Polski Rejestr Statków

RULES

AMENDMENTS NO. 2/2012

to

PUBLICATION NO. 84/P

**REQUIREMENTS CONCERNING THE CONSTRUCTION
AND STRENGTH OF THE HULL AND HULL EQUIPMENT
OF SEA-GOING BULK CARRIERS OF 90 M IN LENGTH AND ABOVE**

2009

GDAŃSK

Amendments No. 2/2012 to *Publication No. 84/P – Requirements Concerning the Construction and Strength of the Hull and Hull Equipment of Sea-going Bulk Carriers of 90 m in Length and above – 2009,* were approved by PRS Board on 29 June 2012 and enter into force on 1 July 2012.

The following amendments to Publication No. 84/P – Requirements Concerning the Construction and Strength of the Hull and Hull Equipment of Sea-going Bulk Carriers of 90 m in Length and above – 2009, have been introduced: *In CONTENTS, the titles of paragraphs* **3.6.7** *and* **3.6.8** *have been amended to read:*

3.6.7   Double side structure in cargo hold area
3.6.8   Single side structure in cargo hold area

2.   *In CONTENTS, the paragraph* **6.4.5** *has been added:*

6.4.5   Flooding check of primary supporting members

3.   *In paragraph* **1.4.3.4**, *at the end, the following definitions have been added:*

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.

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

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.1.4.3.4-2): 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.1.4.3.4-3): from the start of the curvature at the lower turn of the bilge on the bottom to the lesser of:
  a)   a point on the side shell located $0.2D$ above the baseline/local center-line elevation,
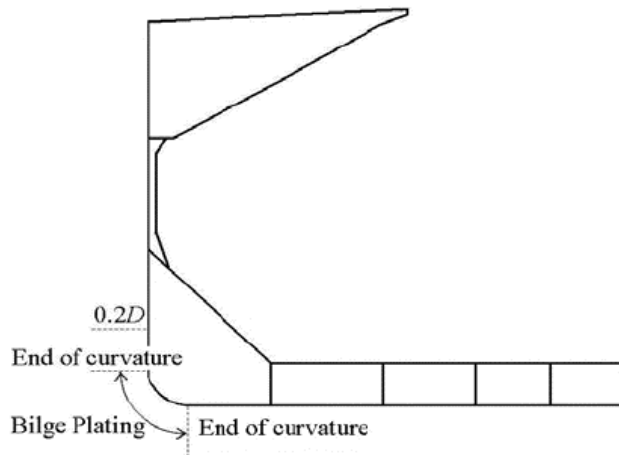 b)   the end of the curvature at the upper turn of the bilge.

Figure 1.4.3.4-2 Vertical extent of bilge plating within the cylindrical part of the hull
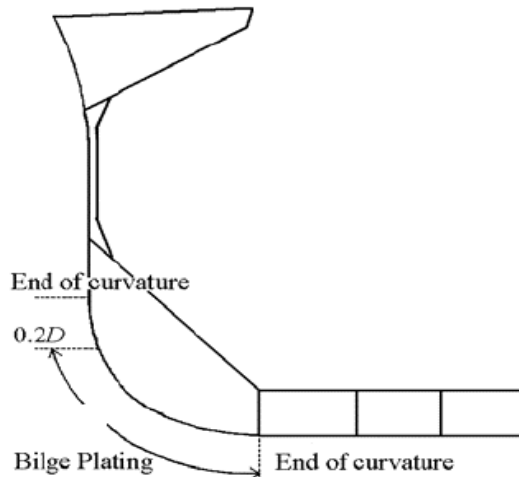

Figure 1.4.3.4-3 Vertical extent of bilge plating outside the cylindrical part of the hull

4. *Figure 1.4.3.4 has been renumbered to 1.4.3.4-1 and its reference in the defi-nition of "Raised quarterdeck" has been altered accordingly.*

5. *Paragraph* **2.1.2.1.1** *has been amended to read:*

A collision bulkhead is to be fitted which is to be watertight up to the bulk-head deck. This bulkhead is to be located at a distance from the forward perpendicular FP_{LL} of not less than $0.05L_{LL}$ or 10 m, whichever is the less, and, except as may be permitted by PRS, not more than $0.08L_{LL}$ or $0.05L_{LL} + 3$ m, whichever is the greater.

6. Sub-chapter **2.1.3** *has been amended to read:*

2.1.3   After peak, machinery space bulkheads and stern tubes

2.1.3.1   General

2.1.3.1.1   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.

2.1.3.1.2   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.

2.1.3.1.3   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.

2.1.3.1.4   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.

2.1.3.1.5   Sterntubes are to 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 sterntube arrangements may be taken at the discretion of the society (SOLAS, ch. II-1, Part B-2, Reg. 12).

7. *Paragraph* **2.2.2.1.3** *has been deleted.*

8. *In paragraph* **2.2.5.1.1**, *the definition of* "T_1" *has been amended to read:*

T_1 – draught at 85% of the least moulded depth, [m]

and the definition of "D_1" *has been deleted.*

9. *The title of sub-chapter* **2.3.2.8** *has been amended to read:*

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

10. *The title of sub-chapter* **2.3.2.9** *has been amended to read:*

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

11. *The title of sub-chapter* **2.3.2.10** *has been amended to read:*

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

12. *The title of sub-chapter* **2.3.2.11** *has been amended to read:*

2.11   Access to top side ballast tanks

13. *In paragraph* **3.3.1.2.1,** *the following entry has been added before the last indention:*

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

14. *Paragraph* **3.5.1.2.2** *has been amended to read:*

3.5.1.2.2   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 coating of internal spaces subject to the amended *SOLAS* regulation are to satisfy the requirements of the IMO performance standard.

For ships contracted 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 PRS.

Consistent with IMO Resolution A.798(19) and IACS UI SC 122, the selection of the coating system, including coating selection, specification and inspection plan, are to be agreed between the shipbuilder, coating system supplier and the owner, in consultation with PRS, prior to commencement of construction. The specification for the coating system for these spaces is to be documented and this documentation is to be verified by PRS and is to be in full compliance with the coating performance standard.

The shipbuilder is to demonstrate that the selected coating system with associated surface preparation and application methods is compatible with the manufacturing processes and methods.

The attending surveyor of PRS will not verify the application of the coatings but will review the reports of the coating inspectors to verify that the specified shipyard coating procedures have been followed.

15. *Paragraph* **3.6.1** *has been amended to read:*

3.6.1   Application

If not specified otherwise, the requirements of this section apply to the hull structure except superstructures and deckhouses. For areas outside the cargo holds area, supplementary requirements are to be found in sub-chapters 9.1 to 9.3.

16. *In paragraph* **3.6.2.3.1***, the last sentence has been amended to read:*

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

17. *In paragraph* **3.6.4.1.1**, *the text before the first formula has been amended to read:*

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:

18. *Paragraph* **3.6.5.2.1** *has been amended to read:*

3.6.5.2.1   Webs of primary supporting members are to be stiffened where the height, in mm, is greater than $100t$, where t is the net web thickness, in mm, of the primary supporting member.

In general, the web stiffeners of primary supporting members are to be spaced not more than $110t$.

The net thickness of web stiffeners and brackets are not to be less than the value obtained from the following formula:

$$t = 3 + 0.015L_2 , \text{[mm]} \hspace{3cm} (3.6.5.2.1)$$

where:

L_2 – rule length L, but to be taken not greater than 300 m;

Additional stiffeners are to be fitted in way of end brackets, at the connection with cross ties, etc. of transverse primary supporting members where shearing stress and/or compressive stress is expected to be high. These parts are not to have holes. Cut outs for penetration of ordinary stiffeners in these parts are to be reinforced with collar plates.

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 6.2.2.3.1, 6.2.4 and 6.3.4.

19. Paragraph **3.6.5.4.1** has been amended to read:

3.6.5.4.1   General

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 determined according to 3.6.4.3.1.

20. *In paragraph* **3.6.6.1.3**, *instead of the first sentence the following text has been inserted:*

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:

$$h = B/20 \qquad\qquad (3.6.6.1.3)$$

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.

21. *The title of paragraph* **3.6.7** *has been amended to read:*

3.6.7 Double side structure in cargo hold area

22. *The title of paragraph* **3.6.8** *has been amended to read:*

3.6.8 Single side structure in cargo hold area

23. *Paragraph* **3.6.9.2.3** *has been amended to read:*

3.6.9.2.3 Inside the line of openings, a transversely framed structure is to be generally adopted for the cross deck structures. Hatch end beams and cross deck beams are to be adequately supported by girders and extended outward to the second longitudinal from the hatch side girders towards 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 Chapter 7 or by means deemed appropriate by PRS.

Smooth connection of the strength deck at side with the deck between hatches is to be ensured by a plate of intermediate thickness.

24. *Paragraph* **3.6.10.5.1** *has been amended to read:*

3.6.10.5.1 Non-tight bulkheads not acting as pillars

Non-tight bulkheads not acting as pillars are to be provided with bulkhead stiffeners with a maximum spacing equal to:
– 0.9 m, for transverse bulkheads,
– two frame spacings, with a maximum of 1.5 m, for longitudinal bulkheads.

The depth of bulkhead stiffener is not to be less than 1/12 of stiffener length.

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

$$t = 3 + 0.015 L_2 \text{, [mm]} \qquad\qquad (3.6.10.5.1)$$

where:
L_2 – rule length L, but not to be taken greater than 300 m.

The net thickness of bulkhead stiffener of flat bar type is in general not to be less than 1/12 of the stiffener length.

A smaller depth of stiffener may be accepted based on calculations showing compliance with 6.2.2.3.1, 6.2.4 and 6.3.4.

25. *In paragraph* **4.5.4.1.1**, *the definition of "p_s, p_w" has been amended to read:*

p_s, p_w – hydrostatic pressure and maximum hydrodynamic pressures among load cases H, F, R and P at considered point of the hull in normal ballast condition. Minimum ballast draught in ballast condition T_B defined in 1.4.2.1.1 is to be considered as T_{LCi} for the calculation of hydrostatic pressure and hydrodynamic pressures.

26. *In* **Table 4.6.4.1.1**, *the lowest cell has been amended to read:*

Compartment or structure to be tested	Testing load height, [m]
where: z_{ml} – Z co-ordinate of the bulkhead deck at side, [m]; z_h – Z co-ordinate of the top of hatch coaming, [m]; z_F – as defined in 4.6.3.2.1; z_{fd} – Z co-ordinate of the freeboard deck, [m]; p_{PV} – setting pressure of safety valves, [bar].	

27. *In* **Table 5.1.2.2.2**, *the content of the first column has been amended to read:*

Ship typology
Single side skin construction
Double side skin construction

28. *In paragraph* **6.1.3.2.3**, *the definition of resultant pressure "p" has been amended to read:*

p – pressure p_F or resultant pressure p, as defined in 4.6.3.3.6 and 4.6.3.3.7 respectively, [kN/m^2];

29. *In paragraph* **6.2.3.6.1**, *the definitions of "F" and "p_G" have been amended to read:*

F – force F_F or resultant F, to be calculated according to 4.6.3.3.6 and 4.6.3.3.7 respectively, [kN];

p_G – pressure p_F or p, to be calculated in way of the middle of the shedders or gusset plates, as applicable, according to 4.6.3.3.6 and 4.6.3.3.7 respectively, [kN/m^2];

30. *Equation 6.2.4.1.3-2 has been amended to read:*

$$\sigma = K_{con} K_{longi} K_{stiff} \frac{\Delta\sigma}{\cos\theta} \text{, [N/mm}^2\text{]} \qquad (6.2.4.1.3-2)$$

31. *In paragraph* **6.3.4.2.2,** *the definitions of "W_{st}" and "w" have been amended to read:*

W_{st} – net section modulus of stiffener (longitudinal or transverse), [cm^3], including effective width of plating according to 6.3.5, taken equal to:
   i) 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 snipped at both ends, W_{st} is the net section modulus calculated at attached plate. However, if M_1 is larger that M_0 and the lateral pressure is applied on the same side as the stiffener, W_{st} is the net section modulus calculated at flange.
   ii) 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 snipped at both ends, W_{st} is the net section modulus calculated at attached plate.

$w = w_0 = w_1$ generally

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

32. *In paragraph* **6.3.4.2.3**, *the first sentence has been amended to read:*

Longitudinal and transverse ordinary stiffeners not subjected to lateral pressure, except for snipped stiffeners, are considered as complying with the requirement of 6.3.4.2.1 if their net moments of inertia I_x and I_y, are not less than the value obtained from the following formula:

33. *Sub-chapter* **6.4.1.6** *has been added:*

6.4.1.6   Flooding check of primary supporting members

6.4.1.6.1   General

Flooding check of primary supporting members is to be carried out according to the requirements in 6.4.5.

34. Sub-chapter **6.4.5** has been added:

6.4.5 Flooding check of primary supporting members

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

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

$$w = \frac{p_F s l^2}{16 \alpha \lambda_S R_Y}, \text{[cm}^3\text{]} \tag{6.4.5.1.1-1}$$

$$A_{sh} = \frac{5 p_F s l}{\alpha \tau_a \sin \phi}, \text{[cm}^2\text{]} \tag{6.4.5.1.1-2}$$

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 Table 6.4.2.6.3-1, determined by considering σ_x in flooded condition;

p_F – pressure, in flooded conditions, defined in 4.6.3.2.1, [kN/m^2].

35. In **Table 7.3.2.1.2**, the content of the second column for the first two items has been amended to read:

Area of interest
Most stressed transverse primary supporting member for double side skin construction
Most stressed transverse primary supporting member for single side skin constructions

36. In paragraph **8.1.1.3.1**, the first sentence has been amended to read:

Fatigue strength is to be assessed, in cargo hold area, for all the connected members at the considered locations described in Table 8.1.1.3.1.

37. In paragraph **8.4.2.3.5**, the definition of "$p_{CW, ij(k)}$" has been amended to read:

$p_{CW, ij(k)}$ – inertial pressure due to dry bulk cargo specified in 4.6.1.3 for a cargo density ρ_C specified in 4.11 and with $f_p = 0.5$ in load case "$i1$" and "$i2$" for loading condition "(k)", [kN/m^2].

38. *In paragraph* **8.6.2.5.1**, *the first sentence has been amended to read:*

For 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 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).

39. *In paragraph* **9.1.0**, *the definitions of "m"," s" and "l" have been amended to read:*
    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 of ordinary stiffeners or primary supporting members, measured at mid-span along the chord, [m];
    l – span of ordinary stiffeners or primary supporting members, measured along the chord between the supporting members, see 3.6.4.2 or 3.6.5.3 respectively, [m];

40. *Paragraph* **9.1.1.1.2** *has been added:*

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 Chapter 6.

41. *Paragraph* **9.1.2.3.2** *has been amended to read:*

9.1.2.3.2   Solid floors

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 3.5 m 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 PRS.

42. *Paragraph* **9.1.2.3.3** *has been amended to read:*

9.1.2.3.3   Bottom girders

In case of transverse framing, the spacing of bottom girders is not to exceed 2.5 m.
In case of longitudinal framing, the spacing of bottom girders is not to exceed 3.5 m.
Larger spacing of bottom girders may be accepted, provided that the structure is verified by means of FEA deemed appropriate by PRS.

43. **Table 9.1.4.2.1-1** *has been amended to read:*

Table 9.1.4.2.1-1
Net minimum thickness of plating

Minimum net thickness, [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	$0.6L^{1/2}$

44. *Paragraph* **9.1.4.4.4** *has been amended to read:*

9.1.4.4.4 Deck primary supporting members

The net scantlings of deck primary supporting members are to be not less than those obtained from the formulae in Table 9.1.4.4.4. The design pressures in the formulae are taken from intact conditions and testing conditions respectively as stated in 9.1.3.2. For a complex deck structure, a calculation deemed appropriate by PRS may be carried out in lieu of the formulae.

Table 9.1.4.4.4
Net scantlings of deck primary supporting members

Condition	Net section modulus w, [cm^3]	Net sectional shear area A_{sh}, [cm^2]
Primary supporting members subjected to lateral pressure in intact condition	$w = \dfrac{(p_S + p_W)sl^2}{0.9mR_Y}10^3$	$A_{sh} = \dfrac{5(p_S + p_W)sl}{\tau_a \sin\phi}$
Primary supporting members subjected to lateral pressure in testing conditions	$w = \dfrac{p_T sl^2}{1.05mR_Y}10^3$	$A_{sh} = \dfrac{5 p_T sl}{1.05\tau_a \sin\phi}$
where: ϕ – angle, [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.		

45. *In sub-chapter* **9.1.5**, *the word "flat" has been deleted entirely.*

46. *In paragraph* **9.2.0**, *the definitions of " m", "s" and "l" have been amended to read:*

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 of ordinary stiffeners or primary supporting members, measured at mid-span along the chord, [m];

l – span of ordinary stiffeners or primary supporting members, measured along the chord between the supporting members, see 3.6.4.2 or 3.6.5.3 respectively, [m];

47. **Table 9.2.4.1.1-1** *has been amended to read:*

Table 9.2.4.2.1-1
Net minimum thickness of plating

Minimum net thickness, [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	$0.6L^{1/2}$

48. *Paragraph* **9.2.4.3.4** *has been amended to read:*

9.2.4.3.4   Deck primary supporting members

The net scantlings of deck primary supporting members are to be not less than those obtained from the formulae in Table 9.2.4.3.4. The design pressures in the formulae are taken from intact conditions and testing conditions respectively as stated in 9.2.2.2. For a complex deck structure, a calculation deemed appropriate by PRS may be carried out in lieu of the formulae.

Table 9.2.4.3.4
Net scantlings of deck primary supporting members

Condition	Net section modulus w, [cm^3]	Net sectional shear area A$_{sh}$, [cm^2]
Primary supporting members subjected to lateral pressure in intact condition	$$w = \frac{(p_S + p_W)sl^2}{0.9mR_Y}10^3$$	$$A_{sh} = \frac{5(p_S + p_W)sl}{\tau_a \sin\phi}$$
Primary supporting members subjected to lateral pressure in testing conditions	$$w = \frac{p_T sl^2}{1.05mR_Y}10^3$$	$$A_{sh} = \frac{5p_T sl}{1.05\tau_a \sin\phi}$$
where: ϕ – angle, [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.		

49. *In paragraph* **9.3.2.1.5,** *the last sentence has been amended to read:*

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.

50. *Sub-chapter* **9.5.4.2** *has been amended to read:*

9.5.4.2   Load point

9.5.4.2.1   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.

9.5.4.2.2   Other pressures

The lateral pressure is to be calculated:
i)   in way of the geometrical centre of gravity of the plate panel, for plating,
ii)   at mid-span, for ordinary stiffeners and primary supporting members
    Internal dynamic lateral pressure to be considered as acting on the bottom of a hatch cover is to be calculated at a point located:
i)   longitudinally, at the hatch cover mid-length,
ii)   transversely, at hatchway side,
iii) vertically, at the top of the hatch coaming for internal ballast water pressure.

51. *Sub-paragraphs* **10.1.5.1.4 i)** *and* **10.1.5.1.4 iv)** *have been amended to read:*

i) bending stress due to M_R:
$\sigma_b = 75$ N/mm^2,

iv) equivalent stress due to bending and shear and equivalent stress due to bending and torsion:

$$\sigma_{v1} = \sqrt{\sigma_b^2 + 3\tau^2} = 100 \text{ N/mm}^2$$

$$\sigma_{v2} = \sqrt{\sigma_b^2 + 3\tau_t^2} = 100 \text{ N/mm}^2$$

52. *Paragraph* **11.2.2.2.2** *has been amended to read:*

11.2.2.2.2 Welding of plates with different thickness

In the case of welding of plates with a difference in as-built thickness 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.

53. *In paragraph* **11.2.2.4.1**, *the last item has been amended to read:*

– abutting plate panels with as-built thickness less than or equal to 12 mm, forming boundaries to the sea below the summer load water line. For as-built thickness greater than 12 mm, deep penetration weld with a maximum root face length $f = T/3$ is acceptable (see Fig. 11.2.2.5.1).

54. *In* **Table 11.3.3.1.1**, *the row for item 4 has been amended to read:*

4	Ballast holds	Structural testing[1]	The greater of i) top of over-flow, or ii) top of hatch coaming	