RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

RULES

Part C Hull Construction and Equipment

2008 AMENDMENT NO.1

Rule No.13 27th February 2008

Resolved by Technical Committee on 30th November 2007

Approved by Board of Directors on 25th December 2007

Rule No.13 27th February 2008
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 C HULL CONSTRUCTION AND EQUIPMENT

Amendment 1-1

Chapter 25 CEMENTING AND PAINTING

Section 25.2 has been amended as follows.

25.2 Painting

25.2.1 General

1 All steel works are to be coated with a suitable paint. Special requirements may be additionally made by the Society in accordance with the kind of ships, purpose of spaces, etc. However, where it is recognized by the Society that the spaces are effectively protected against corrosion of steel works by the means other than painting or due to quality of cargoes, etc., painting may be omitted.

~~**25.2.2 Wash Cement**~~

2 Steelworks in tanks intended for water may be coated with wash cement in lieu of paint.

~~**25.2.3 Cleaning before Painting**~~

3 The surface of steelworks is to be thoroughly cleaned and loose rust, oil and other injurious adhesives are to be removed before being painted. At least the outer surface of shell plating below the load line is to be sufficiently free from rust and mill scale before painting.

25.2.2 Protective Coatings in dedicated seawater ballast tanks and double-side skin spaces

For dedicated seawater ballast tanks of all type of ships of not less than 500 *gross tonnage* engaged on international voyages and double-side skin spaces arranged in bulk carriers engaged on international voyages of 150*m* in length and upwards as defined in **31A.1.2(1)**, the requirements are to be complied with "*PERFORMANCE STANDARD FOR PROTECTIVE COATINGS FOR DEDICATED SEAWATER BALLAST TANKS IN ALL TYPE OF SHIPS AND DOUBLE-SIDE SKIN SPACES OF BULK CARRIERS*" (*IMO Performance Standard for Protective Coatings / IMO* resolution *MEPC*.215(82) as may be amended).

EFFECTIVE DATE AND APPLICATION (Amendment 1-1)

1. The effective date of the amendments is 1 July 2008.

2. Notwithstanding the amendments to the Rules, the current requirements may apply to ships other than ships that fall under the following:

(1) for which the building contract is placed on or after 1 July 2008; or

(2) in the absence of a building contract, the keels of which are laid or which are at *a similar stage of construction* on or after 1 January 2009; or

(Note) The term "*a similar stage of construction*" means the stage at which the construction identifiable with a specific ship begins and the assembly of that ship has commenced comprising at least 50 *tonnes* or 1% of the estimated mass of all structural material, whichever is the less.

(3) the delivery of which is on or after 1 July 2012

Amendment 1-2

Chapter 31B ADDITIONAL REQUIREMENTS FOR EXISTING BULK CARRIERS

31B.5 Hold Frames

31B.5.2 Steel Renewal Criteria and Reinforcing Measures

Sub-paragraph -1(3) has been amended as follows.

1 Steel renewal of the webs of side shell frames and brackets is to be done when $t_M \leq t_{REN}$, where t_M is the measured thickness, in *mm*, and t_{REN} is the renewal thickness, in *mm*, defined as the maximum value of following **(1)** through **(4)**.

(1) $t_{REN} = t_{COAT} - t_C$

t_{COAT}: $0.75\, t_{S12}$ (*mm*)

t_C: The value specified in **Table C31B.5.2** (*mm*)

t_{S12}: Web of hold frame and web of bracket thickness required according to **31.1.6-2** and **31.6.2-5** (*mm*)

(2) $t_{REN} = 0.75\, t_{AB}$

t_{AB}: As build thickness (*mm*)

(3) $t_{REN} = t_{REN,d/t}$

$t_{REN,d/t}$: Web thickness, in *mm*, which satisfies the following web depth to thickness ratio for frames and brackets (applicable only to Zones *A* and *B* ~~only~~ as shown in **Fig. C31B.5.1**). However, regardless of the web depth to thickness ratio, $t_{REN,d/t}$ for lower integral brackets is not to be taken as less than $t_{REN,d/t}$ for the frames as specified in **(a)**. ~~the~~ The following **(a)** may be disregarded, provided that tripping brackets are fitted in accordance with **-6**.

(a) Web depth to thickness ratio for frames at section *b*) (see **Fig. C31B.5.2**)

$65\sqrt{K}$ for symmetrically flanged frames

$55\sqrt{K}$ for asymmetrically flanged frames

(b) Web depth to thickness ratio for the lower brackets at section *a*) (see **Fig. C31B.5.2**)

$87\sqrt{K}$ for symmetrically flanged frames

$73\sqrt{K}$ for asymmetrically flanged frames

Where the value of *K* is as follows:

1.00: Where mild steels *KA*, *KB*, *KD* or *KE* are used.

0.78: Where high tensile steels *KA*32, *KD*32, *KE*32 or *KF*32 are used.

0.72: Where high tensile steels *KA*36, *KD*36, *KE*36 or *KF*36 are used.

When calculating the web depth to the thickness ration of the lower brackets, the web depth of the lower bracket may be measured from the intersection between the sloped bulkhead of the hopper tank and the side shell plate, perpendicularly to the face plate of the lower bracket (See **Fig.C31B.5.3**). In the case of stiffeners fitted on the lower bracket plate,

the web depth may be taken as the distance between the side shell and the stiffener, between the stiffeners or between the stiffeners and the face plate of the brackets, whichever is the largest.

For the side frames, including the lower bracket, located immediately abaft the collision bulkheads, whose scantlings are increased in order that their moment of inertia is such to avoid undesirable flexibility of the side shell, when their web as built thickness t_{AB} is greater than 1.65 *times* of $t_{REN,S}$ defined by **31B.5.3-4**, the thickness $t_{REN,d/t}$ may be taken as the value $t'_{REN,d/t}$ obtained from the following equation.

$$t'_{REN,d/t} = \sqrt[3]{t_{REN,d/t}{}^2 \, t_{REN,S}}$$

(4) $t_{REN} = t_{REN,S}$ (When $t_M \leq t_{COAT}$ in the lower part of side frames as defined in **Fig.C31B.5.1**)

$t_{REN,S}$: As specified in **31B.5.3-4**

When the lower bracket length or depth does not comply with the requirements of **31.6.2-7**, a strength check in accordance with **31B.5.3-5** is to be carried out and renewals or reinforcements effected as required therein.

31B.5.3 Strength check criteria

Sub-paragraph -1 has been amended as follows.

1 In general, loads are to be calculated for the following loading conditions and strength checks are to be carried out for the aft, middle and forward frames of each hold. The scantlings required for frames in intermediate positions are to be obtained by linear interpolation between the results obtained for the above frames. When scantlings of side frames vary within a hold, the required scantlings are also to be calculated for the mid frame of each group of frames having the same scantlings. The scantlings required for frames in intermediate positions are to be obtained by linear interpolation between the results obtained for the calculated frames.

(1) Homogeneous loaded conditions with heavy cargoes (bulk cargo density is not less than 1.78 t/m^3), if carrying such heavy cargoes

(2) Homogeneous loaded conditions with light cargoes (bulk cargo density is less than 1.78 t/m^3)

(3) Non homogeneous loaded conditions with heavy cargoes, if applicable (multi port loading/unloading conditions need not be considered.)

EFFECTIVE DATE AND APPLICATION (Amendment 1-2)

1. The effective date of the amendments is 1 July 2008.

2. Notwithstanding the amendments to the Rules, the current requirements may apply to the surveys for which the application is submitted to the Society before the effective date.

Amendment 1-3

Chapter 1 GENERAL

1.1 General

1.1.7 Materials

Sub-paragraph -2(1) has been amended as follows.

2 Where high tensile steel specified in **Chapter 3, Part K of the Rules** are used, the construction and scantlings of ships are to comply with the following requirements in **(1)** to **(3)** :

(1) The section modulus of the transverse section of hull is not to be less than the value obtained by multiplying the following coefficient to the value specified in **Chapter 15**. And the extent of their use is to be at the discretion of the Society.
0.78 : where high tensile steels *KA*32, *KD*32, *KE*32 or *KF*32 are used.
0.72 : where high tensile steels *KA*36, *KD*36, *KE*36 or *KF*36 are used.
<u>0.68 : where high tensile steels *KA*40, *KD*40, *KE*40 or *KF*40 are used.</u>

(2) The thickness of decks and shell platings, section modulus of stiffeners and other scantlings etc. are to be at the discretion of the Society except the requirements in ~~**1**~~**(1)**.

(3) Where high tensile steels except the ones mentioned in ~~**1**~~**(1)** are used, the construction and scantlings of ships are to be at the discretion of the Society.

1.1.11 Application of Steels

Sub-paragraph -1 has been amended as follows.

1 The steels used for hull structures are to be of the grades provided in **Part K** in accordance with the requirements given in **Table C1.1** and **C1.2**. In applying these requirements *KB, KD* or *KE* may be substituted for *KA* ; *KD* or *KE* for *KB* ; *KE* for *KD* ; *KD*32, *KE*32 or *KF*32 for *KA*32 ; *KE*32 or *KF*32 for *KD*32 ; *KF*32 for *KE*32 ; *KD*36, *KE*36 or *KF*36 for *KA*36 ; *KE*36 or *KF*36 for *KD*36 ; *KF*36 for *KE*36 <u>; *KD*40, *KE*40 or *KF*40 for *KA*40 ; *KE*40 or *KF*40 for *KD*40 ; *KF*40 for *KE*40</u>, respectively.

Sub-paragraph -2 has been amended as follows.

2 Within 0.4*L* amidship, single strake of sheer strake to the strength deck, stringer plate in the strength deck, bilge strake, deck plate adjoining to longitudinal bulkhead and other members of grade *KE, KE*32, *KE*36, <u>*KE*40,</u> *KF*32<u>,</u> ~~and~~ *KF*36 <u>and *KF*40</u> are to have breadth not less than the value given by the following formula, maximum being 1,800 *mm*. As for rounded gunwale, the single strake is to have breadth to the satisfaction of the Society.

$5L_1 + 800 \quad (mm)$

L_1 : Length of ship specified in **2.1.2, Part A** or 0.97 times the length of ship on the load line,

whichever is smaller (*m*)

Sub-paragraph -4 has been amended as follows.

4 The steels with the thickness above 50 *mm* up to 100 *mm* used for stern frame may be of the grades *KE, KE*32, *KE*36, *KE*40.

Notes of Table C1.1 and Table C1.2 have been amended as follows.

Notes:
1. *A*, *B*, *D*, *E* in **Table C1.1** and *AH*, *DH*, *EH* in **Table C1.2** mean the grades of steel as follows:
   (1) A: *KA*, *B*: *KB*, *D*: *KD*, *E*: *KE*
   (2) AH: *KA*32, ~~and~~ *KA*36 and *KA*40, *DH*: *KD*32, ~~and~~ *KD*36 and *KD*40, *EH*: *KE*32, ~~and~~ *KE*36 and *KE*40
2. L_1 in **Table C1.1** and **Table C1.2** is the length of a ship specified in **2.1.2 Part A** or 0.97 times the length of a ship on the load line, whichever is smaller (*m*).
3. In case, strength deck strake adjoining to longitudinal bulkhead which is in way of inner skin bulkhead of double hull ships and is not a deck stringer plate of the strength deck, the deck strake may be applied as ordinary strength deck.
4. In **Table C1.1** and **Table C1.2**, applied part as bilge strake is the following part.
   (1) Where the part bottom flat line is not paralleled to the centre line of a ship is within 0.6 *L* amidship, applied part is within 0.6 *L* amidship.
   (2) Where the part bottom flat line is not paralleled to the centre line of a ship outer 0.6 *L* amidship, applied part is the corresponding part.
5. For rudder and rudder body plates, application of steels in way of lower pintle of type D and type E rudder specified in **Chapter 3** and in way of upper part of type C rudder specified in **Chapter 3** is specially considered by the Society.

Chapter 3 RUDDERS

3.1 General

3.1.2 Materials

Sub-paragraph -3 has been amended as follows.

3 Welded members of rudders such as rudder plates, rudder frames and rudder main pieces are to be made of rolled steel conforming to the requirements in **Part K of the Rules**. The required scantlings may be reduced when high tensile steels are applied. When reducing the scantling, the material factor *K* is to be ~~as follows:~~ the values specified in **1.1.7-2(1)**.
~~0.78 for *HT*32~~
~~0.72 for *HT*36~~

Chapter 15 LONGITUDINAL STRENGTH

15.4 Buckling Strength

15.4.2 Working Stress

Sub-paragraph -1 has been amended as follows.

1 The working compressive stress σ_a of the member considered, for examination of bulking strength according to the requirements in this section, is to be obtained from the following formula, but not less than 30/*K*:

$$\sigma_a = \frac{M_S + M_W}{I} y \times 10^5 \quad (N/mm^2)$$

K : ~~Material factor for the member considered, as specified below:~~ Coefficient corresponding to kinds of steel *e.g.* 1.0 for mild steel the values specified in **1.1.7-2(1)** for high tensile steel.

~~1.00 for mild steels as specified in **Chapter 3 of Part K.**~~

~~0.78 for high tensile steels *KA*32, *KD*32, *KE*32 or *KF*32 as specified in **Chapter 3 of Part K.**~~

~~0.72 for high tensile steels *KA*36, *KD*36, *KE*36 or *KF*36 as specified in **Chapter 3 of Part K.**~~

M_s : Longitudinal bending moment in still water as specified in **15.2.1** (*kN-m*).

M_w : Wave induced longitudinal bending moment as specified in **15.2.1** (*kN-m*).

For members located above the neutral axis, maximum value of M_s and M_w are to be taken respectively from the calculated value in sagging condition according to the location at the athwartship section considered, and for members located below the neutral axis, maximum value M_s and M_w are to be taken in hogging condition.

I : Moment of inertia at the athwartship section considered, as specified in **15.3.1-1** (cm^4).

y : Vertical distance from the neutral axis to the location of the member considered in the athwartship section under consideration.(*m*)

15.4.5 Critical Buckling Stress

Sub-paragraph -1 has been amended as follows.

1 The critical buckling stress in compression σ_c is determined as follows:

$$\sigma_C = \sigma_E \quad \text{when} \quad \sigma_E \le \frac{\sigma_Y}{2}$$

$$\sigma_C = \sigma_Y \left[1 - \frac{\sigma_Y}{4\sigma_E} \right] \quad \text{when} \quad \sigma_E > \frac{\sigma_Y}{2}$$

σ_E : The compressive buckling stress calculated according to **15.4.3** and **15.4.4**

σ_Y : Minimum ~~Y~~yield stress of material ~~of the member considered, which are given as follows~~ as specified in **Part K** (N/mm^2)~~:~~.

~~235: for mild steels as specified in **Chapter 3 of Part K.**~~
~~315: for high tensile steels *KA*32, *KD*32, *KE*32 or *KF*32 as specified in **Chapter 3 of Part K.**~~
~~355: for high tensile steels *KA*36, *KD*36, *KE*36 or *KF*36 as specified in **Chapter 3 of Part K.**~~

2 The critical buckling stress in shear τ_C is determined as follows:

$\tau_C = \tau_E$ when $\tau_E \le \frac{\tau_Y}{2}$

$\tau_C = \tau_Y\left[1 - \frac{\tau_Y}{4\tau_E}\right]$ when $\tau_E > \frac{\tau_Y}{2}$

where

τ_E : The shearing buckling stress calculated according to **15.4.3**

τ_Y : As given by the following:

$\tau_Y = \frac{\sigma_Y}{\sqrt{3}}$

σ_Y : As specified in preceding **-1.**

Chapter 18 SUPERSTRUCTURES

18.4 Additional Requirements for Bulk Carriers, Ore Carriers and Combination Carriers

Sub-paragraph (4) has been amended as follows.

Bulk Carriers defined in **1.3.1(13)**, **Part B of the Rules** are to be provided with forecastles in accordance with following requirements. In ships of which distance from aft bulkhead of forecastle deck to forward transverse hatch coaming is specially short or in ships which requirement in this section, for some special reasons, are not applicable, the arrangement of forecastle deck is to be at the direction of the Society.

(1) The forecastle is to be an enclosed superstructure.

(2) The forecastle is to be located on the freeboard deck with its aft bulkhead fitted in way or aft of the forward bulkhead of the foremost hold. (See **Fig.C18.2**)

(3) The forecastle height H_F above the main deck is to be not less than the value given in the following **(a)** or **(b)** whichever is the greater:

(a) $H_C + 0.5$ (*m*), where H_C is the height of the forward transverse hatch coaming of the foremost cargo hold.

(b) The standard height of superstructure as given in **Table C18.2**. For intermediate value of L_f is to be obtained by linear interpolation.

(4) Where the reduced loading applies to the forward transverse hatch coaming and the hatch cover of the foremost cargo hold in applying **20.2.3-1.(1)(a)** and **Table C20.~~9~~8**

respectively, horizontal distance l_F (m) from the hatch coaming deck to the all points of the aft edge of the forecastle deck is to satisfy the following formula:

$l_F \leq 5\sqrt{H_F - H_C}$

H_F and H_C: As specified in **(3)**

(5) A breakwater is not to be fitted on the forecastle deck with the purpose of protecting the hatch coaming or hatch covers. If fitted for other purposes, it is to be located such that its aft edge at center line is to forward of the after edge of the forecastle deck at horizontal distance l_w (m) satisfying the following formula:

$l_w \geq H_B / \tan 20^\circ$

H_B: Height of the breakwater above the forecastle.

Chapter 20 HATCHWAYS, MACHINERY SPACE OPENINGS AND OTHER DECK OPENINGS

20.2 Hatchways

20.2.5 Additional Requirements for Steel Hatch Covers intended to carry cargoes on them

Sub-paragraph -3, -4 and -5 have been amended as follows.

3 Local plate thickness

For hatch covers on which cargoes are carried, the thickness of top plating t is not to be less than that obtained from following formula.

$t = 1.25S\sqrt{Kh} + 2.5$ (mm)

S: Spacing of stiffeners (m)

h: Design cargo load specified in the preceding **-2** (kN/m^2)

K: ~~Coefficient given in **Table C20.7**~~ Coefficient corresponding to kinds of steel *e.g.* 1.0 for mild steel the values specified in **1.1.7-2(1)** for high tensile steel.

4 Secondary stiffeners

The section modulus of stiffeners supported by girders and subjected to a uniformly distributed loads may be obtained from the direct strength calculations, or obtained from the following formulae.

$0.71CKShl^2$ (cm^3)

C: Coefficient given below according to the type of end connections of stiffeners;
In case of lug at both ends: 1.0
In case of snip at both ends or one end snip and another end lug: 1.5

K: ~~Coefficient given in **Table C20.7**~~ Coefficient corresponding to kinds of steel as specified in the proceeding **-3**.

S: Spacing of stiffeners (m)

h: Design cargo load as specified in the preceding **-2** (kN/m^2)

l: Unsupported span of stiffeners (*m*)

5 Scantlings of primary supporting members and of portable beams

The net scantlings of primary supporting members of steel hatch covers, which are simply supported between hatch coamings with uniformly distributed loads imposed thereupon, and of portable beams are to comply with the following formulae. For steel hatchway covers, *S* and *l* are to read as *b* and *S*, respectively.

Net section modulus at mid-span of portable beams or primary supporting members:

$C_1 K k_1 S h l^2$ (cm^3)

Net moment of inertia at mid-span of portable beams or primary supporting members:

$C_2 k_2 S h l^3$ (cm^4)

Net cross-sectional area of web plates at the ends of portable beams or primary supporting members:

$C_3 K S h l$ (cm^2)

S, *b*, *l*, k_1 and k_2: As specified in **20.2.4-5**

C_1, C_2 and C_3: Coefficients given in **Table C20.~~8~~7**

h: Design cargo loads given by the preceding **-2**

K: Coefficient~~s given in **Table C20.7** according to the type of steels~~ corresponding to kinds of steel as specified in the proceeding **-3**.

Table C20.7 has been deleted, and Table C20.8 has been renumbered to Table C20.7.

~~**Table C20.7 Coefficient *K***~~

~~Type of steel~~	~~Mild steel~~	~~*HT32*~~	~~*HT36*~~
~~***K***~~	~~**1**~~	~~**0.78**~~	~~**0.72**~~

Table C20.~~8~~7 Coefficients C_1, C_2 and C_3

C_1	C_2	C_3
1.07	1.81	0.064*

Note:

*: Steel hatchway covers are not to be applied.

20.2.6 Special Requirements for Portable Beams, Hatchway Covers, Steel Pontoon Covers and Steel Weathertight Covers

Sub-paragraph -4 has been amended as follows.

4 Steel weathertight covers are to comply with the following **(1)** to **(~~3~~4)**.

(1) The depth of steel weathertight covers at supports is not to be less than one-third the depth at mid-span or 150 *mm*, whichever is greater.

(2) The strength and closing arrangements of small or special types of steel weathertight covers to which the requirements in **(1)**, **20.2.4** and **20.2.5** are not applicable and those of covers for hatchways, coaming of which is omitted by **20.2.2-2**, will be specially considered.

(3) The means for securing and maintaining weathertightness are to be to the satisfaction of the Society. The arrangements are to ensure that the weathertightness can be maintained in any sea conditions.

(4) For steel weathertight hatch covers, effective means for stoppers complying with the requirements in **Table C20.~~9~~8** against the horizontal forces acting on their forward end and the side are to be provided.

Table C20.9 has been renumbered to Table C20.8.

Table C20.~~9~~8 Strength Requirements for Stoppers

Design pressure	Following (1) or (2) in accordance with the kind of ships are to be applied. (1) For Bulk Carriers defined in **1.3.1(13)**, **Part B** of the Rules (a) Hatch covers for the foremost cargo hold The longitudinal forces acting on their forward end: 230 kN/m^2 (Where a forecastle complying with the requirements of **18.4** is fitted, the pressure may be reduced to 175 kN/m^2.) The transverse forces: 175 kN/m^2 (b) Other hatch covers The longitudinal forces acting on their forward end and the transverse forces: 175 kN/m^2 (2) Ships other than those specified in the preceding **(1)** Following **(a)** and **(b)** are to be applied. For ships with unusually large freeboard, however, the pressure is to be at the discretion of the Society. (a) Hatch covers for the foremost cargo hold The longitudinal forces acting on their forward end: 230 kN/m^2 (Where a forecastle complying with the requirements of **18.4** is fitted, the pressure may be reduced to 175 kN/m^2.) The transverse forces: 175 kN/m^2 (b) Other hatch covers The longitudinal forces acting on their forward end and the transverse forces: 175 kN/m^2 (In case, one forward transverse hatch coaming is protected by the adjacent forward cargo hold hatch cover or other structures effectively against the green sea forces, however, the longitudinal forces acting on their forward end is to be at the discretion of the Society.)
Allowable equivalent stress	In stoppers, their supporting structures and the stopper welds (calculated at the throat of welds), the equivalent stress is not to exceed the allowable value of 0.8 *times* yield stress of the material.

Chapter 23 BULWARKS, GUARDRAILS, FREEING ARRANGEMENTS, CARGO PORTS AND OTHER SIMILAR OPENINGS, SIDE SCUTTLES, RECTANGULAR WINDOWS, VENTILATORS AND GANGWAYS

23.3 Bow Doors and Inner Doors

23.3.3 Strength Criteria

Sub-paragraph -1 has been amended as follows.

1 Scantling of the prime menders, securing and supporting devices of doors and inner doors are to be determined withstand each design loads using the following permissible stresses:

Shearing stress $\tau = \frac{80}{K}$ (N/mm^2)

Bending stress $\sigma = \frac{120}{K}$ (N/mm^2)

Equivalent stress $\sigma_e = \sqrt{\sigma^2 + 3\tau^2} = \frac{150}{K}$ (N/mm^2)

K : Coefficient ~~as follows ;~~ corresponding to kinds of steel *e.g.* 1.0 for mild steel the values specified in **1.1.7-2(1)** for high tensile steel.

~~where mild steel *KA, KB* or *KE* as specified in **Chapter 3 of Part K** are applied: 1.00~~

~~where high tensile steel *KA*32, *KD*32, *KE*32 or *KF*32 as specified in **Chapter 3 of Part K** are applied: 0.78~~

~~where high tensile steel *KA*36, *KD*36, *KE*36 or *KF*36 as specified in **Chapter 3 of Part K** are applied: 0.72~~

23.4 Side Shell Doors and Stern Doors

23.4.3 Strength Criteria

Sub-paragraph -1 has been amended as follows.

1 Scantlings of the primary members, securing and supporting devices of doors are to be determined to withstand the design loads defined in **23.4.4**, using the following permissible stresses:

shear stress : $\tau = \frac{80}{K}$ (N/mm^2)

bending stress : $\sigma = \frac{120}{K}$ (N/mm^2)

equivalent stress : $\sigma_e = \sqrt{\sigma^2 + 3\tau^2} = \frac{150}{K}$ (N/mm^2)

K: Coefficient ~~as follows;~~ corresponding to kinds of steel *e.g.* 1.0 for mild steel the values specified in **1.1.7-2(1)** for high tensile steel.

~~where mild steel *KA, KB, KD* or *KE* specified in **Chapter 3, Part K** are applied: 1.00~~

~~where high tension steel *KA*32, *KD*32, *KE*32 or *KF*32 specified in **Chapter 3, Part K** are~~

~~applied: 0.78~~
~~where high tension steel *KA*36, *KD*36, *KE*36 or *KF*36 specified in **Chapter 3, Part K** are applied: 0.72~~

Chapter 30 ORE CARRIERS

30.1 Construction and Equipment

30.1.5 Construction and Scantlings of Wing Tanks or Void Spaces

Sub-paragraph -2(6)(a) has been amended as follows.

(6) The construction and scantlings of transverses are to be as required in the following provisions:

(a) The symbols used in **(6)** are as follows:

$Q = Shl_0$

h : Distance from the mid-point of l_0 to the point H_2 above the top of keel (m)

h_s : Distance from the mid-point of b_s to the point H_2 above the top of keel (m)

$H_2 = d + 0.038L \quad (m)$

l_0 : Overall length of side transverses (m), which is equal to the distance between the inner surfaces of face plates of bottom transverses and deck transverses (*See* **Fig.C30.1**)

S : Spacing of transverses (m)

S_1 : Spacing of stiffeners provided depthwise on the web plates of transverses at the portion where cross ties are connected (m)

K : Coefficient corresponding to ~~material strength, and is to be as given below:~~ <u>kinds of steel *e.g.* 1.0 for mild steel the values specified in **1.1.7-2(1)** for high tensile steel.</u>
~~1.00 for *MS*~~
~~0.78 for *HT*32~~
~~0.72 for *HT*36~~

k : Correction factor for brackets, and to be as obtained from the following formula:

$$k = 1 - \frac{0.65(b_1 + b_2)}{l_0}$$

b_1 and b_2 : Arm length of brackets, at respective ends of girders and transverses (m)

b : Arm length of lowest bracket (m). Upper end of the bracket is to be taken as a level of an intersection point of a tangential line of a free edge of the bracket, having an angle of 45 degrees to the base line, and an extended line of an inner edge of the lower parallel part of a side transverse. (*See* **Fig.C30.1**)

b_s : Width of the area supported by cross ties (m) (*See* **Fig.C30.1**)

d_0' : Depth of side transverses at the inner edge of the lowest bracket (m) (*See* **Fig.C30.1**)

a : Depth of slot in the vicinity of inner edge of the lowest bracket (m). Where, however, the slots are provided with collar plates, a may be taken as zero.

A : Sectional area effective to support the axial force from cross tie (cm^2), which is to be taken as follows:

i) Where the face plates of cross ties are continuous to the face plates of transverses in an arc form or a similar form, A is the total sum of the sectional area of the web plate of transverse at the portion between the contact points of the tangents to the arc or similar curve making an angle of 45° to the direction of cross tie, that of the stiffener provided in the axial direction of cross tie on the web plate between the contact points, and 0.50 times that of the face plates at the contact points (*See* **Fig.C30.2(a)**)

ii) Where the face plates of cross ties are continuous to the face plates of transverses in the form of straight line with rounded corners, A is the total sum of the sectional area of the web plate of transverse at the portion between the mid-points of the intersections of the extensions of the lines of inner surface of face plates of both cross tie and transverse with the lines making an angle of 45° to the direction of cross tie in contact with the inner surface plates at the transforming parts, that of the stiffener provided in the axial direction of cross tie on the web plate between the above-mentioned mid-points and 0.50 times that of the face plates at the mid-points (*See* **Fig.C30.2(b)**)

iii) Where the face plates of cross ties are joined directly to the face plates of transverses with a right or nearly right angle and both face plates are connected with brackets and further, stiffeners are provided on the web plate of transverses on the extended lines of face plates of cross tie, A is the total sum of the sectional area of the web plate of transverse at the portion between the mid-points of the intersections of the extensions of lines on inner surface of face plates of both cross tie and transverse with the lines making an angle of 45° to the direction of cross tie in contact with the free edge lines of brackets, and that of the stiffeners provided as mentioned above (*See* **Fig.C30.2(c)**)

C_0, C_1 and C_2 :Coefficient given in **Table C30.1** according to the number of cross ties respectively

Chapter 31B ADDITIONAL REQUIREMENTS FOR EXISTING BULK CARRIERS

31B.5 Hold Frames

31B.5.2 Steel Renewal Criteria and Reinforcing Measures

Sub-paragraph -1(3) has been amended as follows.

(3) $t_{REN} = t_{REN,d/t}$

$t_{REN,d/t}$: Web thickness, in *mm*, which satisfies the following web depth to thickness ratio for frames and brackets (applicable to Zone *A* and *B* only). However, the following **(a)** may be disregarded, provided that tripping brackets are fitted in accordance with **-6**.

(a) Web depth to thickness ratio for frames

$65\sqrt{K}$ for symmetrically flanged frames

$55\sqrt{K}$ for asymmetrically flanged frames

(b) Web depth to thickness ratio for the lower brackets at section *a*) (see **Fig. C31B.5.2**)

$87\sqrt{K}$ for symmetrically flanged frames

$73\sqrt{K}$ for asymmetrically flanged frames

~~Where the value of *K* is as follows:~~ Coefficient corresponding to kinds of steel *e.g.* 1.0 for mild steel the values specified in **1.1.7-2(1)** for high tensile steel.

~~1.00 : Where mild steels *KA*, *KB*, *KD* or *KE* are used.~~

~~0.78 : Where high tensile steels *KA*32, *KD*32, *KE*32 or *KF*32 are used.~~

~~0.72 : Where high tensile steels *KA*36, *KD*36, *KE*36 or *KF*36 are used.~~

When calculating the web depth to the thickness ration of the lower brackets, the web depth of the lower bracket may be measured from the intersection between the sloped bulkhead of the hopper tank and the side shell plate, perpendicularly to the face plate of the lower bracket (See **Fig.C31B.5.3**). In the case of stiffeners fitted on the lower bracket plate, the web depth may be taken as the distance between the side shell and the stiffener, between the stiffeners or between the stiffeners and the face plate of the brackets, whichever is the largest.

For the side frames, including the lower bracket, located immediately abaft the collision bulkheads, whose scantlings are increased in order that their moment of inertia is such to avoid undesirable flexibility of the side shell, when their web as built thickness t_{AB} is greater than 1.65 *times* of $t_{REN,S}$ defined by **31B.5.3-4**, the thickness $t_{REN,d/t}$ may be taken as the value $t'_{REN,d/t}$ obtained from the following equation.

$$t'_{REN,d/t} = \sqrt[3]{t_{REN,d/t}{}^2 \cdot t_{REN,S}}$$

EFFECTIVE DATE AND APPLICATION (Amendment 1-3)

1. The effective date of the amendments is 1 September 2008.

2. Notwithstanding the amendments to the Rules, the current requirements may apply to ships for which the date of contract for construction* is before the effective date.
*"contract for construction" is defined in IACS Procedural Requirement (PR) No.29 (Rev.4).

IACS PR No.29 (Rev.4)

1. The date of "contract for construction" of a vessel is the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. This date and the construction numbers (i.e. hull numbers) of all the vessels included in the contract are to be declared to the classification society by the party applying for the assignment of class to a newbuilding.

2. The date of "contract for construction" of a series of vessels, including specified optional vessels for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective owner and the shipbuilder.
For the purpose of this Procedural Requirement, vessels built under a single contract for construction are considered a "series of vessels" if they are built to the same approved plans for classification purposes. However, vessels within a series may have design alterations from the original design provided:
(1) such alterations do not affect matters related to classification, or
(2) If the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the shipbuilder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval.
The optional vessels will be considered part of the same series of vessels if the option is exercised not later than 1 year after the contract to build the series was signed.

3. If a contract for construction is later amended to include additional vessels or additional options, the date of "contract for construction" for such vessels is the date on which the amendment to the contract, is signed between the prospective owner and the shipbuilder. The amendment to the contract is to be considered as a "new contract" to which **1.** and **2.** above apply.

4. If a contract for construction is amended to change the ship type, the date of "contract for construction" of this modified vessel, or vessels, is the date on which revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder.

Notes:
1. This Procedural Requirement applies to all IACS Members and Associates.
2. This Procedural Requirement is effective for ships "contracted for construction" on or after 1 January 2005.
3. Revision 2 of this Procedural Requirement is effective for ships "contracted for construction" on or after 1 April 2006.
4. Revision 3 of this Procedural Requirement was approved on 5 January 2007 with immediate effect.
5. Revision 4 of this Procedural Requirement was adopted on 21 June 2007 with immediate effect.

Amendment 1-4

Chapter 4 SUBDIVISIONS

Section 4.1 has been amended as follows.

4.1 General

4.1.1 Application

The requirements in this Chapter apply to cargo ships of not less than 500 *gross tonnage* engaged in international voyages and 80 *m* in length for freeboard (L_f) and upwards. However, tankers specified in **Chapter 29** of this Part, ships to which the requirements in **Part N** or **Part S** apply and those ships specifically approved by the Society may be exempted.

4.1.2 Definitions

For the purpose of this chapter, the following definitions apply.

(1) "Compartment" is a part of the hull formed by shells, decks and bulkheads which are to be watertight as a rule.

(2) "Group of compartments" is a part of the hull formed by two or more compartments which are adjacent with each other.

~~(3) "Subdivision load line" is a water line used in determining the subdivision of the ship.~~

(~~4~~3) "Deepest subdivision ~~load line~~ draught" (d_s) is the ~~subdivision load line~~ draught which corresponds to the summer ~~load line~~ draught assigned to the ship in accordance with the requirements of **Part V**.

(4) "Light service draught" (d_l) is the service draught corresponding to the lightest anticipated loading and associated tankage, including, however, such ballast as may be necessary for stability and/or immersion. Passenger ships should include the full complement of passengers and crew on board.

(5) "Partial ~~load line~~ subdivision draught" (d_p) is the ~~subdivision load line~~ draught which corresponds to ~~what is~~ the summation of ~~the draught corresponding to LW specified in 2.1.29 of Part A (hereinafter referred to as "light ship draught")~~ light service draught specified in **(4)** above and 60% of the difference between light ~~ship~~ service draught and the ~~draught corresponding to~~ deepest subdivision ~~load line~~ draught.

(6) "Subdivision length of the ship" (L_s) is the greatest projected moulded length in metres of the ship at or below deck or decks limiting the vertical extent of flooding with the ship at the deepest subdivision ~~load line~~ draught.

(7) "Mid-length" is the midpoint of L_s.

(8) "Aft terminal" is the aft limit of L_s.

(9) "Forward terminal" is the forward limit of L_s.

(10) "Trim" is the difference between the draught forward and the draught aft, where the draughts are measured at the forward and aft terminals respectively, disregarding any rake of keel.

(1~~0~~1) "~~Subdivision b~~Breadth of ship" (B') is the greatest moulded breadth in metres of the ship at or below the deepest subdivision ~~load line~~ draught.

(1~~1~~2) "~~Subdivision d~~Draught" (d') is the vertical distance in metres from ~~base line~~ keel line to the water line in question at ~~mid-length~~ the midpoint of L_s.

(1~~2~~3) "Permeability of a space" (μ) is the proportion, at the immersed part of a compartment (or a group of compartments) estimated a damage, of the volume which can be occupied

by water to the volume of the immersed part. The value of μ is to be given in accordance with **Table C4.1-1** and **Table C4.1-2** according to the service of the space. In the space intended for liquid μ is to be of whichever becomes more severe requirements. Where substantiated by calculations and specifically accepted by the Society, other figures for permeability specified in **Table C4.1-1** and **Table C4.1-2** may be used notwithstanding the provision above.

(13~~4~~) "Internal opening" is the opening provided in decks or bulkheads forming a compartment except exposed one.

(14~~5~~) "External opening" is the opening provided in shells, exposed decks or bulkheads forming a compartment.

(15~~6~~) "Timber deck cargo" means a cargo of timber carried on an uncovered part of a freeboard or superstructure deck. The term does not include wood pulp or similar cargo.

~~(16) "Deepest timber subdivision load line" is the subdivision load line which corresponds to the timber summer draught to be assigned to the ship in accordance with the requirements of **Part V of the Rules**.~~

~~(17) "Respective partial load line" is the light ship draught plus 60% of the difference between the light ship draught and the deepest timber subdivision load line.~~

(17) "Machinery spaces" are spaces between the watertight boundaries of a space containing the main and auxiliary propulsion machinery, including boilers, generators and electric motors primarily intended for propulsion.

Table C4.1-1 Permeability of ~~a Space~~ general compartment

Space for	Locker	Accommodation	Machinery	Void	~~Dry cargo~~	Liquid
Permeability	0.60	0.95	0.85	0.95	~~0.70~~	0 or 0.95

Table C4.1-2 Permeability of cargo compartment

Space for	Permeability at draught d_s	Permeability at draught d_p	Permeability at draught d_l
Dry cargo spaces	0.70	0.80	0.95
Container spaces	0.70	0.80	0.95
Ro-ro spaces	0.90	0.90	0.95
Cargo liquids	0.70	0.80	0.95

4.2 Subdivision Index

Paragraph 4.2.1 has been amended as follows.

4.2.1 Subdivision Index

1 The value of the Required Subdivision Index (R) is to be given by the following formula:

(1) In case ~~$L_s \geq 100m$~~ $L_s > 100m$

~~$R = (0.002 + 0.0009L)^{1/3}$~~

$$R = 1 - \frac{128}{L_s + 152}$$

(2) In case ~~$100m > L_s \geq 80m$~~ $100m \geq L_s \geq 80m$

$$R = 1 - \left[1 / \left(1 + \frac{L_s}{100} \cdot \frac{R_0}{1 - R_0} \right) \right]$$

R_0 : The value R as calculated in accordance with the formula in **(1)** above.

2 The Attained Subdivision Index (A) for ship is to be not less than the Required Subdivision Index (R), calculated in accordance with **-1** above. ~~*R* is to be calculated by the following formula~~ A is obtained by the summation of the partial indices A_s, A_p and A_l, (weighted as shown) calculated for the draughts d_s, d_p and d_l specified in **4.1.2(3)** to **(5)** in accordance with the following formula:

$A = 0.4A_s + 0.4A_p + 0.2A_l$

Each partial index is a summation of contributions from all damage cases taken in consideration, using the following formula:

~~*A*~~ $A_x = \Sigma\, p_i \cdot s_i$

Where, each partial index is not less than $0.5R$.

A_x: Each partial index correspond to draughts, d_s, d_p and d_l specified in **4.1.2(3)** to **(5)**.

p_i : Probability that ~~only~~ a compartment or a group of compartments in question may be flooded (hereinafter referred to as "compartment flooding probability"), which is to be in accordance with the requirements in **4.2.2**.

s_i : Probability of survival after flooding a compartment or a group of compartments in question (hereinafter referred to as "survival probability"), which is to be in accordance with the requirements in **4.2.3**.

i : Indication of each compartment or group of compartments in question.

~~Σ : Summation of all cases of loading in which a compartment or a group of compartments is involved.~~

3 ~~*A*~~ Partial index (A_x) is to be calculated under the following conditions:

(1) ~~Subdivision load lines specified in **4.1.2(2)** and **(3)** are assumed, in principle, to be in parallel with base line.~~ Level trim is to be used for the deepest subdivision draught and the partial subdivision draught. The actual service trim is to be used for the light service draught. Where any service condition, the trim variation in comparison with the calculated trim is greater than $0.005L_s$, one or more additional calculations of A are to be submitted for the same draughts but different trims so that, for all service conditions, the difference in trim in comparison with the reference trim used for one calculation will be less than $0.005L_s$.

(2) All flooding cases for ~~all of~~ a compartment and a group of compartments over the ship's subdivision length are to be taken into account. ~~However, what is counted in *A* may be limited to flooding cases contributing to *A* only.~~

(3) Assumed extent of hull damage is ~~to be limited to one breach with~~ the following ~~extents~~:

(a) Vertical extent is to extend upwards to ~~H_{MAX} specified in **4.2.3-3**~~ $d' + 12.5\ (m)$ from baseline. However, if a lesser extent will give a more severe result, such extent is to be assumed.

(b) ~~Horizontal extent is to extend to the centreline from the side of the ship. However, the damage to any centreline bulkheads may be excluded.~~ Horizontal extent of damage is measured inboard from Ship's side, at a right angle to the centreline at the level of the deepest subdivision draught and damage of the transverse extent greater than half breadth ($B'/2$) of the ship may be exempted. In case that the ship has a compartment formed by longitudinal watertight bulkheads which are not in the ship's centreline, all damages which extend from the outmost compartment (hereinafter referred to as "wing compartment") to the ship's centreline are to be assumed.

(4) In the flooding calculations carried, only one breach of the hull damage need to be assumed and only one free surface need to be considered.

(5) In the case of unsymmetrical arrangements, the calculated A value is to the mean value

obtained from calculations involving both sides. Alternatively, it is to be taken as that corresponding to the side which evidently gives the least favourable result.

(6) When determining the positive righting lever (*GZ*) of the residual stability curve, the displacement for the intact condition is to be used.

Paragraph 4.2.2 has been amended as follows.

4.2.2 Compartment Flooding Probability (p_i)

~~**1** p_i for a single compartment is to be determined by the following procedure according to its longitudinal position.~~

~~(1) Where the compartment considered equals or extends over L_s:~~

~~$p_i = 1$~~

~~(2) Where the aft limit of the compartment considered coincides with the aft terminal:~~

~~$p_i = F + 0.5ap + q$~~

~~where:~~

~~F: Coefficient given below~~

~~$0.4 + 0.25E(1.2 + a)$~~

~~E: Coefficient given below~~

~~$E_1 + E_2 = 1$~~

~~E_1: Coefficient given below~~

~~x_1 / L_s~~

~~x_1: The distance from the aft terminal to the foremost portion of the aft end of the compartment considered (m)~~

~~E_2: Coefficient given below~~

~~x_2 / L_s~~

~~x_2: The distance from the aft terminal to the aftermost portion of the forward end of the compartment considered (m)~~

~~a: Coefficient given below, but not more than 1.2.~~

~~$1.2 + 0.8E$~~

~~p: Coefficient given below~~

~~$E_1 J_{max} = 1$~~

~~E_1: Coefficient given below according to the value of y~~

~~In case $y < 1.0$: $y^2 - (y^3/3)$~~

~~In case $y \geq 1.0$: $y - (1/3)$~~

~~y: Coefficient given below~~

~~J / J_{max}~~

~~J: Nondimensional subdivision length given below~~

~~$E_2 - E_1$~~

~~J_{max}: The maximum nondimensional damage length given below, but not more than 0.24~~

~~$48 / L_s$~~

~~q: Coefficient given below~~

~~$0.4E_2(J_{max})^2$~~

~~E_2: Coefficient given below according to the value of y~~

~~In case $y < 1.0$: $(y^3/3) - (y^4/12)$~~

~~In case $y \geq 1.0$: $(y^2/2) - (y/3) + (1/12)$~~

~~(3) In case that the forward limit of the compartment considered coincides with the forward terminal:~~

~~$p_i = 1 - F + 0.5ap$~~

~~where, F, a and p are as specified in **(2)** above.~~

(4) In case that neither of **(1)** to **(3)** above is applicable:

$p_s = ap$

where, a and p are as specified in **(2)** above.

(5) Notwithstanding the provision of **(2)** to **(4)** above, if the compartment considered extends over the midlength, p_s for such a compartment is to be of the value which is reduced by the amount determined according to the formula for q, in which F_z is calculated taking y to be $((J' / J_{max}))$. J' is to be given bellow according to the value of E:

In case $E \geq 0$: $J - B$

In case $E < 0$: $J + B$

where, J and B are as specified in **(2)** above.

2 p_s for a group of compartments is to be determined in accordance with the following procedure according to the number of compartments in the group of compartments considered. However, in the group of compartments which is consisting of three or more adjacent compartments, if J of one excluded the aftermost and foremost compartments from it is greater than J_{max}, p_s for it is to be of zero.

(1) In case that the group of compartments is consisting of two compartments:

$p_s = p_{n(n+1)} = p_n = p_{(n+1)}$

$p_{n(n+1)}$: p_s for the group of compartments considered which is determined by applying the requirements of preceding **-1** assumed as a single compartment.

(2) In case that the group of compartments is consisting of three compartments:

$p_s = p_{n(n+1)(n+2)} = p_{n(n+1)} = p_{(n+1)(n+2)} + p_{(n+1)}$

$p_{n(n+1)(n+2)}$: p_s for the group of compartments considered which is determined by applying the requirements of preceding **-1** assumed as a single compartment.

(3) In case that the group of compartments is consisting of four compartments:

$p_s = p_{n(n+1)(n+2)(n+3)} = p_{n(n+1)(n+2)} = p_{(n+1)(n+2)(n+3)} + p_{(n+1)(n+2)}$

$p_{n(n+1)(n+2)(n+3)}$: p_s for the group of compartments considered which is determined by applying the requirements of preceding **-1** assumed as a single compartment.

(4) In case that the group of compartments is consisting of five or more adjacent compartments, p_s for it is to be determined by applying the above procedure correspondingly.

3 Where a wing compartment is fitted, p_s for it and inner compartments is to be determined in accordance with the following procedure.

(1) p_s for only a wing compartment considered is to be obtained by multiplying the value, as determined by the requirements of preceding **-1** according to the longitudinal position of the compartment, by the reduction factor r. Where r is to be given below:

In case $J \geq 0.2b/B'$:

$(b/B')\{2.3 + 0.08/(J + 0.02)\} + 0.1$ if $b/B' \leq 0.2$

$0.016/(J + 0.02) + (b/B') + 0.36$ if $b/B' > 0.2$

In case $J < 0.2b/B'$, r is to be determined by linear interpolation between the following values according to the value of J:

$(b/B')\{2.3 + 0.08/(J + 0.02)\} + 0.1$ if $J=0.2b/B'$

1.0 if $J=0$

J: As specified in **-2** above.

b: The mean transverse distance in metres measured at right angles to the centreline at the deepest subdivision load line between the shell and a plane through the outmost portion of and parallel to that part of the longitudinal limits forming the wing compartment considered.

(2) p_s for a group of compartments formed by a wing compartment and adjacent inboard compartments is to be obtained by multiply p_s, which is determined by applying the

~~provision of **-2** above, by the factor (1 - *r*).~~

1 The Compartment Flooding Probability (p_i) for a compartment or group of compartments is to be determined by the following **(1)**, **(2)** or **(3)** according to the number of damaged compartment.

(1) Where the damage involves a single zone only:

$$p_i = p(x1_j, x2_j) \cdot [r(x1_j, x2_j, b_k) - r(x1_j, x2_j, b_{k-1})]$$

Where:

x1: The distance (*m*) from the aft terminal of L_s to the aft end of the zone in question

x2: The distance (*m*) from the aft terminal of L_s to the forward end of the zone in question

b: The mean transverse distance (*m*) measured at right angles to the centreline at the deepest subdivision loadline between the shell and an assumed vertical plane extended between the longitudinal limits used in calculating the factor p_i and which is a tangent to, or common with, all or part of the outermost portion of the longitudinal bulkhead under consideration. This vertical plane is to be so orientated that the mean transverse distance to the shell is a maximum, but not more than twice the least distance between the plane and the shell. If the upper part of a longitudinal bulkhead is below the deepest subdivision loadline the vertical plane used for determination of *b* is assumed to extend upwards to the deepest subdivision waterline. In any case, *b* is not to be taken greater than *B*'/2.

j: The aftmost damage zone number involved in the damage starting with no.1 at the stern

k: The number of a particular longitudinal bulkhead as barrier for transverse penetration in a damage zone counted from shell towards the centre line. However, value of *k* according to side shell is to be taken as zero.

p(*x1*, *x2*): It is specified in **-2**.

r(*x1*, *x2*, *b*): It is specified in **-3**. However, $r(x1, x2, b_0)$ is to be taken as zero.

(2) Where the damage involves two adjacent zones:

$$\begin{aligned} p_i = {} & p(x1_j, x2_{j+1}) \cdot [r(x1_j, x2_{j+1}, b_k) - r(x1_j, x2_{j+1}, b_{k-1})] \\ & - p(x1_j, x2_j) \cdot [r(x1_j, x2_j, b_k) - r(x1_j, x2_j, b_{k-1})] \\ & - p(x1_{j+1}, x2_{j+1}) \cdot [r(x1_{j+1}, x2_{j+1}, b_k) - r(x1_{j+1}, x2_{j+1}, b_{k-1})] \end{aligned}$$

(3) Where the damage involves three or more adjacent zones:

$$\begin{aligned} p_i = {} & p(x1_j, x2_{j+n-1}) \cdot [r(x1_j, x2_{j+n-1}, b_k) - r(x1_j, x2_{j+n-1}, b_{k-1})] \\ & - p(x1_j, x2_{j+n-2}) \cdot [r(x1_j, x2_{j+n-2}, b_k) - r(x1_j, x2_{j+n-2}, b_{k-1})] \\ & - p(x1_{j+1}, x2_{j+n-1}) \cdot [r(x1_{j+1}, x2_{j+n-1}, b_k) - r(x1_{j+1}, x2_{j+n-1}, b_{k-1})] \\ & + p(x1_{j+1}, x2_{j+n-2}) \cdot [r(x1_{j+1}, x2_{j+n-2}, b_k) - r(x1_{j+1}, x2_{j+n-2}, b_{k-1})] \end{aligned}$$

n: The number of adjacent damage zones involved in the damage

2 The Compartment Flooding Probability (p_i) is to be determined by the following **(1)**, **(2)** or **(3)** according to longitudinal position of compartment under consideration.

(1) Where neither limits of the compartment or group of compartments under consideration coincides with the aft or forward terminals:

In case $J \leq J_k$:

$$p(x1, x2) = p_1 = \frac{1}{6} J^2 (b_{11} J + 3 b_{12})$$

In case $J > J_k$:

$$p(x1, x2) = p_2 = -\frac{1}{3}b_{11}{J_k}^3 + \frac{1}{2}(b_{11}J - b_{12}){J_k}^2 + b_{12}JJ_k - \frac{1}{3}b_{21}\left({J_n}^3 - {J_k}^3\right) + \frac{1}{2}(b_{21}J - b_{22})\left({J_n}^2 - {J_k}^2\right) + b_{22}J(J_n - J_k)$$

J: Non-dimensional damage length given below:

$$J = \frac{(x2 - x1)}{L_s}$$

$x1$ and $x2$ are specified in **-1** above.

J_k: As given by the following formula:

In case $L_s \leq 260m$:

$$J_k = \frac{J_m}{2} + \frac{\sqrt{1 - \frac{55}{6}J_m + \frac{121}{4}{J_m}^2}}{11}$$

$$J_m = \min\left\{\frac{10}{33}, \frac{60}{L_s}\right\}$$

In case $L_s > 260m$:

$$J_k = J_k^* \cdot \frac{260}{L_s}$$

$$J_k^* = \frac{J_m^*}{2} + \frac{1 - \sqrt{1 - \frac{55}{6}{J_m}^* + \frac{121}{4}{J_m}^{*2}}}{11}$$

Where: $J_m^* = 3/13$

$$J_m = \frac{60}{L_s}$$

b_{11}, b_{12}, b_{21} and b_{22}: Coefficient given by the following:

$$b_{11} = \frac{1}{6}\left(\frac{2}{(J_m - J_k)J_k} - \frac{11}{{J_k}^2}\right)$$

$$b_{12} = 11 \quad \text{If } L_s \leq 260(m)$$

$$= \frac{1}{6}\left(\frac{11}{J_k} - \frac{1}{J_m - J_k}\right) \quad \text{If } L_s > 260(m)$$

$$b_{21} = -\frac{1}{6}\frac{1}{(J_m - J_k)^2}$$

$$b_{22} = \frac{1}{6}\frac{J_m}{(J_m - J_k)^2}$$

J_n: Normalized length of a compartment or group of compartments is to be taken as the lesser of J and J_m:

(2) Where the aft limit of the compartment or group of compartments under consideration coincides with the aft terminal or the forward limit of the compartment or group of compartments under consideration coincides with the forward terminal:

In case $J \leq J_k$:

$$p(x1, x2) = \frac{1}{2}(p_1 + J)$$

In case $J > J_k$:

$$p(x1, x2) = \frac{1}{2}(p_2 + J)$$

$x1$, $x2$, p_1, p_2, J and J_k are specified in **(1)** above.

(3) Where the compartment or groups of compartments considered extends over the entire subdivision length (L_s):

$p(x1, x2) = 1$

$x1$ and $x2$ are specified in **(1)** above.

3 The factor $r(x1, x2, b)$ is to be determined by the following formulae:

$$r(x1, x2, b) = 1 - (1 - C) \cdot \left[1 - \frac{G}{p(x1, x2)}\right]$$

$x1$, $x2$ and b are specified in **-1** above.

C: Coefficient given by the following:

$$C = 12 \cdot J_b \cdot (-45 \cdot J_b + 4)$$

J_b: Coefficient given by the following:

$$J_b = \frac{b}{15 \cdot B'}$$

G: As given by the following formula:

Where the compartment or groups of compartments considered extends over the entire subdivision length (L_s):

$$G = G_1 = \frac{1}{2} b_{11} {J_b}^2 + b_{12} J_b$$

Where neither limits of the compartment or group of compartments under consideration coincides with the aft or forward terminals:

$$G = G_2 = -\frac{1}{3} b_{11} {J_0}^3 + \frac{1}{2}(b_{11} J - b_{12}) {J_0}^2 + b_{12} J J_0$$

Where the aft limit of the compartment or group of compartments under consideration coincides with the aft terminal or the forward limit of the compartment or group of compartments under consideration coincides with the forward terminal:

$$G = \frac{1}{2} \cdot (G_2 + G_1 \cdot J)$$

b_{11}, b_{12} and J are specified in **-2** above.

J_0: Coefficient given by the following:

$$J_0 = \min(J, J_b)$$

Paragraph 4.2.3 has been amended as follows.

4.2.3 Probability of Survival (s_i)

~~**1** The probability of survival after flooding the compartment or group of compartments is to be determined by the following formula.~~

~~$s_i = 0.5 S_L + 0.5 S_p$~~

~~S_L: The value of S at the deepest subdivision load line~~

~~S_p: The value of S at the partial load line~~

~~S: Coefficient given below. However, if the water line at the final equilibrium state immerses the lower edge of openings through which progressive flooding may take place, it is to be of zero.~~

~~$C\sqrt{0.5RL \cdot GZ_{max}}$~~

~~C: Coefficient according to the final equilibrium angle of heel(θ_e) as given below.~~

~~1.0 if $\theta_e \leq 25^\circ$~~

~~$\sqrt{(30 - \theta_e)/5}$ if $25^\circ < \theta_e \leq 30^\circ$~~

~~0 if $\theta_e > 30^\circ$~~

~~RL: Range of positive righting levers beyond the angle of equilibrium in degrees but not more than 20° However, the range is to be terminated at the angle where openings not capable of being closed weathertight are immersed.~~

~~GZ_{max}: Maximum positive righting lever (m) within RL, but not more than 0.1 m.~~

1 The Probability of Survival (s_i) for any damage case at any initial loading condition is to be obtained from the formula:

$$s_i = \min\{ s_{\text{final,i}} \}$$

$s_{\text{final,i}}$: It is the probability to survive in the final equilibrium stage of flooding.

$$s_{\text{final,i}} = K \cdot \left[\frac{GZ_{\max}}{0.12} \cdot \frac{Range}{16} \right]^{\frac{1}{4}}$$

K: Coefficient given by the following:

$K = 1.0$ if $\theta_e \leq \theta_{\min}$

$K = 1.0$ if $\theta_e \geq \theta_{\max}$

$$K = \sqrt{\frac{\theta_{\max} - \theta_e}{\theta_{\max} - \theta_{\min}}} \quad \text{Otherwise}$$

Where, $\theta_{\min}$ is 25° and $\theta_{\max}$ is 30° for cargo ships.

$GZ_{\max}$: It is the maximum positive righting lever (m) up to the angle θ_v. However, in the calculations of $s_{\text{final,i}}$, It is not to be taken as more than 0.12m.

θ_v: It is the angle (°), in any stage of flooding, where the righting lever becomes negative, or the angle (°) at which an opening incapable of being closed weathertight becomes submerged.

Range: It is the range (°) of positive righting levers measured from the angle θ_e. However, the positive range is to be taken up to the angle θ_v and, in the calculations of $s_{\text{final,i}}$, it is not to be taken as more than 16 °.

θ_e: It is the equilibrium heel angle (°) in any stage of flooding.

~~**2** S for a compartment and/or a group of compartments forward of the collision bulkhead is to be equal to 1.0 calculated assuming the ship to be at its deepest subdivision load line and with assumed unlimited vertical extent of damage.~~

~~**3**~~**2** ~~When a compartment or a group of compartments has the decks, two or more tiers of which are above load line considered, S for such a compartment or a group of compartments is to be the~~

~~summation of the following **(1)** and **(2)**~~ Where horizontal watertight boundaries are fitted above the waterline under consideration, the factor (s) calculated for the lower compartment or group of compartments is to be obtained by multiplying the value as determined in **-1** above by the factor v_m given by following formula.

~~(1) S for the lower compartment or group of compartments is to be obtained by multiplying the value as determined in **-1** above by the reduction factor V given by the following formula. However, when the uppermost deck is lower than H_{max}, V is to be taken as 1.0.~~

~~$(H - d')/(H_{max} - d')$~~

~~where ;~~

~~H: Height from the baseline to the deck considered (m)~~

~~H_{max}: Height from the baseline to the point given below (m):~~

~~In case $L_s \leq 250m$: $d' + 0.056L_s\{1 - (L_s/500)\}$~~

~~In case $L_s \geq 250m$: $d' + 7$~~

$$v_m = v\left(H_{j,n,m}, d'\right) - v\left(H_{j,n,m-1}, d'\right)$$

$H_{j,n,m}$: It is the least height (m) above the baseline within the longitudinal range of $x1_{(j)} \cdots x2_{(j+n-1)}$ of the m-th horizontal boundary which is assumed to limit the vertical extent of flooding for the damaged compartments under consideration;

$H_{j,n,m-1}$: It is the least height (m) above the baseline within the longitudinal range of $x1_{(j)} \cdots x2_{(j+n-1)}$ of the $m-1$-th horizontal boundary which is assumed to limit the vertical extent of flooding for the damaged compartments under consideration;

j, n, $x1$ and $x2$ are specified in **4.2.2-1**.

m: It is each horizontal boundary counted upwards from the waterline under consideration;

$v(H_{j,n,m}, d')$ and $v(H_{j,n,m-1}, d')$: Coefficient given by the following:

$$v\left(H, d'\right) = 0.8\frac{\left(H - d'\right)}{7.8} \qquad \text{if } H_m - d' \leq 7.8m$$

$$v\left(H, d'\right) = 0.8 + 0.2\left[\frac{\left(H - d'\right) - 7.8}{4.7}\right] \qquad \text{Otherwise}$$

$v(H_{j,n,m}, d')$ is to be taken as 1, if H_m coincides with the uppermost watertight boundary of the ship within the range $x1_{(j)} \cdots x2_{(j+n-1)}$, and $v(H_{j,n,0}, d')$ is to be taken as 0.

v_m is to be taken as 0, if v_m determined by above formula is taken as less than 0, and v_m is to be taken as 1, if v_m determined by above formula is taken as more than 1.

~~(2) S for the upper compartment or group of compartments above the horizontal subdivision is to be obtained for simultaneous flooding by multiplying the value as determined in **-1** above by the factor $(1-V)$.~~

3 Where the requirement in **-2** above is applied, in general, each contribution dA to the Attained Subdivision Index A is obtained from the formula:

$$dA = p_i \cdot \left[v_1 \cdot s_{\min 1} + \left(v_2 - v_1\right) \cdot s_{\min 2} + \cdots + \left(1 - v_{m-1}\right) \cdot s_{\min m}\right]$$

v_m: The value calculated in accordance with **-2** above;

s_{min}: The least factor of s for all combinations of damages obtained when the assumed damage extends from the assumed damage height H_m downwards.

4 In all cases, probability of survival (s_i) is to be taken as 0 in those cases where, taking into account sinkage, heel and trim, the openings in accordance with following **(1)** and **(2)** immerse at the final waterline:

(1) The openings through which progressive flooding may take place and such flooding is not accounted for in the calculation of probability of survival (s_i)

(2) Air-pipes, ventilators and the openings which are closed by means of weathertight doors or hatch covers

5 The probability of survival (s_i) is to be taken as 0 if, taking into account sinkage, heel and trim, any of the following **(1)** to **(3)** occur in any intermediate stage or in the final stage of flooding:

(1) Immersion of any vertical escape hatch in the bulkhead deck

(2) Any controls intended for the operation of watertight doors, valves on piping or on ventilation ducts intended to maintain the integrity of watertight bulkheads from above the bulkhead deck become inaccessible or inoperable

(3) Immersion of piping or ventilation ducts maintained a watertight and located within any compartment

~~**4**~~**6** Where the ship carries timber deck cargo, the calculation of s_i may be modified as deemed appropriate by the Society.

4.3 Openings

4.3.2 External Openings

Sub-Paragraph 4.3.2-2(4) has been amended as follows.

1 All external openings, which are below the final damage waterline in the calculation of subdivision index, are to be watertight.

2 The closing appliances for the external openings required to be watertight under the requirements of **-1** above are to be permanently closed at sea, and are to comply with the following **(1)** to **(4)**.

(1) (Omitted)

(2) (Omitted)

(3) (Omitted)

(4) Closing appliances for openings in the shell plating below the bulkhead deck accessible during the voyage, are to be fitted with a device which prevents unauthorized opening, except where specially accepted by the Society.

3 (Omitted)

Chapter 6 DOUBLE BOTTOMS

6.1 General

6.1.1 Application

Sub-Paragraph -1 and -3 have been amended as follows.

1 Ships, in principle, are to be provided with watertight double bottoms extending from the

collision bulkhead to the after peak bulkhead. The longitudinal system of framing is, in general, to be adopted. The inner bottom is to be continued out to the ship's sides in such a manner as to protect the bottom to the turn of the bilge, and is not lower at any part than a plane parallel with the keel line and which is located not less than a vertical distance *h* (*m*) measured from the keel line specified in **2.1.47, Part A of the Rules**.

$h = B'/20$

B' : It is specified in **4.1.2(11)**.

However, in no case is the value of h to be less than 0.76 *m*, and need not be taken as more than 2.0 *m*.

3 Double bottoms may be omitted in way of watertight tanks, including dry tanks of moderate size ~~used exclusively for the carriage of liquids~~ subject to ~~the approval by the Society~~ the safety of the ship is not impaired in the event of bottom or side damage.

Paragraph 6.1.8 has been amended as follows.

6.1.8 Wells

~~Wells for other purposes than draining water are not to be provided except where specially approved by the Society.~~

1 Small wells constructed in the double bottom in connection with drainage arrangements of holds are not to extend downward more than necessary. A well extending to the outer bottom is, however, permitted at the after end of the shaft tunnel.

2 Other wells (e.g. for lubricating oil under main engines) may be permitted by the Society if satisfied that the arrangements give protection equivalent to that afforded by a double bottom complying with this Chapter.

3 For wells specified in **-1** and **-2** above except a well at the end of the shaft tunnel, the vertical distance from the bottom of such a well to a plane coinciding with the keel line specified in **2.1.47, Part A of the Rules** is not to be less than 0.5 *m*.

6.5 Inner Bottom Plating, Margin Plates and Bottom Shell Plating

Paragraph 6.5.2 has been deleted, and paragraphs 6.5.3 to 6.5.6 have been renumbered to 6.5.2 to 6.5.5 respectively.

~~**6.5.2 Intersections of Margin Plates and Shell Plating**~~

~~It is recommended that the intersections of margin plates and shell plating be of sufficient height to protect the bottom up to the turn of bilge of shell plating by the double bottom, and for 0.2 *L* from the stem the margin plates be extended to the ship's sides horizontally as far as practicable.~~

Chapter 13 WATERTIGHT BULKHEADS

13.1 Arrangement of Watertight Bulkheads

Paragraph 13.1.1 has been amended as follows.

13.1.1 Collision Bulkheads

1 All ships are to have a collision bulkhead, at a position not less than $0.05L_f$ or 10 *m*, whichever is less, but not more than $0.08L_f$ or $0.05L_f$ + 3.0 (*m*), whichever is greater, except where larger distance be accepted by the Society due to a special reason as to structure, from the forward terminal of the length for freeboard. However, where any part of the ship below the waterline at 85% of the least moulded depth extends forward beyond the forward terminal of the length for freeboard, the above-mentioned distance is to be measured from a point either:

(a) at the mid-length of such extension ; or
(b) at a distance $0.015L_f$ forward from the above-mentioned forward terminal; or
(c) at a distance 3 *m* forward from the forward terminal ; whichever gives the smallest measurement.

2 The bulkhead may have steps or recesses within the limits specified in the above **-1**.

3 Any access openings, doors, manholes or ducts for ventilation, etc. are not to be cut in the collision bulkhead below ~~freeboard~~ bulkhead deck. Where a collision bulkhead extends up to a deck above the freeboard deck in accordance with the requirements of **13.1.5(2)**, the number of openings in the extension of the collision bulkhead is to be kept to a necessary minimum and all such openings are to be provided with weathertight means of closing.

4 Arrangement of collision bulkhead in a ship provided with bow door is to be at the discretion of the Society. However, where a sloping ramp forms a part of the collision bulkhead above the ~~freeboard~~ bulkhead deck, the part of the ramp which is more than 2.3 *m* above the ~~freeboard~~ bulkhead deck may extend forward of the limit specified in the above **-1**. In this case, the ramp is to be weathertight over its complete length. However, ramps not meeting the above requirement are to be disregarded as an extension of the collision bulkhead.

Section 13.4 has been added as follows.

13.4 Other Watertight Construction

13.4.1 Maintaining the Watertightness of Trunks

For the application of this chapter, trunks required to maintain watertightness are to be capable of withstanding internal or external pressure under the most severe conditions at the intermediate or final stages of flooding.

Chapter 16 PLATE KEELS AND SHELL PLATINGS

16.1 General

Paragraph 16.1.6 has been added as follows.

16.1.6 Moving Parts Penetrating the Shell Plating

Moving parts penetrating the shell plating below the deepest subdivision draught specified in **4.1.2(3)**, are to be fitted with a watertight sealing arrangement acceptable to the Society. The inboard gland is to be located within a watertight space of such volume that, if flooded, the bulkhead deck is not to be submerged. The Society may require that if such a compartment is flooded, essential or emergency power and lighting, internal communication, signals or other emergency devices remain available in other parts of the ship.

Chapter 17 DECKS

17.1 General

Paragraph 17.1.2 has been amended as follows.

17.1.2 Watertightness of Decks

1 Weather decks, except where hatchway and other openings specified in **Chapter 20** are provided, are to be made watertight. Weather decks, however, may be made weathertight, subject to the approval by the Society.

2 Special consideration is to be given to the water influx to the compartments under the bulkhead deck on ro-ro spaces.

3 Special consideration is to be given to maintaining watertightness where the decks are required to be watertight in compliance with the requirements of **Chapter 4**.

Chapter 23 BULWARKS, GUARDRAILS, FREEING ARRANGEMENTS, CARGO PORTS AND OTHER SIMILAR OPENINGS, SIDE SCUTTLES, RECTANGULAR WINDOWS, VENTILATORS AND GANGWAYS

23.4 Side Shell Doors and Stern Doors

23.4.2 Arrangement of Doors

Sub-paragraph -3 has been amended as follows.

2 Where the lower edges of any openings of the doors are situated below the freeboard deck, the doors are to be watertight.

3 Notwithstanding the requirements in **-2**, the lower edges of the doors are not to be below a line drawn parallel to the freeboard deck at side, which has at its lowest point at least 230 *mm* above the ~~upper edge of the uppermost load line~~ deepest subdivision draught specified in **4.1.2(3)**, unless the implementation of additional measures for ensuring watertightness such as the following **(1)** to **(4)**.

(1) A second door of equivalent strength and watertightness is to be fitted inside the watertight door

(2) A leakage detection device is provided in the compartment between the two doors

(3) Drainage of this compartment to the bilges is controlled by a readily accessible screw-down valve

(4) The outer door opens outwards

23.5 Side Scuttles and Rectangular Windows

Paragraph 23.5.2 has been amended as follows.

23.5.2 General Requirement for Position of Side Scuttles

1 No side scuttle is to be provided in such a position as its sill is below a line drawn parallel to the freeboard deck at side and having its lowest point ~~0.025B_f~~ 2.5% of the breadth of the ship (B') specified in **4.1.2(11)** or 500 *mm*, whichever is greater, above the ~~uppermost load line~~ deepest subdivision draught specified in **4.1.2(3)**. All side scuttles sill of which is below the freeboard deck and which are of hinged type are to be provided with locking arrangements.

2 No side scuttle is to be provided to any space solely engaged in carriage of cargoes.

3 The deadlights of side scuttles deemed appropriate by Society may be portable, provided that such scuttles comply with the following requirements **(1)** to **(4)**:

(1) Fitting class *A* side scuttles or class *B* side scuttles is not required.

(2) Such side scuttles are fitted abaft one eighth of the subdivision length (L_s) specified in **4.1.2(6)** from the forward perpendicular.

(3) Such side scuttles are fitted above a line drawn parallel to the bulkhead deck at side and having its lowest point at a height of 3.7 *m* plus 2.5% of the breadth of the ship (B') specified in **4.1.2(11)** above the deepest subdivision draught specified in **4.1.2(3)**.

(4) Such portable deadlights are to be stowed adjacent to the side scuttles they serve.

4 Automatic ventilating side scuttles is not to be fitted in the shell plating below the freeboard deck.

EFFECTIVE DATE AND APPLICATION (Amendment 1-4)

1. The effective date of the amendments is 1 January 2009.

2. Notwithstanding the amendments to the Rules, the current requirements may apply to ships the keels of which were laid or which were at *a similar stage of construction* before the effective date.

(Note) The term "*a similar stage of construction*" means the stage at which the construction identifiable with a specific ship begins and the assembly of that ship has commenced comprising at least 50 *tonnes* or 1% of the estimated mass of all structural material, whichever is the less.

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE

Part C Hull Construction and Equipment

2008 AMENDMENT NO.1

Notice No.9 27th February 2008

Resolved by Technical Committee on 30th November 2007

Notice No.9 27th February 2008
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 C HULL CONSTRUCTION AND EQUIPMENT

Amendment 1-1

C27 EQUIPMENT

C27.2 Towing and Mooring Fittings

C27.2.3 Mooring Fittings

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

2 The breaking strength of ~~the~~ mooring line<u>s</u> specified in **27.2.3-2(1), Part C** of the Rules, may ~~be~~ take~~n~~ into account the requirements in **27.1.5-3, Part C** of the Rules. <u>In this case, the number of mooring lines and their breaking load are to be incorporated into the Towing and Mooring Fitting Arrangement Plan specified in **27.2.4, Part C** of the Rules.</u>

EFFECTIVE DATE AND APPLICATION (Amendment 1-1)

1. The effective date of the amendments is 1 January 2007.

2. Notwithstanding the amendments to the Guidance, the current requirements may apply to ships the keels of which were laid or which were at *a similar stage of construction* before the effective date.
(Note) The term "*a similar stage of construction*" means the stage at which the construction identifiable with a specific ship begins and the assembly of that ship has commenced comprising at least 50 *tonnes* or 1% of the estimated mass of all structural material, whichever is the less.

Amendment 1-2

C25 CEMENTING AND PAINTING

C25.2 Painting

C25.2.1 General

Sub-paragraph -2 has been amended as follows.

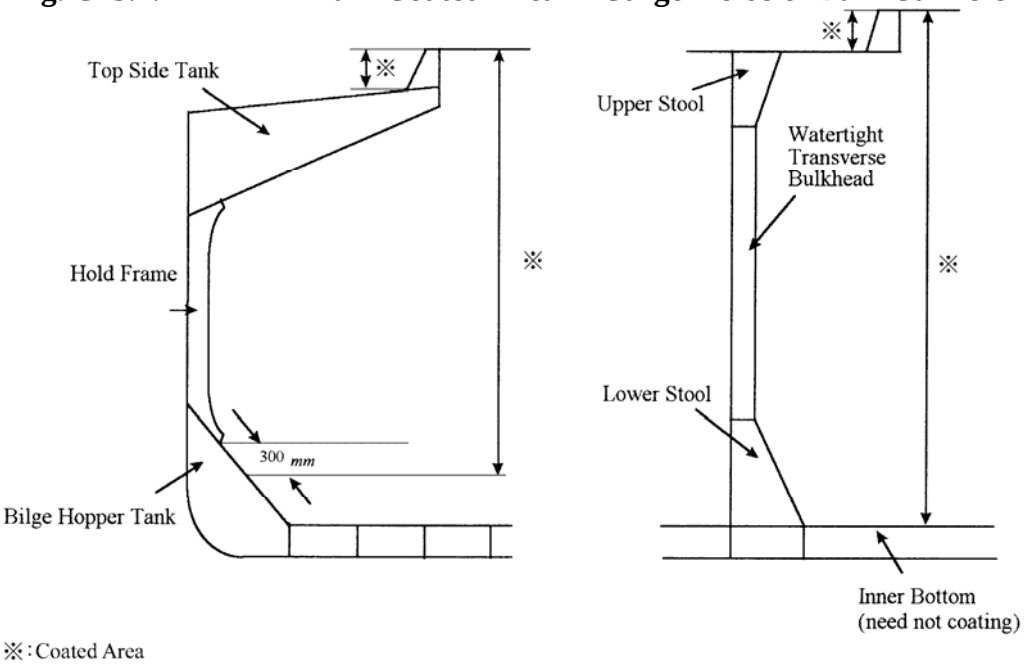
2 Special Requirements
The cases that "Special requirements may be additionally made by the Society" stated in **25.2.1-1, Part C** of the Rules are as follows;

(1) Cargo hold of bulk carriers
Where ships are subject to the requirements of **Chapter 31, Part C** of the Rules, the following scope (See **Fig. C25.2.1-1**) are to have an efficient protective coating (epoxy coating or equivalent) applied in accordance with the manufacturer's recommendation. In the selection of coating due consideration is given by the owner to cargo conditions expected in service,

(a) All internal surfaces of the cargo holds, excluding the flat tank top areas and the hopper tanks sloping plating approximately 300 *mm* below the side shell frame and brackets.

(b) All internal and external surface of hatch coaming and hatch cover

Fig. C25.2.1-1 Minimum Coated Area in Cargo Holds of Bulk Carriers



※: Coated Area

~~(2) Ballast Tank, etc.~~
~~For sea-water ballast tanks (including slop tanks), and double-side skin spaces of ships~~

~~coming under the definition of bulk carrier as specified in **31A.1.2(1), Part C** of the Rules, all internal surfaces are to be coated according to the followings.~~

~~(a) For cargo holds used as salt water ballast spaces coatings for certain part may be dispensed with provided that the alternative measures are taken in the part in question.~~

~~(b) Applicable paints are to be of epoxy type or such type as effective against corrosion and durable.~~

~~(c) The surface of steels are to be properly prepared before coating and the thickness of the coatings is to be adequate.~~

~~(d) Painting is to be of hard protective coatings.~~

~~(e) It is recommended that cathodic protection is applied together with the coatings as a backup.~~

~~(f) For sea water ballast tanks of oil tankers specified in **1.3.1(11), Part B** and ships coming under the definition of bulk carrier as specified in **31A.1.2(1), Part C** of the Rules, and double side skin spaces of ships coming under the above definition of bulk carriers of 150 *m* in length L_f upward, the coatings are preferably to be of a light colour easily distinguishable from rust.~~

Sub-paragraph -3 has been amended as follows.

3 Omission of Painting

In accordance with the requirements of **25.2.1-1, Part C** of the Rules, the cases that painting may be omitted are as follows;

(1) Where ships are applied the requirements of **Chapter 31, Part C** of the Rules and their cargoes are intended to be regularly handled by grabs or similar mechanical appliances, painting for cargo holds may be omitted subject to the following **(a)** and **(b)**.

(a) Omission of painting is to be limited to those members such as inner bottom plates, slant plates of bilge hopper and slant plates of lower stool of transverse bulkheads whose thickness is increased in accordance with the requirements of **31.2.4-2**, **31.2.4-3**, **31.3.2-2** or **31.5.2-1, Part C** of the Rules. However, omission of painting is not accepted for areas within the extent of painting prescribed in **-2(1)**.

(b) The reason and area of omission of painting are to be prescribed in the plans submitted for approval (for example, “Midship Section”, etc. specified in **2.1.2, Part B** of the Rules).

(2) Where ships are specified in **(1)** above and intended to carry exclusively chips of wood, the area which are expected to be effectively protected against corrosion of steel by the secretion of chips of wood (the area except where has normally no touch with the cargoes such as inside of upper deck) may be added to the area of omission of painting specified in **-3(1)(b)** notwithstanding the requirements of above **-2(1)**.

The salt water-beaten structural members in cargo holds used as ballast water tanks is to be thicker by 1.0 *mm* than the requirements of **Chapter 31, Part C** of the Rules. However, the structural members stated in **(1)(a)** and those which are in cargo holds used as ballast water tanks only in port need not be thicker.

(3) Where tanks are exclusively loaded oils, painting for inside of them may be omitted in spite of kind of ships.

EFFECTIVE DATE AND APPLICATION (Amendment 1-2)

1. The effective date of the amendments is 1 July 2008.

2. Notwithstanding the amendments to the Guidance, the current requirements may apply to ships other than ships that fall under the following:

(1) for which the building contract is placed on or after 1 July 2008; or

(2) in the absence of a building contract, the keels of which are laid or which are at *a similar stage of construction* on or after 1 January 2009; or

(Note) The term "*a similar stage of construction*" means the stage at which the construction identifiable with a specific ship begins and the assembly of that ship has commenced comprising at least 50 *tonnes* or 1% of the estimated mass of all structural material, whichever is the less.

(3) the delivery of which is on or after 1 July 2012

Amendment 1-3

C31B ADDITIONAL REQUIREMENTS FOR EXISTING BULK CARRIERS

C31B.5 Hold Frames

C31B.5.2 Steel Renewal Criteria and Reinforcing Measures

Sub-paragraphs -2 to -7 have been added as follows.

1 If the ice class notation in accordance with the requirements in **Chapter 5, Part I** of the Rules is requested to be withdrawn, the additional ice strengthening structure, with the exception of tripping brackets which have already complied with the requirements of **31B.5.2-5, Part C** of the Rules, is not to be considered to contribute to compliance with **31B.5, Part C** of the Rules.

2 For the application of **31B.5.2, Part C** of the Rules, when Zone *B* in **Fig. C31B.5.1, Part C** of the Rules is made up of different plate thicknesses, the lesser thickness is to be used.

3 With respect to $t_{REN,d/t}$ in **31B.5.2-1(3)(a), Part C** of the Rules, the value of t_M is to be based on Zone *B* in **Fig. C31B.5.1, Part C** of the Rules.

4 For the application of **31B.5.2-2, Part C** of the Rules, when lower brackets were not fitted with flanges at the design stage, flanges are to be fitted so as to meet the strength requirements in **31B.5.3-1, Part C** of the Rules. The full width of the bracket flange is to extend up beyond the point at which the frame flange reaches full width. Adequate back-up structure in the hopper is to be ensured, and the bracket is to be aligned with the back-up structure.

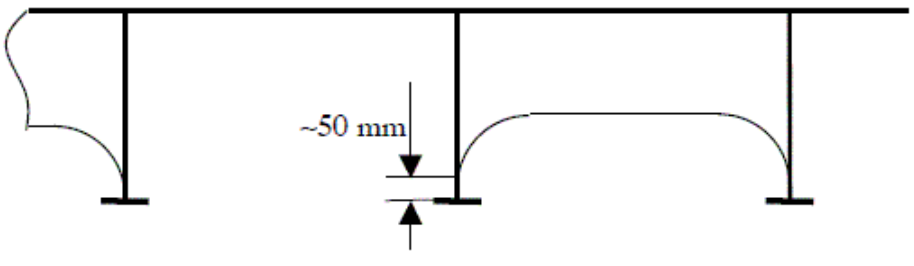
5 For the application of **31B.5.2-6, Part C** of the Rules, tripping brackets not connected to the frame flanges are to have soft toes, and the distance between the bracket toe and the frame flange is not to be greater than 50*mm*. (see **Fig. C31B.5.2**)

6 For the application of **31B.5.2-6, Part C** of the Rules, where side frames and side shell are made of higher tensile steel, tripping brackets made of mild steel may be accepted, provided the electrodes used for welding are those required for the particular higher tensile steel grade, and the thickness of the tripping brackets is equal to the frame web thickness.

7 For the application of **31B.5.2, Part C** of the Rules, when renewal is required, surface preparation and coating for the renewed structures are to be carried out in accordance with the provisions of **C25.2.1-2(1).**

Fig. C31B.5.2 has been added as follows.

Fig. C31B.5.2 Example of Tripping Brackets not Connected to Frame Flanges



EFFECTIVE DATE AND APPLICATION (Amendment 1-3)

1. The effective date of the amendments is 1 July 2008.

2. Notwithstanding the amendments to the Guidance, the current requirements may apply to the surveys for which the application is submitted to the Society before the effective date.

Amendment 1-4

C1 GENERAL

C1.1 General

C1.1.1 Application

Sub-paragraph -2 has been amended as follows.

1 For reduction of scantlings of structural members of ships, etc. to be classed for restricted service, the provisions in **1.1.1-2, Part CS** of the Rules are to apply except for those specially prescribed in this Part.

2 The steels with the thickness above 50 up to 100 *mm* used for ~~stern frame,~~ rudder horn and shaft bracket can be of the grades *KD*, *KD*32, *KD*36 or *KD*~~36~~40.

3 In applying to **Part C** of the Rules, scantling draught (d_s) which is larger than *d* specified in **2.1.2, Part A** of the Rules may be applicable instead of *d* due to convenience of design, etc. However, in case the difference between d_s and *d* exceeds 300 *mm*, *L*, *W* and C_b specified in **Part A** of the Rules are to be of the value corresponding to d_s.

C6 DOUBLE BOTTOMS

C6.1 General

C6.1.1 Application

Sub-paragraph -5(3) has been amended as follows.

5 Scantlings of structural members of double bottom for ships intended to carry steel coils are recommended to comply not only with **Chapter 6, Part C** of the Rules but also with the following requirement.

(1) The provision specified in **C6.1.1-3** is determined by assuming **Fig. C6.1.1-4** as the standard means of securing steel coils.

(2) Thickness of inner bottom plates for the ships of longitudinal framing system is to be not less than the value obtained from the following formula.

$$\sqrt{kQ\{(1.65\beta - 2.3)\alpha - 6\beta + 12.2\}} + 1.5 \quad (mm)$$

where,

k : Coefficient, to be used 1.65 for mild steel in general.

Q : Mass of steel coils loaded per panel of inner bottom plating, in general, as obtained from the following formula:

$$\frac{Wn_1n_2}{1000n_3} \quad (ton)$$

In case where steel coils are lined up in one tier with a key coil, Q is to be of 1.4 *times* the value obtained from the formula.

W : Mass of one steel coil (*kg*)

n_1 : Number of tiers of steel coils

n_2 : Number of load points per panel of inner bottom plates, as given in **Table C6.1.1-2** according to the value of n_3 and a/l_s

n_3 : Number of dunnages supporting one steel coil

α : Aspect ratio of panel of inner bottom platings. When α exceeds 3.0, α is to be taken as 3.0.

β : As obtained from the following formula: *c/a*

a : Spacing of floors (*mm*)

c : Distance between load points per panel of inner bottom plating in ship length (*mm*), which is obtained in **Table C6.1.1-1** according to the value of n_2 and n_3

l_s : Length of a steel coil (*mm*)

(3) Where inner bottom platings are of high tensile steel, the formula specified in above **(2)** is to be applied as follows.

In case of ~~*HT*~~*KA*32, *KD*32, *KE*32 or *KF*32: 0.78*k* to be used instead of *k*

In case of ~~*HT*~~*KA*36, *KD*36, *KE*36 or *KF*36: 0.72*k* to be used instead of *k*

In case of *KA*40, *KD*40, *KE*40 or *KF*40: 0.68*k* to be used instead of *k*

(4) The scantlings of longitudinals of inner bottom platings are to be determined by the simple beam theory in the following conditions.

(a) Model:
Simple beam fixed at solid floor and/or simply supported at vertical strut.

(b) Allowable stress:
$8.2(24-12f_B)$ *N/mm*^{2}, where f_B is specified in **6.4.3, Part C** of the Rules.

(c) Load condition:
Concentrated load at the position of dunnages where the steel coils are loaded just on longitudinals.

(5) Compressive buckling strength against steel coil load are to be examined for solid floor and girder plates.

C15 LONGITUDINAL STRENGTH

C15.3 Shearing Strength

C15.3.1 Thickness of Shell Plating of Ships without Longitudinal Bulkhead

Sub-paragraph -1(2) has been amended as follows.

1 Ships with bilge hopper tanks and/or topside tanks
Where the sloping plates of the bilge hopper tank and topside tank are joined to the side shell plating and are considered to be effective to carry a part of the shearing force, the shear current at the transverse section of the hull under consideration may be calculated directly and the thickness of the side shell plating forming a part of the bilge hopper tank and topside tank may be determined. However, when performing this direct calculation and determining the thickness of plating, shearing force given in **(1)** is made to act on the transverse section of the hull, and shearing stresses which develop in the side shell plating forming a part of the bilge hopper tank and topside tank and in the sloping plates are obtained, and these values are to be less than the allowable stress given in **(2)**.

(1) The value of shearing force acting on the transverse section of hull is obtained from the following formulae, whichever is greater.

$|F_s + F_w(+) - \Delta F_c|$ (kN)

$|F_s + F_w(-) - \Delta F_c|$ (kN)

$F_s, F_w(+)$ and $F_w(-)$: As specified in **15.3.1-1, Part C** of the Rules

ΔF_c : As specified in the following **-2**

(2) Allowable stress in side shell plating within bilge hopper tank or topside tank and in sloping plate

$\frac{90}{K}$ (N/mm^2)

K : ~~0.78 for *HT*32~~
~~0.72 for *HT*36~~
Coefficient corresponding to kinds of steel *e.g.* 1.0 for mild steel the values specified in **1.1.7-2(1) of the Rules** for high tensile steel.

C20 HATCHWAYS, MACHINERY SPACE OPENINGS AND OTHER DECK OPENINGS

C20.2 Hatchways

C20.2.5 Additional Requirements for Steel Hatch Covers intended to carry cargoes on them

Notes of Table C20.2.5-1 have been amended as follows.

Table C20.2.5-1 Allowable Values

Kind of loads	Bending stress	Shear stress	Deflection/ l
Loads due to cargoes carried and liquid cargo or water ballast, etc.	$0.5\eta\sigma_F$	$0.33\eta\sigma_F$	0.0035
In case wheeled vehicles are used for loading/unloading only during the port, against wheel loads	$0.625\eta\sigma_F$	$0.415\eta\sigma_F$	0.0035

Notes:

σ_F :Means minimum upper yield stress or proof stress of the material (N/mm^2).

η : Coefficient according to grades of material are as follows:

For grade *KA*, *KB*, *KD*, and *KE*	$\eta = 1.00$
For grade *KA* 32, *KD* 32, *KE* 32, and *KF*32	$\eta = 0.96$
For grade *KA* 36, *KD* 36, *KE* 36, and *KF*36	$\eta = 0.92$
For grade *KA* 40, *KD* 40, *KE* 40, and *KF*40	$\eta = 0.89$

C20.2.9 Steel Hatchway Covers for Deep Tanks

Sub-paragraph -1(2) has been amended as follows.

(2) The scantlings of stiffeners are to comply with the following formulae.
Section modulus at mid-span:
$C_1Kk_1Shl^2(cm^3)$
Moment of inertia at mid-span:
$C_2k_2Shl^3(cm^4)$
Cross sectional area of web plates at the ends of stiffeners:
$C_3KShl\ (cm^2)$
S : As specified in **(1)**.
l : Unsupported span (m).
C_1, C_2 and C_3: Coefficients given by **Table C20.2.9-1**.
K: Coefficient ~~given by **Table C20.7, Part C** of the Rule~~s corresponding to kinds of steel *e.g.* 1.0 for mild steel the values specified in **1.1.7-2(1) of the Rules** for high tensile steel.

k_1 and k_2: Coefficient given by **Table C20.4, Part C** of the Rules.

h: As given by the following formulae according to the arranged direction of stiffeners. (kN/m^2)

Transverse direction (in case hatch covers are opened/closed in the longitudinal direction):

$9.81 \times 0.85(12a/L + 0.125b + h')$ (kN/m^2)

Longitudinal direction (in case hatch covers are opened/closed in the transverse direction):

$9.81 \times 0.85(8a/L + 0.188b + h')$ (kN/m^2)

a, b, h' and L: As specified in **(1)**.

C31 BULK CARRIERS

C31.1 General

C31.1.5 Direct Calculations

Sub-paragraph (3) has been amended as follows.

(3) Allowable Stress

(a) Allowable stress for ~~mild steel members~~ kind of structural model

i) Allowable stress for the case of modelling by using shell elements

The permissible values of normal stress σ and equivalent stress σ_e of each member are to be as given in **Table C31.1.5-2**. The allowable stresses in the transverse rings and side frames which corresponds to the values obtained as the results of the calculations by remeshing with fine meshes according to the requirements in **1.3.1-1(4) of the Annex C1.1.22-1 "GUIDANCE FOR DIRECT CALCULATIONS"**, are to be as given in **Table C31.1.5-3**.

ii) Allowable stress for the case of modelling by using beam elements

The permissible values for respective members are to be approximately same as those given in **Table C31.1.5-2** and **Table C31.1.5-3**, but they are to be determined for respective cases after the submission of necessary materials and data to the Society in accordance with **1.~~1~~3.1-~~2(3)~~3 of the Annex C1.1.22-1 "GUIDANCE FOR DIRECT CALCULATIONS**." In this case, the values for the members of double bottoms are to be determined in accordance with those given in **Table C31.1.5-4** as the standards.

iii) Allowable stress for double bottom modelled into sandwich structure

The allowable values of normal stress σ, mean shearing stress τ and equivalent stress σ_e in members forming the double bottom are to be as specified in **Table C31.1.5-5**.

(b) Allowable Stress in the case where hull girder section modulus has a fair

allowances.

The allowable values of normal stress in lengthwise direction in the bottom shell and inner bottom plating may be as determined from the following formula, expressed with a unit of N/mm^2

For structural model by using shell elements

145 /~~k~~K - 35f~~α~~

For structural model by using beam elements

135 /~~k~~K - 35f~~α~~

For sandwich structure model

135 / ~~k~~K - 35f~~α~~

~~k~~K: ~~A value specified in **1.4.1-1(1)(b) of the Annex C1.1.22-1 "GUIDANCE FOR DIRECT CALCULATIONS**." Where materials of mild steel are used as structural members, k is to be taken as 1.0.~~ Coefficient corresponding to kinds of steel *e.g.* 1.0 for mild steel the values specified in **1.1.7-2(1) of the Rules** for high tensile steel.

f: The ratio of the hull girder section modulus for the bottom specified in **15.2.1, Part C** of the Rules to the section modulus for the bottom of the ship in question.

~~α: 1.0 In case where the extent of use of high tensile steel does not fulfil the requirements of the **Annex C1.1.7 "GUIDANCE FOR HULL CONTAINING HIGH TENSILE STEEL MEMBERS**", α is to be taken as 1/k.~~

(c) Allowable Stress in loading/unloading conditions in harbour

The allowable stress in loading/unloading conditions in harbour may be 110% of the values given by **Tables C31.1.5-2** to **C31.1.5-5**.

Table C31.1.5-2 has been amended as follows.

Table C31.1.5-2 Allowable Stress for Modelling by using Shell Elements

Structural members considered		σ_l	σ_t, σ_v	σ_e
Longitudinal strength members	Bottom shell plating; inner bottom plating; sloping plate of bilge hopper tanks or topside tanks	110/*K*	145/*K*	145/*K*
	Girder		-	175/*K*
Transverse strength members	Sloping plate of stools; transverse bulkhead		145/*K*	175/*K*
	Floor ; Cross Deck		-	175/*K*

Notes:

1. Unit: N/mm^2
2. σ_e : $\sqrt{\left(\sigma_l^2 - \sigma_l \cdot \sigma_t + \sigma_t^2 + 3\tau^2\right)}$ (for longitudinal strength members)

   : $\sqrt{\left(\sigma_v^2 - \sigma_v \cdot \sigma_t + \sigma_t^2 + 3\tau^2\right)}$ (for transverse strength members)

   σ_l : Normal stress in lengthwise direction

   σ_t : Normal stress in breadthwise direction

   σ_v : Normal stress in depthwise direction

   τ : Shearing stress
3. Openings in floors and girders, if any, are to be taken into consideration in evaluating the stresses.
4. The point of detecting stress is to be the centre of the element.
5. Cross deck is to be included in applicable members of direct strength calculation in case of loading of high-density cargoes.
6. Coefficient corresponding to kinds of steel *e.g.* 1.0 for mild steel the values specified in **1.1.7-2(1) of the Rules** for high tensile steel.

Table C31.1.5-3 has been amended as follows.

Table C31.1.5-3 Allowable Stress for Modelling by using Shell Elements (For Results of the Calculations by remeshing with Fine Meshes)

Structural members considered		σ_a	τ	σ_e
Transverse rings	Parallel part	-	-	175/$\underline{K}$
	Corners	195/$\underline{K}$	-	195/$\underline{K}$
Side frames	Middle of parallel part	175/$\underline{K}$	-	175/$\underline{K}$
	Upper and lower ends of parallel part	215/$\underline{K}$	70/$\underline{K}$	195/$\underline{K}$

Notes:

1. Unit: N/mm^2
2. σ_a : Normal stress of face plate
3. σ_e : $\sqrt{\sigma_x^2 - \sigma_x \cdot \sigma_y + \sigma_y^2 + 3\tau^2}$ (The element coordinate system is to be *X*-*Y* rectangular coordinate system.)
   σ_x : Normal stress in *X*-direction of element coordinate system
   σ_y : Normal stress in *Y*-direction of element coordinate system
   τ : Shearing stress on the *X* face in the *Y*-direction of element coordinate system
4. The point of detecting stress is to be the centre of the element.
5. Coefficient corresponding to kinds of steel *e.g.* 1.0 for mild steel the values specified in **1.1.7-2(1) of the Rules** for high tensile steel.

Table C31.1.5-4 has been amended as follows.

Table C31.1.5-4 Allowable Stress for Modelling by using Beam Elements

Structural members considered	σ_l	σ_t	τ	σ_e
Girders; floors	-	-	100/$\underline{K}$	175/$\underline{K}$
Inner bottom plating; bottom shell plating	100/$\underline{K}$	145/$\underline{K}$	-	-

Notes:

1. Unit: N/mm^2
2. σ_e : $\sqrt{\sigma^2 + 3\tau^2}$ (Equivalent stress)
   σ : $\sigma_a + \sigma_b$ (Normal stress)
   σ_a : Axial stress
   σ_b : Bending stress
   σ_l : Normal stress in lengthwise direction
   σ_t : Normal stress in breadthwise direction
   τ : Mean shearing stress
3. Openings in floors and girders, if any, are to be taken into consideration in evaluating the stress.
4. Coefficient corresponding to kinds of steel *e.g.* 1.0 for mild steel the values specified in **1.1.7-2(1) of the Rules** for high tensile steel.

Table C31.1.5-5 has been amended as follows.

Table C31.1.5-5 Allowable Stress for Double Bottom Modelled into Sandwich Structure

Structural members considered	σ_l	σ_t	τ	σ_e
Girders; floors	-	-	100/$\underline{K}$	175/$\underline{K}$
Inner bottom plating; bottom shell plating	100/$\underline{K}$	145/$\underline{K}$	-	145/$\underline{K}$

Notes:

1. Unit; N/mm^2
2. σ_e : As per notes to **Table C31.1.~~3~~5-4** (Girders, floors)

σ_e : $\sqrt{\left(\sigma_l^2 - \sigma_l \cdot \sigma_t + \sigma_t^2 + 3\tau^2\right)}$ (Inner bottom plating, bottom shell plating)

σ_l, σ_t and τ : As per notes to **Table C31.1.~~3~~5-~~2~~4**.

3. Openings in floors and girders, if any, are to be taken into consideration in evaluating the stress.
4. Coefficient corresponding to kinds of steel *e.g.* 1.0 for mild steel the values specified in **1.1.7-2(1) of the Rules** for high tensile steel.

C32 CONTAINER CARRIERS

C32.2 Longitudinal Strength

Paragraph C32.2.2 has been amended as follows.

C32.2.2 Torsional Strength

The torsional strength of hull at each sectional position from the collision bulkhead to the watertight bulkhead at the fore end of the machinery space is to be such that the following relationship is satisfied:

$$\sqrt{(0.75\sigma_V)^2 + \sigma_H^2 + \sigma_\omega^2} + \sigma_S \leq \frac{1000}{5.72K}$$

where:

σ_S,σ_V and σ_H : As obtained from the following formula; however warping stress is to be added to σ_S when torsional moment is generated in the ship by unbalanced loading of cargoes.

$$\sigma_S = 1000\frac{|M_S|}{Z_V}$$

$$\sigma_V = 1000\frac{M_W}{Z_V}$$

$$\sigma_H = 1000\frac{M_H}{Z_H}$$

M_S : As specified in **15.2.1-1, Part C** of the Rules

M_W : M_W (+) or M_W (-) as specified in **15.2.1-1, Part C** of the Rules whichever is of the same sign as M_S

M_H : As obtained from the following formula:

$0.45C_1L^2d(C_b + 0.05)C_H$ (*kN-m*)

C_H : Coefficient, as given in **Table C32.2.2-1**, whose value depends on the ratio of the distance *x* (*m*) from the aft end of *L* to the position of the section under consideration, where intermediate values are to be determined by interpolation.

Z_V : Section modulus of strength deck with respect to longitudinal bending of hull at the position of the section under consideration (cm^3).

Z_H : Section modulus of hatch side with respect to horizontal bending of hull at the position of the section under consideration (cm^3).

C_1 : As specified in **15.2.1-1, Part C** of the Rules

Table C32.2.2-1 Coefficient C_H

x/L	0.0	0.4	0.7	1.0
C_H	0.0	1.0	1.0	0.0

σ_ω : Warping stress due to torsion of hull, which is calculated according to the following formula for ships of ordinary types of construction using the dimensions and scantlings at the midship section (N/mm^2). Values for other types are to be in accordance with the discretion of the Society.

$$\sigma_\omega = 0.000318 \frac{\omega l_C M_T}{I_\omega + 0.04 l_C^2 J}$$

M_T : As given by the following formula:

$$M_T = 7.0 K_2 C_\omega^2 B^3 \left(1.75 + 1.5 \frac{e}{D_S} \right) \quad (kN\text{-}m)$$

C_ω : Water plane area coefficient.

e : As given by the following formula:

$$e = e_1 - \frac{d_0}{2}$$

e_1 : As given by the following formula:

$$e_1 = \frac{(3D_1 - d_1) d_1 t_d + (D_1 - d_1)^2 t_S}{3 d_1 t_d + 2(D_1 - d_1) t_S + B_1 t_b / 3}$$

d_0 : Height of double bottom (m)

d_1 : Breadth of double hull side (m)

D_1 : As given by the following formula:

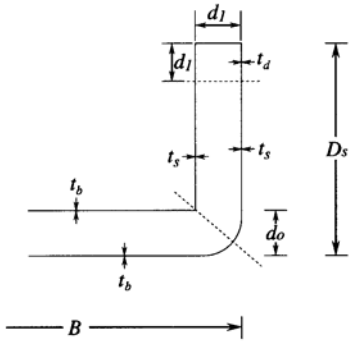
$$D_1 = D_S - \frac{d_0}{2}$$

B_1 : As given by the following formula:

$$B_1 = B - d_1$$

t_d, t_s, t_b : Mean thickness of deck part, ship's side part, and bottom part where their respective ranges are as given in **Fig. C32.2.2-1** (m). Mean thickness may be determined considering all the longitudinal strength members included within this range.

Fig. C32.2.2-1



K_2: As given by the following formulae:

$$K_2 = \sqrt{1-\left(\frac{300-L_1}{300}\right)^2} \qquad \text{for ships with } L_1 < 300\ m$$

1.0 for ships with $L_1 \geq 300\ m$

ω: As given by the following formula:

$$\omega = \frac{B_1}{2}(D_1 - e_1)1\frac{d_1}{2}(D_1 + e_1)$$

l_C: Distance from the collision bulkhead to watertight bulkhead of the fore end of machinery room (*m*).

I_ω: As given by the following formula:

$$I_\omega = B_1^{\,2}\{d_1 t_d I_d + (D_1 - d_1)t_S I_S + B_1 t_b I_b\}$$

I_d: As given by the following formula:

$$I_d = (D_1 - e_1)\left\{\frac{3}{2}(D_1 - e_1) - d_1\right\} + \frac{d_1^2}{3}$$

I_S: As given by the following formula:

$$I_S = (D_1 - d_1)\left\{\frac{1}{3}(D_1 - d_1) - e_1\right\} + e_1^2$$

I_b: As given by the following formula:

$$I_b = \frac{e_1^2}{6}$$

J: As given by the following formula. However, the mean thickness of t'_d, t'_S, t'_b is to be calculated only by the use of the strength deck, side shell, bottom shell, inner bottom and longitudinal bulkhead platings, and other longitudinal strength members are not to be included.

$$J = \frac{2\{Bd_0 + 2(D_S - d_0)d_1\}^2}{3d_1/t'_d + 2(D_1 - d_1)/t'_S + B_1/t'_b}$$

K: ~~1.0 for mild steel ships; the following are to apply where high tensile steel is used:~~ Coefficient corresponding to kinds of steel *e.g.* 1.0 for mild steel the values specified in **1.1.7-2(1) of the Rules** for high tensile steel.

~~0.78 for *HT32*~~

~~0.72 for *HT36*~~

Annex C1.1.7 GUIDANCE FOR HULL CONSTRUCTION CONTAINING HIGH TENSILE STEEL MEMBERS

1.1 General

Paragraph 1.1.1 has been amended as follows.

1.1.1 Application

Where materials of high tensile steel *KA*32, *KD*32, *KE*32 ~~or~~, *KF*32 (hereinafter to be referred to as "*HT*32") ~~and~~, *KA*36, *KD*36, *KE*36 ~~or~~ 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 ~~and~~, *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.

1.2 Structural Members

1.2.1 General

Sub-paragraph -1(2) has been amended as follows.

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 scantlings of structural members are determined by the direct calculation methods according to the prescriptions in **29.6.2**, **30.1.3** or **31.1.~~3~~5, Part C** of the Rules, the permissible stresses in members of high tensile steel are, as a standard, ~~to be equal to (1/*K*) times (*K* is as per **1.2.1-2(2))** the values determined~~ in accordance with the **C29.6.2~~-4~~** ~~and~~, **C3~~1~~0.1.3~~(3)~~** and **C31.1.5**. Further, the structures are to be subjected to examinations on strength against buckling under the load conditions prescribed in the Guidance.

(3) Where the section modulus of hull girder amidships is reduced by using high tensile steel in accordance with the provisions in **1.1.7-2(1), Part C** of the Rules, the constructions and scantlings are to comply with the provisions under **1.2.3**, in addition to compliance with **(1)** and **(2)** 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.

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

2 Symbols

Unless otherwise specified, the symbols 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 C** 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 ~~to be taken as~~ the coefficient corresponding to kinds of steel:

0.78 (for *HT*32)

0.72 (for *HT*36)

0.68 (for *HT*40)

The values specified in **1.1.7-3, Part C** 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) Symbols not specially defined herein are to be as defined in related provisions in **Part C**.

1.2.3 Special Rules for Longitudinal Strength Members

Notes (b) of Fig.2.5 have been amended 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, for tankers (however, 3.0, for cases where side shell plating forms boundaried of cargo oil tanks planned to carry ballast as well) (*mm*)

2.5, for other ships (*mm*)

Longitudinal bulkhead

3.5, for tankers (*mm*)

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:

in case of tankers

1.27 (for *HT*32)

1.38 (for *HT*36)

1.46 (for *HT*40)

in case of other ships

1.34 (for *HT*32)

1.45 (for *HT*36)

1.54 (for *HT*40)

However, in case 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 strength deck at the middle of *L*, where mild steel construction is assumed

S_{e2} : Effective sectional area of 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

$\frac{a}{K}$

Annex C1.1.22-1 GUIDANCE FOR DIRECT CALCULATIONS

1.2 Design Loads

1.2.1 General

Sub-paragraph -1(5) has been amended as follows.

1 Classification of Loads

(1) The loads due to longitudinal bending moment of hull girder at the forward and aft end boundaries of the structure model may, as a rule, not be taken into consideration. When these loads are taken into consideration, however, the allowable stress to be applied to the results of calculations is to be determined at the directions of the Society.

(2) The design loads to be taken into consideration are, as a rule, to be the loads due to cargo and water ballast loaded on board, hydrostatic pressure and wave loads.

(3) The load due to the inertia force of cargo is to be considered in addition to those specified in **(2)** above, when the Society considers it is necessary.

(4) The cargo holds where dynamic impact loads, such as sloshing loads are predicted, are to be specially considered and proper data in this connection are to be submitted.

(5) The loads for oil tankers, ore carriers and bulk carriers are to be in accordance with the requirements specified in **C29.~~3~~6.~~1~~2**, **C30.1.3** and **C31.1.~~3~~5** of the Guidance respectively, in addition to those in this **1.2**.

1.4 Allowable Stress

1.4.1 General

Sub-paragraph -1 has been amended as follows.

1 Allowable Stress

(1) For tankers, ore carriers and bulk carriers, ~~W~~when the loads specified in **1.2.1-1** are to be applied to the structural model according to the **1.3** above, the scantlings of members are to be determined so that the values of stress in each of them may not exceed the values given ~~below~~ in **C29.6.2**, **C30.1.3** and **C31.1.5** of the Guidance respectively.

~~(a) Allowable stress for mild steel members~~

~~For tankers, ore carriers and bulk carriers, values specified in **C29.6.2**, **C30.1.3** and **C31.1.3** of the Guidance respectively, are to be applied. Where nothing particular is provided for, the values are to be left to the Society's directions.~~

~~(b) Allowable stress for high tensile steel members~~

~~Values according to **(a)** above divided by the coefficient *k* specified below may be used.~~

~~For high tensile steel *KA*32, *KD*32, *KE*32 and *KF*32 as specified in **Chapter 3, Part K** of the Rules~~

~~*k* =0.78~~

~~For high tensile steel *KA*36, *KD*36, *KE*36 and *KF*36 as specified in **Chapter 3, Part K** of the Rules~~

~~*k* =0.72~~

(2) When the section modulus of hull girder contains a fair margin, the permissible value of normal stress in the lengthwise is to be left to the directions of the Society.

Annex C1.1.22-2 GUIDANCE FOR BUCKLING STRENGTH CALCULATION

1.3 Buckling Strength Calculation

1.3.1 Procedure of Buckling Strength Calculation (*See* Table 3.1)

Sub-paragraph -3(2) has been amended as follows.

3 Equivalent Plastic Buckling Stress

(1) When the equivalent elastic buckling stress σ_{cr} is greater than half of the yield stress σ_Y the equivalent plastic buckling stress σ'_{cr} is to be calculated as given in **Table 3.1**.

(2) The yield stress σ_Y is to be defined as the value given below:

~~$\frac{235}{k}$~~

where ~~*k*~~*K* is ~~any of~~ the ~~following values:~~ coefficient corresponding to kinds of steel *e.g.* 1.0 for mild steel the values specified in **1.1.7-2(1) of the Rules** for high tensile steel.

~~For mild steel *KA*, *KB*, *KD* and *KE* as specified in **Chapter 3, Part K** of the Rules: 1.00~~

~~For high tensile steel *KA*32, *KD*32, *KE*32 and *KF*32 as specified in **Chapter 3, Part K** of the Rules: 0.78~~

~~For high tensile steel *KA*36, *KD*36, *KE*36 and *KF*36 as specified in **Chapter 3, Part K** of the Rules: 0.72~~

Annex C34.1.2 GUIDANCE FOR PREPARATION OF LOADING MANUAL

1.4 Allowable Values for Longitudinal Strength

1.4.2 Allowable values for longitudinal still water bending moment (M_S)

Sub-paragraph -1(2) has been amended as follows.

1 For ships to which the requirements in **Chapter 32, Part C** of the Rules are applied, the value obtained from the following **(1)** or **(2)** whichever is smaller is to be taken as the allowable value for each positive and negative moment at a transverse section of the ship under consideration. However, these values are to satisfy the requirements in **C15.4.1**.

(1) Value determined by longitudinal bending strength

For positive value: $\frac{fZ}{5.72C} - M_W(+)$ (*kN-m*)

For negative value: $-\left(\frac{fZ}{5.72C} + M_W(-)\right)$ (*kN-m*)

f : As specified in the following (a) or (b).

(a) 1.0. For ships to which the requirements in **1.1.7-2(1), Part C** and **1.3.1-2(1), Part CS** of the Rules are not applied. However, for ships to which the requirements with f_B or f_D in **Part C** of the Rules or **Part C** of the Guidance are applied, the value of f is to be taken as f_B or f_D.

(b) The value of f_{BH} or f_{DH} determined by the requirements in **2.1.2(1)** of the **Annex C1.1.7**, **GUIDANCE FOR HULL CONSTRUCTION CONTAINING HIGH TENSILE STEEL MEMBERS** for ships to which the requirements in **1.1.7-2(1) of Part C** or **1.3.1-2(1) of Part CS** of the Rules is applied.

Z : Section modulus of transverse section of the ship with respect to the ship's bottom or strength deck at the position under consideration (cm^3)

C : Coefficient specified in **C15.1.1(3)** of the Guidance. However, in case where $C_b' \geq 0.65$, C = 1.0.

C_b' : As specified in **15.2.1-1**, **Part C** of the Rules

$M_W(+)$ and $M_W(-)$: As specified in **15.2.1-1, Part C** of the Rules

(2) Value determined by torsional strength. However, in case where torsional moment is generated in the hull due to uneven cargo stowage, the warping stress value used in applying the requirements in **C32.2.2** is to be deducted from the value in [ ] in the following formulae.

For positive value: $\left[\frac{1000}{5.72K} - \sqrt{(0.75\sigma_V(+))^2 + \sigma_H^2 + \sigma_W^2}\right]\frac{Z_V}{1000}$ (*kN-m*)

For negative value: $-\left[\frac{1000}{5.72K} + \sqrt{(0.75\sigma_V(-))^2 + \sigma_H^2 + \sigma_W^2}\right]\frac{Z_V}{1000}$ (*kN-m*)

$\sigma_V(+)$ and $\sigma_V(-)$: As specified in following formulae.

$$\sigma_V(+) = 1000\frac{M_W(+)}{Z_V}$$

$$\sigma_V(-) = 1000\frac{M_W(-)}{Z_V}$$

$M_W(+)$ and $M_W(-)$: As specified in **15.2.1-1, Part C** of the Rules

σ_H , σ_W and Z_V : As specified in **C32.2**

K : 1.0. However, where high tensile steels are used for bottom plates or strength deck plating, the ~~following~~ values are~~ to be taken:~~ specified in **1.1.7-2(1)**, **Part C** of the Rules.

~~0.78, where high tensile steel *KA*32, *KD*32, *KE*32 or *KF*32specified in **Chapter 3, Part K** of the Rules is used.~~

~~0.72, where high tensile steel *KA*36, *KD*36, *KE*36 or *KF*36 specified in **Chapter 3, Part K** of the Rules is used.~~

EFFECTIVE DATE AND APPLICATION (Amendment 1-4)

1. The effective date of the amendments is 1 September 2008.

2. Notwithstanding the amendments to the Guidance, the current requirements may apply to ships for which the date of contract for construction* is before the effective date.
*"contract for construction" is defined in IACS Procedural Requirement (PR) No.29 (Rev.4).

IACS PR No.29 (Rev.4)

1. The date of "contract for construction" of a vessel is the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. This date and the construction numbers (i.e. hull numbers) of all the vessels included in the contract are to be declared to the classification society by the party applying for the assignment of class to a newbuilding.

2. The date of "contract for construction" of a series of vessels, including specified optional vessels for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective owner and the shipbuilder.

For the purpose of this Procedural Requirement, vessels built under a single contract for construction are considered a "series of vessels" if they are built to the same approved plans for classification purposes. However, vessels within a series may have design alterations from the original design provided:

(1) such alterations do not affect matters related to classification, or

(2) If the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the shipbuilder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval.

The optional vessels will be considered part of the same series of vessels if the option is exercised not later than 1 year after the contract to build the series was signed.

3. If a contract for construction is later amended to include additional vessels or additional options, the date of "contract for construction" for such vessels is the date on which the amendment to the contract, is signed between the prospective owner and the shipbuilder. The amendment to the contract is to be considered as a "new contract" to which **1.** and **2.** above apply.

4. If a contract for construction is amended to change the ship type, the date of "contract for construction" of this modified vessel, or vessels, is the date on which revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder.

Notes:

1. This Procedural Requirement applies to all IACS Members and Associates.
2. This Procedural Requirement is effective for ships "contracted for construction" on or after 1 January 2005.
3. Revision 2 of this Procedural Requirement is effective for ships "contracted for construction" on or after 1 April 2006.
4. Revision 3 of this Procedural Requirement was approved on 5 January 2007 with immediate effect.
5. Revision 4 of this Procedural Requirement was adopted on 21 June 2007 with immediate effect.

Amendment 1-5

C4 SUBDIVISIONS

C4.1 General

Paragraph C4.1.2 has been amended as follows.

C4.1.2 Definitions

1 The wording "deck or decks limiting the vertical extent of flooding" stated in **4.1.2(6), Part C** of the Rules means, in principle, the weather deck. However, when the ship has multi-tires decks above ~~H_{MAX}~~ d_S + 12.5 (m) at the deepest subdivision ~~load line specified in **4.2.3-3, Part C** of the Rules~~ draught, it means the deck just above ~~H_{MAX}~~ d_S + 12.5 (m).

2 The wording "specifically accepted by the Society" stated in **4.1.2(13), Part C** of the Rules means the carriage of timber and wood chip in cargo holds. Figures specified in **Table C4.1.2** may be used as the permeability of compartment.

Table C4.1.2 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

C4.2 Subdivision Index

C4.2.1 Subdivision Index

Sub-Paragraph -1 has been deleted.

Sub-paragraphs -2 and -3 have been renumbered to -1 and -2 respectively.

~~**1** The wording "assumed hull damage" stated in **4.2.1-2(3), Part C** of the Rules presupposes that the hull, compartments and group of compartments of the ship are symmetric. Therefore, where they are asymmetric, the attained subdivision index A are to be calculated on both sides and the smaller value is to be of A of the ship considered. Where the A value is less than the required subdivision index R and the difference between A and R is recognized as small value, the mean value obtained from calculations involving both sides may be used as A of the ship.~~

~~**2**~~**1** If pipes, ducts or tunnels are provided within an assumed damaged compartment or group of compartments, they are to be arranged to prevent that the progressive flooding to other compartments, or they are to be fitted with the devices which can easily control the progressive flooding to other compartments. However, such requirements forementioned need not apply to the ships whose attained subdivision index taken the progressive flooding therethrough into consideration satisfies the requirements in **4.2, Part C** of the Rules.

~~**3**~~**2** Where penetrations for pipings, ventilations, electrical cables, etc. are provided in bulkheads, decks and shells forming a compartment, the watertight integrity of them is equivalent to these bulkheads, decks and shells.

Sub-paragraphs -3 and -4 have been added as follows.

3 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 C** of the Rules, transverse damage penetration may extend beyond the centreline bulkhead.

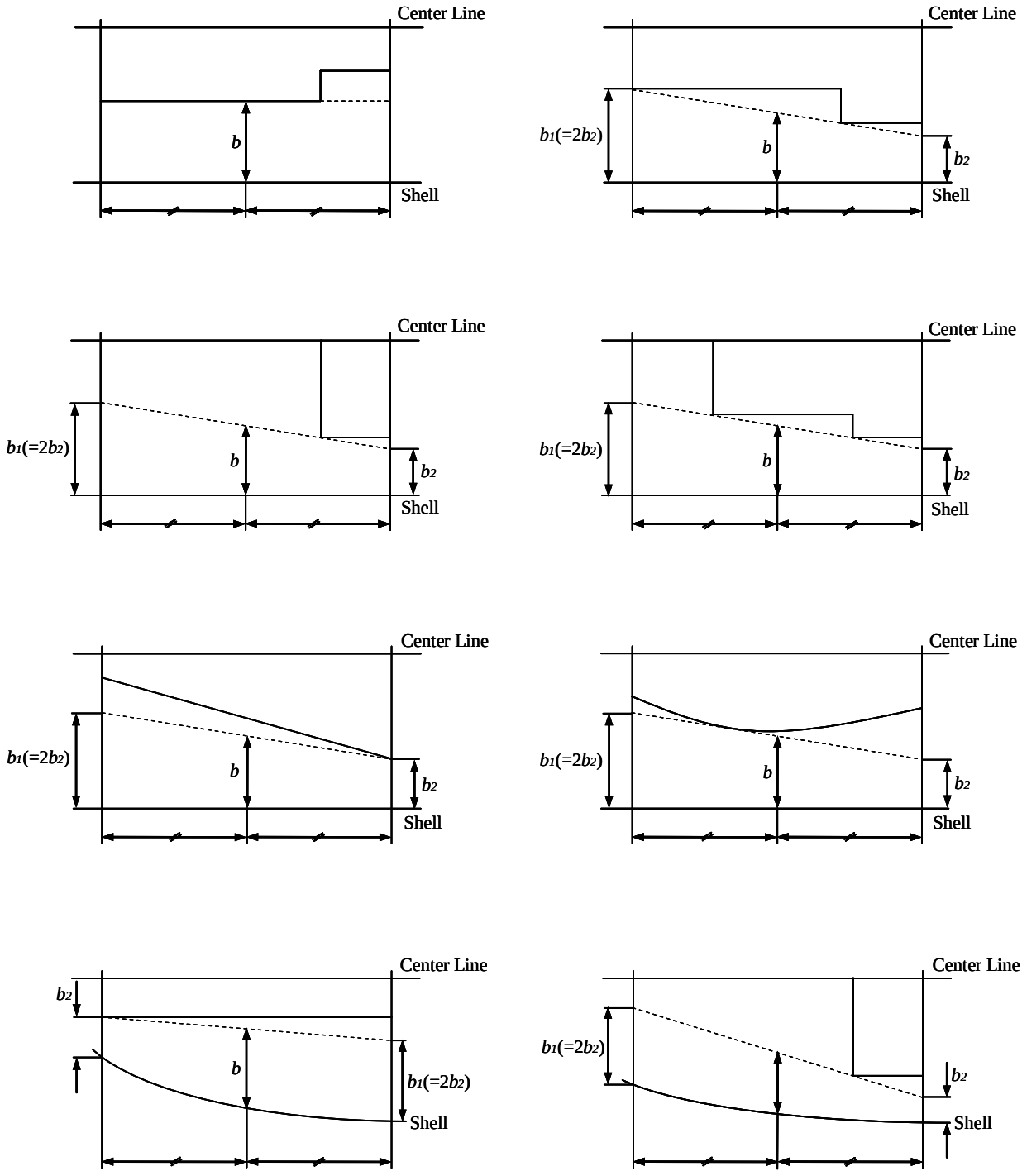
4 Where corrugated bulkheads are fitted, they may be treated as ordinary stiffened bulkheads as long as the corrugation is of the same order as the stiffening structure. Pipes and valves directly adjacent to the bulkhead may be considered to be a part of the bulkhead. The same applies for small recesses, drain wells, etc.

Paragraph C4.2.2 has been added as follows.

C4.2.2 Compartment Flooding Probability

In application of the requirement of **4.2.2-1, Part C** 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.C4.2.2**.

Fig.C4.2.2 Examples of assumed vertical plane (In case of single damage zone)



Paragraph C4.2.3 has been amended as follows.

C4.2.3 Survival Probability

1 Openings (e.g., access openings provided in the end bulkhead of the superstructure, cargo hatchways, air pipes, ventilators etc.), which are provided only with the weathertight closing apparatuses specified in **Part C** of the Rules, are to be treated as that progressive flooding takes place through them when the water line at the final equilibrium state immerses their lower edge.

2 The calculation of s_i in **4.2.3-47, Part C** of the Rules ~~are~~is to be treated as follows;

(1) Where the timber deck cargo is stowed to the standard height of one superstructure or more, account may be taken of the buoyancy of the cargo, the stowage of which is in compliance with the provisions of **Chapter 3** of the *CODE OF SAFE PRACTICE FOR SHIPS CARRYING TIMBER DECK CARGOES, 1991* (resolution *A*.715(17)).

(2) Account may be taken of the buoyancy of only one standard superstructure height of timber deck cargo, assuming that such cargo has permeability of 25% of the volume occupied by the cargo.

(3) Where the timber deck cargo is taken into account as the buoyancy, the buoyancy of the cargo in way of damage zone is to be ignored. However, when considering the vertical extent of damage, the upper deck may be regarded as a horizontal subdivision and calculating damage cases limited vertically to the upper deck with the corresponding ~~*V*~~v_m -factor, the timber deck cargo may be taken in to account as the buoyancy in accordance with the preceding **(2)**.

~~(4) Where the timber draught is assigned to the ship in accordance with the requirements of **Part V** of the Rules, for the purpose of the application of the requirements of **4.2.3, Part C** of the Rules, the values of S_L and S_P specified in **4.2.3-1, Part C** of the Rules are to correspond to the values at deepest timber subdivision load line and respective partial load line, respectively.~~

3 Unsymmetrical flooding is to be in accordance with following **(1)** and **(2)**.

(1) Unsymmetrical flooding is to be kept to a minimum consistent with the efficient arrangements.

(2) Where it is necessary to correct large angles of heel, the means adopted is to, where practicable, be self-acting, but in any case where controls to equalization devices are provided they is to be operable from above the bulkhead deck. These fittings together with their controls is to be acceptable to the Society.

4 Where cross-flooding fittings are required, the time for equalization is not to exceed 10 min.

5 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.

C4.3 Openings

Table C4.2.3 has been amended as follows.

Table C4.3.1 Requirements for Closing Devices for Internal/External Openings

	Position relative to equilibrium or intermediate waterplane	Frequency of use (See **C4.3.1-2)**	Type of closing appliances	Remote controls	Control in listed conditions	Open/close indications	Audible alarms	Notices	Devices to prevent opening	Reference regulation in **Part C of the Rules**
Internal openings	At or below	Used	POS	Required	Required	All operating positions (incl. bridge)	Required	Not Required	Not required	**4.3.1-2(2)**
		Norm. closed	S or H*2	Not required	Required	Bridge & all operating positions	NA*3	Required *4,6	Not required	**4.3.1-2(3)**
		Perm. closed (cargo spaces)	S or H	Prohibited	Not required	Not required	NA	Required *5	Required *7	**4.3.1-2(4)**
		Perm. closed (others)	S or H	Prohibited	Not required	Not required	NA	Required *5	Required *7	**4.3.1-2(5)**
External openings	At or below	Perm. closed	S or H	Not required	Not required	Bridge	NA*3	Required *5	Required *7*8	**4.3.2-2**
	Above *1	Perm. closed	S or H	Not required	Not required	Bridge	NA*3	Required *5	Required *7	**4.3.2-3**
		Norm. closed	S or H*2	Not required	Required	Bridge	NA*3	Required *4	Required *7	**4.3.2-3**

(Notes)

POS : Power operated, sliding or rolling

S : Sliding or rolling

H : Hinged

*1 : Subject to the application in **4.3.2-3, Part C of the Rules**

*2 : If hinged, this door is to be of quick acting or single action type

*3 : If remotely operated, this door is to be provided with an audible alarm

*4 : "Kept closed at sea"

*5 : "Not to be opened at sea"

*6 : If provided with means of remote closure, notices might not be required

*7 : Applicable only to closing appliances accessible during the voyage

*8 : Applicable only to those closing appliances fitting above the bulkhead deck and accessible during the voyage

C6 DOUBLE BOTTOMS

C6.1 General

C6.1.1 Application

Sub-paragraphs -3 to -6 have been renumbered to -4 to -7 respectively.

Sub-paragraph -3 has been added as follows.

3 Application for the omission of double bottom or unusual bottom arrangements given by requirements of **4.2.3-2** or **4.2.3-3 Part C** of the Rules is to be in accordance with following **(1)** and **(2)**.

(1) When it is assumed that such spaces are subject to the bottom damage, compartments is to be arranged to demonstrate that the factor s_i, when calculated in accordance with **4.2.3, Part C** of the Rules, is not less than 1 for all service conditions. Assumed extent of damage is to be in accordance with following **Table C6.1.1-1**. If any damage of a lesser extent than the maximum damage specified in **Table C6.1.1-1** would result in a more severe condition, such damage is to be considered.

(2) Flooding of such spaces is not to render emergency power and lighting, internal communication, signals or other emergency devices inoperable in other parts of the ship.

Table C6.1.1-1 and Table C6.1.1-2 have been renumbered to Table C6.1.1-2 and Table C6.1.1-3 respectively.

Table C6.1.1-1 has been added as follows.

Table C6.1.1-1 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*'/60 or 10*m*, whichever is less	*B*'/60 or 5*m*, whichever is less
Vertical extent, measured from the keel line	*B*'/20 or 2*m*, whichever is less	*B*'/20 or 2*m*, whichever is less

Notes:

1. Keel line is to be in accordance with **4.2.3, Part A** of the Rules.
2. Ship breadth (*B*') is to be in accordance with **4.1.2(11), Part C** of the Rules.

In case of applying the requirement of -5(2), Table C6.1.1-1 and Table C6.1.1-2 have been renumbered to Table C6.1.1-2 and Table C6.1.1-3 respectively.

C6.5 Inner Bottom Plating, Margin Plates and Bottom Shell Plating

Paragraph C6.5.6 has been renumbered to C6.5.5.

C6.5.~~6~~5 Bottom Shell Plating

C13 WATERTIGHT BULKHEADS

C13.1 Arrangement of Watertight Bulkheads

Paragraph C13.1.2 has been added as follows.

C13.1.2 After peak bulkhead

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

Section C13.4 has been added as follows.

C13.4 Other Watertight Construction

C13.4.1 Maintaining for Watertightness of Trunk

Double bottom (including watertight compartment specified in **6.1.1-3 Part C** of the Rules), double side shell and aft peak tank as well as trunks and others leading to such constructions, are to be capable of supporting at least the pressure due to a head of water up to the bulkhead deck.

C17 DECKS

Paragraph C17.1.2 has been amended as follows.

C17.1.2 Watertightness of Decks

1 Where the rudder stock penetrates the deck lower than the point located 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 **17.1.2-2 Part C** of the Rules, where all or part of the penetration of the bulkhead deck is on the main ro-ro deck, the trunks for ventilation provided for compartment below the bulkhead deck are to be capable of withstanding impact pressure due to internal water motions of water trapped on the ro-ro deck.

3 With respect to the provisions of **17.1.2-3 Part C** 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 17 Part C** 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 C** 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 C** of the Rules.

EFFECTIVE DATE AND APPLICATION (Amendment 1-5)

1. The effective date of the amendments is 1 January 2009.

2. Notwithstanding the amendments to the Guidance, the current requirements may apply to ships the keels of which were laid or which were at *a similar stage of construction* before the effective date.

(Note) The term "*a similar stage of construction*" means the stage at which the construction identifiable with a specific ship begins and the assembly of that ship has commenced comprising at least 50 *tonnes* or 1% of the estimated mass of all structural material, whichever is the less.