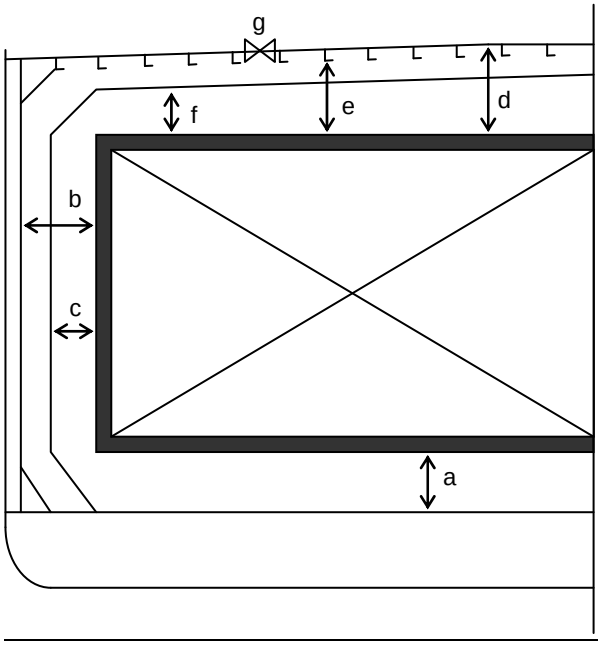
Location(1)	ships not less than 5,000 tonnes deadweight	ships less than 5,000 tonnes deadweight
a. insulation ~ inner bottom plate	600 *mm*	600 *mm*
b. insulation ~ side frame	600 *mm*	450 *mm*
c. insulation ~ girder	450 *mm*(2)	450 *mm*(2)
d. insulation ~ upper deck	600 *mm*	600 *mm*
e. insulation ~ deck beam	600 *mm*	450 *mm*
f. insulation ~ deck girder	450 *mm*(2)	450 *mm*(2)
g. horizontal opening	600 *mm* ×600 *mm*	500 *mm* ×500 *mm*

Notes:

(1) Refer to **Fig. CS26.1.2** for the relevant locations

(2) Where openings are provided in order to make the relevant location readily accessible from each side, it may be 0.5 times the width of face plate or 50 *mm*, whichever is smaller.

Fig. CS26.1.2



CS26.1.4 Specifications of Means of Access and Ladders

1 Means of access that are safe to use referred to in **26.1.4-1**, **Part CS** of the Rules mean those meeting the following conditions.

(1) Ladders and steps are not to be fitted on a surface which is unnecessarily outside the inside line of the hatch coaming.

(2) Hand grips are to be provided appropriately.

(3) Ladders and steps are to be extended upward and downward as deemed necessary.

(4) No hollows are to be allowed in flights of ladders.

2 With respect to the provisions of **26.1.4, Part CS** of the Rules, stagings and walkways forming sections of permanent means of access are to be constructed as follows.

(1) The clear width of stagings and walkways is not to be less than 600 *mm*, except for going around vertical webs where the minimum clear width may be reduced to 450 *mm*, and have guard rails over the open side of their entire length.

(2) Elevated passageways forming sections of a permanent means of access are to be provided with guard rails of 750 *mm* in height on the open side.

(3) Where horizontal girders or similar structures are utilized as stagings, etc., lightening holes of a diameter exceeding 100 *mm* are to have fixed gratings.

3 With respect to the provisions of **26.1.4, Part CS** of the Rules, ladders and steps utilized for permanent means of access are to be constructed as follows.

(1) The width of ladders and steps is to be not less than 250 *mm* and the distance from the wall to the free edge of footsteps, not less than 120 *mm*. Footsteps are to be arranged at a regular interval not less than 250 *mm* but not more than 350 *mm*, or of an equivalent arrangement.

(2) Landings are to be provided at an interval not exceeding 9 *m* on vertical ladders and at a vertical interval of 12 *m* on inclined ladders.

4 Where portable ladders are utilized in accordance with the provisions of **CS26.1.3-2(5)**, appropriate measures such as horizontal bars which are provided between two transverse frames for hanging a ladder, are to be taken for their safe use.

5 Where rafts are utilized for means of access, they are to comply with the following conditions.

(1) The tanks are to have pumping arrangements for filling and discharging a capacity appropriate for ordinary water ballast tanks.

(2) Where swash bulkheads are provided in the tank, they are to have openings for passage in their upper part, or each part that is separated from others by such swash bulkheads is to have an access hatch or manhole. The dimensions of these hatches or manholes may be determined assuming that rafts will be inflated in the tanks.

(3) The raft is to be capable of carrying 3 persons, and where an inflatable type is used, be able to stay afloat safely even if one of the airtight chambers is broken. A ship is to have at least one raft, but it is recommended to have at least two.

CS26.2 Special Requirements for Oil Tankers

Paragraph CS26.1.2 has been added as follows.

CS26.2.1 Application

1 With respect to the provisions of **26.2**, **Part CS of the Rules**, this regulation does not apply to oil tankers other than those having integral tanks for the carriage of oil in bulk. Even in cases where the provisions of **26.2**, **Part CS of the Rules** are applied, **CS26.1.2-2** and **CS26.1.3-3** are also to be applied to the means of access to the hold spaces for independent tanks as well as and to the means of access within said hold spaces.

Paragraph CS26.2.2 has been added as follows.

CS26.2.2 General

1 For the purpose of **26.2, Part CS** of the Rules, appropriate means of access are to be provided to enable close-up examinations of positions where close-up examinations and thickness measurements are required in accordance with the provisions of **Part B** of the Rules and positions with critical structural areas. In application, “critical structural areas” are locations which have been identified from calculations to require monitoring or from the service history of similar or sister ships to be susceptible to cracking, buckling, deformation or corrosion which would impair the

structural integrity of the ship. Each space for which close-up inspection is not required such as fuel oil tanks and void spaces forward of cargo area, may be provided with a means of access necessary for overall survey intended to report on the overall conditions of the hull structure.

2 For the purpose of **26.2**, **Part CS** of the Rules, the following definitions apply.

(1) Rung means the step of a vertical ladder or step on a vertical surface.

(2) Tread means the step of an inclined ladder or step for a vertical access opening.

(3) Flight of an inclined ladder means the actual stringer length of an inclined ladder. For vertical ladders, it is the distance between the platforms.

(4) Stringer means either:

(a) The frame of a ladder

(b) The stiffened horizontal plating structure fitted on the side shell, transverse bulkheads and/or longitudinal bulkheads in the space

For the purpose of ballast tanks of less than 5 *m* width forming double side spaces, the horizontal plating structure is credited as a stringer and a longitudinal permanent means of access, if it provides a continuous passage of 600 *mm* or more in width past frames or stiffeners on the side shell or longitudinal bulkhead. Openings in stringer plating utilized as permanent means of access shall be arranged with guard rails or grid covers to provide safe passage on the stringer or safe access to each transverse web.

(5) Vertical ladder means a ladder of which the inclined angle is 70 *degrees* and over up to 90 *degrees*. A vertical ladder shall not be skewed by more than 2 *degrees*.

(6) Overhead obstructions mean the deck or stringer structure including stiffeners above the means of access.

(7) Distance below deck head means the distance below the plating.

(8) Cross deck means the transverse area of the main deck which is located inboard and between hatch coamings.

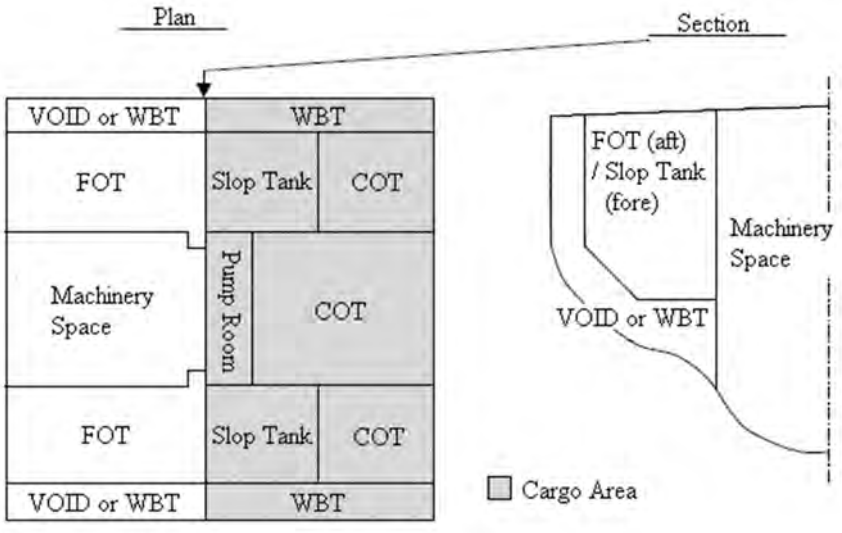
(9) Cargo area means either:

(a) For oil tankers, area as defined in **2.1.35**, **Part A** of the Rules but excluding deck areas

However, spaces protecting oil fuel tank(s) in the machinery space as shown in **Fig. CS26.2.2** need not be applicable to the provisions of **26.2, Part CS** of the Rules, even though they have a cruciform contact with the cargo oil tank or slop tank.

(b) For bulk carriers, cargo spaces and other spaces such as ballast tanks, cofferdams and void spaces within cargo spaces or adjacent to cargo spaces in the ship's transverse section

Fig. CS26.2.2



Paragraph CS26.2.3 has been amended as follows.

CS26.2.3 Means of Access to Spaces

~~**1** With respect to the provisions of **26.2.3-2, Part CS** of the Rules, the wording "not intended for the carriage of oil or hazardous cargoes" applies only to "similar compartments", and access may be from pump-rooms, deep cofferdams, pipe tunnels, cargo holds and double hull spaces.~~

~~**2** "Deck" specified in **26.2.3-3, Part CS** of the Rules means "weather deck".~~

1 With respect to the provisions of **26.2.3**, **Part CS** of the Rules, the vertical distance between deck and horizontal stringer; horizontal stringers; deck or horizontal stringer and the bottom of the space; deck or horizontal stringer and platform; and platforms means the vertical distance between the upper surface of the lower deck, horizontal stringer or platform and the lower surface of the upper deck, horizontal stringer or platform

2 With respect to the provisions of **26.2.3**, **Part CS** of the Rules, special attention is to be paid to the structural strength where any access opening is provided in the main deck or cross deck.

3 With respect to the provisions of **26.2.3-2, Part CS** of the Rules, the wording "not intended for the carriage of oil or hazardous cargoes" applies only to "similar compartments", and access may be from pump-rooms, deep cofferdams, pipe tunnels, cargo holds and double hull spaces.

4 "Deck" specified in **26.2.3-3, Part CS** of the Rules means "weather deck".

5 With respect to the provisions of **26.2.3-4, Part CS** of the Rules, where deemed necessary for aligning resting platform arrangements with hull structures, the vertical distance from the deck to a platform, between such platforms, or a platform and the tank bottom may be not more than 6.6 *m*.

6 With respect to the provisions of **26.2.3-4(2)** and **(4), Part CS of the Rules**, adjacent sections of a vertical ladder are to be in accordance with following **(1)** to **(3)**. (Refer to **Fig. CS26.2.3-1**, **Fig. CS26.2.3-2** and **Table CS26.2.3**)

(1) The minimum "lateral offset" between two adjacent sections of a vertical ladder is the distance between the sections, upper and lower, so that the adjacent stringers are spaced at least 200 *mm* apart, measured from half thickness of each stringer.

(2) Adjacent sections of vertical ladder are to be installed so that the upper end of the lower section is vertically overlapped, in respect to the lower end of the upper section, to a height of 1,500 *mm* in order to permit a safe transfer between ladders. However, this requirement does not apply to cases where structural members (e.g. side stringers) are used to move between adjacent vertical ladders and are provided with safety measures such as handrails.

(3) No section of the access ladder is to be terminated directly or partly above an access opening.

Fig. CS26.2.3-1 Vertical Ladder – Ladder Passing through Linking Platform

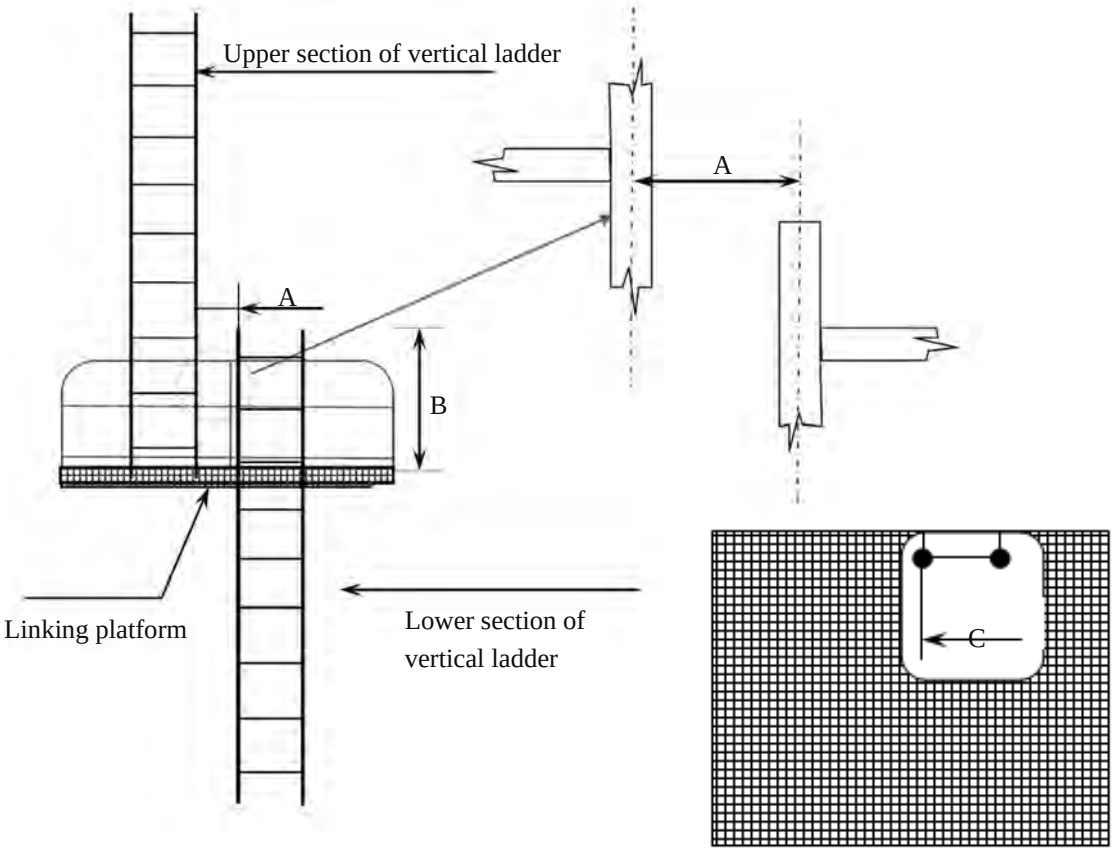


Fig. CS26.2.3-2 Vertical Ladder - Side Mount

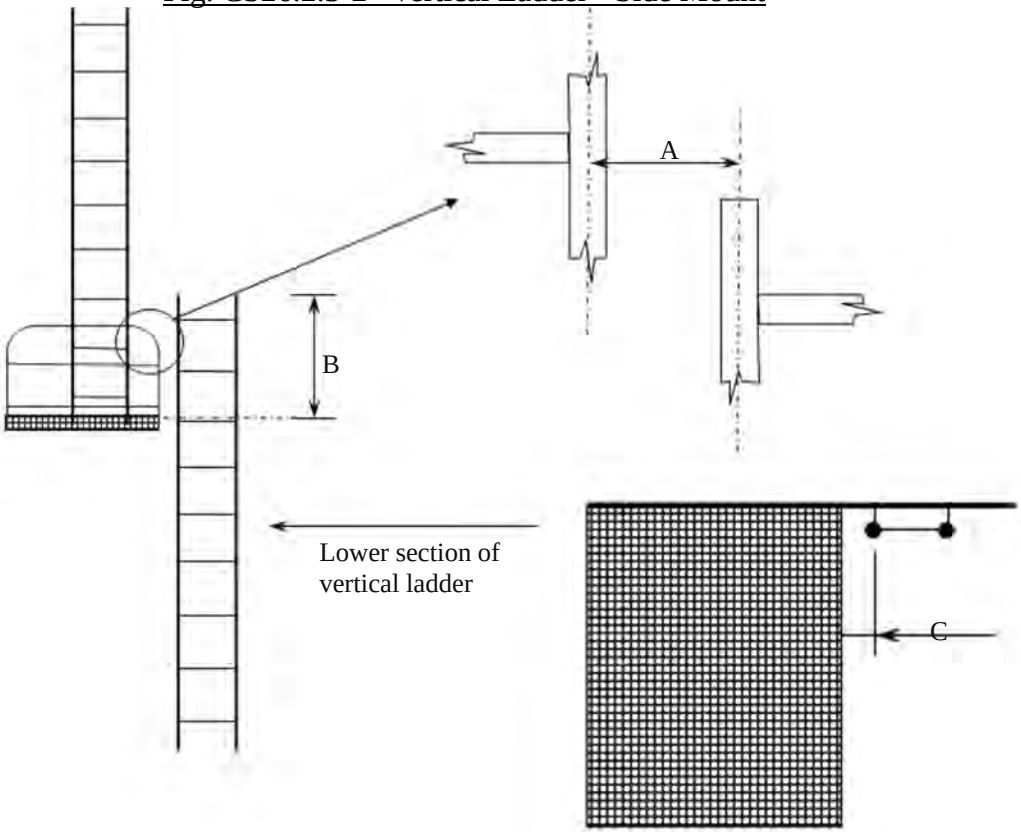


Table CS26.2.3 Dimensions

A	Horizontal separation between two vertical ladders, stringer to stringer	≥ 200 *mm*
B	Stringer height above landing or intermediate platform	≥ 1,500* *mm*
C	Horizontal separation between ladder and platform	100 *mm* ≤ C < 300 *mm*
Note * : the minimum height of the handrail of resting platform is 1,000 *mm*		

Paragraph CS26.2.4 has been added as follows.

CS26.2.4 Means of Access within Spaces

1 Alternative means of access specified in **26.2.4**, **Part CS** of the Rules include, but are not limited to, such devices as:

(1) Hydraulic arm fitted with a stable base

(2) Wire lift platform

(3) Staging

(4) Rafting

(5) Robot arm or remotely operated vehicle (*ROV*)

(6) Portable ladders more than 5 *m* long are only to be utilized if fitted with a mechanical device to secure the upper end of the ladder. Where hooks for securing at the upper end of a ladder are provided as a mechanical device, such hooks are to be designed so that a movement fore/aft and sideways can be prevented at the upper end of the ladder

(7) Other means of access, approved by and acceptable to the Society

2 With respect to the provisions of **26.2.4, Part CS** of the Rules, the selection of an alternative means of access is to be based on the following conditions. Refer to **Annex 14.16, Part 1, Part C of the Rules** for details.

(1) Such means provide accessibility and safety equivalent to permanent means

(2) Such means are suitable for use in an environment of the intended spaces

(3) Where the use of means such as *ROV* for the inspection of under deck structures, such means can be introduced into the space directly from a deck access

(4) Such means comply with or are based on appropriate safety standards

(5) Where the use of means other than those specified in **CS26.2.4-1(3)**, **(4)** or **(6)**, such means are approved by the Administration and the ship's owner

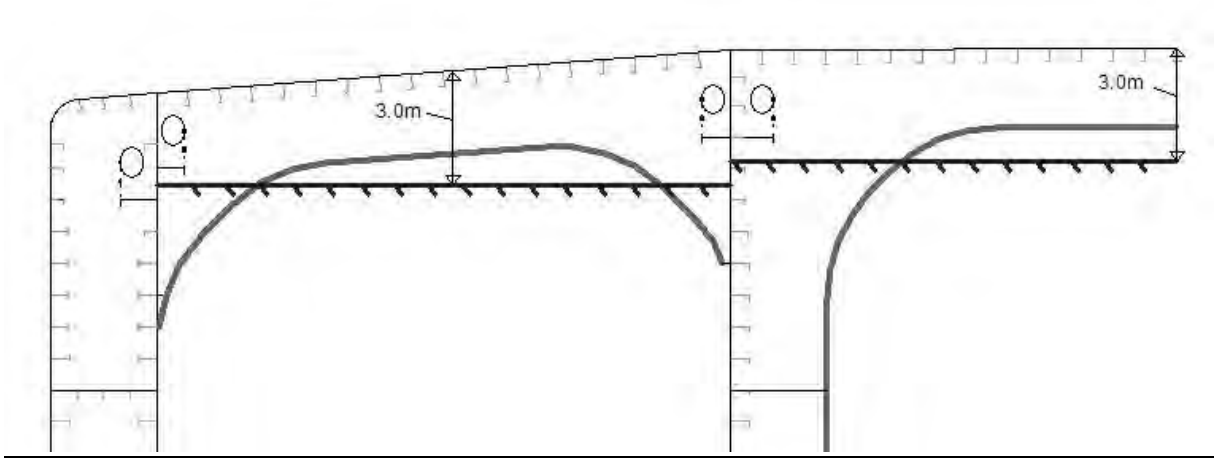
3 Where a boat is used as an alternative means, **CS26.1.4-5** is to apply. Rafts or boats alone may be allowed for survey of the under deck areas for tanks or spaces if the depth of the webs is not more than 1.5 *m*. If the depth of the webs is more than 1.5 *m*, rafts or boats alone may be allowed only if permanent means of access are provided to allow safe entry and exit. This means either:

(1) Access direct from the deck via a vertical ladder and small platform approximately 2 *m* below the deck in each bay

(2) Access to the deck from a longitudinal permanent platform having ladders to the deck at each end of the tank

The platform is to, for the full length of the tank, be arranged at or above the maximum water level needed for rafting of the under deck structure. For this purpose, the ullage corresponding to the maximum water level is to be assumed not more than 3 *m* from the deck plate measured at the midspan of the deck transverses and in the middle of the length of the tank. (Refer to **Fig. CS26.2.4**) A permanent means of access from the longitudinal permanent platform to the water level indicated above is to be fitted in each bay (*e.g.*, permanent rungs on one of the deck webs inboard of the longitudinal permanent platform).

Fig. CS26.2.4 Use of Rafts/Boats



4 With respect to the provisions of **26.2.4**, **Part CS** of the Rules, it is to be demonstrated that portable means for inspection can be deployed and made readily available in the areas where needed.

5 For the purpose of **26.2.4**, **Part CS** of the Rules, the height of a space means the vertical distance between the top surface of the bottom plate of the space and the lower surface of the top plate of the space. In general, the height is to be measured from the lowest position to the highest position in each tank. However, for a space the height of which varies at different bays/sections, the requirements of **26.2.4**, **Part C** of the Rules may be applied to such bays/sections of that space which fall under the criteria.

6 With respect to the provisions of **26.2.4**, **Part CS** of the Rules, special attention is to be paid to the structural strength where any access opening is provided in the structural members.

7 Unless stated otherwise in **26.2.4**, **Part CS** of the Rules, vertical ladders that are fitted on vertical structures for inspection are to comprise of one or more ladder linking platforms spaced not more than 6 *m* apart vertically and displaced to one side of the ladder. Adjacent sections of ladder are to be laterally offset from each other by at least the width of the ladder. For the purpose of complying with the above, adjacent sections of ladders are to be in accordance with **CS26.2.3-6**.

8 The requirements of **26.2.4-1**, **Part CS** of the Rules are also to be applied to void spaces in the cargo area, comparable in volume to cargo tanks and ballast tanks.

9 In the application of **26.2.4-1(1)**, **Part CS** of the Rules, the provisions of **(a)** to **(c)** define access to underdeck structures and the provisions of **(d)** to **(f)** define access to vertical structures. These provisions are linked to the presence of underdeck structures and transverse webs on longitudinal bulkheads. If there are no underdeck structures (deck longitudinals and deck transverses) but there are vertical structures in the cargo tank supporting transverse and longitudinal bulkheads (including brackets supporting deck transverses), in addition to access in accordance with applicable provisions of **(d)** to **(f)** of **26.2.4-1(1)**, **Part CS** of the Rules, access in accordance with the provisions of **(a)** to **(c)** of **26.2.4-1(1)**, **Part CS** of the Rules is to be provided for inspection of the upper parts of vertical structure on transverse and longitudinal bulkheads. For example, there is need to provide continuous longitudinal permanent means of access in accordance with the provisions of **26.2.4-1(1)(b)**, **Part CS** of the Rules when the deck longitudinals and deck transverses are fitted on the deck but supporting brackets are fitted under the deck.

10 In the application of **26.2.4-1(1)(d)**, **Part CS of the Rules**, for water ballast tanks of 5 *m* or more in width, such as on an ore carrier, side shell plating shall be considered in the same way as "longitudinal bulkhead".

11 Notwithstanding **-1**, for the application of **26.2.4-1(1)(d)**, **Part CS** of the Rules, wire lift

platforms or other means which can provide an equal level of safety as permanent means of access specified in that sub-paragraph, are assumed as alternative means of access. However, rafting and permanent fittings for rafting are not permitted as alternatives to the continuous longitudinal permanent means of access specified in **CS26.2.4-1(2)**.

12 "Means of access deemed appropriate by the Society" stipulated in **26.2.4-1(4), Part CS** of the Rules generally presumes the use of boats. The provisions of **-3** above apply.

13 The requirements of **26.2.4-2**, **Part CS** of the Rules also apply to wing tanks designed as void spaces.

14 For the purpose of **26.2.4-2**, **Part CS** of the Rules, the continuous permanent means of access may be a wide longitudinal, which provides access to critical details on the opposite side by means of platforms attached as necessary on the web frames. Where the vertical opening of the web frame is located in way of the open part between the wide longitudinal and the longitudinal on the opposite side, platforms are to be provided on both sides of the web frames to allow safe passage through the web frame.

15 With respect to the vertical distance of 6 *m* specified in **26.2.4-2(1) (a)** and **(b)**, **Part CS** of the Rules, excess of not more than 10% may be accepted as a reasonable deviation, where deemed necessary for the integration of the permanent means of access with the structure itself.

16 Means of access specified in **26.2.4-2(1)(a)**, **Part CS** of the Rules are to be connected to an access ladder from the deck required in **26.2.3-1**, **Part CS** of the Rules. Where two access hatches are required, access ladders at each end of the tank are to lead to the means of access.

17 With respect to the provisions of **26.2.4-2(2)**, **Part CS** of the Rules, notwithstanding the provisions of **-5**, the height of a bilge hopper tank located outside of the parallel part of the ship may be taken as the maximum of the clear vertical distance measured from the bottom plating to the hopper plating of the tank.

18 With respect to the provisions of **26.2.4-2(2)**, **Part CS** of the Rules in regards to the foremost and aftermost bilge hopper ballast tanks with raised bottoms, a combination of transverse and vertical means of access for access to the upper knuckle point for each transverse web may be accepted in place of the longitudinal permanent means of access.

19 With respect to the provisions of **26.2.4-2(2)**, **Part CS** of the Rules, a ladder or ladders are to be provided between the longitudinal continuous permanent means of access and the bottom of the space.

20 With respect to the provisions of **26.2.4-4**, **Part CS** of the Rules, the use of alternative means of access may be accepted where:

(1) Such means provide accessibility and safety equivalent to permanent means

(2) The use of such means are approved by the Administration and the ship's owner

Paragraph CS26.2.5 has been added as follows.

CS26.2.5 Specifications for Means of Access and Ladders

1 With respect to the provisions of **26.2.5-1**, **Part CS** of the Rules, permanent means of access are to be designed so as to ensure sufficient residual strength during the service life of the ship and, in general, the initial corrosion protection which is the same as the hull structural members is to be applied.

2 With respect to the provisions of **26.2.5-3**, **Part CS** of the Rules, slopping structures are structures that are sloped by 5 or more degrees from the horizontal plane when a ship is in the upright position at even-keel. Non-skid construction is to be such that the surface on which personnel walk provides sufficient friction to the sole of boots even when the surface is wet and covered with thin sediment.

3 Details of the guard rails required in **26.2.5-4, Part CS** of the Rules are to be in accordance with the following.

(1) Where guard rails are divided into several parts, the gaps of discontinuous top handrail are not to exceed 50 *mm*. When the top and mid handrails are connected by a bent rail, the outside radius of the bent part is not to exceed 100 *mm* (see **Fig. CS26.2.5-1**).

(2) The gaps between the top handrail and other structural members are not to exceed 50 *mm*.

(3) Where guard rails are divided into several parts, the maximum distance between the adjacent stanchions across the handrail gaps is to be 350 *mm*. However, when the top and mid handrails are connected together, the maximum distance may be 550 *mm* (see **Fig. CS26.2.5-1**).

(4) The maximum distance between the stanchion and other structural members is not to exceed 200 *mm*. However, when the top and mid handrails are connected together, the maximum distance may be 300 *mm* (see **Fig. CS26.2.5-1**).

4 For guard rails required in **26.2.5-4**, **Part CS** of the Rules, use of alternative materials such as *GRP* is to be subject to compatibility with the liquid carried in the tank. Non-fire resistant materials are not to be used for means of access to a space with a view to securing an escape route at high temperatures.

5 The minimum clear opening of 600 *mm* × 600 *mm* specified in **26.2.5-5**, **Part CS** of the Rules is to be rounded appropriately and may have corner radii up to 100 *mm* maximum. Where larger corner radii are adopted for avoiding stress concentration, a larger opening is to be provided so as to ensure accessibility equivalent to a opening of 600 *mm* × 600 *mm*. For example, 600 *mm* × 800 *mm* with 300 *mm* of corner radii may be accepted.

6 The minimum clear opening of 600 *mm* × 800 *mm* specified in **26.2.5-6**, **Part CS** of the Rules is to be rounded appropriately and may have corner radii up to 300 *mm* maximum. Such openings, in general, are to be 800 *mm* in height. However, an opening of 600 *mm* in height and 800 *mm* in width may be accepted as access openings in vertical structures where it is not desirable to make large openings in the structural strength aspects, i.e. girders and floors in double bottom tanks.

7 With respect to the provisions of **26.2.5-6**, **Part CS** of the Rules, an access opening having other dimensions, i.e. an opening as shown in **Fig. CS26.2.5-2**, may be accepted subject to verification of easy evacuation of an injured person on a stretcher.

8 With respect to the provisions of **26.2.5-6**, **Part CS** of the Rules, where the vertical manhole is at a height of more than 600 *mm* above the bottom plate, it is to be demonstrated that an injured person can be easily evacuated.

9 Smaller dimensions of minimum clear opening stipulated in **26.2.5-7**, **Part CS** of the Rules are to be in accordance with **Table S3.4.4**, **Part S** of the Guidance.

Fig. CS26.2.5-1 Detail of Handrails

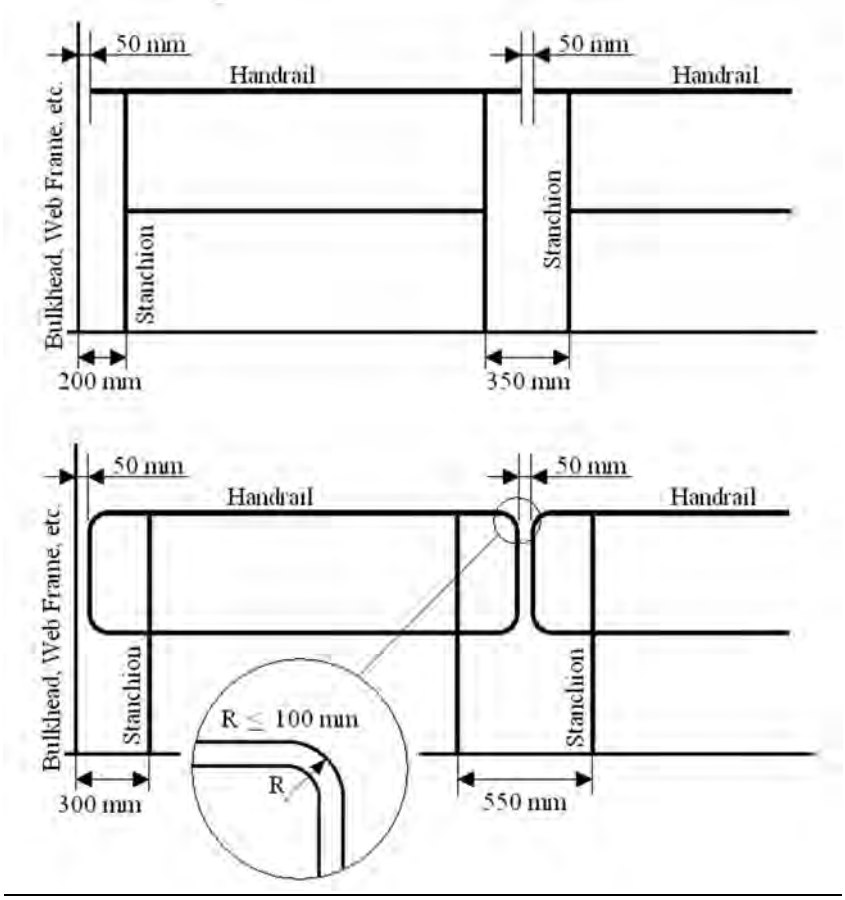
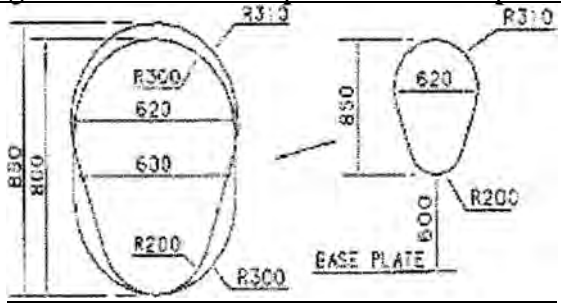


Fig. CS26.2.5-2 Example of Vertical Opening



10 With respect to the provisions of **26.2.5-8**, **Part CS** of the Rules, where the vertical manhole is at a height of more than 600 *mm* above the bottom plate, it is to be demonstrated that an injured person can be easily evacuated.

11 With respect to the provisions of **26.2.5-9**, **Part CS** of the Rules, details of ladders and other means are to be in accordance with the following.

(1) Permanent inclined ladders are to be inclined at an angle of less than 70 *degrees*. There is to be no obstructions within 750 *mm* of the face of the inclined ladder, except that in way of an opening this clearance may be reduced to 600 *mm*. Such clearance is to be measured perpendicular to the face of the ladder. A minimum climbing clearance in width is to be 600 *mm*. For this purpose, handrails may be provided within such climbing clearance. Resting platforms of adequate dimensions are to be provided, normally at a maximum of 6 *m* vertical height. Where deemed necessary for aligning resting platform arrangements with hull structures, the vertical distance from deck to such platforms, between such platforms or such

platforms and the tank bottom may be not more than 6.6 *m*. In this case, the flights of inclined ladders are not to be more than 9 *m* in actual length. Ladders and handrails are to be constructed of steel or equivalent material of adequate strength and stiffness and securely attached to the structure by stays. The method of support and length of stay is to be such that vibration is reduced to a practical minimum. In cargo holds, ladders are to be designed and arranged so that cargo handling difficulties are not increased and the risk of damage from cargo handling gear is minimized.

(2) The width of inclined ladders between stringers is not to be less than 400 *mm*. The width of inclined ladders for access to a cargo hold in bulk carriers is to be at least 450 *mm*. The treads are to be equally spaced at a distance apart, measured vertically, of between 200 *mm* and 300 *mm*. When steel is used, the treads are to be formed of two square bars of not less than 22 *mm* × 22 *mm* in section, fitted to form a horizontal step with the edges pointing upward. The treads are to be carried through the side stringers and attached thereto by double continuous welding. All inclined ladders are to be provided with handrails of substantial construction on both sides. The vertical height of handrails is not to be less than 890 *mm* from the centre of the step and two course handrails is to be provided where the gap between stringer and top handrail is greater than 500 *mm*.

(3) For vertical ladders, the width and construction are to be in accordance with the following. Other details are to be in accordance with international or national standards accepted by the Society.

(a) The minimum width of vertical ladders is to be 350 *mm*.

(b) The vertical distance between the rungs is to be equal and is to be between 250 *mm* and 350 *mm*.

(c) When steel is used, the rungs are to be formed of single square bars of not less than 22 *mm* × 22 *mm* in section, fitted to form a horizontal step with the edges pointing upward.

(d) Vertical ladders are to be secured at intervals not exceeding 2.5 *m* apart to prevent vibration.

(e) A minimum climbing clearance in width is to be 600 *mm* other than the ladders placed between the hold frames. A clearance of 600 *mm* perpendicular to the ladder is to be kept as far as possible.

(4) For spiral ladders, the width and construction are to be in accordance with international or national standards accepted by the Society.

(5) Resting platforms placed between ladders are to follow the provisions of **26.2.5-1** to **-4**, **Part CS** of the Rules.

(6) Portable ladders are to be in accordance with or are based on appropriate safety standards. No free-standing portable ladder is to be more than 5 *m* long unless accepted by the provisions of **CS26.2.4-1.(6)**.

(7) For the selection of portable and movable means of access, refer to **Annex 14.16, Part 1, Part C of the Rules**.

Paragraph CS26.2.6 has been added as follows.

CS26.2.6 Ship Structure Access Manual

1 The Ship Structure Access Manual required in **26.2.6-1**, **Part CS** of the Rules is to contain at least the following two parts.

(1) Part I

This part is to comprise plans, instructions and inventory required in **26.2.6-1.(1)** to **(7)**, **Part CS** of the Rules and the following matters are to be addressed. This part is to be approved by the Society when any content is changed.

(a) Approval/re-approval procedure for the manual, i.e. any changes of the permanent,

portable, movable or alternative means of access within the scope of **26.2**, **Part CS** of the Rules are subject to review and approval by the Society.

(b) Verification of means of access is to be part of a survey for continued effectiveness of the means of access in that space which is subject to the survey.

(c) Inspection of means of access is to be carried out by the crew and/or a competent inspector of the company as a part of regular inspection and maintenance.

(d) Actions to be taken if means of access are found unsafe to use.

(e) In case of use of portable equipment, plans showing the means of access within each space indicating from where and how each area in the space can be inspected.

(2) Part II

This part is to comprise of forms for record of inspections and maintenance, and change of inventory of portable equipment due to additions or replacements after construction. The form in this part is approved by the Society when the ship is under survey for classification during construction.

2 The Ship Structure Access Manual required in **26.2.6-1(8)**, **Part CS** of the Rules is to be prepared in a language(s) which all the crew can understand. As a minimum the English version is to be provided.

3 "Critical structural areas" specified in **26.2.6-1(3)**, **Part CS** of the Rules are to be in accordance with the provisions of **CS26.2.2-1**.

Annex CS1.3.1-1 has been added as follow

Annex CS1.3.1-1 GUIDANCE FOR HULL CONSTRUCTION CONTAINING HIGH TENSILE STEEL MEMBERS

1.1 General

1.1.1 Application

Where materials of high tensile steel *KA*32, *KD*32, *KE*32, *KF*32 (hereinafter to be referred to as "*HT*32"), *KA*36, *KD*36, *KE*36 and *KF*36 (hereinafter to be referred to as "*HT*36") and *KA*40, *KD*40, *KE*40 and *KF*40 (hereinafter to be referred to as "*HT*40") prescribed in **Chapter 3, Part K** of the Rules are used as structural members, the constructions and scantlings are to comply with the following provisions, in addition to those prescribed in the Rules. Where materials of high tensile steel other than *HT*32, *HT*36 and *HT*40 are used, the constructions and scantlings may be properly modified with due consideration for the mechanical properties of the materials to be used.

1.1.2 Details of Construction

1 Where materials of different strengths are mixed in the hull structure, due consideration is to be given to the stress in the lower tensile materials adjacent to high tensile materials.

2 Where stiffeners of lower tensile material are supported by girders of high tensile material, due consideration is to be given to the stiffness of girders and the dimensions of stiffeners to avoid excessive stress in the stiffeners.

3 For members of high tensile steel, special attention is to be paid to the details of constructions to avoid high concentration of stress.

4 Where materials of high tensile steel are extensively used in the hull structure, its designs are to be subjected to detailed study of strength, and their results are to be submitted to the Society.

1.2 Structural Members

1.2.1 General

1 Scantlings of Structural Members

(1) The scantlings of structural members of high tensile steel are not to be less than that obtained by the methods stipulated under **1.2.2** below.

(2) Where the section modulus of hull girder amidships is reduced by using high tensile steel in accordance with the provisions in **1.3.1-2(1), Part CS** of the Rules, the constructions and scantlings are to comply with the provisions under **1.2.3**, in addition to compliance with **(1)** above, if the strength deck and the bottom are constructed on the longitudinal framing system. If the strength deck or the bottom is constructed on the transverse framing system, the constructions and scantlings are to be subject to Society's special consideration.

2 Expressions

Unless specified otherwise, the expressions employed in this Guidance are to be as stipulated in **(1)** to **(4)** below.

(1) f_{DH} and f_{BH} are to be as follows:

$$f_{DH} = \frac{Z_{Mreq}}{Z_{DH\ ship}}$$

$$f_{BH} = \frac{Z_{Mreq}}{Z_{BH\ ship}}$$

Z_{Mreq}: Section modulus of hull determined according to the requirements in **Chapter 15, Part CS** of the Rules when mild steel is used.

$Z_{DH\ ship}$ and $Z_{BH\ ship}$: Actual hull section moduli at strength deck and bottom respectively.

(2) *K* is the coefficient corresponding to the kind of steel:

0.78 (for *HT*32)

0.72 (for *HT*36)

0.68 (for *HT*40, however, 0.66 may be taken where a fatigue assessment of the structure is performed to verify compliance with the requirements of the Society.)

The values specified in **1.3.1-4, Part CS** of the Rules (for stainless steel and stainless clad steel)

(3) Plate thickness t_M, section modulus Z_M and moment of inertia I_M are those required by the Rules for members and structures of mild steel, and t_H, Z_H and I_H are those for high tensile steel.

(4) Expressions not stipulated here are to be as defined in relevant provisions in **Part CS** of the Rules.

1.2.2 Determination of Scantlings of Structural Members

1 Double Bottoms

The formulae for determining the scantlings of structural members of the double bottom prescribed in **Chapter 6, Part CS** of the Rules, are to be replaced by the formulae in **Table 1.2-1**.

2 Frames

(1) The formulae for determining the scantlings of frames prescribed in **Chapter 7, Part CS** of the Rules, are to be replaced by the formulae in **Table 1.2-2**.

(2) Lower ends of frames

At the lower ends of hold frames and web frames, their section moduli in a range of about 300 *mm* from the upper end of lower brackets are not to be less than the values determined by the following formula:

$Z_H = Z_M$

Where appropriate considerations are given to the construction of the lower ends of frames, however, Z_H may be as determined by the formulae in **Table 1.2-2**.

3 Beams, Pillars and Deck Girders

The formulae in **Chapters 10**, **11** and **12, Part CS** of the Rules, for determining the scantlings of beams, pillars and deck girders are to be replaced by those in **Table 1.2-3**.

4 Watertight Bulkheads

The formulae in **Chapter 13, Part CS** of the Rules, for determining the scantlings of watertight bulkheads are to be replaced by those in **Table 1.2-4**.

5 Deep Tanks

The formulae in **Chapter 14, Part CS** of the Rules, for determining scantlings of deep tanks are to be replaced by those in **Table 1.2-5**.

6 Shell Plating

The formulae in **Chapter 16, Part CS** of the Rules, for shell plating are to be replaced by those in **Table 1.2-6**.

7 Decks

The formulae in **Chapter 17, Part CS** of the Rules, for thickness of deck plating are to be replaced by the following formula:

$t_H = \sqrt{K}(t_M - 2.5) + 2.5\ \ (mm)$

1.2.3 Special Rules for Longitudinal Strength Members

1 Application

The provisions under this paragraph apply to the use of high tensile steel for the reduction of the hull girder section modulus in the midship part according to **1.3.1-2(1), Part CS** of the Rules in ships having longitudinally framed strength deck and bottom.

2 Extents of Use of High Tensile Steel

Materials of high tensile steel are to be used in the following parts **(1)** to **(7)**.

(1) Longitudinal strength members from the strength deck or the bottom to the points specified below respectively. (*See* **Fig. 1.2-1** and **Fig. 1.2-2**)

(a) Strength deck part

$$b_D = y_D\left(1 - \frac{1}{f_{DH}}\right) \ (m)$$

Where y_D is the distance (m) from the neutral axis of the cross-section of hull to the strength deck

(b) Bottom part

$$b_B = y_B\left(1 - \frac{1}{f_{BH}}\right) \ (m)$$

Where y_B is the distance (m) from the neutral axis of the cross-section of hull to the top of the keel

Fig. 1.2-1. High Tensile Steel Used in Deck and Bottom

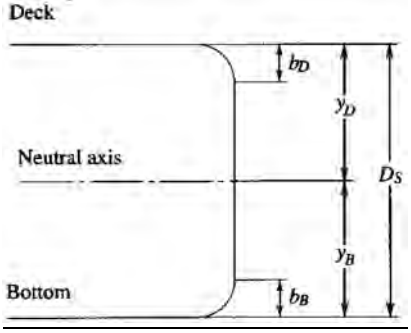
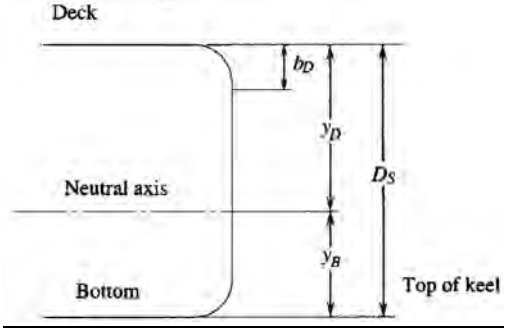


Fig. 1.2-2 High Tensile Steel Used in Deck only



(2) Longitudinal strength members on strength deck

(3) Portions as shown in **Fig. 1.2-3** of the deck inside the line of openings

(4) Hatch coamings and their horizontal stiffeners within the extents shown in **Fig. 1.2-4**.

(5) Gutter bars and bilge keels welded to high tensile steel materials

Where bilge keels are of riveted construction, materials except flat bars welded to shell plating do not need to be of high tensile steel.

(6) Doubling plates fitted to longitudinal strength members of high tensile steel for reinforcing openings, etc.

(7) It is recommended that the range of 0.5L amidships be constructed of high tensile steel. If the

range of 0.5*L* amidships is not covered by high tensile steel, special consideration should be given to the continuity of section modulus of hull girder between the ranges of 0.4*L* and 0.5*L* amidships.

Fig. 1.2-3 Deck

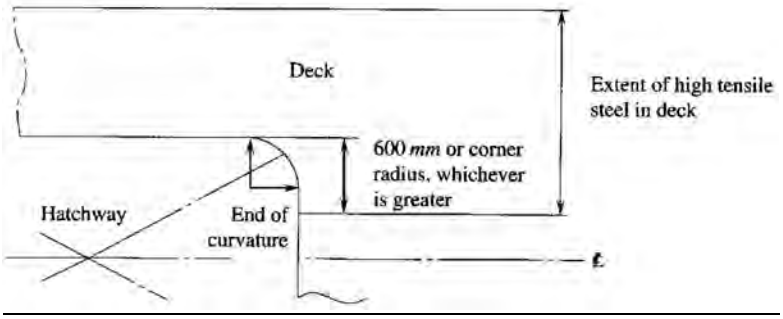
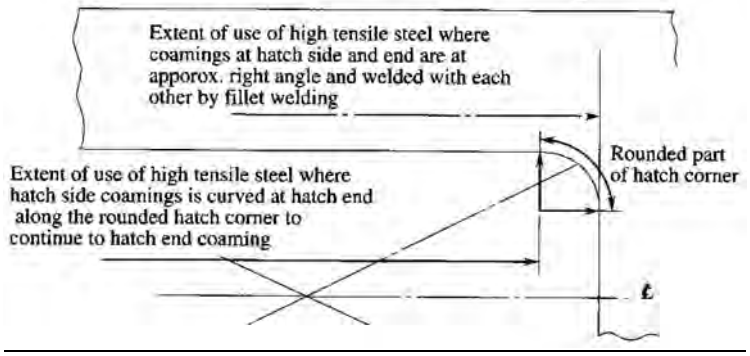


Fig. 1.2-4 Hatch Coaming



3 Scantlings of Structural Members

(1) The scantlings of structural members of high tensile steel are to be in accordance with **(3)** below, in addition to compliance with **1.2.2** above.

(2) The scantlings of structural members of mild steel are to be in accordance with **(3)** below, in addition to compliance with the Rules, provided that f_D and f_B in the formulae in the provisions concerned are to be replaced by f_{DH} and f_{BH} in **1.2.1-2** above respectively.

(3) The ratio of depth to thickness of flat bars used in longitudinal beams and frames, and the slenderness ratio of longitudinal side frames attached to longitudinal beams and shear strakes are to be as specified in the Rules.

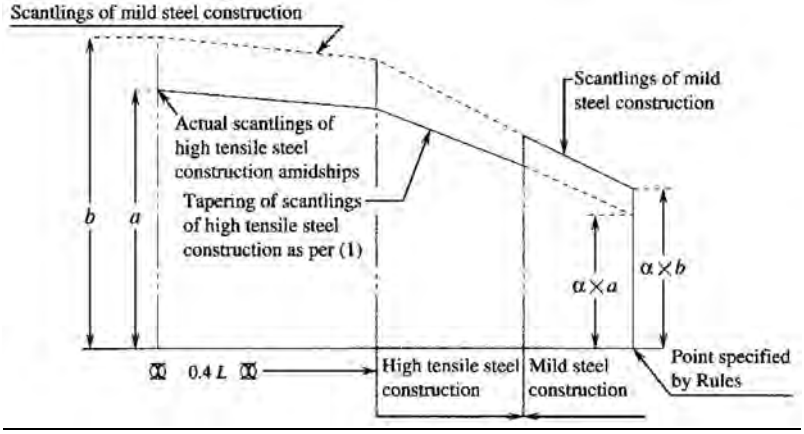
4 Tapering of Longitudinal Strength Members

(1) The manner of tapering of longitudinal strength members of high tensile steel is to comply with the provisions of the Rules, assuming that the entire hull be constructed of high tensile steel.

(2) Where the midship part is constructed of high tensile steel, the scantlings of mild steel members forward of and abaft the midship part are to be in accordance with **Fig. 1.2-5**.

(3) At the connection point of high tensile steel materials and mild steel materials, due consideration should be given to the continuity of strength so that an appreciable difference of plate thickness may be avoided.

Fig. 1.2-5 Scantlings of Mild Steel Members at Fore and Aft Part of Ship



Where:

α: Rule reduction ratio at the point specified by the Rules

a: Actual scantlings of high tensile steel members at the middle of L

b: Scantlings of members at the middle of L for mild steel construction given as follows:

(a) Thickness of shell plating and longitudinal bulkheads

$$\frac{1}{\sqrt{K}}(a - t_c) + t_c \ (mm)$$

t_c: As follows:

Side shell plating

2.5 (mm), for tankers (however, 3.0, where side shell plating forms boundaries of cargo oil tanks planned to carry ballast as well)

2.5 (mm), for other ships

Longitudinal bulkhead

3.5 (mm), for tankers

2.5, for other ships (mm)

(b) Effective sectional area of longitudinal strength members of strength deck

$b = \beta a$

Where β is to be as follows:

For tankers

1.27 (for *HT*32)

1.38 (for *HT*36)

1.46 (for *HT*40)

For other ships

1.34 (for *HT*32)

1.45 (for *HT*36)

1.54 (for *HT*40)

However, where the effective sectional area of longitudinal strength members of the strength deck in the middle of L has been determined, where mild steel construction is assumed, the value may be given as follows:

$$\beta = \frac{S_{e1}}{S_{e2}}$$

S_{e1}: Effective sectional area of the strength deck at the middle of L, where mild steel construction is assumed

S_{e2}: Effective sectional area of the strength deck at the middle of L, for ships made of high tensile steels

(c) Section modulus of stiffeners of longitudinal frames, beams and bulkheads

$\frac{a}{K}$

Table 1.2-1 Double Bottoms

Members	Paragraph No.	Scantlings
Open floors	**6.5.2-1.**	Section modulus: $KCShl^2 (cm^3)$
Bottom longitudinals	**6.6.2-1.**	Section modulus: $KCShl^2 (cm^3)$
Vertical struts	**6.6.3-2.**	Sectional area: $2.2KSbh\ (cm^2)$
Inner bottom plating	**6.7.1**	Thickness of inner bottom plating: $3.8S\sqrt{dK} + 2.5\ (mm)$
Longitudinal shell stiffeners & bottom longitudinals in strengthened bottom forward	**6.9.4**	Section modulus: $0.53KP\lambda l^2\ (cm^3)$

Table 1.2-2 Frames

Members	Paragraph No.	Scantlings
Hold frames	**7.3.2**	Section modulus: $Z_H = KZ_M$
Longitudinals on side shell plating	**7.4.1**	Section modulus: $Z_H = KZ_M$
Web frames	**7.4.2**	Section modulus: $Z_H = KZ_M$ Web thickness: $\frac{C_2K}{1000} \cdot \frac{Shl}{d_1} + 2.5\ (mm)$
Tween-deck frames	**7.5.2**	Section modulus: $Z_H = KZ_M$
Transverse frames below freeboard decks forward of collision bulkhead	**7.6.1**	Section modulus: $Z_H = KZ_M$
Longitudinals below freeboard decks forward of collision bulkhead	**7.6.2**	Section modulus: $Z_H = KZ_M$

Table 1.2-3 Beams, Pillars and Deck Girders

Members	Paragraph No.	Scantlings
Longitudinal beams and Transverse beams	**10.2.3** **10.3.3**	Section modulus: $Z_H = KZ_M$
Pillars	**11.2.1**	Sectional area: $\frac{0.223K\omega}{2.72-\frac{l}{k_0\sqrt{K}}}\ (cm^2)$
Deck girders	**12.2.1** and **12.3.1** **12.2.2** and **12.3.2** **12.2.3** and **12.3.3**	Section modulus: $Z_H = KZ_M$ Moment of inertia: $I_H = I_M$ Web thickness (i) Longitudinal girders under strength deck outside the line of openings in midship part $10\sqrt{f_{DH}}S_1 + 2.5\ (mm)$ Other longitudinal and transverse girders $10S_1 + 2.5\ (mm)$ (ii)Within $0.2l$ from ends $\frac{4.43K}{1000} \cdot \frac{bhl}{d_0} + 2.5\ (mm)$ $0.813 \cdot \sqrt[3]{\frac{bhlS_1^2}{d_0}} + 2.5\ (mm)$

Table 1.2-4 Watertight Bulkhead

Members	Paragraph No.	Scantlings
Bulkhead plating	**13.2.1**	Thickness: $3.2S\sqrt{Kh} + 2.5$ (*mm*), but not to be less than $5.9S + 2.5$ (*mm*)
Stiffeners	**13.2.3**	Section modulus: $Z_H = KZ_M$
Girders supporting stiffeners	**13.2.5**	Section modulus: $Z_H = KZ_M$ Moment of inertia of section: $I_H = KI_M$
Corrugated bulkheads	**13.2.9**	Thickness: $3.4CS_1\sqrt{Kh} + 2.5$ (*mm*), but not to be less than $5.9CS_1 + 2.5$ (*mm*) Section modulus per half pitch: $Z_H = KZ_M$ Plate thickness within $0.2l$ from ends of generating line: Web part $0.0417\frac{CKShl}{d_0} + 2.5$ (*mm*) $1.74 \cdot \sqrt[3]{\frac{CShlb^2}{d_0}} + 2.5$ (*mm*) Flange part $\frac{12}{\sqrt{K}}\ a + 2.5$ (*mm*)

Table 1.2-5 Deep Tanks

Members	Paragraph No.	Scantlings
Bulkhead plating	**14.2.2**	Thickness: $3.6S\sqrt{Kh} + 3.5$ (*mm*)
Stiffeners	**14.2.3**	Section modulus: $Z_H = KZ_M$
Girders supporting stiffeners	**14.2.4**	Section modulus: $Z_H = KZ_M$ Moment of inertia of section: $I_H = KI_M$
Corrugated bulkheads	**14.2.8**	Thickness: $3.6CS_1\sqrt{Kh} + 3.5$ (*mm*) Section modulus per half pitch: $Z_H = KZ_M$ Plate thickness within $0.2l$ from ends: Web plate $0.0417\frac{CKShl}{d_0} + 3.5$ (*mm*) $1.74 \cdot \sqrt[3]{\frac{CShlb^2}{d_0}} + 3.5$ (*mm*) Flange plate $\frac{12}{\sqrt{K}}a + 3.5$ (*mm*)

Table 1.2-6 Shell Plating

Members	Paragraph No.	Scantlings
Shell plating under strength deck	**16.3.1**	Minimum thickness: $(0.044L + 5.6)\sqrt{K}$ (*mm*)
Side shell	**16.3.2**	Thickness for transverse framing system: $4.1S\sqrt{(d + 0.04L)K} + 2.5$ (*mm*)
Bottom shell	**16.3.4**	(1) Thickness for transverse framing system: $4.7S\sqrt{(d + 0.035L)K} + 2.5$ (*mm*) (2) Thickness for longitudinal framing system: $4.0S\sqrt{(d + 0.035L)K} + 2.5$(*mm*)
Shell Plating for End Parts	**16.4.1**	Thickness: $(0.044L + 5.6)\sqrt{K}$ (*mm*)
Shell Plating for 0.3 *L* from the Fore End	**16.4.2**	Thickness: $1.34S\sqrt{KL} + 2.5$ (*mm*)
Shell Plating for 0.3 *L* from the After End	**16.4.3**	Thickness: $1.20S\sqrt{KL} + 2.5$ (*mm*)
Shell plating at strengthened bottom forward	**16.4.4**	Thickness: $CS\sqrt{KP} + 2.5$ (*mm*)

Appendix 1 has been deleted.

~~Appendix 1 APPLICATION OF PART C OF THE GUIDANCE~~

~~The **Part C** of the Guidance is to be applied as the Guidance related to the prescriptions in **Part CS** of the Rules, as shown in the **Table CS**.~~

~~Table CS Correspondence Table of Guidance between Part CS and Part C~~

Part CS	Part C	Part CS	Part C	Part CS	Part C
1.1.3	**C1.1.3**[See Note 1]	14.1.3	**C14.1.3**	21.1.2	**C23.1.2**[See Note 21]
1.3.1	**C1.1.7** **C1.1.11** and **C1.1.12**	14.2.3	**C14.2.3**	21.1.3	**C23.1.3**[See Note 22]
		15.1.1	**C15.1.1**	21.2.1	**C23.2.1**[See Note 23]
		15.2.1	**C15.2.1**	21.2.2	**C23.2.2**[See Note 24]
2.1.1	**C2.1.1**	15.2.3	**C15.2.3**	21.2.3	**C23.2.3**
2.2.2	**C2.2.2**	16.3.3	**C16.3.3**	21.3	**C23.3**
2.2.3	**C2.2.3**	16.4.4	**C16.4.4**	21.4	**C23.4**[See Note 25]
2.2.4	**C2.2.4**	16.5.3	**C16.6.1**	21.5.1	**C23.5.1**[See Note 26]
3	**C3**	16.6.1	**C16.7.1**	21.5.3	**C23.5.3**[See Note 27]
4	**C4**[See Note 2]	16.6.2	**C16.7.2**	21.5.7	**C23.5.7**[See Note 28]
5	**C5**	17.1.1	**C10.2.1**[See Note 10]	21.6.5	**C23.6.5**[See Note 29]
6.6.2	**C6.4.3 2**	17.2.1	**C17.1.1**	21.6.7	**C23.6.7**[See Note 30]
6.7.1	**C6.5.1 1** and **4**	17.2.2	**C17.1.2**	21.6.8	**C23.6.8**
6.9	**C6.8**	17.2.4	**C17.1.4**[See Note 11]	21.7.1	**C23.7.1**[See Note 31]
7.5.2	**C7.6.2**[See Note 5]	17.2.5	**C17.1.5**	21.7.2	**C23.7.2**
7.5.3	**C7.6.3**[See Note 6]	17.3.2	**C17.2.2**	21.8.1	**C23.8.1**[See Note 32]
8.3	**C7.5.3**	17.3.4	**C17.2.4**	22.2.1	**C24.2.1**
9.1.2	**C9.1.2**[See Note 7]	17.3.5	**C17.2.5**	22.4.1	**C25.2.1**[See Note 33]
9.1.3	**C9.1.3**	17.4.1	**C17.3.1**	22.4.2	**C25.2.2**
10.1.2	**C10.1.2**	17.4.5	**C17.3.5**	22.4.3	**C25.2.3** [See Note 34]
10.2.3	**C10.3.3**[See Note 8]	18	**C18**	23	**C27**
10.3.2	**C10.4.2**	19.1.2	**C20.1.2**[See Note 12]	24.1.1	**C29.1.1**[See Note 35] [See Note 36]
10.7.1	**C10.9.1**	19.2.4	**C20.2.4**[See Note 13]		
11.1.2	**C11.1.2**	19.2.5	**C20.2.5**[See Note 14]	24.1.2	**C29.1.2**[See Note 37]
11.2.1	**C11.2.1**	19.2.6	**C20.2.6**[See Note 15]	24.3.2	**C29.4.2**
12.1.3	**C12.1.3**	19.2.10	**C20.2.10**[See Note 16]	24.9.4	**C29.7.4**[See Note 38]
12.1.4	**C12.1.4**	19.2.12	**C20.2.12**[See Note 17]	24.11.5	**C29.12.4**
12.2.1	**C12.2.1**[See Note 9]	19.2.13	**C20.2.13**[See Note 18]	25.1.2	**C34.1.2**[See Note 39]
13.1.1	**C13.1.1**	19.3.5	**C20.3.5**[See Note 19]	26	**C35**
13.1.4	**C13.1.4**	19.4.2	**C20.4.2**		
13.2.3	**C13.2.3**	20.2.2	**C21.2.2**		
13.3	**C13.3**	21.1.1	**C23.1.1**[See Note 20]		

~~Notes:~~

~~1. In Guidance **C1.1.3 2(2)(a), 5.5.2, Part C** of the Rules is to be read as **5.4.3, Part CS** of the Rules.~~

~~In Guidance **C1.1.3 2(2)(b), 7.6.2 2, Part C** of the Rules is to be read as **7.5.2 1, Part CS** of the Rules.~~

~~In Guidance **C1.1.3 2(2)(c), 10.2.1 2, Part C** of the Rules is to be read as **17.1.1 2, Part CS** of the Rules.~~

~~In Guidance **C1.1.3 2(2)(e), 18.2.1 1, Part C** of the Rules is to be read as **18.2.1 1, Part CS** of the Rules.~~

~~In Guidance **C1.1.3 2(2)(g), 20.1.2, Part C** of the Rules is to be read as **19.1.2, Part CS** of the Rules.~~

~~In Guidance **C1.1.3 4, 1.1.3 5, Part C** of the Rules is to be read as **1.1.3 2, Part CS** of the Rules.~~

~~2. In Guidance **C4.2.3 2, 23.6.5 2, Part C** of the Rules is to be read as **21.6.5 2, Part CS** of the Rules.~~

~~3. (Deleted)~~

~~4. (Deleted)~~

~~5. In Guidance **C7.6.2, 7.6.2, Part C** of the Rules is to be read as **7.5.2, Part CS** of the Rules.~~

~~6. In Guidance **C7.6.3**, **7.6.2-2**, **7.7.1** and **7.8.1, Part C** of the Rules are to be read as **7.5.2-1**, **7.6.1** and **7.6.3, Part CS** of the Rules.~~

~~7. In Guidance **C9.1.2**, **9.2.2-2(2), Part C** of the Rules is to be read as **9.2.2-5, Part CS** of the Rules.~~

~~8. In Guidance **C10.3.3**, **10.3.3-1** and **10.3.3-2, Part C** of the Rules are to be read as **10.2.3-1** and **10.2.3-2, Part CS** of the Rules.~~

~~9. In Guidance **C12.2.1**, **12.2.1-1** and **12.2.1-2, Part C** of the Rules are to be read as **12.2.1-1** and **12.2.1-2, Part CS** of the Rules.~~

~~10. In Guidance **C10.2.1**, **10.2.1-1, Part C** of the Rules is to be read as **17.1.1-1, Part CS** of the Rules.~~

~~11. In Guidance **C17.1.4**, **17.1.4-2, Part C** of the Rules is to be read as **17.2.4-2, Part CS** of the Rules.~~

~~12. In Guidance **C20.1.2**, **20.1.2, Part C** of the Rules is to be read as **19.1.2, Part CS** of the Rules.~~

~~13. In Guidance **C20.2.4**, **20.2.4** and **20.2.10, Part C** of the Rules are to be read as **19.2.4** and **19.2.10, Part CS** of the Rules.~~

~~14. In Guidance **C20.2.5**, **20.2.4** and **20.2.5, Part C** of the Rules are to be read as **19.2.4** and **19.2.5, Part CS** of the Rules.~~

~~15. In Guidance **C20.2.6**, **20.2**, **20.2.4**, **20.2.6** and **20.2.5, Part C** of the Rules are to be read as **19.2**, **19.2.4**, **19.2.6** and **19.2.5, Part CS** of the Rules.~~

~~16. In Guidance **C20.2.10**, **20.2.10-2, Part C** of the Rules is to be read as **19.2.10-2, Part CS** of the Rules.~~

~~17. In Guidance **C20.2.12**, **20.2.12, Part C** of the Rules is to be read as **19.2.12, Part CS** of the Rules.~~

~~18. In Guidance **C20.2.13**, **20.2.13, Part C** of the Rules is to be read as **19.2.13, Part CS** of the Rules.~~

~~19. In Guidance **C20.3.5**, **20.3.5** and **20.1.2, Part C** of the Rules are to be read as **19.3.5** and **19.1.2, Part CS** of the Rules.~~

~~20. In Guidance **C23.1.1**, **23.1.1-2(2), Part C** of the Rules is to be read as **21.1.1-2(2), Part CS** of the Rules.~~

~~21. In Guidance **C23.1.2**, **23.1.2, Part C** of the Rules is to be read as **21.1.2, Part CS** of the Rules.~~

~~22. In Guidance **C23.1.3**, **23.1.3-4, Part C** of the Rules is to be read as **21.1.3-4, Part CS** of the Rules.~~

~~23. In Guidance **C23.2.1**, **23.2.1-3**, **23.2.1-4** and **23.2.2-4, Part C** of the Rules are to be read as **21.2.1-3**, **21.2.1-4** and **21.2.2-4, Part CS** of the Rules.~~

~~24. In Guidance **C23.2.2**, **23.2.2**, **23.2.2-1**, **23.2.2-2** and **23.2.2-3, Part C** of the Rules are to be read as **21.2.2**, **21.2.2-1**, **21.2.2-2** and **21.2.2-3, Part CS** of the Rules.~~

~~25. In Guidance **C23.4.5-2**, "$L^{\pm}$" is to be read as "*L*". *L* is ship's length specified in **2.1.2, Part A** of the Rules.~~

~~26. In Guidance **C23.5.1-2**, **23.5.1-1** and **Table C23.5, Part C** of the Rules is to be read as **21.5.1-1** and **Table CS21.5, Part CS** of the Rules.~~

~~27. In Guidance **C23.5.3**, **23.5.3-5, Part C** of the Rules is to be read as **21.5.3-5, Part CS** of the Rules.~~

~~28. In Guidance **C23.5.7**, **23.5.7-3, Part C** of the Rules is to be read as **21.5.7-3, Part CS** of the Rules.~~

~~29. In Guidance **C23.6.5**, **23.6.5** and **23.6.5-1, Part C** of the Rules are to be read as **21.6.5** and **21.6.5-1, Part CS** of the Rules.~~

~~30. In Guidance **C23.6.7**, **23.6.7**, **23.6.1** and **20.1.2, Part C** of the Rules are to be read as **21.6.7**, **21.6.1** and **19.1.2, Part CS** of the Rules.~~

~~31. In Guidance **C23.7.1**, **Chapter 19**, **23.1.2-2** and **23.7.1, Part C** of the Rules are to be read as **Chapter 18**, **21.1.2-2** and **21.7.1, Part CS** of the Rules.~~

~~32. In Guidance **C23.8.1**, **23.8.1, Part C** of the Rules is to be read as **21.8.1, Part CS** of the Rules.~~

~~33. Ships not engaged on international voyages need not to apply the provisions of **C25.2.1-2.**~~

~~34. In Guidance **C25.2.3**, **25.2.3, Part C** of the Rules is to be read as **22.4.3, Part CS** of the Rules.~~

~~35. In Guidance **C29.1.1-1(1), Chapter 29, Part C** of the Rules is to be read as **Chapter 24, Part CS** of the Rules.~~

~~36. In Guidance **C29.1.1-3(1)(b)(i)**, **29.4**, **29.5** and **29.6, Part C** of the Rules are to be read as **24.3**, **24.4** and **24.7, Part CS** of the Rules.~~

~~37. In Guidance **C29.1.2-4(1)**, **29.1.2-2, Part C** of the Rules is to be read as **24.1.2-2, Part CS** of the Rules.~~

~~38. In Guidance **C29.7.4**, **29.7.4, Part C** of the Rules is to be read as **24.9.4, Part CS** of the Rules.~~

~~39. In Guidance **C34.1.2**, **34.1.2-1, Part C** of the Rules is to be read as **25.1.2-1, Part CS** of the Rules.~~

EFFECTIVE DATE AND APPLICATION

1. The effective date of the amendments is 1 July 2023.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to the following ships:

(1) ships for which the date of contract for construction is before the effective date; or

(2) sister ships of ships subject to the current requirements for which the date of contract for construction is before 1 January 2025.