COMMON STRUCTURAL RULES FOR BULK CARRIERS

JULY 2010

Rule Changes Notice
~
Number 1 to the 2010 Edition

Notes: (1) These Rule Changes enter into force on 1st July 2012.

(2) This Rule Change Notice should be read in conjunction with the July 2010 consolidated edition of Bulk Carriers CSR.

For technical background for Rule Changes in this present document, reference is made to separate document Technical Background for Rule Changes Proposal.

List of changes

Chapter 1 General Principles

Section 4 Symbols and Definitions

3. Definitions

KC 1009

The following definitions are added:

3.21 Single Side Skin and Double Side Skin construction

3.21.1 Single side skin construction

A hold of single side skin construction is bounded by the side shell between the inner bottom plating or the hopper tank plating when fitted, and the deck plating or the topside tank plating when fitted.

3.21.2 Double side skin construction

A hold of double side skin construction is bounded by a double side skin, including hopper tank and topside tank when fitted.

KC 567

The following definition is added:

3.22 Bilge

3.22.1 Bilge plating

The bilge plating is the curved plating between the bottom shell and side shell. It is to be taken as follows:

- within the cylindrical part of the ship (see Fig.4):
  from the start of the curvature at the lower turn of bilge on the bottom to the end of the curvature at the upper turn of the bilge,
- outside the cylindrical part of the ship (see Fig.5):
  From the start of the curvature at the lower turn of the bilge on the bottom to the lesser of:
  - a point on the side shell located 0.2D above the baseline/local centreline elevation.
  - the end of the curvature at the upper turn of the bilge.

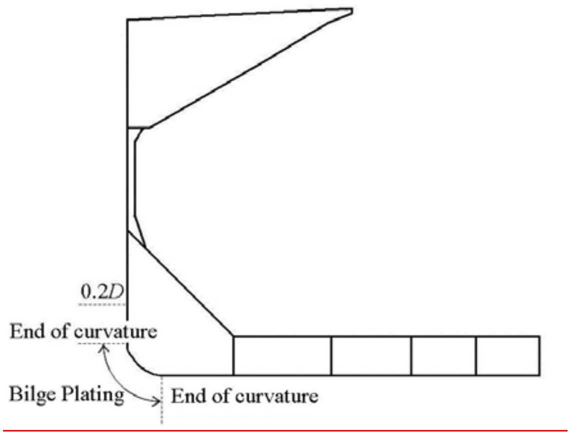


Figure 4: vertical extent of bilge plating within the cylindrical part of the hull

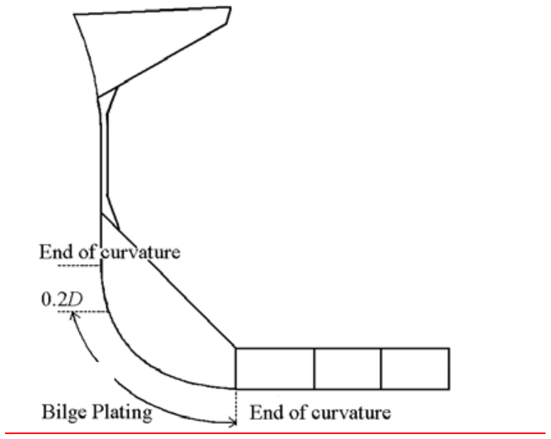


Figure 5: vertical extent of bilge plating outside the cylindrical part of the hull

Note: *Figure 4 in Ch.1 Sec.4 [4.1.1] and its reference are to be changed into Figure 6.*

Chapter 2 General Arrangement Design

Section 1 Subdivision Arrangement

2. Collision bulkhead

2.1 Arrangement of collision bulkhead

2.1.1

KC 903

The current text is replaced by the following one:

Ref. SOLAS Ch. II-1, Part B-2, Reg. 12

A collision bulkhead is to be fitted which is to be watertight up to the bulkhead deck. This bulkhead is to be located at a distance from the forward perpendicular FP_{LL} of not less than ~~5 per cent of the length L_{LL} of the ship~~ 0.05L_{LL} or 10 m, whichever is the less, and, except as may be permitted by the Society, not more than ~~8 per cent of L_{LL}~~ 0.08L_{LL} or 0.05L_{LL}+3 m, whichever is the greater.

3. After peak, machinery space bulkheads and stern tubes

KC 798

The following titles are modified as follow:

3.1 General

3.1.1 ~~General~~

The current text is replaced by the following one:

~~*Ref. SOLAS Ch. II-1, Part B, Reg. 11*~~

~~*An after peak bulkhead, and bulkheads dividing the machinery space from the cargo spaces forward and aft, are also to be fitted and made watertight up to the freeboard deck. The after peak bulkhead may, however, be stepped below the bulkhead deck, provided the degree of safety of the ship as regards subdivision is not thereby diminished.*~~

An aft peak bulkhead, enclosing the stern tube and rudder trunk in a watertight compartment, is to be provided. Where the shafting arrangements make enclosure of the stern tube in a watertight compartment impractical alternative arrangements will be specially considered.

The following requirements are added:

3.1.2

The aft peak bulkhead may be stepped below the bulkhead deck, provided that the degree of safety of the ship as regards subdivision is not thereby diminished.

3.1.3

The aft peak bulkhead location on ships powered and/or controlled by equipment that does not require the fitting of a stern tube and/or rudder trunk will also be subject to special consideration.

3.1.4

The aft peak bulkhead may terminate at the first deck above the summer load waterline, provided that this deck is made watertight to the stern or to a watertight transom floor.

Section 2 Compartment Arrangement

2. Cofferdams

2.1 Cofferdam arrangement

2.1.3

KC 793

This requirement is deleted

~~Spaces intended for the carriage of flammable liquids are to be separated from accommodation and service spaces by means of a cofferdam.~~

Void

5. Minimum Bow Height

5.1 General

5.1.1

KC 1082

The reference number to ILLC is replaced by the following one:

Ref. ILLC, as amended (Resolution MSC.~~143(77)~~ 223(82) Reg. 39(1))

KC 1082

The definition of T_1 is replaced by the following one:

T_1 : Draught at 85% of the ~~depth for freeboard D_1~~ least moulded depth , in m

The definition of D_1 is deleted:

~~*D_1 : Depth for freeboard, is the moulded depth amidship plus the freeboard deck thickness at side. The depth for freeboard in a ship having a rounded gunwale with a radius greater than 4% of the breadth (B) or having topsides of unusual form is the depth for freeboard of a ship having a midship section with vertical topsides and with the same round of beam and area of topside section equal to that provided by the actual midship section.*~~

Section 3 Access Arrangement

2 Technical provisions for means of access

KC 1009

The following title is changed as follow:

~~**2.8 Access to double side skin tanks in double side bulk carriers**~~

2.8 Access to double side skin tanks of double side skin construction

KC 1009

The following title is changed as follow:

~~**2.9 Access to vertical structures of cargo holds in single side bulk carriers**~~

2.9 Access to vertical structures of cargo holds of single side skin construction

KC 1009

The following title is changed as follow:

~~**2.10 Access to vertical structures of cargo holds in double side bulk carriers**~~

2.10 Access to vertical structures of cargo holds of double side skin construction

KC 1009

The following title is changed as follow:

~~**2.11 Access to top side ballast tanks in single side bulk carriers**~~

2.11 Access to top side ballast tanks

Chapter 3 Structural Design Principles

Section 3 Corrosion Additions

1. Corrosion additions

1.2 Corrosion addition determination

1.2.1 Corrosion additions for steel

KC 773

The following text is to be added before the last paragraph:

The corrosion addition of a longitudinal stiffener is determined according to the coordinate of the connection of the stiffener to the attached plating.

Section 5 Corrosion Protection

1 General

1.2 Protection of seawater ballast tanks and void double side skin spaces

1.2.2

NO KC entry

The first paragraph is modified as follow:

For ships contracted for construction on or after 8 December 2006, the date of IMO adoption of the amended SOLAS regulation II-1/3-2, by which an IMO "Performance standard for protective coatings for ballast tanks and void spaces" will be made mandatory, the coatings of internal spaces subject to the amended SOLAS regulation are to satisfy the requirements of the IMO performance standard.

NO KC entry

The following paragraph is added after the first paragraph:

For ships contracted for construction on or after 1 July 2012, the IMO performance standard is to be applied as interpreted by IACS UI SC 223 and UI SC 227. In applying IACS UI SC 223, "Administration" is to be read to be the "Classification Society".

1.3 Protection of cargo hold space

1.3.3 Side areas to be coated

KC 1009

The third item of the bullet list is modified as follow (the remaining text and figure are not modified):

The areas to be coated are the internal surfaces of:

- the inner side plating
- the internal surfaces of the topside tank sloping plates
- the internal surfaces of the hopper tank sloping plates for a distance of 300 mm below the frame end bracket for ~~single side bulk carriers~~ holds of single side skin construction, or below the hopper tank upper end for ~~double side bulk carriers~~ holds of double side skin construction.

1.3.4 Transverse bulkhead areas to be coated

KC 1009

The text is modified as follow:

The areas of transverse bulkheads to be coated are all the areas located above an horizontal level located at a distance of 300 mm below the frame end bracket for ~~single side bulk carriers~~ holds of single side skin construction, or below the hopper tank upper end for ~~double side bulk carriers~~ holds of double side skin construction.

Section 6 Structural Arrangement Principles

1 Application

KC 414

The current text is replaced by the following one:

If not specified otherwise, the requirements of this section apply to ~~the cargo hold area~~ the hull structure except superstructures and deckhouses. For ~~other~~ areas outside the cargo holds area, ~~the requirements of Ch 9 Sec 1 to Ch 9 Sec 4 are to be applied~~ supplementary requirements are to be found in Ch. 9 Sec 1 to Ch. 9 Sec 3.

2. General principles

2.3 Connections with higher tensile steel

2.3.1 Connections with higher tensile steel

KC 207
KC 208
KC 398

The last sentence of the last paragraph is replaced by the following one:

The same requirement is generally applicable for non continuous longitudinal stiffeners welded on the web of a primary member contributing to the hull girder longitudinal strength as hatch coamings, stringers and girders.

4 Ordinary stiffener

4.1 Profile of stiffeners

4.1.1 Stiffener profile with a bulb section

KC 1004

The first paragraph is replaced by the following one:

The properties of bulb profile sections are to be determined by exact calculations. If it is not possible, a bulb section may be taken as equivalent to a built-up section. The dimensions of the equivalent built-up section are to be obtained, in mm, from the following formulae.

5. Primary supporting members

5.2 Stiffening arrangement

5.2.1

KC 328

The third paragraph is modified as follow:

The net thickness of web stiffeners and brackets, in mm, are not to be less than ~~the minimum net thickness of the primary members on which they are fitted.~~ the value obtained from the following formula:

$t = 3 + 0.015 L_2$

where:

L_2 : Rule length L, but to be taken not greater than 300 m

The last paragraph is modified as follows:

KC 760

Depth of stiffener of flat bar type is in general to be more than 1/12 of stiffener length. A smaller depth of stiffener may be accepted based on calculations showing compliance with Ch 6 Sec 2 [2.3.1], Ch 6 Sec 2 [4] and Ch 6 Sec 3 [4].

5.4 Effective breadth of primary supporting member

5.4.1 General

KC 590

The current text is replaced by the following one:

The effective breadth b_p of the attached plating of a primary supporting member to be considered in the actual net section modulus for the yielding check ~~is to be taken as the mean spacing between adjacent primary supporting members~~ is to be determined according to [4.3.1].

6 Double bottom

6.1 General

6.1.3 Height of double bottom

KC 758

The first paragraph of the requirement is modified as follow.

~~Unless otherwise specified, the height of double bottom is not to be less than B/20 or 2 m whichever is the lesser.~~

Where a double bottom is required to be fitted the inner bottom shall be continued transversely in such a manner as to protect the bottom to the turn of the bilge.

Such protection will be deemed satisfactory if the inner bottom 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 measured from the keel line, as calculated by the formula:

$h = B/20$

However, in no case is the value of h to be less than 760 mm, and need not be taken as more than 2,000 mm.

The following title is changed as follow:

KC 414

7. Double side structure in cargo hold area

The following title is changed as follow:

KC 414

8. Single side structure in cargo hold area

9. Deck structure

9.2 General arrangement

9.2.3 Deck between hatches

KC 630

The first paragraph is to be replaced by the following one:

Inside the line of openings, a transversely framed structure is to be generally adopted for the cross deck structures., hHatch end beams and cross deck beams are to be adequately supported by girders and extended up outward to the second longitudinal from the hatch side girders towards the bulwark the deck side. Where this is impracticable, intercostal stiffeners are to be fitted between the hatch side girder and the second longitudinal.

If the extension of beams outward to the second longitudinal is not achievable, structural checks of the structure are to be performed in compliance with the requirements in Ch.7 or by means deemed appropriate by the Society.

10. Bulkhead structure

10.5 Non-tight bulkheads

10.5.1 Non-tight bulkheads not acting as pillars

KC 417

The following paragraph is added before the current last one:

The net thickness of bulkhead stiffener, in mm, is not to be less than the value obtained from the following formula:

$t = 3 + 0.015 L_2$

where:

L_2 : Rule length L, but to be taken not greater than 300 m

KC 760

The last paragraph is modified as follows:

The depth of bulkhead stiffener of flat bar type is in general not to be less than 1/12 of stiffener length. A smaller depth of stiffener may be accepted based on calculations showing compliance with Ch 6 Sec 2 [2.3.1], Ch 6 Sec 2 [4] and Ch 6 Sec 3 [4]. ~~The net thickness of bulkhead stiffener is not to be less than the minimum thickness required for the considered bulkhead plate.~~

Chapter 4 Design Loads

Section 5 External Pressures

4. Pressure in bow area

4.1 Bow flare area pressure

4.1.1

KC 653

The definition of p is replaced by the following one:

p_S, p_W : Hydrostatic pressure and maximum hydrodynamic pressures among load cases H, F, R and P~~, calculated in normal ballast condition at T_B~~ at considered point of the hull in normal ballast condition. Minimum ballast draught in ballast condition T_B defined in Ch 1, Sec 4, [2.1.1] is to be considered as T_{LCi} for the calculation of hydrostatic pressure and hydrodynamic pressures.

Section 6 Internal Pressures and Forces

4. Testing lateral pressure

4.1 Still water pressure

4.1.1

KC 966

In Table 2, the text concerning ballast hold and the notes at the bottom of the table are changed as follow:

Table 2 Testing load height

Compartment or structure to be tested	Testing load height, in m
…	…

Compartment or structure to be tested	Testing load height, in m
where: z_{ml} : Z co-ordinate, in *m*, of the ~~margin line~~ bulkhead deck at side. z_h : Z co-ordinate, in *m*, of the top of hatch coaming. z_F : As defined in **[3.2.1]**. z_{fd} : Z co-ordinate, in *m*, of the freeboard deck. p_{PV} : Setting pressure, in *bar*, of safety valves.	

Chapter 5 Hull Girder Strength

Section 1 Yielding Check

2. Hull girder stresses

2.2 Shear stresses

2.2.2 Simplified calculation of shear stresses induced by vertical shear forces

KC 1009

The text is modified as follow in the first column of the table 1 ***(the remaining text and figures are unchanged)****:*

Table 1: Shear stresses induced by vertical shear forces

Ship typology	Location	t, in mm	δ
Single side ~~ship~~ skin construction	Sides	t_S	0,5
Double side ~~ship~~ skin construction	Sides	t_S	$0.5(1-\phi)$
	Inner sides	t_{IS}	0.5ϕ

where:

t_S, t_{IS} : Minimum net thicknesses, in mm, of side and inner side, respectively

t_{SM}, t_{ISM} : Mean net thicknesses, in mm, over all the strakes of side and inner side , respectively. They are calculated as $\Sigma(\ell_i\, t_i) / \Sigma\ell_i$, where ℓ_i and t_i are the length, in m, and the net thickness, in mm, of the i^th^ strake of side and inner side.

ϕ : Coefficient taken equal to: $\phi = 0.275 + 0.25\dfrac{t_{ISM}}{t_{SM}}$

Chapter 6 Hull Scantlings

Section 1 Plating

3. Strength check of plating subjected to lateral pressure

3.2 Plating thickness

3.2.3 Net thickness of the corrugations of transverse vertically corrugated watertight bulkheads separating cargo holds for flooded conditions

KC 565

The definition of p is replaced by the following one:

p : pressure p_F or resultant pressure p, in kN/m^2, as defined in Ch 4, Sec 6 [3.3.6] and [3.3.7], respectively

Section 2 Ordinary stiffeners

3. Yielding check

3.6 Scantlings of transverse vertically corrugated watertight bulkheads separating cargo holds for flooded conditions

3.6.1 Bending capacity and shear capacity of the corrugations of transverse vertically corrugated watertight bulkheads separating cargo holds

KC 565

The definition of p is replaced by the following one:

F : force F_F or resultant force F, in kN, to be calculated according to Ch 4, Sec 6, [3.3.6] and [3.3.7], respectively

p_G : pressure p_F or resultant pressure p, in kN/m², to be calculated in way of the middle of the shedders or gusset plates, as applicable, according to Ch 4, Sec 6, [3.3.6] and [3.3.7], respectively

4. Web stiffeners of primary supporting members

4.1 Net scantlings

4.1.3 Connection ends of web stiffeners

KC 764

The second formula is modified as follow (new formula in red box):

Where the web stiffeners of primary supporting members are welded to ordinary stiffener face plates, the stress at ends of web stiffeners of primary supporting members in water ballast tanks, in N/mm^2, is to comply with the following formula when no bracket is fitted:

$\sigma \le 175$

where:

~~$\sigma = 1.1 K_{con} K_{longi} K_{stiff} \dfrac{\Delta\sigma}{\cos\theta}$~~

$$\sigma = K_{con} K_{longi} K_{stiff} \frac{\Delta\sigma}{\cos\theta}$$

Section 3 Buckling and ultimate strength of ordinary stiffeners and stiffened panels

4. Buckling criteria of partial and total panels

4.2 Ultimate strength in lateral buckling mode

4.2.2 Evaluation of the bending stress σ_b

KC 768

The requirement is modified as follow (all the text is included here for the sake of the editor but only the changes are to be considered):

The bending stress σ_b, in N/mm^2, in the stiffeners is equal to:

$$\sigma_b = \frac{M_0 + M_1}{W_{st}\, 10^3}$$

with:

M_0 : Bending moment, in N.mm, due to the deformation w of stiffener, taken equal to:

$$M_0 = F_{Ki} \frac{p_z w}{c_f - p_z}$$

With $(c_f - p_z) > 0$

M_1 : Bending moment, in N.mm, due to the lateral load p, taken equal to:

$$M_1 = \frac{pba^2}{24 \cdot 10^3} \quad \text{for longitudinal stiffeners}$$

$$M_1 = \frac{pa(n \cdot b)^2}{8c_S 10^3}$$ for transverse stiffeners, with n equal to 1 for ordinary transverse stiffeners.

W_{st} : Net section modulus of stiffener (longitudinal or transverse), in cm^3, including effective width of plating according to [5], taken equal to:

- if a lateral pressure is applied on the stiffener:

  W_{st} is the net section modulus calculated at flange if the lateral pressure is applied on the same side as the stiffener.

  W_{st} is the net section modulus calculated at attached plate if the lateral pressure is applied on the side opposite to the stiffener.

  Note: For stiffeners sniped at both ends, W_{st} is the net section modulus calculated at attached plate. However, if M_1 is larger than M_0 and the lateral pressure is applied on the same side as the stiffener, Wst is the net section modulus calculated at flange.

- if no lateral pressure is applied on the stiffener:

  W_{st} is the minimum net section modulus among those calculated at flange and attached plate

  Note: For stiffeners sniped at both ends, W_{st} is the net section modulus calculated at attached plate.

c_S : Factor accounting for the boundary conditions of the transverse stiffener

$c_S = 1.0$ for simply supported stiffeners

$c_S = 2.0$ for partially constraint stiffeners

p : Lateral load in kN/m^2, as defined in Ch 4, Sec5 and Ch 4, Sec 6 calculated at the load point as defined in Ch 6, Sec 2, [1.4]

F_{Ki} : Ideal buckling force, in N, of the stiffener, taken equal to:

$$F_{Kix} = \frac{\pi^2}{a^2} EI_x 10^4 \quad \text{for longitudinal stiffeners}$$

$$F_{Kiy} = \frac{\pi^2}{(nb)^2} EI_y 10^4 \quad \text{for transverse stiffeners}$$

I_x, I_y : Net moments of inertia, in cm^4, of the longitudinal or transverse stiffener including effective width of attached plating according to [5]. I_x and I_y are to comply with the following criteria:

$$I_x \geq \frac{bt^3}{12 \cdot 10^4}$$

$$I_y \geq \frac{at^3}{12 \cdot 10^4}$$

p_z : Nominal lateral load, in N/mm², of the stiffener due to σ_x, σ_y $^{\sigma_x}$, $^{\sigma_y}$ and τ

$$p_{zx} = \frac{t_a}{b}\left(\sigma_{xl}\left(\frac{\pi b}{a}\right)^2 + 2c_y\sigma_y + \tau_1\sqrt{2}\right) \quad \text{for longitudinal stiffeners}$$

$$p_{zy} = \frac{t_a}{a}\left(2c_x\sigma_{xl} + \sigma_y\left(\frac{\pi a}{nb}\right)^2\left(1 + \frac{A_y}{at_a}\right) + \tau_1\sqrt{2}\right) \quad \text{for transverse stiffeners}$$

$$\sigma_{xl} = \sigma_x\left(1 + \frac{A_x}{b \cdot t_a}\right)$$

t_a : Net thickness offered of attached plate, in mm

c_x, c_y : Factor taking into account the stresses vertical to the stiffener's axis and distributed variable along the stiffener's length taken equal to:

$0.5\,(1+\psi)$ for $0 \leq \psi \leq 1$

$\dfrac{0.5}{1-\psi}$ for $\psi < 0$

A_x, A_y : Net sectional area, in mm², of the longitudinal or transverse stiffener respectively without attached plating

$$\tau_1 = \left[\tau - t\sqrt{R_{eH}E\left(\frac{m_1}{a^2} + \frac{m_2}{b^2}\right)}\right] \geq 0$$

m_1, m_2 : Coefficients taken equal to:

for longitudinal stiffeners:

$\dfrac{a}{b} \geq 2{,}0$: $m_1 = 1.47$ $m_2 = 0.49$

$\dfrac{a}{b} < 2{,}0$: $m_1 = 1.96$ $m_2 = 0.37$

for transverse stiffeners:

$\dfrac{a}{n \cdot b} \geq 0{,}5$: $m_1 = 0.37$ $m_2 = \dfrac{1.96}{n^2}$

$\dfrac{a}{n \cdot b} < 0{,}5$: $m_1 = 0.49$ $m_2 = \dfrac{1.47}{n^2}$

$w = w_0 + w_1$ generally

$w = |w_0 - w_1|$ for stiffeners sniped at both ends, on which the same side lateral pressure as the stiffener is applied.

w_0 : Assumed imperfection, in mm, taken equal to:

$$w_0 = \min(\frac{a}{250}, \frac{b}{250}, 10) \quad \text{for longitudinal stiffeners}$$

$$w_0 = \min(\frac{a}{250}, \frac{n \cdot b}{250}, 10) \quad \text{for transverse stiffeners}$$

For stiffeners sniped at both ends w_0 must not be taken less than the distance from the midpoint of attached plating to the neutral axis of the stiffener calculated with the effective width of its attached plating.

w_1 : Deformation of stiffener, in mm, at midpoint of stiffener span due to lateral load p. In case of uniformly distributed load the following values for w_1 may be used:

$$w_1 = \frac{pba^4}{384 \cdot 10^7 EI_x} \quad \text{for longitudinal stiffeners}$$

$$w_1 = \frac{5ap(nb)^4}{384 \cdot 10^7 EI_y c_S^2} \quad \text{for transverse stiffeners}$$

c_f : Elastic support provided by the stiffener, in N/mm², taken equal to:

- for longitudinal stiffeners:

$$c_f = F_{Kix} \frac{\pi^2}{a^2}(1 + c_{px})$$

$$c_{px} = \frac{1}{1 + \dfrac{0.91\left(\dfrac{12 \cdot 10^4 I_x}{t^3 b} - 1\right)}{c_{xa}}}$$

c_{xa} : Coefficient taken equal to :

$$c_{xa} = \left[\frac{a}{2b} + \frac{2b}{a}\right]^2 \quad \text{for} \quad a \geq 2b$$

$$c_{xa} = \left[1 + \left(\frac{a}{2b}\right)^2\right]^2 \quad \text{for} \quad a < 2b$$

- for transverse. stiffeners:

$$c_f = c_S F_{Kiy} \frac{\pi^2}{(n \cdot b)^2}\left(1 + c_{py}\right)$$

$$c_{py} = \frac{1}{1 + \dfrac{0.91\left(\dfrac{12 \cdot 10^4 I_y}{t^3 a} - 1\right)}{c_{ya}}}$$

c_{ya} : Coefficient taken equal to:

$$c_{ya} = \left[\frac{nb}{2a} + \frac{2a}{nb}\right]^2 \qquad \text{for} \qquad nb \geq 2a$$

$$c_{ya} = \left[1 + \left(\frac{nb}{2a}\right)^2\right]^2 \qquad \text{for} \qquad nb < 2a$$

4.2.3 Equivalent criteria for longitudinal and transverse ordinary stiffeners not subjected to lateral pressure

KC 800

The requirement is modified as follow (all the text is included here for the sake of the editor but only the changes are to be considered):

Longitudinal and transverse ordinary stiffeners not subjected to lateral pressure, except for sniped stiffeners, are considered as complying with the requirement of [4.2.1] if their net moments of inertia I_x and I_y, in cm^4, are not less than the value obtained by the following formula:

- For longitudinal stiffener : $I_x = \dfrac{p_{zx} a^2}{\pi^2 10^4} \left(\dfrac{w_0 h_w}{\dfrac{R_{eH}}{S} - \sigma_x} + \dfrac{a^2}{\pi^2 E} \right)$

- For transverse stiffener : $I_y = \dfrac{p_{zy} (nb)^2}{\pi^2 10^4} \left(\dfrac{w_0 h_w}{\dfrac{R_{eH}}{S} - \sigma_y} + \dfrac{(nb)^2}{\pi^2 E} \right)$

Section 4 Primary supporting members

1 General

KC 654

The following article is added:

1.6 Flooding check of primary supporting members

1.6.1 General

Flooding check of primary supporting members is to be carried out according to the requirements in [5].

The following article is added:

KC 654

5 Flooding check of primary supporting members

5.1 Net section modulus and net shear sectional area under flooded conditions

5.1.1

The net section modulus w, in cm³, the net shear sectional area A_{sh}, in cm² subjected to flooding are to be not less than the values obtained from the following formulae:

$$w = \frac{p_F s \ell^2}{16 \alpha \lambda_S R_Y} 10^3$$

$$A_{sh} = \frac{5 p_F s \ell}{\alpha \tau_a \sin\phi}$$

Where :

α: Coefficient taken equal to:

$\alpha = 0.95$ for the primary supporting member of collision bulkhead,

$\alpha = 1.15$ for the primary supporting member of other watertight boundaries of compartments.

λ_S : Coefficient defined in Ch 6, Sec 4 Table 11, determined by considering σ_X in flooded condition.

p_F : Pressure, in kN/m², in flooded conditions, defined in Ch 4, Sec 6, [3.2.1].

Chapter 7 Direct Strength Analysis

Section 3 Detailed Stress Assessment

2 Analysis model

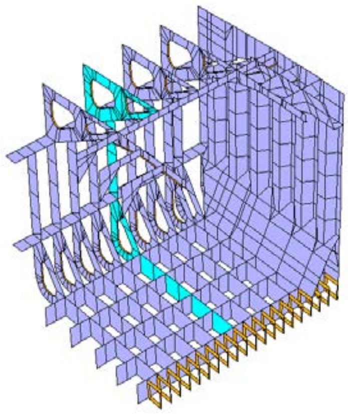
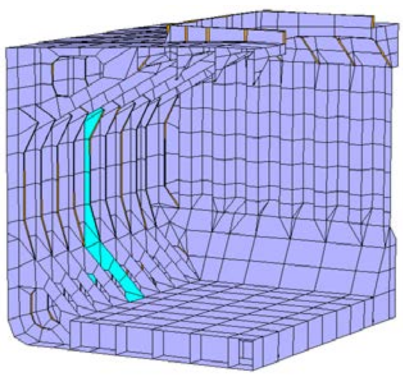
2.1 Areas to be refined

2.1.2

KC 1009

*The text is modified as follow in the second column of the table 2 **(the remaining text and figures are unchanged)**:*

Table 1: Typical details to be refined

Structural member	Area of interest	Additional specifications	Description
Primary supporting member	Most stressed transverse primary supporting member for double ~~skin~~ side ~~bulk carriers~~ skin constructions	Refining of the most stressed transverse primary supporting members located in: • double bottom • hopper tank • double skin side • topside tank	
	Most stressed transverse primary supporting member for single ~~skin~~ side ~~bulk carriers~~ skin constructions	Refining of the most stressed transverse primary supporting members located in: • double bottom • hopper tank • topside tank side shell frame with end brackets and connections to hopper tank and topside tank	
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Chapter 8 Fatigue Check of Structural Details

Section 1 General Consideration

1. General

1.3 Subject members

1.3.1

KC 854

The current text is replaced by the following one before Table 1:

Fatigue strength is to be assessed, in cargo hold area, ~~for members described in Tab 1, at the considered locations.~~ for all the connected members at the considered locations described in Tab 1.

Section 4 Stress Assessment of Stiffeners

2. Hot spot stress range

2.3 Stress range according to the simplified procedure

2.3.5 Stress due to dry bulk cargo pressure

KC 571

The definition of $p_{cw,ij(k)}$ is replaced by the following one:

$p_{CW,ij(k)}$: Inertial pressure, in kN/m^2, due to dry bulk cargo specified in Ch 4, Sec 6, [1.3] for a cargo density ρ_C specified in Ch.4 Annex 3,, and with f_p = 0.5, in load case "*i*1" and "*i*2" for loading condition "(k)"

Appendix 1 Cross Sectional Properties for Torsion

2 Example calculation for a single side hull cross section

2.5 Notes

2.5.1

KC 1009

The first sentence of the requirement is modified as follow (the remaining text of the requirement is unchanged):

For ~~single side bulk carriers~~ holds of single side skin construction,, the hull cross section normally can be simplified in a section with four boxes (cell 1 cargo hold, cell 2 and 3 wing tanks and cell 4 hopper tanks and double bottom as shown in the calculation example) whereas the cross section of ~~a double side bulk carriers~~ holds of double side skin construction, can be simplified to a cross section with two closed cells only (cell 1 cargo hold, cell 2 double hull).

Chapter 9 Other Structures

Section 1 Fore Part

Symbols

KC 666

The symbols' values and definitions are modified as follow:

m : Coefficient taken equal to:

m = 10 for vertical stiffeners, vertical primary supporting members

m = 12 for other stiffeners, other primary supporting members

s : Spacing, in m, of ordinary stiffeners or primary supporting members, measured at mid-span along the chord

l : Span, in m, of ordinary stiffeners or primary supporting members, measured along the chord between the supporting members, see Ch 3, Sec 6, [4.2] or [5.3] respectively.

1. General

1.1 Application

KC 524

The following text is added:

1.1.2

Fore part structures which form the boundary of spaces not intended to carry liquids, and which do not belong to the outer shell, are to be subjected to lateral pressure in flooding conditions. Their scantlings are to be determined according to the relevant criteria in Ch.6.

2. Arrangement

2.3 Floors and bottom girders

2.3.2 Solid floors

KC 759

The item is amended as follows:

In case of transverse framing, solid floors are to be fitted at every frame.

In case of the longitudinal framing, the spacing of solid floors is not to be greater than 3.5m or four transverse frame spaces, whichever is the smaller. Larger spacing of solid floors may be accepted, provided that the structure is verified by means of FEA deemed appropriate by the Society.

2.3.3 Bottom girder

KC 759

The item is amended as follows:

In case of transverse framing, the spacing of bottom girders is not to exceed 2.5m.

In case of longitudinal framing, the spacing of bottom girders is not to exceed 3.5m.

Larger spacing of bottom girders may be accepted, provided that the structure is verified by means of FEA deemed appropriate by the Society.

4. Scantlings

4.2 Plating

4.2.1

KC 494

The last row is added to Table 1 as follow:

Table 1 Net minimum thickness of plating

Minimum net thickness, in mm	
Bottom	$5.5 + 0.03L$
Side	$0.85L^{1/2}$
Inner bottom	$5.5 + 0.03L$
Strength deck	$4.5 + 0.02L$
Platform and wash bulkhead	6.5
Transverse and longitudinal watertight bulkheads	$0.6L^{1/2}$

4.4 Primary supporting members

4.4.4 Deck primary supporting members

KC 666

The current text is replaced by the following one:

~~Scantlings of deck primary supporting members are to be in accordance with Ch 6, Sec 4, considering the loads in [3.2] and [3.3].~~

The net scantlings of deck primary supporting members are to be not less than those obtained from the formulae in Table 5. The design pressures in the formulae are taken from intact conditions and testing conditions respectively as stated in [3.2]. For a complex deck structure, a calculation deemed appropriate by the Society may be carried out in lieu of the formulae.

Table 5 Net scantlings of deck primary supporting members

Condition	**Net section modulus *w*, in cm^3**	**Net sectional shear area A_{sh}, in cm^2**
Primary supporting members subjected to lateral pressure in intact conditions	$w = \frac{(p_S + p_W)s\ell^2}{0.9mR_Y}10^3$	$A_{sh} = \frac{5(p_S + p_W)s\ell}{\tau_a \sin\phi}$
Primary supporting members subjected to lateral pressure in testing conditions	$w = \frac{p_T s\ell^2}{1.05mR_Y}10^3$	$A_{sh} = \frac{5p_T s\ell}{1.05\tau_a \sin\phi}$

where:

ϕ : Angle, in deg, between the primary supporting member's web and the shell plate, measured at the middle of the primary supporting member's span; the correction is to be applied when ϕ is less than 75.

The subsequent existing Table 5 to Table 7 shall be renumbered accordingly.

KC 567

The title is replaced modified as follow:

5. Strengthening of ~~flat~~ bottom forward area

5.1 Application

5.1.1

KC 567

The current text is replaced by the following one:

The ~~flat~~ bottom forward area to be reinforced is the ~~flat~~ part of the ship's bottom extending forward of $0.2V\sqrt{L}$ from the fore perpendicular end, up to a height of $0.05T_B$ or 0.3 m above base line, whichever is the smaller.

5.2 Bottom plating

5.2.1

KC 567

The first paragraph is replaced by the following one:

The net thickness, in mm, of the ~~flat~~ bottom forward area, is not to be less than:

5.3 Ordinary stiffeners

5.3.1

KC 567

The first paragraph is replaced by the following one:

The net section modulus, in cm^3, of transverse or longitudinal ordinary stiffeners of the ~~flat~~ bottom forward area is not to be less than:

5.3.2

KC 567

The first paragraph is replaced by the following one:

The net shear area, in cm^2, of transverse or longitudinal ordinary stiffeners of the ~~flat~~ bottom forward area is not to be less than:

Section 2 AFT PART

Symbols

KC 666

The symbols' values and definitions are modified as follow:

m : Coefficient taken equal to:

m = 10 for vertical stiffeners, vertical primary supporting members

m = 12 for other stiffeners, other primary supporting members

s : Spacing, in m, of ordinary stiffeners or primary supporting members, measured at mid-span along the chord

l : Span, in m, of ordinary stiffeners or primary supporting members, measured along the chord between the supporting members, see Ch 3, Sec 6, [4.2] or [5.3] respectively.

4 Scantlings

4.1 Plating

4.1.1

KC 494

The last row is added to Table 1 as follow:

Table 1 Net minimum thickness of plating

Minimum net thickness, in mm	
Bottom	$5.5 + 0.03L$
Side	$0.85L^{1/2}$
Inner bottom	$5.5 + 0.03L$
Strength deck	$4.5 + 0.02L$
Platform and wash bulkhead	6.5
Transverse and longitudinal watertight bulkheads	$0.6L^{1/2}$

4.3 Primary supporting members

4.3.4 Deck primary supporting members

KC 666

The current text is replaced by the following one:

~~Scantlings of deck primary supporting members are to be in accordance with Ch 6, Sec 4, considering the loads in [2.2].~~

The net scantlings of deck primary supporting members are to be not less than those obtained from the formulae in Table 5. The design pressures in the formulae are taken from intact conditions and testing conditions respectively as stated in [2.2]. For a complex deck structure, a direct strength calculation may be carried out in lieu of the formulae.

Table 5 Net scantlings of deck primary supporting members

Condition	Net section modulus w, in cm^3	Net sectional shear area A_{sh}, in cm^2
Primary supporting members subjected to lateral pressure in intact conditions	$w = \dfrac{(p_S + p_W)s\ell^2}{0.9mR_Y}10^3$	$A_{sh} = \dfrac{5(p_S + p_W)s\ell}{\tau_a \sin\phi}$
Primary supporting members subjected to lateral pressure in testing conditions	$w = \dfrac{p_T s\ell^2}{1.05mR_Y}10^3$	$A_{sh} = \dfrac{5 p_T s\ell}{1.05\tau_a \sin\phi}$

where:

ϕ : Angle, in deg, between the primary supporting member's web and the shell plate, measured at the middle of the primary supporting member's span; the correction is to be applied when ϕ is less than 75.

The subsequent existing Table 5 and Table 6 shall be renumbered accordingly.

Section 3 Machinery Space

2. Double bottom

2.1 Arrangement

2.1.5 Side bottom girders in way of machinery seatings

KC 836

The current text for the fourth paragraph is replaced by the following one:

Forward of the machinery space forward bulkhead, the bottom girders are to be generally tapered for at least three frame spaces and are to be effectively connected to the hull structure.

Section 5 Hatch Covers

4. Load Model

4.2 Load Point

KC 304

The title and the requirement are changed as follow:

~~4.2.1 Wave lateral pressure for hatch covers on exposed decks~~

4.2.1 Sea pressures

The wave lateral pressure to be considered as acting on each hatch cover is to be calculated at a point located~~:~~ longitudinally, at the hatch cover mid-length.

- ~~longitudinally, at the hatch cover mid-length~~
- ~~transversely, on the longitudinal plane of symmetry of the ship~~
- ~~vertically, at the top of the hatch cover.~~

KC 304

The title is changed as follow:

~~4.2.2 Lateral pressures other than the wave pressure~~

4.2.2 Other pressures

The lateral pressure is to be calculated:

- in way of the geometrical centre of gravity of the plate panel, for plating
- at mid-span, for ordinary stiffeners and primary supporting members.

KC 304

The following text is added to the requirement:

Internal dynamic lateral pressure to be considered as acting on the bottom of a hatch cover is to be calculated at a point located:

- longitudinally, at the hatch cover mid-length
- transversely, at hatchway side
- Vertically, at the top of the hatch coaming for internal ballast water pressures

Chapter 10 Hull Outfitting

Section 1 Rudder and Manoeuvring Arrangement

5. Rudder body, rudder bearings

5.1 Strength of rudder body

5.1.4

KC 568

In the article, the current values are replaced by the following ones:

- bending stress, N/mm², due to M_R:

  σ_b = ~~90~~ 75

- equivalent stress, in N/mm2, due to bending and shear and equivalent stress due to bending and torsion:

$$\sigma_{v1} = \sqrt{\sigma_b^2 + 3\tau^2} = \text{~~120~~}100$$

Chapter 11 Construction and Testing

Section 2 Welding

2. Types of welded connections

2.2 Butt welding

2.2.2 Welding of plates with different thicknesses

KC 938

The text of this item is replaced by the following one:

In the case of welding of plates with a difference in as-built thickness ~~equal to or~~ greater than 4 mm, the thicker plate is normally to be tapered. The taper has to have a length of not less than 3 times the difference in as-built thickness.

2.4 Full penetration welds

2.4.1 Application

KC 848

The last item in the list is replaced by the following one:

- abutting plate panels with as-built thickness less than or equal to 12mm, forming boundaries to the sea below the summer load water line. For as-built thickness greater than 12mm, deep penetration weld with a maximum root face length f = T/3 is acceptable (see Fig.2).

Section 3 Testing of Compartments

3. Testing requirements

3.1 General

3.1.1

KC 966

In Table 1, the line No 4 and note 2 are changed as follow:

Item number	Structural to be tested	Type of testing	Structural test pressure	Remarks
…	…	…	…	…
4	Ballast holds	Structural testing (1)	The greater of ~~the following:~~ • ~~head of water up to the~~ top of overflow, or • ~~0.9 head of water above top of hatch~~ top of hatch coaming	
…	…	…	…	…

COMMON STRUCTURAL RULES FOR BULK CARRIERS

JULY 2010

Rule Changes Notice Technical Background
~
Number 1 to the 2010 Edition

Notes: (1) These Rule Changes enter into force on July 2012.

(2) This Rule Change Notice Technical Background should be read in conjunction with the July 2010 consolidated edition of Bulk Carriers CSR.

Table of contents

List of Tables

List of Figures

1. INTRODUCTION

1.1 Scope of application

This Technical Background is intended for the understanding of the following Rule Change Notice:

- **Rule Change Notice number** : Number 1 to the 2010 Edition
- **Entry into force of the Rule Change Notice** : July 2012
- **Concerned rules** : Common Structural Rules for Bulk Carriers
- **Edition date of the rules** : July 2010

1.2 Content of the document

As the changes are initiated by questions in the IACS Knowledge Centre (KC), this document presents all the KC entries that lead to rules changes and give for each the following elements:

- The description of the change ,
- The modifications made accordingly,
- The scantling impacts.

It is to be pointed up that a KC entry may lead to changes in more than one item in the text and that any item in the text may be affected by more than one KC entry.

1.3 Cross references

Table 1 gives the list of KC leading to a change in each modified item in the rules.

Table 2 gives the list of rule changes induced by each KC entry.

Table 1 – KC per rule references

Chapter	Section	Sub.1	Sub.2	Sub.3	Table	Figure	KC ref. *'click to go'*
1	4	3	21	1			1009
				2			1009
			22	1			567

Chapter	Section	Sub.1	Sub.2	Sub.3	Table	Figure	KC ref. *'click to go'*
2	1	2	1	1			903
		3	1	1			798
	2	2	1	3			793
				4			793
		5	1	1			KC 1082
	3	2	8				1009
			9				1009
			10				1009
			11				1009
3	3	1	2	1			773
	5	1	2	2			PSPC application
			3	3			1009
				4			1009
	6	1					414
		2	3	1			207
							208
							398
		4	1	1			1004
		5	2	1			328
							760
			4	1			590
		6	1	3			758
					2		966
		7					414
		8					414
		9	2	3			630
		10	5	1			417
							760
4	5	4	1	1			653
5	1	2	2	2	1		653
6	1	3	2	3			565
	2	3	6	1			565
		4	1	3			764
	3	4	2	2			768
				3			800
	4	1	6	1			654
		5	1				654
7	3	2	1	2	2		1009
8	1	1	3	1			854
	4	2	3	5			571

Chapter	Section	Sub.1	Sub.2	Sub.3	Table	Figure	KC ref. *'click to go'*
	A1	2	5	1			1009
9	1	Symbols					666
					1		494
		1	1	2			524
		2	3	2			759
		4	4	4			666
		5	1	1			567
			2	1			567
			3	1			567
				2			567
	2	Symbols					666
					1		494
		4	3	1			666
			3	4			666
	3	2	1	5			836
	5	4	2	1			304
				2			304
10	1	5	1	4			568
11	2	2	2	2			938
			4	1			848
	3				1		966

Table 2 – Changes applied per KC entries

KC ref. *'click to go'*	Chapter	Section	Sub.1	Sub.2	Sub.3	Table	Figure
PSPC	3	5	1	2	2		
207	3	6	2	3	1		
208	3	6	2	3	1		
304	9	5	4	2	1		
					2		
328	3	6	5	2	1		
398	3	6	2	3	1		
414	3	6	1				
			7				
			8				
417	3	6	10	5	1		
494	9	1				1	

KC ref. *'click to go'*	Chapter	Section	Sub.1	Sub.2	Sub.3	Table	Figure
		2				1	
524	9	1	1	1	2		
565	6	1	3	2	3		
		2	3	6	1		
567	1	4	3	22	1		
	9	1	5	1	1		
				2	1		
				3	1		
					2		
568	10	1	5	1	4		
571	8	4	2	3	5		
590	3	6	5	4	1		
630	3	6	9	2	3		
653	5	1	2	2	2		
654	6	4	1	6	1		
			5	1			
666	9	1	Symbols				
			4	4	4		
		2	Symbols				
			4	3	1		
					4		
758	3	6	6	1	3		
759	9	1	2	3	2		
760	3	6	5	2	1		
			10	5	1		
764	6	2	4	1	3		
773	3	6	1	2	1		
798	2	1	3	1	1		
800	6	3	4	2	2		
836	9	3	2	1	5		
848	11	2	2	4	1		
854	8	1	1	3	1		
903	2	1	2	1	1		
938	11	2	2	2	2		
966	3	6				2	

KC ref. *'click to go'*	**Chapter**	**Section**	**Sub.1**	**Sub.2**	**Sub.3**	**Table**	**Figure**
	11	3				1	
1004	3	6	4	1	1		
1009	1	4	3	21	1		
					2		
	2	3	2	8			
				9			
				10			
				11			
	3	5	1	3	3		
					4		
	7	3	2	1	2		
	8	A1	2	5	1		
KC 1082	2	2	5	1	1		

2. CHANGE DESCRIPTIONS

2.1 PSPC application

2.1.1 Rule Change description

This change is not based on a KC question.

The proposed amendment is to indicate the adoption date of the *Performance standard for protective coatings for ballast tanks and void spaces* by IMO, and to reference the IACS Unified Interpretation UI SC223 and SC227 for transparent application by IACS members.

2.1.2 Applied change

2.1.2.1. Chapter 3 Section 5 [1.2.2]

Details are added about the application of PCPC to CSR BC.

2.1.3 Impact on scantling

There is no impact on scantlings.

2.2 KC 207, 208 & 398 – Connection with high tensile steel

2.2.1 Rule Change description

The requirement in Chapter 3 Section 6 [2.3.1] is of general scope. As the stress level due to hull girder bending in longitudinal member not contributing to hull girder longitudinal strength, is verified in order to satisfy the requirement in Ch 5, Sec 1, [3.1.1], application of the requirements in Ch 3, Sec 6, [2.3.1] might be mitigated.

In addition, designs where non continuous stiffeners made of mild steel are welded on girders made of high tensile steels are already accepted by classification societies.

The requirement is made less mandatory for non-continuous longitudinal stiffeners by adding the word “generally”.

2.2.2 Applied change

2.2.2.1. Chapter 3 Section 6 [2.3.1]

The word “generally” is added in the last sentence of the item between “The same requirement” and “is applicable”.

2.2.3 Impact on scantling

This requirement is about the steel grade to be used for non-continuous longitudinal stiffeners when they are welded on the web of a primary supporting member contributing to the hull girder longitudinal strength. As the scantling of these stiffeners is assessed in the hull girder strength, there is no valuable modification of the scantling or the steel weight.

2.3 KC 304 – Load Calculation point for Hatch Cover

2.3.1 Rule Change description

Currently, the load model used for hatch covers defines a single load calculation point in Chapter 9 Section 5 [4.2.1] for sea pressures or internal ballast water pressures.

In addition the wording “Wave lateral pressure” may lead to some confusion, as it is used for “dynamic pressure” (induced by the sea waves).

The main intention of this rule change is to differentiate the actions of

- external sea loads acting on the top of the hatch cover and which effects are described initially by ILLC,
- internal ballast water acting on the bottom of hatch covers.

The current requirement in Chapter 9 Section 5 [4.2.1] defines the load calculation point for external sea pressures only. As the ILLC approach used in these rules is based only on the longitudinal position of the hatch cover, the requirement is modified to refer only to the longitudinal position.

For the other pressures acting on a hatch cover, the current requirement in Chapter 9 Section 5 [4.2.2] defines the load calculation point for “other lateral pressures” for plating, ordinary stiffeners or primary supporting members.

The particular case of internal water ballast pressure is added with the definition of the load calculation point to be considered on the inner face of the hatch cover. The calculated pressure is then to be used over the different structural elements of the hatch cover at the positions defined in the requirement.

This changes intents to clarify all these points in the rules by:

- changing the title of Chapter 9 Section 5 [4.2.1] to “Sea pressures”
- changing the title of Chapter 9 Section 5 [4.2.2] to “Other pressures”
- adding the definition of the load calculation point on the bottom of the hatch coaming as follow:
    - longitudinally, at the hatch cover mid-length,
    - transversely, at hatchway side,
    - vertically, at the top of the hatch coaming.

2.3.2 Applied change

2.3.2.1. Chapter 9 Section 5 [4.2.1]

The title is changed to “Sea pressures” in order to clearly state this is about sea pressures only. The requirement is simplified to refer only to the longitudinal position, which is used in the ILLC formula.

2.3.2.2. Chapter 9 Section 5 [4.2.2]

The title is changed to clearly state this is about “other pressures”.

The particular case of the internal water ballast pressure acting on the bottom of the hatch cover is considered by adding the definition of the coordinates of the load calculation point to the existing requirement.

2.3.3 Impact on scantling

The proposed change has consequences only onto the values of the pressure to be considered acting on the bottom of the hatch cover.

2.4 KC 328 – Net thickness of web stiffeners and brackets of primary supporting members

2.4.1 Rule Change description

The requirement in the third paragraph of Chapter 3 Section 6 [5.2.1] stating that the net thickness of web stiffeners and brackets is not to be less than the minimum net thickness of the primary supporting member on which they are fitted, is quite severe, especially for the stiffener with Bulb, Angle or T shape section.

According to the CSR BC Technical Background, this regulation was established referring to the rules of various classification Societies.

In order to investigate the net thickness of web stiffeners and brackets, corresponding data is gathered, which includes 4 types of non-CSR Bulk Carriers, Handysize, Handymax, Panamax and Capsize, 16 ships totally, all of them are well in service.

2.4.1.1. Description of study

According to the investigation about the net thickness of web stiffeners and brackets on representative PSMs such as:

- double bottom floor,
- double bottom girder,
- PSM in bilge hopper tank and in topside tank,

it is found that the net offered thickness of web stiffeners and brackets for some bulk carriers are thinner than the minimum required net thickness of the PSM on which they are fitted.

On the basis of the requirement of ordinary stiffener in Chapter 6, Section 2, [2.2.1]:

$t = 3 + 0.015\ L_2$,

a study about the proposed rule change is carried out for the requirement in Chapter 3 Section 6 [5.2.1].

In addition, it is to be noted that the scantlings of web stiffener on PSM are to satisfy the requirements in Chapter 6, Section 2, [4.1.1] and/or [4.1.2] also.

The investigation data are summarized in Appendix 2, where the net offered thickness is equal to that the gross thickness diminished of the corrosion addition given in Chapter 3, Section 3, Table 1.

2.4.1.2. Conclusion of study

The conclusion is as follow.

1. Double bottom floor

   The net offered thickness of web stiffener in three types, Panamax-1, Capesize-1 and Capesize-3, is less than the requirement in Chapter 3 Section 6 [5.2.1], but greater than that in the proposed Rule Change.

2. Double bottom Girder

   The net offered thickness of web stiffener in four types, Panamax-2, Capesize-1, Capesize-2 and Capesize-3, is less than the requirement in Chapter 3 Section 6 [5.2.1], but greater than that in the proposed Rule Change.

3. PSM in bilge hopper tanks

   The net offered thickness of web stiffener/bracket in six types, Handysize-1, Handysize-2, Panamax-1, Panamax-2, Capesize-1 and Capesize-3, is less than the requirement in Chapter 3 Section 6 [5.2.1], but greater than that in the proposed Rule Change.

4. PSM in topside tanks

   The net offered thickness of web stiffener/bracket in seven types, Handysize-1, Handysize-2, Handymax-1, Panamax-1, Panamax-2, Capesize-1 and Capesize-3, is less than the requirement in Chapter 3 Section 6 [5.2.1], but greater than that in the proposed Rule Change except only the web stiffener in Panamax-1.

Based on the above investigation, it is reasonable and realistic that the requirement in the third paragraph of Chapter 3 Section 6 [5.2.1] is modified as that the net thickness of web stiffeners and brackets are not to be less than (3 + 0.015 L_2), in mm.

This requirement is similar to those of Chapter 6, Section 2, [2.2.1] and is added in the article for the convenience of the reader with all the needed definitions.

2.4.2 Applied change

2.4.2.1. Chapter 3 Section 6 [5.2.1]

The formula given in Chapter 6, Section 2, [2.2.1], third paragraph, replaces the current requirement. The definition of L_2 is also given.

2.4.3 Impact on scantling

Because a web stiffener is to satisfy the requirements in Chaper3, Section 6, [5.2.1], Chaper6, Section 2, [4.1.1] and [4.1.2], the impact on scantling can be ignored for flat bar (FB), but the requirements are less than those before the proposed rule change for the stiffener with Bulb, Angle or T shape section.

2.4.3.1. Example definition

1. **Basic data**
   - Rule length: L = 280.33 m
   - Corrosion addition: t_C = 3.0 mm (The web stiffener is in a ballast tank.)
   - web net thickness of PSM: t = 10.0 mm
2. **Web stiffener**
   - k1 = 0.225,
   - p = 358.56 N/m^2
   - s = 0.84 m,
   - l = 2.73 m (The symbols are the same as Chaper6, Section2, [4.1.1].)
   - s = 1.794 m,
   - S_s = 0.84 m (The symbols are the same as Chaper6, Section 2, [4.1.2].)

2.4.3.2. Comparison of current an proposed requirements

1. **Requirements in Chaper3, Section 6, [5.2.1]**

   Web net thickness of the web stiffener: t_W=10.0 mm (Chaper3, Section 6, [5.2.1])

2. **Requirements of the proposed Rule Change**

   Web net thickness of the web stiffener: t_W=7.0 mm

3. **Requirements in Chaper6, Section 2, [4.1.1] and [4.1.2]**

   The net sectional area of the web stiffener: A=18.50 cm^2 (Chaper6, Section 2, [4.1.1])
   The net s section modulus of the web stiffener: W=56.77 cm3 (Chaper6, Section 2, [4.1.2])

4. **Offered scantling of the web stiffener**

   In order to satisfy the requirement in Chaper3, Section 6, [5.2.1], the web net thickness of the web stiffener is to be 10.0 mm. In addition, the requirements in Chaper6, Section 2, [4.1.1] and [4.1.2] have to be considered. The results are listed in Table 3.

Table 3 – KC 328 – offered net scantlings of the web stiffeners which satisfy the requirement in Chaper3, Section 6, [5.2.1], Chaper6, Section 2, [4.1.1] and [4.1.2]

Dimension mm×mm	Type	Ch3/Sec6/[5.2.1] tW (mm)	Ch6/Sec2/[4.1.1] A (cm^2)	Ch6/Sec2/[4.1.2] W (cm^3)

185×13	FB	10.0	18.50	57.04
300×13	HP	10.0	42.90	351.88
300×13+90×17	L	10.0	41.54	356.36

2.4.3.3. Application of the rule change

According to the proposed rule change, the required net thickness is applied to web stiffeners, 7.0 mm, the results are listed in Table 4.

Table 4 – KC 328 – offered net scantlings of the web stiffeners which satisfy the requirement of the proposed Rule Change

Dimension mm×mm	Type	Ch3/Sec6/[5.2.1] tW (mm)	Ch6/Sec2/[4.1.1] A (cm^2)	Ch6/Sec2/[4.1.2] W (cm^3)
185×10	FB	7.0	12.95	39.93
220×10	HP	7.0	21.75	130.72
250×10+90×15	L	7.0	27.73	223.37

2.4.3.4. Conclusion

For flat bar, although the required web net thickness is less in the proposed rule change, the values of A and W in Table 2 are less than the values in point 3 of 2.4.3.2 (Requirements in Chapter 6, Section 2, [4.1.1] and [4.1.2]).

Because the requirements in Chaper6, Section 2, [4.1.1] and [4.1.2] are to be satisfied, the impact on the dimension of the web stiffener can be ignored.

For the stiffener with Bulb, Angle or T shape section, the dimensions of web stiffener given by this rule change are lower than those given in the 2010 edition.

Last, this rule change for the net thickness of web stiffeners and brackets of the primary supporting members is in line with the current practice.

2.5 KC 414 – Application of structural arrangement principles

2.5.1 Rule Change description

The structural arrangement principles defined in Chapter 3 Section 6 are applicable to the complete hull structure except superstructures and deckhouses; in addition several references in Chapter 3 Section 6 are made to areas outside the cargo holds.

Specific additional requirements for other areas (fore part, aft part, machinery space, superstructures, deckhouses, hatch covers, openings) are found in Chapter 9.

The scope of application of the general principles in Chapter 3 Section 6 is extended to the complete hull structure and references are made to specific requirements from Chapter 9.

2.5.2 Applied change

2.5.2.1. Chapter 3 Section 6 [1]

The article is changed to extend the scope of this section to the whole hull structure, except deckhouses or superstructures. Supplementary requirements of Chapter 9 are mentioned.

2.5.2.2. Chapter 3 Section 6 [7]

The title of this article is changed to indicate the limitation of its scope to the cargo hold area.

2.5.2.3. Chapter 3 Section 6 [8]

The title of this article is changed to indicate the limitation of its scope to the cargo hold area.

2.5.3 Impact on scantling

Under the assumption that none of the requirements in Ch. 3 Sec. 6 with respect to end brackets, tripping brackets, steel grade has been fulfilled outside the cargo hold area previously, one may expect a minor scantling increase.

In general the scantling impact can be ignored.

2.6 KC 417 –Net thickness of non-tight bulkhead stiffeners not acting as pillars

2.6.1 Rule Change description

The requirement in the last sentence of Chapter 3 Section 6 [10.5.1], that the net thickness of bulkhead stiffener is not to be less than the minimum thickness required for the considered bulkhead plate, is quite severe, especially for the stiffener with Bulb, Angle or T shape sections.

In order to investigate the net thickness of web stiffeners and brackets, corresponding data is gathered, which includes 4 types of non-CSR Bulk Carriers, Handysize, Handymax, Panamax and Capsize, 16 ships totally, all of them are well in service.

According to the investigation about the net thickness of bulkhead stiffeners on non-tight bulkheads not acting as pillars such as wash bulkheads, it is found that the net offered thickness of bulkhead stiffeners for some bulk carriers are thinner than the minimum required net thickness of the bulkheads. So, a proposed Rule Change is carried out for the requirement in Chapter 3 Section 6 [10.5.1].

The investigation data are summarized in the following Table 5 and Figure 1.

Table 5 – KC 417 – Investigation data about the net thickness of bulkhead stiffener of non-tight bulkheads not acting as pillars

Ship type	L (m)	Bulkhead stiffenerof Non-tight bulkheads not acting as pillars				
		Net thickness of Non-tight bulkheads	Net thickness of bulkhead stiffener (mm)	Type of bulkhead stiffener	CSR-BC	RCP
					Min net required thickness for bhd stiffener	
Handysize-1	172.66	11	**5**	B	6.5	5.5
Handysize-2	160.4	9	7	L	6.5	5.5
Handysize-3	172.66	7	7	B	6.5	5.5
Handysize-4						
Handymax-1	184.2	11	9	L	6.5	6
Handymax-2	182	9	7	L	6.5	5.5
Handymax-3	181.5	7	7	B	6.5	5.5
Handymax-4						
Pana-1	218.25	8	**6**	B	6.5	6.5
Pana-2	220	8.5	8	L	6.5	6.5
Pana-3	214.22	8	7	L	6.5	6
Pana-4						
Cap-1	280.33	10.5	**6**	L	6.5	7
Cap-2	292	9	9	L	6.5	7.5
Cap-3	260	9	9	L	6.5	7
Cap-4						

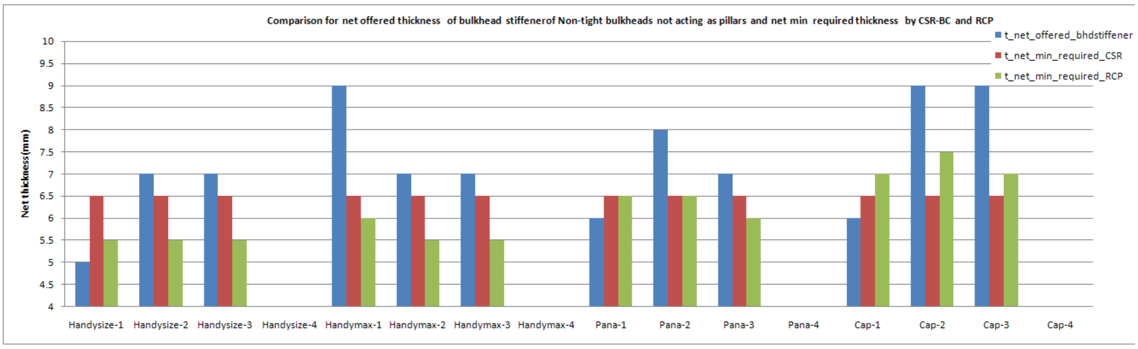

Figure 1 – KC 417 – Comparison for the net offered thickness of bulkhead stiffener of non-tight bulkheads not acting as pillars and net min required thickness in CSR-BC and the proposed Rule Change

The conclusion is following:

The net offered thickness of bulkhead stiffener in three types, Handysize-1, Panamax-1 and Capesize-1, is less than both the requirements in Chapter 3 Section 6 [10.5.1] and the proposed Rule Change.

Based on the above investigation, it is reasonable and realistic that the requirement in the last sentence of the last paragraph of Chapter 3 Section 6 [10.5.1] is modified as that the net thickness of bulkhead stiffeners are not to be less than (3 + 0.015 L_2), in mm.

2.6.2 Applied change

2.6.2.1. Chapter 3 Section 6 [10.5.1]

The last sentence of the last paragraph is to be changed to "The net thickness of bulkhead stiffeners are not to be less than the minimum net thickness defined in Chapter 6, Section 2, [2.2.1], i.e. 3 + 0.015 L_2, in mm."

2.6.3 Impact on scantling

There are some changes on the scantlings of bulkhead stiffeners of non-tight bulkheads not acting as pillars before and after this rule change.

- For ships with rule length L from 90m to 216m, the required net thickness of the proposed Rule Change is less than that before.
- For ships with rule length L from 217 to 249m, there is no change before and after the proposed Rule Change.
- For ships with rule length L 250m or above, the required net thickness of the proposed Rule Change is greater than that before.

The comparison data are summarized in the Table 6 and Figure 2,

Table 6 – KC 417 – Comparison for the required net thickness of bulkhead stiffener of non-tight bulkheads not acting as pillars in CSR and the proposed Rule Change

Rule Length	RCP 3+0.015×L	CSR	After rounded to the closest half mm		RCP−CSR	(RCP−CSR) /CSR
			RCP	CSR		
90	4.35	6.50	4.50	6.50	−2.00	−30.77%
100	4.50	6.50	4.50	6.50	−2.00	−30.77%
110	4.65	6.50	4.50	6.50	−2.00	−30.77%
120	4.80	6.50	5.00	6.50	−1.50	−23.08%
130	4.95	6.50	5.00	6.50	−1.50	−23.08%
140	5.10	6.50	5.00	6.50	−1.50	−23.08%
150	5.25	6.50	5.50	6.50	−1.50	−15.38%
160	5.40	6.50	5.50	6.50	−1.00	−15.38%
170	5.55	6.50	5.50	6.50	−1.00	−15.38%
180	5.70	6.50	5.50	6.50	−1.00	−15.38%
190	5.85	6.50	6.00	6.50	−0.50	−7.69%
200	6.00	6.50	6.00	6.50	−0.50	−7.69%
210	6.15	6.50	6.00	6.50	−0.50	−7.69%
220	6.30	6.50	6.50	6.50	0.00	0.00%
230	6.45	6.50	6.50	6.50	0.00	0.00%
240	6.60	6.50	6.50	6.50	0.00	0.00%
250	6.75	6.50	7.00	6.50	0.50	7.69%
260	6.90	6.50	7.00	6.50	0.50	7.69%
270	7.05	6.50	7.00	6.50	0.50	7.69%
280	7.20	6.50	7.00	6.50	0.50	7.69%
290	7.35	6.50	7.50	6.50	1.00	15.38%
300	7.50	6.50	7.50	6.50	1.00	15.38%
310	7.50	6.50	7.50	6.50	1.00	15.38%
320	7.50	6.50	7.50	6.50	1.00	15.38%
330	7.50	6.50	7.50	6.50	1.00	15.38%
340	7.50	6.50	7.50	6.50	1.00	15.38%
350	7.50	6.50	7.50	6.50	1.00	15.38%

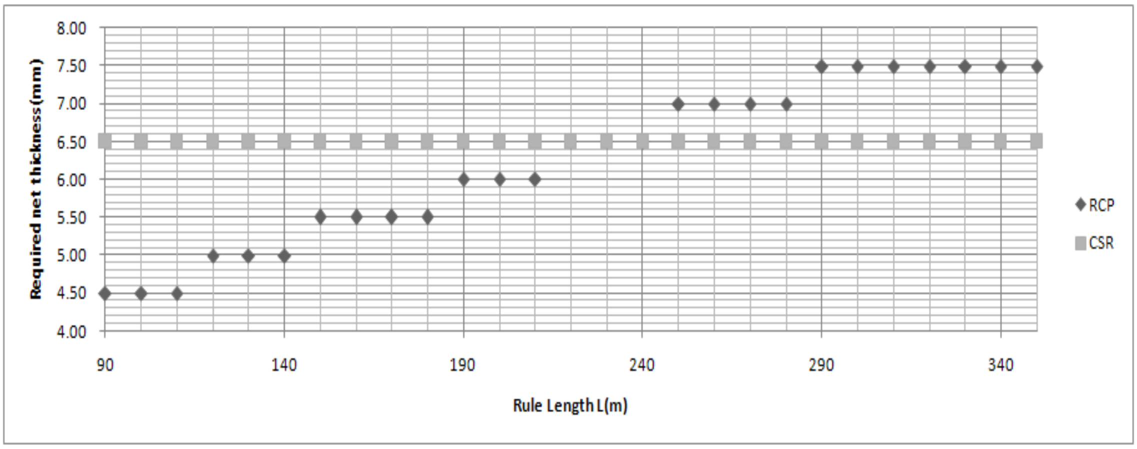

Figure 2 – KC 417 – Comparison for the required net thickness of bulkhead stiffener of non-tight bulkheads not acting as pillars in CSR and the proposed Rule Change

2.7 KC 494 –Transverse and longitudinal watertight bulkheads minimum net thickness

2.7.1 Rule Change description

Chapter 9 Section 1 Table 1 and Chapter 9 Section 2 Table 1 give the minimum net thicknesses for plating of several structural members. These tables are extracts of Table 6.1.2 but without values for the transverse and longitudinal watertight bulkheads.

The corresponding lines are added and the same minimum net thickness as in table 6.1.2 is required.

2.7.2 Applied change

2.7.2.1. Chapter 9 Section 1 [Table 1]

The line corresponding to the transverse and longitudinal watertight bulkheads is copied from Chapter 6 Section 1 Table 2 to Chapter 9 Section 1 Table 1.

2.7.2.2. Chapter 9 Section 2 [Table 1]

The line corresponding to the transverse and longitudinal watertight bulkheads is copied corresponding line from Chapter 6 Section 1 Table 2 to Chapter 9 Section 2 Table 1.

2.7.3 Impact on scantling

This correction is adding a minimum required net thickness.

As the final net thickness to consider is greater, there is no impact on scantling or on steel weight.

2.8 KC 524 – Fore Part structures in flooding condition

2.8.1 Rule Change description

Ships are to be designed to have sufficient reserve strength to withstand in flooding scenarios as a functional requirement. However, there is no specific paragraph in fore part referring to need of scantling assessments in case the fore part is arranged with floodable spaces. The proposed amendment is to clarify that Chapter 9, Section 2, [1.1.2] is also applicable to the fore part.

2.8.2 Applied change

2.8.2.1. Chapter 9, Section 1, [1.1.2]

The new paragraph Chapter 9, Section 1, [1.1.2] is added for calculating the scantlings in flooding conditions.

2.8.3 Impact on scantling

There is no change in terms of steel weight by comparing that before and after the proposed Rule Change since the required values is smaller than the one of existing design in general.

2.9 KC 565 – Scantlings of transverse vertically corrugated watertight bulkhead separating cargo holds for flooded conditions

2.9.1 Rule Change description

The proposal is to clarify the pressure and force to be considered when determine the scantlings of transverse vertically corrugated watertight bulkhead separating cargo holds for flooded conditions. In the calculation, not only the resultant pressures and forces but also the pressures and forces in flooded empty holds should be considered.

2.9.2 Applied change

2.9.2.1. Chapter 6 Section 1 [3.2.3]

Cross reference of Ch 4, Sec 6, [3.3.6] is added into the definition of p.

2.9.2.2. Chapter 6 Section 2 [3.6.1]

Cross reference of Ch 4, Sec 6, [3.3.6] is added into the definitions of F and p_G.

2.9.3 Impact on scantling

This amendment gives more precise application of resultant pressure and force when determine the scantlings of transverse vertically corrugated watertight bulkhead separating cargo holds for flooded conditions but is not changing the approach. There is consequently no impact on scantling or steel weight.

2.10 KC 567 – Bilge definition

2.10.1 Rule Change description

The definition of the bilge area is not given in the current CSR BC and as shown in Figure 3 below, it may lead to ambiguities particularly in fore and aft parts where the curved part of the side shell is wider than in the "central" area.

The CSR OT in 4/1.8.1.1 gives in turn a concrete definition of the bilge plating within the 0.4L amidships area and outside.

As tankers and bulkers have similar hull shapes, proportions and coefficients and are submitted to similar sea pressures, it is possible to use a similar definition in CSR BC than in CSR OT.

On this basis, the proposed definition distinguishes:

- the cylindrical part of the hull where the bilge is clearly defined
- The other parts where a maximum height – already defined in CSR OT – is considered in order to limit the bilge extent even if the curved plating is continuing above.

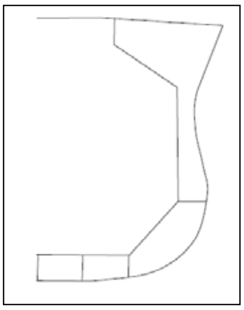

Figure 3 – KC 567 – ambiguous bilge area in the fore part.

The requirements for the aft and fore parts are to be applied in addition to the ones triggered by this definition; this applies to the strengthening of the flat bottom area in the fore part in Chapter 9 Section 1 [5.2].

Consequently, the term "flat" is not used anymore in Chapter 9 Section 1 for avoiding misunderstandings, as the current requirements give a clear definition of the reinforced area.

2.10.2 Applied change

2.10.2.1. Chapter 1 Section 4 [3.22] and [3.22.1]

A new sub-article and a new requirement are added to incorporate the definition of the bilge plating.

2.10.2.2. Chapter 9 Section 1 [5] [5.1.1] [5.2.1] [5.3.1] [5.3.2]

The word "flat" is removed from the titles or the requirements.

2.10.3 Impact on scantling

2.10.3.1. Cylindrical area

On the cylindrical part, the bilge definition is matching the current practice and therefore, there is no impact on scantling or on steel weight.

2.10.3.2. Forward to the cylindrical area

The rule change does not change the definition of the areas to be reinforced in the forward area. There is consequently no impact on scantling or on steel weight.

2.11 KC 568 – Strength of Rudder Body

2.11.1 Rule Change description

The reason to change is to make the rules in line with URS 10.

2.11.2 Applied change

2.11.2.1. Chapter 10 Section 1 [5.1.4]

Allowable bending and Von Mises stress is changed to be in line with URS 10.

2.11.3 Impact on scantling

The reduction of allowable stress will result in a minor increase in scantlings.

2.12 KC 571 – Cargo mass in fatigue stress assessment

2.12.1 Rule Change description

For fatigue strength assessment, the cargo density used is to be as much "realistic" as possible.

Therefore, the cargo density according to Chapter 4 Appendix 3 should be used for fatigue strength assessment not only by direct analysis specified in Chapter 8 Section 3, but also simplified method specified in Chapter 8 Section 4 [2.3.5].

2.12.2 Applied change

2.12.2.1. Chapter 8 Section 4 [2.3.5]

In the definition of the inertial pressure due to the dry bulk cargo, the value of the cargo density to be used is added.

2.12.3 Impact on scantling

There is no impact on scantling or steel weight as this change is intended to clarify the load case to consider in fatigue strength assessment.

2.13 KC 590 – Effective breadth of attached plating for primary supporting members

2.13.1 Rule Change description

The definition of the effective breadth of attached plating of primary supporting members given in Chapter 3 Section 6 [5.4.1] does not consider the spacing and is in contradiction with the definition given in Chapter 6 Section 4 [Symbols] which refers to Chapter 3 Section 6 [4.3.1].

The definition given in Chapter 3 Section 6 [4.3.1] is used. This change is made for clarifying the requirements.

2.13.2 Applied change

2.13.2.1. Chapter 3 Section 6 [5.4.1]

The last sentence of the item is modified in order to refer to Chapter 3 Section 6 [4.3.1] for the determination of the effective breadth of the attached plating.

2.13.3 Impact on scantling

In Chapter 6 Section 4 [Symbols], the effective breadth b_p to consider for primary supporting members is already defined as per Chapter 3 Section 6 [4.3.1].

For ships having a length L less than 150m, the requirements in Chapter 6 Section 4 are thus made in accordance with this definition. For ships having a length L greater than 150m, the scantlings of primary supporting members are to comply with the results of direct calculations that are not concerned by this definition.

There is consequently no impact on scantling or steel weight.

2.14 KC 630 – Deck between hatches

2.14.1 Rule Change description

Firstly, regarding the structural arrangement, the definition of the beams under consideration in this item is clarified: these are hatch end beams and cross deck beams. In addition, the term “bulwark” is replaced by “deck side” in order to match the designs where a bulwark is not fitted.

Secondly, as some designs are not able to comply with these prescriptive requirements, the use of a direct strength analysis as per Chapter 7 in these rules is now allowed.

2.14.2 Applied change

2.14.2.1. Chapter 3 Section 6 [9.2.3]

First change: the general term “beams” is replaced by “hatch end beams and cross deck beams” and the term “bulwark” is replaced by “deck side”.

Second change: addition of the sentence which allows the use of direct strength analysis for the arrangements that do not comply with the prescriptive requirements in this sub-article.

2.14.3 Impact on scantling

The first correction has no impact on scantling.

The designs concerned by the direct strength analysis are supposed to be made of less structural elements than those complying with the prescriptive requirements in this item.

Consequently, this change does not increase the steel weight induced by this requirement. In addition, the use of a direct strength analysis is not supposed to affect the scantlings.

2.15 KC 653 – Bow flare area pressure

2.15.1 Rule Change description

In Ch 4, Sec 5, [4.1.1], bow flare area pressure is specified but calculation point and draft to be considered are not clearly specified.

According to the background of this requirement, the following assumptions are to be considered for this requirement:

(1) Hydrostatic pressure and hydrodynamic pressures among load cased H, F, R and P, calculated in normal ballast condition

(2) T_B, minimum ballast draught at midship in normal ballast condition as specified in Ch 1, Sec 4, [2.1.1] is to be considered for the calculation of hydrostatic pressure and hydrodynamic pressures

(3) Any considered point of the hull is to be used for a calculation point

To be in line with the above, the definitions of hydrostatic pressure and hydrodynamic pressures are modified.

2.15.2 Applied change

2.15.2.1. Chapter 4 Section 5 [4.1.1]

The definitions of hydrostatic pressure and hydrodynamic pressures are modified in order to make the calculation points and draught to be considered clear.

2.15.3 Impact on scantling

This change is intended to clarify the definitions of hydrostatic pressure and hydrodynamic pressures and does not include any scantling requirement. This change does not affect the scantlings or the steel weight.

2.16 KC 654 – Primary supporting members under flooded condition.

2.16.1 Rule Change description

Under flooding condition, the scantlings of collision bulkhead and other watertight boundaries are calculated according to Chapter 6, Section 1, [3.2.2] for bulkhead plating and Chapter 6, Section 2, [3.2.5] for ordinary stiffeners.

However, there is no specific requirement for the primary supporting members (PSM). Hence a new requirement for PSM's has been developed based on similar method as for ordinary stiffeners considering the parameter "α".

The α parameter set to 1.15 leads to lower values of net section modulus and net shear sectional area lower than in intact condition (see Chapter 6, Section 4, [2.6.3]).

2.16.2 Applied change

2.16.2.1. Chapter 6, Section 4, [1.6.1]

A new paragraph is added giving a reference to flooding requirements for PSM

2.16.2.2. Chapter 6, Section 5

The new section is added for calculation of scantlings for primary supporting members under flooded conditions. The formula is based on similar requirement given in Chapter 6, Section 2, [3.2.5] for ordinary stiffeners.

2.16.3 Impact on scantling

The new requirement will have an impact on watertight structure which is not normally subject to liquid load. Typical examples are collision bulkhead, engine room bulkhead and other watertight boundaries which is not part of a liquid tank boundary.

There is little or no change in terms of steel weight by comparing that before and after the proposed Rule Change since the required values is in general smaller than the one of existing design in general. Details of calculation results can be found in Annex I.

2.17 KC 666 – Deck Primary Supporting Members

2.17.1 Rule change description

As stated in Pt. 9 Sec. 1 [4.4.4] and Pt. 9 Sec. 2 [4.3.4], scantlings of deck PSM in fore and aft peak areas are currently to be determined according to Ch. 6, Sec. 4.

This has created some confusion in application of scantlings requirements for PSM in fore and aft peaks which are different from those of side PSM as shown in the following table.

This rule change is to align the scantlings requirements of deck PSM in fore and aft peaks to those of side PSM. Reference is made to the TB Document of CSR 2006 edition.

Table 7 – KC 666 – Comparison of current scantlings requirements for PSM

Item	Requirement	Cargo area (Ch.6. Sec.4)	Fore and aft peaks (Ch.9 Sec.1 & Sec.2)	
			Deck	Side
Min. thickness	Web thickness of PSM	$t = 0.6\sqrt{L_2}$	$t = 0.7\sqrt{L_2}$ (*1)	$t = 0.7\sqrt{L_2}$ (*1)
Section modulus	$w = \frac{(p_S + p_W)s\ell^2}{m\lambda_S R_Y}10^3$	$\lambda_S = 0.8$ $m = 10$	$\lambda_S = 0.8$ $m = 10$	$\lambda_S = 0.9$ $m = 10$ (*2)
Shear area	$A_{sh} = \frac{5(p_S + p_W)s\ell}{\tau_a \sin\phi}$	$\tau_a = 0.4R_Y$	$\tau_a = 0.4R_Y$	$\tau_a = \frac{R_Y}{\sqrt{3}}$

(*1) Minimum web thickness for PSM is stated in fore peak area. In aft peak area, similar requirement applies only to floors.

(*2) The m-coefficients stated in Ch.9 Sec.1 and Sec.2 [Symbols] are specified only for stiffeners.

2.17.2 Applied change

2.17.2.1. Chapter 9 Section 1 [Symbols]

1. The m-coefficient is specified explicit for PSM.
2. Span and spacing are re-defined to cover both stiffeners and PSM.

2.17.2.2. Chapter 9 Section 1 [4.4.4]

1. The scantlings formulae and allowable stresses of deck PSM in fore peak area are specified explicit in the new Table 5.
2. The allowable normal stress and the allowable shear stress are taken from ordinary stiffeners same as side PSM.
3. Reference to bow flare area pressure in [3.3] is taken out which is not relevant for deck PSM.
4. For complex deck structure, opening for a direct calculation is included to replace the scantlings formulae.

2.17.2.3. Chapter 9 Section 2 [Symbols]

1. The m-coefficient is specified explicit for PSM.
2. Span and spacing are re-defined to cover both stiffeners and PSM.

2.17.2.4. Chapter 9 Section 2 [4.3.4]

1. The scantlings formulae and allowable stresses of deck PSM in aft peak area are specified explicit in the new Table 5.
2. The allowable normal stress and the allowable shear stress are taken from ordinary stiffeners same as side PSM.

For complex deck structure, opening for a direct calculation is included to replace the scantlings formulae.

2.17.3 Impact on scantlings

According to the rule change, allowable stresses of deck PSM in intact conditions will increase in fore and aft peak areas, i.e., normal stress by +11% and shear stress by +44%. In addition, requirements in testing conditions are introduced for deck PSM. Consequently, required scantlings of deck PSM in intact conditions will be reduced as shown in the Appendix. Impact on steel weight is not expected because actual scantlings are normally above the requirements.

2.18 KC 758 – Height of double bottom

2.18.1 Rule Change description

The last version of the SOLAS Ch. II-1, Part B-2, Reg. 9 (2) entered in application in January 2009 is to be considered and thus replaces the first paragraph of the requirement.

2.18.2 Applied change

2.18.2.1. Chapter 3 Section 6 [6.1.3]

The text of the first paragraph is replaced by an adapted version of the herein referenced SOLAS regulation.

2.18.3 Impact on scantling

The main change induced by this modification is the addition of a lower limit of 0.76m for the double-bottom height.

It can be considered that this lower limit is far below the current practices, even in the moulded parts of the hull.

There is consequently no impact on steel weight or on scantling.

2.19 KC 759 – Spacing of solid floors

2.19.1 Rule Change description

In Ch.9 Sec.1 [2.3.2], prescriptive requirement is given with respect to spacing of solid floors in case of longitudinal framing. However, it was agreed in KC 759 that a larger spacing may be acceptable, when the bottom structure is verified by FEA deemed appropriate by the Society.

2.19.2 Applied change

2.19.2.1. Chapter 9 Section 1 [2.3.2]

In the second paragraph which is applicable for longitudinal framing, a new sentence is inserted so that a larger spacing of solid floors may be acceptable based on FEA.

2.19.3 Impact on scantling

In general the scantling impact can be ignored.

2.20 KC 760 – Depth of web stiffener

2.20.1 Rule Change description

The requirement to depth of web stiffeners is based on a simplified assessment of the buckling strength of the stiffener. The formulation is derived based on the assumptions that the web stiffener is of flat bar type, and that the web stiffener length is approximately the same as the shorter side of the web plate.

The requirement is a simple, conservative means to proportion web stiffeners, however, it has been found to be too conservative for cases where the above mentioned assumptions are not satisfied.

Based on the above, it was agreed in KC 760 that Ch3 Sec 6 [5.2.1] is only applicable to web stiffeners of flat bar type. The rule text has been modified accordingly.

As an alternative to the simple conservative descriptive requirement, the rule text has been amended to allow a more advanced buckling check in accordance with Ch6 Sec3, given that the slenderness requirement in Ch 6 Sec 2 [2.3.1] and specific web stiffener requirements in Ch 6 Sec 2 [4] are satisfied.

The rule change as described above is also to be applicable for non-tight bulkheads.

2.20.2 Applied change

2.20.2.1. Chapter 3 Section 6 [5.2.1]

It is clarified that the requirement to depth of web stiffener depth is only applicable to flat bar type stiffeners.

The rule text has been amended to allow a more advanced buckling check in accordance with Ch6 Sec3.

Chapter 3 Section 6 [10.5.1]

It is clarified that the requirement to depth of web stiffener depth is only applicable to flat bar type stiffeners.

The rule text has been amended to allow a more advanced buckling check in accordance with Ch6 Sec3.

2.20.3 Impact on scantling

The rule proposal is made to align the Rules with well proven industry practice. Impact on steel weight is considered negligible.

2.21 KC 764 – Connection ends of web stiffeners

2.21.1 Rule Change description

The formula for evaluating the stress at the ends of web stiffeners of primary supporting members in water ballast tanks comes from the NK rules – Guidance Part C C1.1.14 (1) of the 2010 edition – in which the coefficient of 1.1 is a "Correction coefficient for corrosion".

As the CSR BC uses the net scantling approach, this coefficient should not be considered and the formula is amended accordingly.

2.21.2 Applied change

2.21.2.1. Chapter 6 Section 2 [4.1.3]

The coefficient 1.1 is removed from the formula giving the stress.

2.21.3 Impact on scantling

Removing this coefficient decreases the calculated stress of 9%. In turn, this allows the stress range $\Delta\sigma$ to be increased of 10% for the same design. This stress range $\Delta\sigma$ is a function of several dimensions and of the stiffening arrangement through the dynamic load *W*.

In addition, this requirement is intended to ensure that the connection of stiffeners to longitudinals have sufficient fatigue strength.

2.22 KC 768 & KC 800 – Ultimate Strength in Lateral Buckling Mode

2.22.1 Rule Change description

2.22.1.1. Ch. 6 Sec. 3 [4.2.2]

Relevant KC ID : 768

In Ch.6 Sec.3 [4.2.2], it is not clear about how to calculate net section modulus of stiffeners snipped at both ends.

When a stiffener snipped at both ends is under compression, compressive stress is induced at the attached plate by a moment due to eccentricity of a compression force off the neutral axis of the stiffener. Consequently the net section modulus is in general calculated at the attached plate.

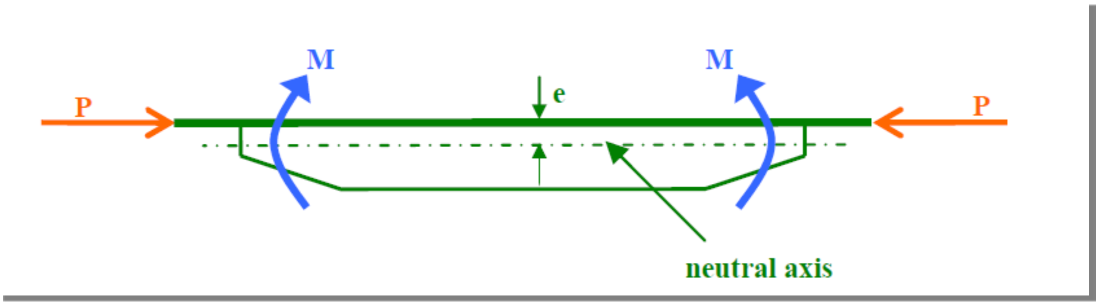

Figure 4 – KC 768 & 800 – Moment and forces on a snipped stiffener in lateral buckling.

However, when a stiffener snipped at both ends is subject to lateral pressure acting on the stiffener side, and when M_1 induced by lateral pressure is larger than M_0 induced by the deformation, the flange is in compression. Therefore the net section modulus is calculated at the flange.

When a stiffener snipped at both ends is subject to lateral pressure acting on the stiffener side, M_0 and M_1 are in opposite direction. Therefore the deformation w shall be the absolute value of difference between w_0 and w_1.

2.22.1.2. Ch. 6 Sec. 3 [4.2.3]

In Ch.6 Sec.3 [4.2.3], it is not clear about whether this requirement is applicable to stiffeners snipped at both ends or not.

It is clarified by KC800 that Ch.6 Sec.3 [4.2.3] is applicable to stiffeners other than snipped at both ends.

2.22.2 Applied change

2.22.2.1. Ch. 6 Sec. 3 [4.2.2]

In the definition of net section modulus W_{st}, it is clarified about how to calculate for stiffeners snipped at both ends.

In the definition of deformation w, it is clarified about how to calculate for stiffeners snipped at both ends.

2.22.2.2. Ch. 6 Sec. 3 [4.2.3]

A note is inserted in order to clarify that Ch.6 Sec.3 [4.2.3] is applicable only to stiffeners other than snipped at both ends.

2.22.3 Impact on scantling

The scantling impact is negligible in terms of steel weight.

2.23 KC 773 – Corrosion addition of longitudinal stiffeners

2.23.1 Rule Change description

When a longitudinal stiffener is concerned by different corrosion additions (e.g. the face plate of the stiffener is within the 3m below the tank top and the web plate is outside this area), the severest corrosion addition is to be applied. This principle is not easy to apply, particularly for prescriptive softwares, as the stiffener's properties are evaluated on the basis of the coordinate of the connection point between the stiffener and the attached plating.

The same approach is kept for the corrosion addition to consider for a longitudinal stiffener: it is the value at the coordinate of its connection point to the attached plating.

2.23.2 Applied change

2.23.2.1. Chapter 3 Section 3 [1.2.1]

A sentence is added to specify that the corrosion addition of a longitudinal stiffener is based on the coordinates of its connection point to the plating.

2.23.3 Impact on scantling

There is no impact on the dimensions obtained from the prescriptive approach, due to the net scantling approach used in the CSR

The impact on the steel weight is not evaluated.

2.24 KC 793 – Cofferdam arrangement

2.24.1 Rule Change description

The requirement in Chapter 2 Section 2 [2.1.3] is about arrangement for fire safety. This is also covered by SOLAS in Chapter II-2 with extensive details.

Therefore, this requirement is not needed in the CSR BC and is deleted from it. The subsequent requirement is renumbered.

2.24.2 Applied change

2.24.2.1. Chapter 2 Section 2 [2.1.3]

This requirement is removed: the text is replaced by "void".

2.24.3 Impact on scantling

SOLAS requirements about fire safety are applicable and overrule the deleted requirement. There is consequently no impact on steel weight or scantling.

2.25 KC 798 – SOLAS Subdivision arrangement

2.25.1 Rule Change description

The previous requirement of SOLAS Chapter II-1, Part B, Regulation 11 (*cf.* App.3.2) is changed to the new version of SOLAS Ch. II-1, Part B-2, Reg. 12 (9), (*cf.* App.3.3) applicable from January 2009.

Before January 2009, in SOLAS Chapter II-1, Part B, the arrangement of "*Peak and machinery space bulkheads, shaft tunnels, etc.*" was declined in regulation 10 (7) (*cf.* App.3.1) for passenger ships and in regulation 11 (8) for cargo ships.

The main difference was the inclusion of an afterpeak bulkhead in the case of passenger ships and of specific arrangement principles.

While the current reference in CSR BC Chapter 2 Section 1 [3.1.1] is the correct one, the text is from the regulation 10 (7).

The new version in regulation 12 (9) has merged the former two ones and thus is to be adapted to the case of bulk carriers.

The relevant part of this new version of the requirement is copied in the CSR BC text and the last sentence of the requirement regarding the after peak bulkhead is removed as the new SOLAS regulation makes it clearly intended to passenger ships only.

2.25.2 Applied change

2.25.2.1. Chapter 2 Section 1 [3.1.1]

The text of this requirement is changed to the relevant parts of the new text of SOLAS Ch. I-1, Part B-2, Reg. 12 (9).

The last sentence of the initial text is removed.

The symbol L is replaced by the symbol L_{LL} for the consistency with the other requirements in the CSR BC.

As this is not the complete SOLAS text, the reference to the SOLAS regulation is not added before and the text is not in italic. The reference to the SOLAS regulation is to be found through the technical background.

2.25.3 Impact on scantling

The new text gives more precise requirement for the after peak bulkhead but is not changing the approach. There is consequently no impact on steel weight or scantling.

2.26 KC 836 – Side bottom girders in way of machinery seatings

2.26.1 Rule Change description

In KC 836 it was agreed that the requirement that side bottom girders in way of machinery seatings have to be tapered for at least three frame spacings forward of the E/R bulkhead is too rigid. In order to ensure design flexibility, it was agreed that the requirement should be replaced by a more general requirement to structural continuity.

2.26.2 Applied change

2.26.2.1. Chapter 9 Section 3 [2.1.5]

The requirement in the fourth paragraph that side bottom girders in way of machinery seatings have to be tapered for at least three frame spacings forward of the E/R bulkhead has been replaced by a more general requirement to structural continuity.

2.26.3 Impact on scantling

In some cases tapering brackets in the double bottom may be avoided. Impact on steel weight is considered negligible.

2.27 KC 848 – Harmonisation of welding of abutting plates below the waterline

2.27.1 Rule Change description

The requirements of CSR BC for the welding of abutting plate panels forming boundaries to sea water below the summer waterline differs from those of CSR OT:

- In CSR BC Chapter11 Section 2 [2.4.1], a full penetration weld is to be always applied.
- In CSR OT 6/5.3.4.3 (f), full penetration welding is to be applied only for plate panels having a gross thickness less than or equal to 12mm.

  For thicker plates, partial penetration welding is allowed, provided the root face length is smaller than the third of the gross thickness of the plates.

Industry is also reporting that full penetration welding is unpractical and unnecessary for thick plates (i.e. having a gross thickness greater than 12mm).

The current requirements of CSR BC are harmonised with those of CSR OT in order to meet the current practices of industry.

2.27.2 Applied change

2.27.2.1. Chapter 11 Section 2 [2.4.1]

In the last item of the list:

- The lower limit of 12mm in as-built thickness is added for the application of the full penetration welding.
- The application of deep penetration welding to thicker plates is added with a reference to Fig.2 for the definition of the root face.

Deep penetration welding is considered in Chapter11 Section 2 [2.5] but in a general manner, without a list of applicable items. Therefore, it has been considered preferable for the sake of the reader to keep the deep penetration welding requirement in the full penetration section, for this particular kind of plates.

2.27.3 Impact on scantling

The rules requirement is about the practice of the industry.

The resulting differences on scantling or steel weights are not evaluated.

2.28 KC 854 – Members subjected to fatigue strength assessment

2.28.1 Rule Change description

Regarding Tab 1 in Chapter 8, Section 1, the intent at the time of development of the CSR-BC was not to check the inner bottom only, but the whole connection of inner bottom with sloping and/or vertical plate of lower stool, which includes all the plates. The whole connection means the connection of plating members of inner bottom, side of lower stool, girders and floors in DB and diaphragms in lower stool.

In addition, it is to be noted that, when making fatigue assessment of such connection, if fatigue problems are found in any of the above plating members, then reinforcements are to be considered for all the concerned plating members. It means that Table 1 concerns all the plating members involved in the inner bottom/lower stool connection and not only the inner bottom plating.

2.28.2 Applied change

2.28.2.1. Chapter 8 Section 1 [1.3.1]

The text of this item is modified to indicate that all the connected members are to be checked and that all connected members are to be reinforced when a problem is found.

Table 1 is kept as it is.

2.28.3 Impact on scantling

The applied modification is only intended to enforce the understanding of the readers. There is no modification on the scantling or the steel weight.

2.29 KC 903 – Collision Bulkhead

2.29.1 Rule Change description

In order to be in line with the SOLAS requirements, the former text from SOLAS Ch. II-1, Part B, Reg. 11, is replaced by the text from SOLAS Ch. II-1, Part B-2, Reg.12 (1) which was previously the Annex 2 of MSC resolution 216(82).

2.29.2 Applied change

2.29.2.1. Chapter 2 Section 1 [2.1.1]

The text of this item is changed in order to be inline with the SOLAS text. The initial term “Administration” in the SOLAS text is replaced by “Society” and is not in italic in order to identify the change.

2.29.3 Impact on scantling

The change in the SOLAS text is mainly about the arrangement of this collision bulkhead. There is no defined scantling. The possible impact on the steel weight is not evaluated.

2.30 KC 938 – Harmonisation of tapering between abutting plates

2.30.1 Rule Change description

Tapering is required between plates of different thicknesses in both CSR BC and CSR OT:

- In CSR BC Chapter 11 Section 2 [2.2.2], the criterion for applying tapering is a difference in as-built thickness equal to or greater than 4mm.
- In CSR OT 6/5.2.2.2, the criterion for applying tapering is a difference "by more than" 4mm.

In order to harmonise these criteria, the CSR BC requirement is modified in order to consider a difference in thickness between the abutting plates strictly greater than 4mm.

2.30.2 Applied change

2.30.2.1. Chapter 11 Section 2 [2.2.2]

In the first sentence the term "equal to or greater than" is replaced by "greater than".

2.30.3 Impact on scantling

The rules requirement is about the practice and does not give dimensions of the tapering.

The resulting differences on scantling or steel weights are not evaluated.

2.31 KC 966 – Load Testing Height

2.31.1 Rule Change description

According to the comment from industry and further investigations, the conclusion is that 0.9 m head of water above top of hatch is irrational to carry out the structural test of ballast hold. It is very difficult to keep the testing load height specified because the hatch cover of a ballast hold is generally not watertight but weathertight. Ballast hold is subject to higher liquid pressure in rough sea and the test itself is not intended for the hatch covers.

Furthermore, IACS is developing a new version (Rev.4, July 2011) of the UR S14 "Testing Procedures of Watertight Compartments" on the basis of a guideline (*cf.* App.4.1) for tight test of compartments. This document is attached in Appendix 3.

In this new version of UR S14, the load test height for ballast hold is not 0.9m above top of hatch but top of hatch coaming.

This does not apply to the overhead of 0.9 m used in Chapter 4, Section 6 Table 2, kept as a design overhead.

In addition, the definitions of the coordinates are clarified in Chapter 3 Section 6 Table 2.

2.31.2 Applied Changes

2.31.2.1. Chapter 3 Section 6 [4.1.1] Table 2

- In the last line of the table, containing the definition:
  - In the z_{ml} definition, the term "margin line" is changed to "the bulkhead deck at side"

- In the z_h definition, the term “hatch” is changed to “hatch coaming”.

2.31.2.2. Chapter 11 Section 3 [3.1.1] Table 1

- The “0.9m head of water above the highest point of tank” in line 4 column “Structural test pressure” is replaced by the “head of water above top of hatch coaming”;

2.31.3 Impact on scantling

2.31.3.1. Chapter 3 Section 6 [4.1.1] Table 2

The changes are clarifying the terms used in order to match the current practice. There is consequently no impact on scantling or steel weight.

2.31.3.2. Chapter 11 Section 3 [3.1.1] Table 1

In general the scantling impact can be ignored.

The main purpose of structural test is not to determine a scantling of structural members but to check the soundness of the structure. Ballast hold is subject to higher liquid pressure in rough sea and scantling is determined by pressure in sea going condition.

2.32 KC 1004 – Bulb stiffener’s properties

2.32.1 Rule Change description

In some cases, the use of an equivalent angle section for the determination of the characteristics of a bulb stiffeners leads to significant differences with the exact values.

For example, the inertial moment about the horizontal neutral axis of a bulb 200x10 is:

- Equivalent angle section: $I = 1019cm^4$
- Direct method:
  - Holland Profile: $I = 1017cm^4$
  - Russian Profile: $I = 1083cm^4$

The use of values obtained by direct methods is requested and in addition, the harmonisation of the two set of CSR rules is needed.

2.32.2 Applied Changes

2.32.2.1. Chapter 3 Section 6 [4.1.1]

A sentence allowing the use of exact values for the dimensions and properties of a bulb section is added to the text. The use of an equivalent angle section is kept.

2.32.3 Impact on scantling

As the mass of the bulb profile should be given by the manufacturer and so available to the designers, there is no impact on the steel weight.

2.33 KC 1009 – Single side and double side definitions

2.33.1 Rule Change description

The SOLAS XII Reg.1 has been updated with definitions of single side skin and double side skin bulk carriers.

As some requirements in the CSR BC are specifically intended to each kind of bulk carriers, these definitions are added to the rules.

It is to be noted that these definitions are in addition to the definition of a CSR bulk carriers as per Chapter1 Section 1 [1.1].

2.33.1.1. SOLAS definitions

Definitions of bulk carriers, single side skin and double side skin bulk carriers are given by IMO in SOLAS regulations and by IACS in UR Z and partially in the CSR BC (*cf.* Appendix 3).

SOLAS Chapter IX, Regulation 1 (6.) defines the bulk carriers in terms of:

- Intended cargoes: dry cargoes in bulk;
- General design of the cargo space: single deck, top-side tanks, hopper side tanks.

SOLAS Chapter XII, Regulation 1 (1. to 4.) defines the bulk carriers in terms of:

- Intended cargoes: dry cargoes in bulk;
- Single-side skin:
    - any part of a cargo hold is bounded by the side shell
    - cargo holds bounded by a double-side skin with the following criterion on its width:

Table 8 – KC 1009 – Double-side skin width equivalent to a single-side skin as per SOLAS XII.

Width of the double-side skin	Construction period[1]
≤ 760 mm	Before 1st January 2000
≤ 1000 mm	Between 1st January 2000 and 1st July 2006

- Double-side skin when the ship side is made of the side shell and a longitudinal bulkhead connecting the double-bottom to the deck, including hopper side and top-side tanks if any.

The resolution MSC.79(70) refers to the resolution 6 of the SOLAS Conference 4 held in 1997 about the interpretation of the definition of a bulk carrier.

In its resolution 6, the SOLAS Conference 4 merged the definition of Chapter IX Regu1ation (6.) and Chapter XII Regulation 1 by applying the general design to any bulk carrier.

2.33.1.2. IACS definitions

UR Z10.2.1.2.1 defines a bulk carrier similarly as SOLAS Chapter IX Regulation 1 (6.), *cf.* 2.33.1.1.

UR Z10.2.1.2.2 and UR Z10.5.1.2.1 define a double skin bulk carrier a bulk carrier where all cargo holds are bounded by a double-side skin, regardless of the width of enclosed space.

2.33.1.3. CSR BC application

As per CSR BC Chapter 1 Section 1 [1.1.1], the CSR BC is applicable to bulk carrier ships contracted for construction on of after 1st April 2006.

[1] SOLAS XII Reg.1 (8) defines the construction as the date when the keel is laid or when the ship is at a similar stage of construction.

2.33.1.4. Analysis

For bulk carriers contracted for construction after the 1st July 2006, there is no more applicable width requirement for the consideration of a double-side skin design.

The definitions given by IACS are including the SOLAS definitions and interpretations in terms of

- Intended cargoes: dry cargo in bulk.
- General design of the cargo space: single deck, top-side tanks, hopper side tanks.
- Single-side skin: any part of a cargo hold is bounded by the side shell.
- Double-side skin when the ship side is made of the side shell and a longitudinal bulkhead connecting the double-bottom to the deck, including hopper side and top-side tanks if any.

CSR BC already uses the above definition of a bulk carrier in terms of intended cargoes and general design. In addition, it allows hybrid designs where among possible designs, holds of single skin and double skin constructions can be mixed.

In order to cover all the possibilities, the definitions single-side skin constructions and double-side skin constructions are added and can be applied to each hold.

The definitions of single-side skin and double-side skin constructions are as follow:

- <u>Single-side skin construction</u>

  All the cargo holds are bounded by the side shell between the hopper plating or the inner bottom and the top-side tank plating or the deck.

- <u>Double-side skin construction</u>

  All the cargo holds are bounded by a double-side, including the hopper tank and the top-side tanks when fitted.

Notes:

- Between 1st April and 1st July 2006, width limit of 1000 mm for double-side skin is applicable and contradicts the above definitions.
  Considering that this sibling period is short and that no problem has been reported, it is decided to not consider this specific case.

- These definitions are not considering the possible needs for access to the double-side space.
  The provisions and technical specifications given SOLAS Chapter II-1 Regulation 3.6 are applicable and will govern the dimensions and access equipments of the double side space.
  It is therefore not needed to add any mention of it in the definition of a double-side skin bulk carrier.

In addition, the terms "bulk carriers" are replaced accordingly in other locations in the text.

2.33.2 Applied Changes

2.33.2.1. Chapter 1 Section 4 [3.21] [3.21.1] [3.21.2]

The new article [3.21] is added for the definitions of holds of single side skin and double side skin constructions. It contains the following new sub-articles:

- [3.21.1] for the single side skin bulk carriers,
- [3.21.2] for the double side skin bulk carriers.

2.33.2.2. Chapter 2 Section 3 [2.8] [2.9] [2.10] [2.11]

The words "single side bulk carriers" and "double side bulk carriers" are replaced by "holds of single side skin construction" and "holds of double side skin construction" respectively in the different titles.

2.33.2.3. Chapter 3 Section [5] [1.3.3] [1.3.4]

The words "single side bulk carriers" and "double side bulk carriers" are replaced by "holds of single side skin construction" and "holds of double side skin construction" respectively in the different requirements.

2.33.2.4. Chapter 5 Section 1 [Table 1]

The words “single side ships” and “double side ships” are replaced by “single side skin construction” and “double side skin construction” respectively in the first column of the table. This does not affect the formulas or the approach.

2.33.2.5. Chapter 7 Section 3 [Table 2]

The words “bulk carriers” and “bulk carriers” are replaced by “skin construction” and “skin construction” respectively in the second column of the table. This does not affect the formulas or the approach.

2.33.2.6. Chapter 8 Appendix 1 [2.5.1]

The words “single side bulk carriers” and “double side bulk carriers” are replaced by “holds of single side skin construction” and “holds of double side skin construction” respectively in the requirement.

2.33.3 Impact on scantling

This change is intended to clarify the definition of bulk carriers and does not include any scantling requirement.

This change does not affect the scantlings or the steel weight.

2.34 KC 1082 – Minimum bow height

2.34.1 Rule Change description

The reason to change is to make the rules in line with ILLC (Resolution MSC.223(82)).

2.34.2 Applied change

2.34.2.1. Chapter 2 Section 2 [5.1.1]

The definition of draught T_1 is to be replaced by the one as specified in ILLC. (Resolution MSC.223(82))

2.34.3 Impact on scantling

There is no impact on scantling.

Appendix 1. KC666 related documents

App.1.1. Introduction

Scantlings of deck PSM in fore and aft peaks have been compared taking actual bulk carriers in three representative size groups as example, i.e.Handymax, Panamax and Capesize.

Table 9 – KC 666 – Main characteristics of typical bulk carriers

Ship size	Capacity	Applied Rules	Freeboard type
Handymax	55,000 dwt	CSR	B
Panamax	80,000 dwt	Non-CSR	B-60
Capesize	180,000 dwt	CSR	B-60

App. 1.1.1 Comparison of scantlings

With a typical deck transverse, the following requirements are calculated and compared against actual scantlings.

- Minimum web thickness of deck PSM (fore peak only) $t = 0.7\sqrt{L_2}$
- Section modulus of deck PSM $w = \dfrac{Ps\ell^2}{10\sigma}10^3$
- Shear area of deck PSM $A_{sh} = \dfrac{5Ps\ell}{\tau \sin\phi}$

App. 1.1.2 Allowable stresses

As discussed in KC 666, allowable stresses for PSM are different between cargo area and fore and aft peak areas and between side PSM and deck PSM. For PSM on side structure, allowable stresses are taken from those of ordinary stiffeners as explained in the TB document for CSR 2006 edition. This rule change is to align the requirements for deck PSM and side PSM in line with ordinary stiffeners. In connection with this rule change, allowable stresses are newly introduced for testing conditions which are not specified in the cargo area.

Table 10 – KC 666 – Allowable stresses

Condition	Intact condition		Testing condition
	Current rules	New rules	
Normal stress σ	$\sigma \le 0.8R_Y$	$\sigma \le 0.9R_Y$	$\sigma \le 1.05R_Y$
Shear stress τ	$\tau \le 0.4R_Y$	$\tau \le R_Y/\sqrt{3}$	$\tau \le 1.05R_Y/\sqrt{3}$

App.1.2. Fore peak area

App. 1.2.1 Target deck structure in fore peak area

Typical deck transverse on fore peak tank top is selected as illustrated below in Table 11 and Figure 5.

Scantlings of deck PSM on the forecastle deck are determined by Ch.9 Sec.4 and therefore are kept outside the scope of this study.

Table 11 – KC 666 – Fore peak arrangements for typical bulk carriers

Ship size	Capacity	Freeboard type	Arrangement[1)]
Handymax	55,000 dwt	B	Type A
Panamax	80,000 dwt	B-60	Type B
Capesize	180,000 dwt	B-60	Type B

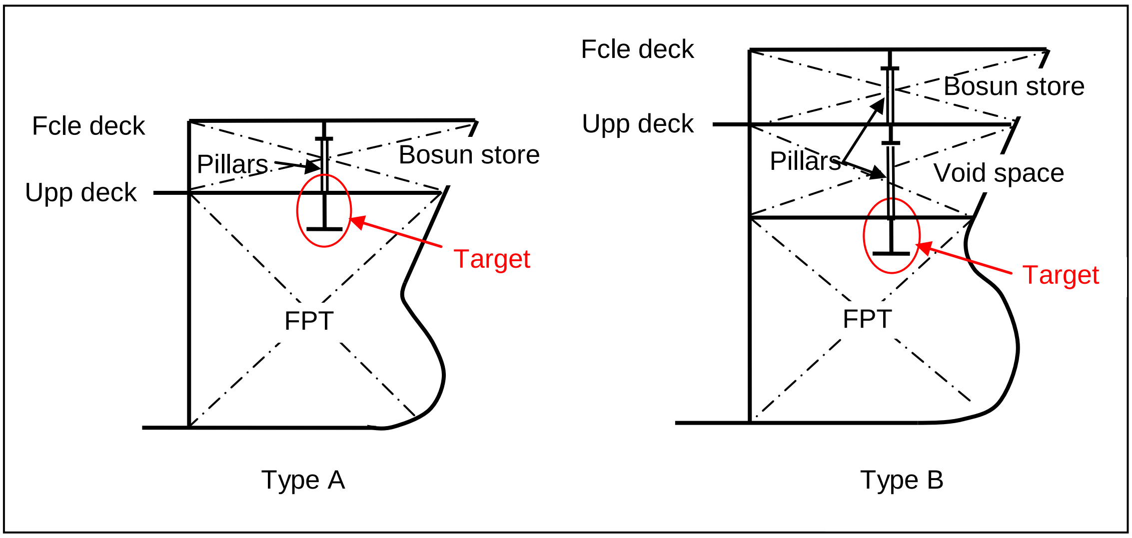

Figure 5 – KC 666 – Possible fore peak arrangements

App. 1.2.2 Applied loads in fore peak area

The following design loads have been considered:

1. External pressure on exposed deck (4/5.2)
2. Tank testing pressure (4/6.4)
3. Hydrostatic and hydrodynamic pressures (4/5.1)

   They are not relevant for deck structure.

4. Inertial pressure of fore peak tank (4/6.2).

   Inertial pressure on fore peak tank top is small compared to tank testing pressure and hence neglected.

5. Bow flare area pressure (4/5.4)

   This is not relevant for deck structure.

6. Lateral pressure in flooded condition (4/6.3)

Flooded condition may be relevant for a deck facing dry compartments. This is not applicable to fore peak tank top.

7. Design load in stores

   Design load in store space is not specified except for superstructure and deck house (9/4.3). A design load of 5 kN/m2 for unexposed decks is insignificant and hence neglected.

App. 1.2.3 Scantlings calculation

For sake of simplicity, effect of longitudinal side girders forming deck grillage is ignored except for C.L. girder thereby simple rule formulae can be applied. External pressure acting on the forecastle deck is transmitted to the fore peak tank top by a set of pillars. For sake of simplicity, the external pressure load supported by the pillars is re-distributed over the deck transverse on the fore peak tank top. In case of the Capesize bulk carrier, strength of the deck structure had to be checked by a direct calculation due to complexity of actual construction. For a complex deck structure, a direct strength calculation, typically beam model type, is considered necessary.

App. 1.2.4 Comparison of scantlings

Actual scantlings of deck transverse are compared against required scantlings according to the current rules and the new rules respectively.

App. 1.2.4.1 Comparison of net section modulus

Table 12 – KC 666 – Fore peak, net section modulus with the current rules

Ship size	Actual net section modulus (cm3) (A)	Required net section modulus (cm3)		Ratio (A) / (B)	Ratio (A) / (C)
		Intact condition (B)	Test condition (C)		
Handymax	2,663	1,781	NA	1.50	NA
Panamax	7,077	3,919	NA	1.81	NA
Capesize	15,439	11,129	NA	1.39	NA

Table 13 – KC 666 – Fore peak, net section modulus with the proposed change

Ship size	Actual net section modulus (cm3) (A)	Required net section modulus (cm3)		Ratio (A) / (B)	Ratio (A) / (C)
		Intact condition (B)	Test condition (C)		
Handymax	2,663	1,583	826	1.68	3.22
Panamax	7,077	3,483	4,790	2.03	1.48
Capesize	15,439	9,892	17,140	1.56	0.90[*1]

*1 According to a beam model calculation including deck structures above and connecting pillars, maximum normal stress of 0.76 R_Y and maximum shear stress of 0.49 R_Y are obtained which are acceptable according to the new rules.

App. 1.2.4.2 Comparison of net shear area

Table 14 – KC 666 – Fore peak, net shear area with the current rules

Ship size	Actual net shear area (cm2) (A)	Required net shear area (cm2)		Ratio (A) / (B)	Ratio (A) / (C)
		Intact condition (B)	Test condition (C)		
Handymax	75.1	35.6	NA	2.11	NA
Panamax	114	65.3	NA	1.75	NA
Capesize	182	122	NA	1.49	NA

Table 15 – KC 666 – Fore peak, net shear area with the proposed change

Ship size	Actual net shear area (cm2) (A)	Required net shear area (cm2)		Ratio (A) / (B)	Ratio (A) / (C)
		Intact condition (B)	Test condition (C)		
Handymax	75.1	24.7	14.3	3.04	5.25
Panamax	114	45.3	69.1	2.52	1.65
Capesize	182	84.7	163	2.15	1.12[*1]

*1 According to a beam model calculation including deck structures above and connecting pillars, maximum normal stress of 0.76 R_Y and maximum shear stress of 0.49 R_Y are obtained which are acceptable according to the new rules.

App. 1.2.4.3 Comments from the comparative study

The following comments are made from the comparative study:

1. Actual scantlings of deck PSM in fore peak area are much above the requirements of the current rules. This is a common observation with the three example ships.
2. According to the new rules, required section modulus will be further reduced from the current requirements by 11% which may give rise to a significant reduction in actual scantlings if the structures are fully optimised according to the new rules.
3. In case of fore peak with void space (type B arrangement), tank testing condition may be decisive for deck PSM on fore peak tank top. This condition is missing in the current rules and therefore comparison is not possible.
4. Increase of allowable shear stress by 44% has no impact on actual scantlings. In all three example ships, required minimum web thickness (9/1[4.4.1]) will satisfy the web shear area requirement.
5. In case of the Capesize bulk carrier with a complex deck structure, a beam model calculation is performed to confirm that the actual scantlings comply with the rules.
6. In case of the Handymax bulk carrier, the face plate thickness of the deck PSM is thinner than the web plate thickness. It is observed that there is no proportional requirement for PSM in general and that the current minimum thickness requirement of Ch.9 Sec.1 [4.4.1] applies only to web plate of PSM.

App.1.3. Aft peak area

App. 1.3.1 Target deck structure in aft peak area

The same three ships as fore peak area (see Table 9) are used for the study of aft peak area. A typical deck transverse on upper deck is selected as illustrated in Figure 6.

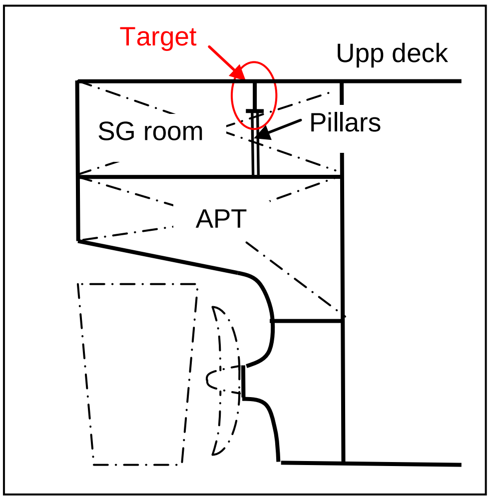

Figure 6 – KC 666 – used aft peak arrangements

App. 1.3.2 Applied loads in aft peak area

The following design loads have been considered:

1. External pressure on exposed deck (4/5.2)
2. Hydrostatic and hydrodynamic pressures (4/5.1)
   This is not relevant for deck structure.
3. Lateral pressure in flooded condition (4/6.3)
   This is not applicable to upper deck where flooded water head is zero.

App. 1.3.3 Scantlings calculation

For sake of simplicity, effect of longitudinal side girders forming deck grillage is ignored except for C.L. girder thereby simple rule formulae can be applied.

App. 1.3.4 Comparison of scantlings

Actual scantlings of deck transverse are compared against required scantlings according to the current rules and the new rules respectively.

App. 1.3.4.1 Comparison of net section modulus

Table 16 – KC 666 – Aft peak, net section modulus with the current rules

Ship size	Actual net section modulus (cm3) (A)	Required net section modulus (cm3)		Ratio (A) / (B)	Ratio (A) / (C)
		Intact condition (B)	Test condition (C)		
Handymax	1,142	708	NA	1.61	NA
Panamax	2,952	975	NA	3.03	NA
Capesize	3,325	2,452	NA	1.36	NA

Table 17 – KC 666 – Aft peak, net section modulus with the proposed change

Ship size	Actual net section modulus (cm3) (A)	Required net section modulus (cm3)		Ratio (A) / (B)	Ratio (A) / (C)
		Intact condition (B)	Test condition (C)		
Handymax	1,142	630	NA	1.81	NA
Panamax	2,952	867	NA	3.40	NA
Capesize	3,325	2,179	NA	1.53	NA

App. 1.3.4.2 Comparison of net shear area

Table 18 – KC 666 – Aft peak, net shear area with the current rules

Ship size	Actual net shear area (cm2) (A)	Required net shear area (cm2)		Ratio (A) / (B)	Ratio (A) / (C)
		Intact condition (B)	Test condition (C)		
Handymax	38.4	16.5	NA	2.33	NA
Panamax	60.0	22.7	NA	2.64	NA
Capesize	77.0	37.8	NA	2.04	NA

Table 19 – KC 666 – Aft peak, net shear area with the proposed change

Ship size	Actual net shear area (cm2) (A)	Required net shear area (cm2)		Ratio (A) / (B)	Ratio (A) / (C)
		Intact condition (B)	Test condition (C)		
Handymax	38.4	11.4	NA	3.37	NA
Panamax	60.0	15.7	NA	3.82	NA
Capesize	77.0	26.2	NA	2.94	NA

App. 1.3.4.3 Comments from the comparative study

The following comments are made from the comparative study:

1) Actual scantlings of deck PSM in aft peak area are much above the requirements of the current rules. This is a common observation with the three example ships.
2) According to the new rules, required section modulus will be further reduced from the current requirements by 11% which may give rise to a significant reduction in actual scantlings if the structures are fully optimised according to the new rules.
3) Increase of allowable shear stress by 44% has no impact on actual scantlings. In all three example ships, web shear area requirement will be satisfied if suitable web thickness is maintained for PSM which should be included in the rules same as fore peak area.

App.1.4. Conclusion

The following conclusion may be drawn from this consequence study.

1. Actual scantlings of deck PSM in fore and aft peak areas are much above the requirements. This is a common observation with the three example ships. Increase of hull steel weight is therefore not likely with this rule change.
2. According to the new rules, required section modulus will be further reduced from the current requirement by 11% which may give rise to a significant reduction in actual scantlings if the structures are fully optimised according to the new rules.
3. In case of fore peak with a large void space above fore peak tank, tank testing condition may be decisive for deck PSM on fore peak tank top.
4. Increase of allowable shear stress by 44% from the current rules has no impact on actual scantlings provided minimum web thickness (9/1[4.4.1]) is required for PSM.
5. For a complex deck structure, direct calculation should be acceptable instead of the simple rule formulae.

Appendix 2. KC 328 related documents

Table 20 – KC 328 - net thickness of web stiffeners and brackets on double bottom floor

Ship type	L (m)	Double bottom Floor					
		Net thickness of PSM (mm)	Net thickness of web stiffener	Net thickness of bracket (mm)	Type of web stiffener	CSR-BC	RCP
						Min net required thickness for web stiffener/bracket	
Handysize-1	172.66	12	10	11	FB	8	5.5
Handysize-2	160.4	9	9	9	FB	7.5	5.5
Handysize-3	174.55	8	9	9	FB	8	5.5
Handysize-4							
Handymax-1	184.2	12	8	9	FB	8	6
Handymax-2	182	8	9	—	FB	8	5.5
Handymax-3	181.5	8	9	9	FB	8	5.5
Handymax-4							
Pana-1	218.25	9	**8.5**	—	FB	9	6.5
Pana-2	220	8.5	9	—	FB	9	6.5
Pana-3	214.22	9	9	—	FB	9	6
Pana-4							
Cap-1	280.33	10.5	**9**	—	FB	10	7
Cap-2	292	10.5	12	—	FB	10.5	7.5
Cap-3	260	9	**9**	—	FB	10	7
Cap-4							

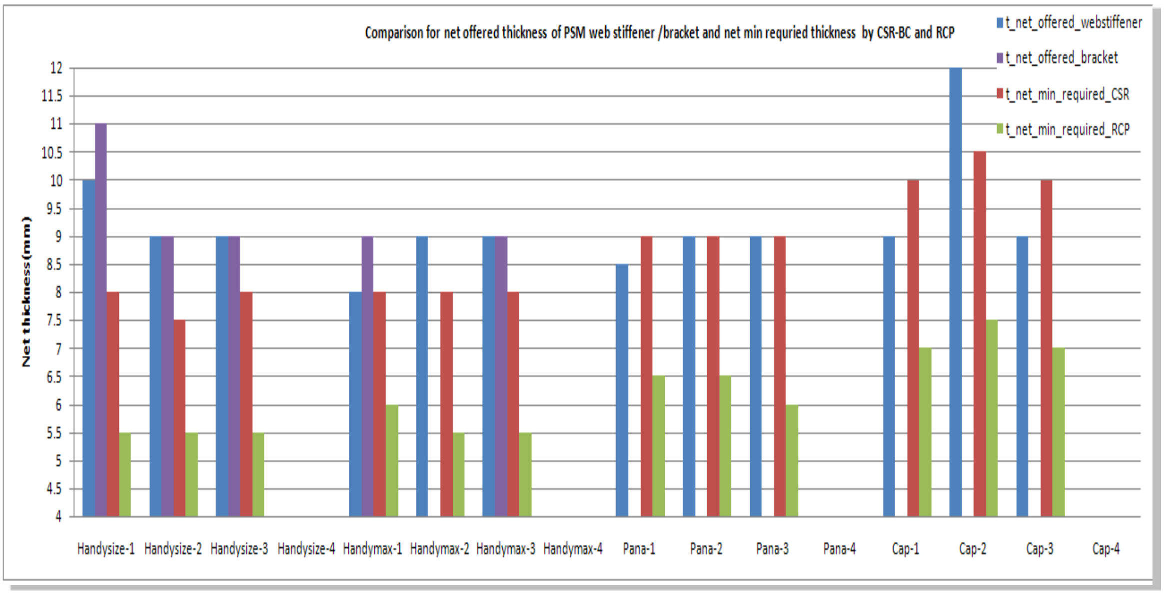

Figure 7 – KC 328 - Comparison for net offered thickness of PSM web stiffener/bracket and net minimum required thickness in CSR-BC and the proposed Rule Change on double bottom floor

Table 21 – KC 238 net thickness of web stiffeners and brackets on double bottom girder

Ship type	L (m)	Double bottom Girder					
		Net thickness of PSM (mm)	Net thickness of web stiffener (mm)	Net thickness of bracket (mm)	Type of web stiffener	CSR-BC	RCP
						Min net required thickness for web stiffener/bracket	
Handysize-1	172.66	12	10	10	FB	8	5.5
Handysize-2	160.4	12	9	—	FB	7.5	5.5
Handysize-3	174.55	8	9	—	FB	8	5.5
Handysize-4							
Handymax-1	184.2	10.5	10	8	FB	8	6
Handymax-2	182	10.5	9	—	FB	8	5.5
Handymax-3	181.5	8	9	—	FB	8	5.5
Handymax-4							
Pana-1	218.25	10.5	9	—	FB	9	6.5
Pana-2	220	12	**8**	—	FB	9	6.5
Pana-3	214.22	10	9	—	L	9	6
Pana-4							
Cap-1	280.33	12	**9**	—	FB	10	7
Cap-2	292	15	**9**	—	FB	10.5	7.5
Cap-3	260	10	**9**	—	FB	10	7
Cap-4							

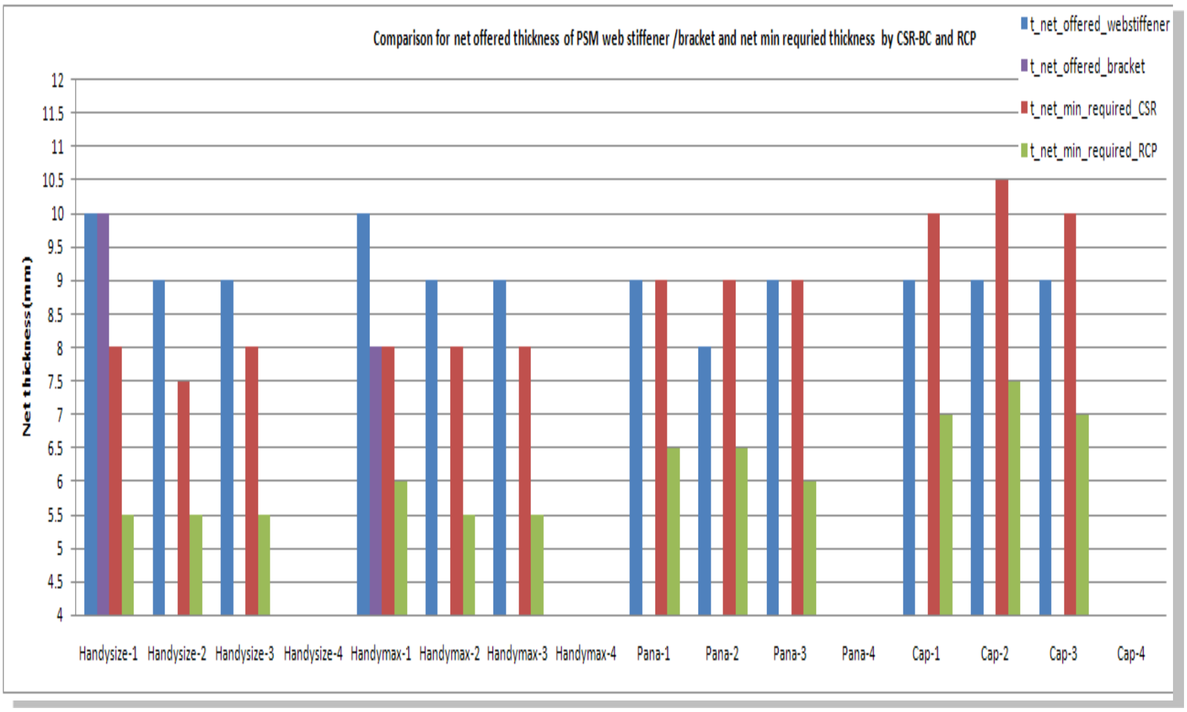

Figure 8 – KC 328 – Comparison for net offered thickness of PSM web stiffener/bracket and net minimum required thickness in CSR-BC and the proposed Rule Change on double bottom girder

Table 22 – KC 328 – net thickness of web stiffeners and brackets on PSM in bilge hopper tanks

Ship type	L (m)	PSM in bilge hopper tanks					
		Net thickness of PSM (mm)	Net thickness of web stiffener (mm)	Net thickness of bracket (mm)	Type of web stiffener	CSR-BC	RCP
						Min net required thickness for web stiffener/bracket	
Handysize-1	172.66	12	9	7	FB	8	5.5
Handysize-2	160.4	10.5	7	7	FB	7.5	5.5
Handysize-3	174.55	8	9	—	FB	8	5.5
Handysize-4							
Handymax-1	184.2	12	10	9	L	8	6
Handymax-2	182	8	9	9	FB	8	5.5
Handymax-3	181.5	8	9	—	FB	8	5.5
Handymax-4							
Pana-1	218.25	9	**8.5**	**8**	FB	9	6.5
Pana-2	220	8.5	**8**	**8**	FB	9	6.5
Pana-3	214.22	9	9	—	FB	9	6
Pana-4							
Cap-1	280.33	11	**9**	10	FB	10	7
Cap-2	292	10.5	11	11	FB	10.5	7.5
Cap-3	260	9	**9**	**9**	FB	10	7
Cap-4							

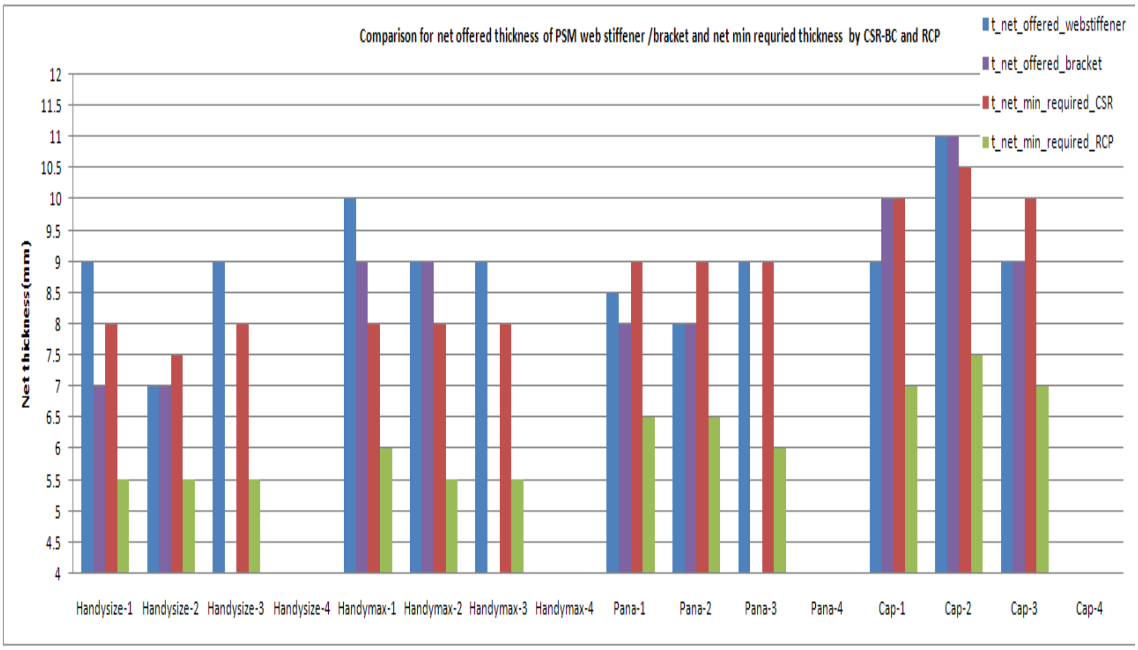

Figure 9- KC 328 – Comparison for net offered thickness of PSM web stiffener/bracket and net minimum required thickness in CSR-BC and the proposed Rule Change on PSM in bilge hopper tanks

Table 23 – KC 328 – net thickness of web stiffeners and brackets on PSM in topside tanks

Ship type	L (m)	PSM in topside tanks					
		Net thickness of PSM (mm)	Net thickness of web stiffener (mm)	Net thickness of bracket (mm)	Type of web stiffener	CSR-BC	RCP
						Min net required thickness for web stiffener/bracket	
Handysize-1	172.66	10	9	**6**	B	8	5.5
Handysize-2	160.4	7	**7**	**7**	FB	7.5	5.5
Handysize-3	174.55	8	9	—	FB	8	5.5
Handysize-4							
Handymax-1	184.2	8	**7**	**7**	FB	8	6
Handymax-2	182	8	9	9	FB	8	5.5
Handymax-3	181.5	8	9	—	FB	8	5.5
Handymax-4							
Pana-1	218.25	7.5	**6**	**7.5**	L	9	6.5
Pana-2	220	8.5	**8**	**8**	FB	9	6.5
Pana-3	214.22	9	9	—	FB	9	6
Pana-4							
Cap-1	280.33	11	**8**	**8.5**	L	10	7
Cap-2	292	9.5	11	11	FB	10.5	7.5
Cap-3	260	10	**8**	**8**	FB	10	7
Cap-4							

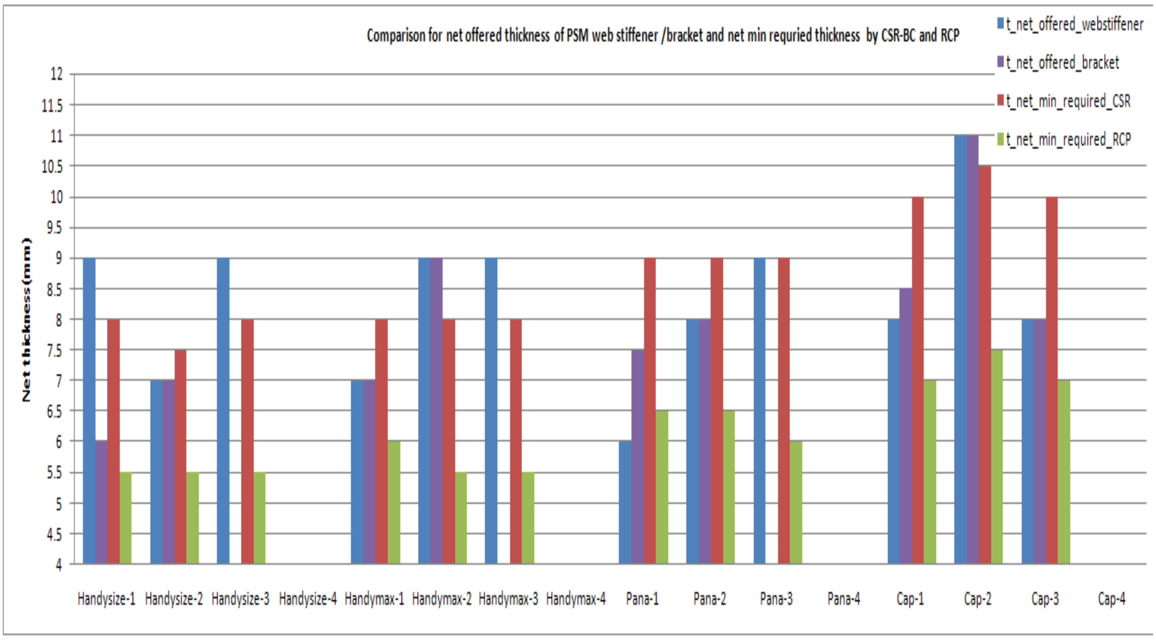

Figure 10 – KC 328 – Comparison for net offered thickness of PSM web stiffener/bracket and net minimum required thickness in CSR-BC and the proposed Rule Change on PSM in topside tanks

Appendix 3. KC 798 Related documents

The following documents are the different versions of the SOLAS regulations affecting the bulkead arrangement and reflected therefore in the CSR BC. The relevant parts of these texts for KC 798 are highlighted.

App.3.1. SOLAS Chapter II-1 – Part B – Regulation 10

The initial SOLAS regulation about subdivision arrangement which has served in fact as a basis for the CSR Chapter 2 Section 1 [3.1.1] is as follow.

Chapter II-1 - Construction - Structure, subdivision and stability, machinery and electrical installations

Part B - Subdivision and stability

Regulation 10 - Peak and machinery space bulkheads, shaft tunnels, etc., in passenger ships

1. A forepeak or collision bulkhead shall be fitted which shall be watertight up to the bulkhead deck. This bulkhead shall be located at a distance from the forward perpendicular of not less than 5% of the length of the ship and not more than 3 m plus 5% of the length of the ship.

2. Where any part of the ship below the waterline extends forward of the forward perpendicular, e.g. a bulbous bow, the distances stipulated in paragraph 1 shall be measured from a point either:

.*1*. at the mid-length of such extension; or

.*2*. at a distance 1.5% of the length of the ship forward of the forward perpendicular; or

.*3*. at a distance 3 m forward of the forward perpendicular;

whichever gives the smallest measurement.

3. Where a long forward superstructure is fitted, the forepeak or collision bulkhead on all passenger ships shall be extended weathertight to the next full deck above the bulkhead deck. The extension shall be so arranged as to preclude the possibility of the bow door causing damage to it in the case of damage to, or detachment of, a bow door.

4. The extension required in paragraph 3 need not be fitted directly above the bulkhead below, provided that all parts of the extension are not located forward of the forward limit specified in paragraph 1 or paragraph 2. However, in ships constructed before 1 July 1997:

.*1*. where a sloping ramp forms part of the extension, the part of the extension, which is more than 2.3 m above the bulkhead deck, may extend no more than 1 m forward of the forward limits specified in paragraph 1 or paragraph 2; and

.*2*. where the existing ramp does not comply with the requirements for acceptance as an extension to the collision bulkhead and the position of the ramp prevents the siting of such extension within the limits specified in paragraph 1 or paragraph 2 , the extension may be sited within a limited distance aft of the aft limit specified in paragraph 1 or paragraph 2. The limited distance aft should be no more than is necessary to ensure non interference with the ramp. The extension to the collision bulkhead shall open forward and comply with the requirements of paragraph 3 and shall be so arranged as to preclude the possibility of the ramp causing damage to it in the case of damage to, or detachment of, the ramp.

5. Ramps not meeting the above requirements shall be disregarded as an extension of the collision bulkhead.

6. In ships constructed before 1 July 1997, the requirements of paragraphs 3 and 4 shall apply not later than the date of the first periodical survey after 1 July 1997.

7. An afterpeak bulkhead, and bulkheads dividing the machinery space, as defined in regulation 2, from the cargo and passenger spaces forward and aft, shall also be fitted and made watertight up to the bulkhead deck. The afterpeak bulkhead may, however, be stepped below the bulkhead deck, provided the degree of safety of the ship as regards subdivision is not thereby diminished.

8. In all cases stern tubes shall be enclosed in watertight spaces of moderate volume. The stern gland shall be situated in a watertight shaft tunnel or other watertight space separate from the stern tube compartment and of such volume that, if flooded by leakage through the stern gland, the margin line will not be submerged.

App.3.2. SOLAS Chapter II-1 – Part B – Regulation 11

The initial SOLAS regulation about subdivision arrangement which should have served as a basis for the CSR Chapter 2 Section 1 [3.1.1] is as follow.

Chapter II-1 - Construction - Structure, subdivision and stability, machinery and electrical installations

Part B - Subdivision and stability

Regulation 11 - Peak and machinery space bulkheads and stern tubes in cargo ships

. (Paragraphs 8 and 9 of this regulation apply to ships constructed on or after 1 February 1992)

1. For the purpose of this regulation *freeboard deck, length of ship* and *forward perpendicular* have the meanings as defined in the International Convention on Load Lines in force.

2. A collision bulkhead shall be fitted which shall be watertight up to the freeboard deck. This bulkhead shall be located at a distance from the forward perpendicular of not less than 5 % of the length of the ship or 10 m, whichever is the less, and, except as may be permitted by the Administration, not more than 8% of the length of the ship.

3. Where any part of the ship below the waterline extends forward of the forward perpendicular, e.g. a bulbous bow, the distances stipulated in paragraph 2 shall be measured from a point either:

.*1*. at the mid-length of such extension; or

.*2*. at a distance 1.5% of the length of the ship forward of the forward perpendicular; or

.*3*. at a distance 3 m forward of the forward perpendicular;

whichever gives the smallest measurement.

4. The bulkhead may have steps or recesses provided they are within the limits prescribed in paragraph 2 or 3. Pipes piercing the collision bulkhead shall be fitted with suitable valves operable from above the freeboard deck and the valve chest shall be secured at the bulkhead inside the forepeak. The valves may be fitted on the after side of the collision bulkhead provided that the valves are readily accessible under all service conditions and the space in which they are located is not a cargo space. All valves shall be of steel, bronze or other approved ductile material. Valves of ordinary cast iron or similar material are not acceptable. No door, manhole, ventilation duct or any other opening shall be fitted in this bulkhead.

5. Where a long forward superstructure is fitted the collision bulkhead shall be extended weathertight to the deck next above the freeboard deck. The extension need not be fitted directly above the bulkhead below provided it is located within the limits prescribed in paragraph 2 or 3 with the exemption permitted by paragraph 6 and the part of the deck which forms the step is made effectively weathertight.

6. Where bow doors are fitted and a sloping loading ramp forms part of the extension of the collision bulkhead above the freeboard deck the part of the ramp which is more than 2.3 m above the freeboard deck may extend forward of the limit specified in paragraph 2 or 3 . The ramp shall be weathertight over its complete length.

7. The number of openings in the extension of the collision bulkhead above the freeboard deck shall be restricted to the minimum compatible with the design and normal operation of the ship. All such openings shall be capable of being closed weathertight.

8. Bulkheads shall be fitted separating the machinery space from cargo and passenger spaces forward and aft and made watertight up to the freeboard deck.

9. Stern tubes shall be enclosed in a watertight space (or spaces) of moderate volume. Other measures to minimize the danger of water penetrating into the ship in case of damage to stern tube arrangements may be taken at the discretion of the Administration.

App.3.3. SOLAS Chapter II-1 – Part B-2 – Regulation 12

The current SOLAS regulation about subdivision arrangement which is to be considered from now on in the CSR Chapter 2 Section 1 [3.1.1] is as follow.

Chapter II-1 - Construction - Structure, subdivision and stability, machinery and electrical installations

Part B-2 - Subdivision, Watertight and Weathertight Integrity

Regulation 12 - Peak and machinery space bulkheads, shaft tunnels, etc.

1. A collision bulkhead shall be fitted which shall be watertight up to the bulkhead deck. This bulkhead shall be located at a distance from the forward perpendicular of not less than 0.05*L* or 10 m, whichever is the less, and, except as may be permitted by the Administration, not more than 0.08*L* or 0.05*L* + 3 m, whichever is the greater.

2. Where any part of the ship below the waterline extends forward of the forward perpendicular, e.g., a bulbous bow, the distances stipulated in paragraph 1 shall be measured from a point either:

.*1*. at the mid-length of such extension;

.*2*. at a distance 0.015*L* forward of the forward perpendicular; or

.*3*. at a distance 3 m forward of the forward perpendicular,

whichhever gives the smallest measurement.

3. The bulkhead may have steps or recesses provided they are within the limits prescribed in paragraph 1 or 2.

4. No doors, manholes, access openings, ventilation ducts or any other openings shall be fitted in the collision bulkhead below the bulkhead deck.

5.1. Except as provided in paragraph 5.2, the collision bulkhead may be pierced below the bulkhead deck by not more than one pipe for dealing with fluid in the forepeak tank, provided that the pipe is fitted with a screw-down valve capable of being operated from above the bulkhead deck, the valve chest being secured inside the forepeak to the collision bulkhead. The Administration may, however, authorize the fitting of this valve on the after side of the collision bulkhead provided that the valve is readily accessible under all service conditions and the space in which it is located is not a cargo space. All valves shall be of steel, bronze or other approved ductile material. Valves of ordinary cast iron or similar material are not acceptable.

5.2. If the forepeak is divided to hold two different kinds of liquids the Administration may allow the collision bulkhead to be pierced below the bulkhead deck by two pipes, each of which is fitted as required by paragraph 5.1, provided the Administration is satisfied that there is no practical alternative to the fitting of such a second pipe and that, having regard to the additional subdivision provided in the forepeak, the safety of the ship is maintained.

6. Where a long forward superstructure is fitted the collision bulkhead shall be extended weathertight to the deck next above the bulkhead deck. The extension need not be fitted directly above the bulkhead below provided it is located within the limits prescribed in paragraph 1 or 2 with the exception permitted by paragraph 7 and that the part of the deck which forms the step is made effectively weathertight. The extension shall be so arranged as to preclude the possibility of the bow door causing damage to it in the case of damage to, or detachment of, a bow door.

7. Where bow doors are fitted and a sloping loading ramp forms part of the extension of the collision bulkhead above the bulkhead deck the ramp shall be weathertight over its complete length. In cargo ships the part of the ramp which is more than 2.3 m above the bulkhead deck may extend forward of the limit specified in paragraph 1 or 2. Ramps not meeting the above requirements shall be disregarded as an extension of the collision bulkhead.

8. The number of openings in the extension of the collision bulkhead above the freeboard deck shall be restricted to the minimum compatible with the design and normal operation of the ship. All such openings shall be capable of being closed weathertight.

9. Bulkheads shall be fitted separating the machinery space from cargo and accommodation spaces forward and aft and made watertight up to the bulkhead deck. In passenger ships an afterpeak bulkhead shall also be fitted and made watertight up to the bulkhead deck. The afterpeak bulkhead may, however, be stepped below the bulkhead deck, provided the degree of safety of the ship as regards subdivision is not thereby diminished.

10. In all cases stern tubes shall be enclosed in watertight spaces of moderate volume. In passenger ships the stern gland shall be situated in a watertight shaft tunnel or other watertight space separate from the stern tube compartment and of such volume that, if flooded by leakage through the stern gland, the bulkhead deck will not be immersed. In cargo ships other measures to minimize the danger of water penetrating into the ship in case of damage to stern tube arrangements may be taken at the discretion of the Administration.

Appendix 4. KC 966 related document

The following attachment is the IACS guideline as provided in KC 966 in the knowledge centre database. The relevant parts of these texts for KC 966 are highlighted.

App.4.1. IACS Guideline for Procedures of Testing Tanks and Tight Boundaries

IACS Guideline for Procedures of Testing Tanks and Tight Boundaries

1. General

These test procedures are to ensure the weathertightness of structures/shipboard outfitting, the watertightness of tanks and watertight boundaries and structural adequacy of tanks.

Tightness of all tanks and tight boundaries of the ships at the new construction and, when major conversions or repairs* have been made, those relevant to the major conversions/repairs should be confirmed by these test procedures prior to delivery of the ship.

* Major repair means a repair affecting structural integrity.

2. Application

2.1 All gravity tanks** and other boundaries required to be watertight or weathertight should be tested in accordance with this Guideline and proven tight and structurally adequate as follows:

- *Gravity Tanks* for their tightness and structural adequacy
- *Watertight Boundaries Other Than Tank Boundaries* for their watertightness, and - *Weathertight Boundaries* for their weathertightness

** Gravity tank means a tank having a design working pressure not greater than 70 kPa at the top of the tank.

2.2 The testing of cargo containment systems of liquefied gas carriers should be in accordance with standards deemed appropriate by the Administration.

2.3 Testing of structures not listed in Table 1 or 2 should be specially considered.

3. Types of Tests and Definition of Test

3.1 The following two types of test are specified in this requirement:

Structural Test: A test to verify the structural adequacy of the construction of the tanks. This may be a hydrostatic test or, where the situation warrants, a hydropneumatic test.

Leak Test: A test to verify the tightness of the boundary. Unless a specific test is indicated, this may be a hydrostatic/hydropneumatic test or air test. *Leak test* with remark *3 in Table 1 includes hose test as an acceptable medium of the test.

3.2 Definition of each type of test is as follows:

Hydrostatic Test: (Leak and Structural) A test by filling the space with a liquid to specified head.

Hydropneumatic Test: (Leak and Structural) A test wherein space is partially filled with liquid and air pressure applied on top of the liquid surface.

Hose Test: (Leak) A test to verify the tightness of the joint by a jet of water.

Air Tests: (Leak) A test to verify the tightness by means of air pressure differential and leak detection solution. It includes tank air test and joint air test, such as *compressed air test* and vacuum box test.

Compressed Air Fillet Weld Test: *(Leak)*	An air test of fillet welded tee joint and leak indicating solution applied on the fillet welds.
Vacuum Box Test: *(Leak)*	A box over a joint with leak indicating solution appliedon the fillet or butt welds. Vacuum is created inside the box to detect any leaks.
Ultrasonic Test: *(Leak)*	A test to verify the tightness of a sealing by means of ultrasonic.
Penetration Test: *(Leak)*	A test to verify that no continuous leakages exist in the boundaries of a compartment by means of low surface tension liquids.

4. Test Procedures

4.1 General

Tests should be carried out in the presence of the Surveyor at a stage sufficiently close to the completion of the work with all hatches, doors, windows, etc. installed and all penetrations including pipe connections fitted, and before any ceiling and cement work is applied over the joints. Specific test requirements are given in 4.4 and Table 1. For the timing of application of coating and provision of safe access to joints, see 4.5, 4.6 and Table 3.

4.2 Structural Test Procedures

4.2.1 Type and Time of Test

Where a structural test is specified in Table 1 or Table 2, a hydrostatic test in accordance with 4.4.1 will be acceptable. Where practical limitations (strength of building berth, light density of liquid, etc.) prevent the performance of a hydrostatic test, a hydropneumatic test in accordance with 4.4.2 may be accepted as an equivalent method.

Provided the results of a leak test are confirmed satisfactory, a hydrostatic test for confirmation of structural adequacy may be carried out while the vessel is afloat.

4.2.2 Number of Structural Test

(1) Structural test should be carried out for at least one tank of same construction (i.e., same design and same workmanship) on each vessel provided all subsequent tanks are tested for leaks by an air test.

However, where structural adequacy of a tank was verified by structural testing required in Table 1, the subsequent vessels in the series (i.e., sister ships built in the same shipyard) may be exempted from such testing for other tanks which have the structural similarity to the tested tank, provided that the water-tightness in all boundaries of exempted tanks are verified by leak tests and thorough inspection should be carried out. For sister ships built several years after the last ship of the series, such exemption may be reconsidered. In any case, structural testing should be carried out for at least one tank for each vessel in order to assure structural fabrication adequacy.

(2) For watertight boundaries of spaces other than tanks (excluding chain lockers), structural testing may be exempted, provided that the water-tightness in all boundaries of exempted spaces are verified by leak tests and thorough inspection should be carried out.

(3) These subsequent tanks may require structural test if found necessary after the structural testing of the first tank.

(4) Tanks for structural test should be selected so that all representative structural members are tested for the expected tension and compression.

4.3 Leak Test Procedures

For leak test specified in Table 1, tank air test, compressed air fillet weld test, vacuum box test in accordance with 4.4.3 through 4.4.6, or their combination will be acceptable.

Hydrostatic or hydropneumatic test may also be accepted as leak test provided 4.5 and 4.6 are complied with. Hose test will also be acceptable for the locations as specified in Table 1 with the foot note *3.

Joint air test may be carried out in the block stage provided all work of the block that may affect the tightness of the joint is completed before the test. See also 4.5.1 for the application of final coating and 4.6 for safe access to joint and their summary in Table 3.

4.4 Details of Tests

4.4.1 Hydrostatic Test

Unless other liquid is approved, hydrostatic test is to consist of filling the space by fresh water or sea water, whichever is appropriate for testing of the space, to the level specified in Table 1 or Table 2.

In case a tank for cargoes with higher density is to be tested with fresh water or sea water, the testing pressure height should be specially considered.

4.4.2 Hydropneumatic Test

Hydropneumatic test where approved should be such that the test condition in conjunction with the approved liquid level and air pressure will simulate the actual loading as far as practicable. The requirements and recommendations for tank air tests in 4.4.4 will also apply to hydropneumatic test.

4.4.3 Hose Test

Hose test should be carried out with the pressure in the hose nozzle maintained at least at $2 \cdot 10^5$ Pa during the test. The nozzle should have a minimum inside diameter of 12 mm and be at a distance to the joint not exceeding 1.5meters.

Where hose test is not practical because of possible damage to machinery, electrical equipment insulation or outfitting items, it may be replaced by a careful visual examination of welded connections, supported where necessary by means such as a dye penetrant test or ultrasonic leak test or an equivalent.

4.4.4 Tank Air Test

All boundary welds, erection joints and penetrations including pipe connections should be examined in accordance with the approved procedure and under a pressure differential above atmosphere pressure not less than $0.15 \cdot 10^5$ Pa with a leak indication solution applied.

It is recommended that the air pressure in the tank be raised to and maintained at about $0.20 \cdot 10^5$ Pa for approximately one hour, with a minimum number of personnel around the tank, before lowered to the test pressure of $0.15 \cdot 10^5$ Pa.

A U-tube with a height sufficient to hold a head of water corresponding to the required test pressure should be arranged. The cross sectional area of the U-tube should be not less than that of the pipe supplying air to the tank. In addition to U-tube, a master gauge or other approved means to verify the pressure should be approved.

4.4.5 Compressed Air Fillet Weld Test

In this air test, compressed air is injected from one end of fillet welded joint and the pressure verified at the other end of joint by a pressure gauge on the opposite side. Pressure gauges should be arranged so that an air pressure of at least $0.15 \cdot 10^5$ Pa can be verified at each end of all passages within the portion being tested.

Note: Where the leak test is required in way of the fabrication applying the partial penetration weld, compressed air test is also applied in the same manner for fillet weld where the root face is sufficiently large, i.e., 6 – 8 mm.

4.4.6 Vacuum Box Test

A box (vacuum tester) with air connections, gauges and inspection window is placed over the joint with leak indicator applied. The air within the box is removed by an ejector to create a vacuum of $0.20 \cdot 10^5$ – $0.26 \cdot 10^5$ Pa inside the box.

4.4.7 Ultrasonic Test

An arrangement of an ultrasonic echoes sender inside of a compartment and a receiver outside. A location where the sound is detectable by the receiver displays a leakage in the sealing of the compartment.

4.4.8 Penetration Test

A test of butt welds by using of a low surface tension liquid at one side of a compartment boundary. If no liquid were detected on the opposite sides of the boundaries after expiration of a definite time this means the verification of tightness of the compartments boundaries.

4.4.9 Other Test

Other methods of testing may be considered by each society upon submission of full particulars prior to commencement of the testing.

4.5 Application of Coating

4.5.1 Final Coating

For butt joints by automatic process, final coating may be applied anytime before completion of leak test of the space bounded by the joint.

For all other joints, final coating should be applied after the completion of leak test of the joint. See also Table 3.

The Surveyor reserves a right to require leak test prior to the application of final coating over automatic erection butt welds.

4.5.2 Temporary Coating

Any temporary coating which may conceal defects or leaks should be applied at a time as specified for final coating. This requirement does not apply to shop primer.

4.6 Safe Access to Joints

For leak tests, a safe access to all joints under examination should be provided. See also Table 3.

Table 1
Test Requirements for Tanks and Boundaries

	Tank or boundaryto be tested	Test type	Test head or pressure	Remarks
1	Double bottom tanks*4	Leak &Structural*1	The greater of - top of the overflow, - to 2.4m above top of tank *2, or - to bulkhead deck	
2	Double bottom voids*5	Leak	See 4.4.4 through 4.4.6, as applicable	
3	Double side tanks	Leak & Structural*1	The greater of - top of the overflow,	

	Tank or boundaryto be tested	Test type	Test head or pressure	Remarks
			- to 2.4m above top of tank *2, or - to bulkhead deck	
4	Double side voids	Leak	See 4.4.4 through 4.4.6, as Applicable	
5	Deep tanks other than those listed elsewhere in this table	Leak & Structural*1	The greater of - top of the overflow, or - to 2.4m above top of tank *2	
6	Cargo oil tanks	Leak & Structural*1	The greater of - top of the overflow, - to 2.4m above top of tank *2, or - to top of tank *2 plus setting of any pressure relief valve	
7	Ballast hold of bulk carriers	Leak & Structural*1	The greater of - top of the overflow, or - top of cargo hatch coaming	
8	Peak tanks	Leak & Structural*1	The greater of - top of the overflow, or - to 2.4m above top of tank *2	After peak to be tested after installation of stern tube
9	a. Fore peak voids	Leak	See 4.4.4 through 4.4.6, as applicable	
	b. Aft peak voids	Leak	See 4.4.4 through 4.4.6, as applicable	After peak to be tested after installation of stern tube
10	Cofferdams	Leak	See 4.4.4 through 4.6, as applicable	
11	a. Watertight bulkheads	Leak	See 4.4.3 through 4.4.6, as applicable	
	b. Superstructure end bulkhead	Leak	See 4.4.3 through 4.4.6, as applicable	
12	Watertight doors below freeboard or bulkhead deck	Leak *6	See 4.4.3 through 4.4.6, as applicable	
13	Double plate rudder blade	Leak	See 4.4.4 through 4.4.6, as applicable	
14	Shaft tunnel clear of deep tanks	Leak *3	See 4.4.3 through 4.4.6, as applicable	
15	Shell doors	Leak *3	See 4.4.3 through 4.4.6, as applicable	
16	Weathertight hatch covers and closing appliances	Leak *3	See 4.4.3 through 4.4.6, as applicable	Hatch covers closed by tarpaulins and battens excluded
17	Dual purpose tank/dry cargo hatch cover	Leak *3	See 4.4.3 through 4.4.6, as applicable	In addition to structural test in item 6 or 7
18	Chain locker	Leak & Structural	Top of chain pipe	
19	Independent tanks	Leak & Structural*1	The greater of - top of the overflow, or - to 0.9m above top of tank	
20	Ballast ducts	Leak & Structural*1	The greater of - ballast pump maximum pressure, or - setting of any pressure relief valve	

Note:

*1 Structural test is to be carried out for at least one tank of same construction (i.e., same design and same workmanship) on each vessel provided all subsequent tanks are tested for leaks by an air test. However, where structural adequacy of a tank was verified by structural testing, the subsequent vessels in the series (i.e., sister ships built in the same shipyard) may be exempted from such testing for other tanks which have the structural similarity to the tested tank, provided that the water-tightness in all boundaries of exempted tanks are verified by leak tests and thorough inspection are to be carried out. In any case, structural testing is to be carried out for at least one tank for each vessel in order to assure structural fabrication adequacy. (See 4.2.2(1))

*2 Top of tank is deck forming the top of the tank excluding any hatchways.

*3 *Hose Test* may also be considered as a medium of the test. See 3.2.

*4 Including tanks arranged in accordance with the provisions of SOLAS regulation II-1/9.4

*5 Including duct keels and dry compartments arranged in accordance with the provisions of SOLAS regulation II-1/9.4

*6 Where water tightness of watertight door has not confirmed by prototype test, testing by filling watertight spaces with water is to be carried out. See SOLAS regulation II-1/16.2 and MSC/Circ.1176.

Table 2
Additional Test Requirements for Special Service Ships/Tanks

	Type of Ship/Tank	**Structures to be tested**	**Type of Test**	**Test Head or Pressure**	**Remarks**
1	Liquefied gas carrier	Cargo containment systems (See remarks)	See 4.4.1	See 4.4.1	See also Table 1 for other tanks and boundaries
2	Edible liquid tanks	Independent tanks	Leak & Structural	The greater of - top of the overflow, or - to 0.9m above top of tank *1	
3	Chemical carrier	Integral or independent cargo tanks	Leak & Structural	The greater of - to 2.4m above top of tank *1, or - to top of tank *1 plus setting of any pressure relief valve	

Note:

*1 Top of tank is deck forming the top of the tank excluding any hatchways.

Table 3
Application of Leak Test, Coating and Provision of Safe Access For Type of Welded Joints

Type of Welded Joints		**Leak Test**	**Coating** *1		**Safe Access** *2	
			Before Leak Test	After Leak Test & before Structural Test	Leak Test	Structural Test
Butt	Automatic	Not required	Allowed	N/A	Not required	Not required
	Manual or Semi-automatic	Required	Not allowed	Allowed	Required	Not required
Fillet	Boundary including penetrations	Required	Not allowed	Allowed	Required	Not required

Note:

*1 Coating refers to internal (tank/hold coating), where applied, and external (shell/deck) painting. It does not refer to shop primer.

*2 Temporary means of access for verification of the leak test

Appendix 5. KC 1009 related documents

The following documents are IMO and IACS definitions and recommendations regarding the definitions of bulk carriers. The relevant parts of these texts for KC 1009 are highlighted.

App.5.1. SOLAS Chapter IX – Regulation 1

The first definition of a bulk carrier is given in the following SOLAS regulation.

SOLAS - International Convention for the Safety of Life at Sea

Chapter IX - Management for the safe operation of ships

Regulation 1 - Definitions

. For the purpose of this chapter, unless expressly provided otherwise:

1. International Safety Management (ISM) *Code* means the International Management Code for the Safe Operation of Ships and for Pollution Prevention adopted by the Organization by resolution A.741(18), as may be amended by the Organization, provided that such amendments are adopted, brought into force and take effect in accordance with the provisions of article VIII of the present Convention concerning the amendment procedures applicable to the annex other than chapter I.
2. Company means the owner of the ship or any other organization or person such as the manager, or the bareboat charterer, who has assumed the responsibility for operation of the ship from the owner of the ship and who on assuming such responsibility has agreed to take over all the duties and responsibilities imposed by the International Safety Management Code.
3. Oil tanker means an oil tanker as defined in regulation II-1/2.22.
4. Chemical tanker means a chemical tanker as defined in regulation VII/8.2.
5. Gas carrier means a gas carrier as defined in regulation VII/11.2.
6. Bulk carrier means a ship which is constructed generally with single deck, top-side tanks and hopper side tanks in cargo spaces, and is intended primarily to carry dry cargo in bulk, and includes such types as ore carriers and combination carriers.

   (*Refer to resolution MSC.79(70) relating to interpretation of provisions of SOLAS chapter XII on additional safety measures for bulk carriers.*)
7. Mobile offshore drilling unit (MODU) means a vessel capable of engaging in drilling operations for the exploration for or exploitation of resources beneath the sea-bed such as liquid or gaseous hydrocarbons, sulphur or salt.
8. High-speed craft means a craft as defined in regulation X/1.

App.5.2. SOLAS Chapter XII – Regulation 1

The second definition of a bulk carrier is given in the following SOLAS regulation

SOLAS - International Convention for the Safety of Life at Sea

Chapter XII - Additional safety measures for bulk carriers

Regulation 1 - Definitions

. For the purpose of this chapter:

1. Bulk carrier means a ship which is intended primarily to carry dry cargo in bulk, including such types as ore carriers and combination carriers.

   Reference is made to:

For ships constructed before 1 July 2006, resolution 6, Interpretation of the definition of bulk carrier, as given in chapter IX of SOLAS 1974, as amended in 1994, adopted by the 1997 SOLAS Conference.

The Interpretation of the provisions of SOLAS chapter XII on Additional safety measures for bulk carriers, adopted by the Maritime Safety Committee of the Organization by resolution MSC.79(70).

The application provisions of Annex 1 to the Interpretation of the provisions of SOLAS chapter XII on Additional safety measures for bulk carriers, adopted by the Maritime Safety Committee of the Organization by resolution MSC.89(71).

2. Bulk carrier of single-side skin construction means a bulk carrier as defined in paragraph 1, in which:

.1. any part of a cargo hold is bounded by the side shell; or

.2. where one or more cargo holds are bounded by a double-side skin, the width of which is less than 760 mm in bulk carriers constructed before 1 January 2000 and less than 1,000 mm in bulk carriers constructed on or after 1 January 2000 but before 1 July 2006, the distance being measured perpendicular to the side shell.

Such ships include combination carriers in which any part of a cargo hold is bounded by the side shell.

3. Bulk carrier of double-side skin construction means a bulk carrier as defined in paragraph 1, in which all cargo holds are bounded by a double-side skin, other than as defined in paragraph 2.2.

4. Double-side skin means a configuration where each ship side is constructed by the side shell and a longitudinal bulkhead connecting the double bottom and the deck. Hopper side tanks and top-side tanks may, where fitted, be integral parts of the double-side skin configuration.

5. Length of a bulk carrier means the length as defined in the International Convention on Load Lines in force.

6. Solid bulk cargo means any material, other than liquid or gas, consisting of a combination of particles, granules or any larger pieces of material, generally uniform in composition, which is loaded directly into the cargo spaces of a ship without any intermediate form of containment.

7. Bulk carrier bulkhead and double bottom strength standards means "Standards for the evaluation of scantlings of the transverse watertight vertically corrugated bulkhead between the two foremost cargo holds and for the evaluation of allowable hold loading of the foremost cargo hold" adopted by resolution 4 of the Conference of Contracting Governments to the International Convention for the Safety of Life at Sea, 1974 on 27 November 1997, as may be amended by the Organization, provided that such amendments are adopted, brought into force and take effect in accordance with the provisions of article VIII of the present Convention concerning the amendment procedures applicable to the Annex other than chapter I.

8. Bulk carriers constructed means bulk carriers the keels of which are laid or which are at a similar stage of construction.

9. A similar stage of construction means the stage at which:

.1. construction identifiable with a specific ship begins; and

.2. assembly of that ship has commenced comprising at least 50 tonnes or one per cent of the estimated mass of all structural material, whichever is less.

10. Breadth (B) of a bulk carrier means the breadth as defined in the International Convention on Load Lines in force.

App.5.3. Resolution MSC.79(70)

Resolution MSC.79(70)

Interpretation of the Provisions of SOLAS Chapter XII on Additional Safety Measures for Bulk Carriers - (adopted on 11 December 1998)

The Maritime Safety Committee

. RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

. NOTING that the 1997 SOLAS Conference adopted new *chapter XII* of the International Convention for the Safety of Life at Sea (SOLAS), 1974 concerning additional safety measures for bulk carriers,

. NOTING FURTHER that SOLAS *chapter XII* is expected to enter into force on 1 July 1999,

. DESIRING to ensure that all Contracting Governments to the 1974 SOLAS Convention implement SOLAS *chapter XII* in a consistent and uniform manner,

. RECOGNIZING, therefore, the need to establish, for that purpose, guidance on applications of, and the interpretation to, the relevant provisions of that chapter,

. RESPONDING to the requests of the 1997 SOLAS Conference, as recorded in Conference resolutions 6 and 8 thereof,

1.. URGES Governments concerned to:

.1. ensure that bulk carriers to which SOLAS *chapter XII* applies are clearly identified as such, either on the Safety Management Certificate issued under the provisions of SOLAS *chapter IX*, or in the booklet required under the provisions of SOLAS *regulation XII/8*;

.2. further ensure that where the identification of "bulk carrier" on the Safety Management Certificate issued under the provisions of SOLAS *chapter IX* is in question, the interpretation of "bulk carrier" contained in resolution 6 of the 1997 SOLAS Conference be accepted for the issuance and verification of compliance with chapter IX;

.3. ensure that ships to which SOLAS *regulation XII/4.2* applies are not permitted to be subject to the provisions of SOLAS *regulation XII/9* by means of modifications that would render non watertight one or more watertight transverse bulkheads; and

.4. interpret the provisions of SOLAS *regulation XII/10.2* as follows:

"For bulk carriers of 150 m in length and upwards of single side skin construction constructed before 1 July 1999, any cargo carried on or after the implementation date specified in regulation 3 and declared to have a density within the range of 1250 to 1780 kg/m^3 shall have its density verified by an accredited testing organization, unless such bulk carriers comply with all the relevant requirements of this chapter applicable to be carriage of solid bulk cargoes having a density of 1780 kg/m^3 and above."; and

2.. INVITES Governments concerned to bring the contents of this resolution to the attention of all parties concerned.

App.5.4. SOLAS/CONF.4 – Resolution 6

SOLAS/CONF.4

Resolutions of the Conference of Contracting Governments to the International Convention for the Safety of Life at Sea, 1974 - (November 1997)

Resolution 6 - Interpretation of the definition of "bulk carrier", as given in chapter IX of SOLAS 1974, as amended in 1994 - (Adopted on 27 November 1997) - The Conference

The Conference,

. HAVING ADOPTED amendments to the International Convention for the Safety of Life at Sea (SOLAS), 1974, as amended, concerning the safety of bulk carriers.

. NOTING that SOLAS chapter IX will enter into force on 1 July 1998,

. NOTING ALSO that bulk carriers will have to comply with the requirements of SOLAS chapter IX by 1 July 1998,

. NOTING FURTHER that the expected entry into force of the new SOLAS chapter XII on 1 July 1999 will make new requirements mandatory for bulk carriers,

. RECOGNIZING that a number of SOLAS Contracting Governments have identified certain ambiguities in the definition of the term "bulk carrier", as given in SOLAS regulation IX/1.6, causing diverging interpretations of this term,

. RECOGNIZING FURTHER the need to establish, for the purpose of the application of the new SOLAS chapter XII, guidance to Contracting Governments and to the industry as to which ships are subject to the new requirements,

. BEING AWARE of the urgent need to establish, for the purpose of the application of SOLAS chapter IX on 1 July 1998, a clear guidance to Contracting Governments and to the industry as to which specific ships are subject to the requirements of the International Safety Management (ISM) Code,

. DESIRING to ensure that all Contracting Governments should implement the ISM Code and the new SOLAS chapter XII in their capacity as flag State or as port State exercising control under the provisions of the

Convention, in a consistent, systematic and harmonized manner, with a view of facilitating international seaborne trade,

. CONSCIOUS of the fact that SOLAS chapter IX should be applied taking into account Conference resolution 9, as soon as possible,

1.. URGES SOLAS Contracting Governments to interpret the definition of the term "bulk carrier", given in regulation IX/1.6, for the purpose of the application of SOLAS regulation IX/2.1.2 and chapter XII to mean:

- ships constructed with single deck, top-side tanks and hopper side tanks in cargo spaces and intended primarily to carry dry cargo in bulk; or
- ore carriers[1]; or
- combination carriers[2];

2.. INVITES the Maritime Safety Committee of the International Maritime Organization to consider, as soon as possible:

(a). actions necessary to remove the ambiguity which exists in the definition of the term "bulk carrier" as given in SOLAS regulation IX/1.6; and

(b). any other appropriate action which will facilitate the easy identification of the type of ship by SOLAS Contracting Governments when exercising their rights of control under the provisions of that Convention.

App.5.5. UR Z10.2- Rev. 27 (March 2009)

The following excerpt gives the definitions of bulk carriers as per IACS UR Z10.2 - *Hull Surveys of Bulk Carriers*:

1.2 Definitions

1.2.1 Bulk Carrier

A Bulk Carrier is a ship which is constructed generally with single deck, topside tanks and hopper side tanks in cargo spaces, and is intended primarily to carry dry cargo in bulk.
Combination carriers are included[3].

1.2.2 Double Skin Bulk Carrier

A Double Skin Bulk Carrier is a ship which is constructed generally with single deck, topside tanks and hopper side tanks in cargo spaces, and is intended primarily to carry dry cargo in bulk, including such types as ore carriers and combination carriers[4], in which all cargo holds are bounded by a double-side skin (regardless of the width of the wing space).

[1] *Ore carrier* means a sea-going single-deck ship having two longitudinal bulkheads and a double bottom throughout the cargo region and intended for the carriage of ore cargoes in the centre holds only

[2] *Combination carrier* has the same meaning as in SOLAS regulation II-2/3.27.

[3] For single skin combination carriers additional requirements are specified in UR Z10.1.

[4] For combination carriers with longitudinal bulkheads additional requirements are specified in UR Z10.1 or UR Z10.4, as applicable.

App.5.6. **UR Z10.5- Rev. 9 (March 2009)**

The following excerpt gives the definitions of bulk carriers as per IACS UR Z10.5 - *hull surveys of double skin bulk carriers*:

1.2 Definitions

1.2.1 Double Skin Bulk Carrier

A Double Skin Bulk Carrier is a ship which is constructed generally with single deck, top-side tanks and hopper side tanks in cargo spaces, and is intended primarily to carry dry cargo in bulk, including such types as ore carriers and combination carriers1), in which all cargo holds are bounded by a double-side skin (regardless of the width of the wing space).

Appendix 6. KC 1082 related documents

App.6.1. SOLAS Chapter IX – Regulation 1

MSC 82/24/Add.1

ANNEX 9

RESOLUTION MSC.223(82)

(adopted on 8 December 2006)

ADOPTION OF AMENDMENTS TO THE PROTOCOL OF 1988 RELATING TOTHE INTERNATIONAL CONVENTION ON LOAD LINES, 1966, AS AMENDEDTHE MARITIME SAFETY COMMITTEE,

RECALLING Article 28(b) of the Convention on the International Maritime Organization concerning the functions of the Committee,

RECALLING FURTHER article VI of the Protocol of 1988 relating to the International Convention on Load Lines, 1966 (hereinafter referred to as the "1988 Load Lines Protocol") concerning amendment procedures,

HAVING CONSIDERED, at its eighty-second session, amendments to the 1988 Load Lines Protocol proposed and circulated in accordance with paragraph 2(a) of article VI thereof,

1. ADOPTS, in accordance with paragraph 2(d) of article VI of the 1988 Load Lines Protocol, amendments to the 1988 Load Lines Protocol, the text of which is set out in the Annex to the present resolution;

2. DETERMINES, in accordance with paragraph 2(f)(ii)(bb) of article VI of the 1988 Load Lines Protocol, that the said amendments shall be deemed to have been accepted on 1 January 2008, unless, prior to that date, more than one third of the Parties to the 1988 Load Lines Protocol or Parties the combined merchant fleets of which constitute not less than 50% of the gross tonnage of the world's merchant fleet, have notified their objections to the amendments;

3. INVITES the Parties concerned to note that, in accordance with paragraph 2(g)(ii) of article VI of the 1988 Load Lines Protocol, the amendments shall enter into force on 1 July 2008 upon their acceptance in accordance with paragraph 2 above;

4. REQUESTS the Secretary-General, in conformity with paragraph 2(e) of article VI of the 1988 Load Lines Protocol, to transmit certified copies of the present resolution and the text of the amendments contained in the Annex to all Parties to the 1988 Load Lines Protocol;

5. FURTHER REQUESTS the Secretary-General to transmit copies of this resolution and its Annex to Members of the Organization, which are not Parties to the 1988 Load Lines Protocol.

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MSC 82/24/Add.1
ANNEX 9
Page 2

ANNEX

AMENDMENTS TO THE PROTOCOL OF 1988 RELATING TO THE INTERNATIONAL CONVENTION ON LOAD LINES, 1966, AS AMENDED

ANNEX B
ANNEXES TO THE CONVENTION AS MODIFIED BY THE PROTOCOL OF 1988 RELATING THERETO

ANNEX I
REGULATIONS FOR DETERMINING LOAD LINES

CHAPTER II
CONDITIONS OF ASSIGNMENT OF FREEBOARD

Regulation 22 – Scuppers, inlets and discharges

1 In paragraph (4) of the regulation, the reference to “(2)” is replaced by reference to “(1)”.

CHAPTER III
FREEBOARDS

Regulation 39 – Minimum bow height and reserve buoyancy

2 In paragraph (1) of the regulation, the words “dl is the draught at 85% of the depth D, in metres;” are replaced by the words “dl is the draught at 85% of the least moulded depth, in metres;”.

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