RULES

AMENDMENTS No. 1/2010

to

PUBLICATION NO. 84/P

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

2010

GDAŃSK
Amendments No. 1/2010 to *Publication No. 84/P – Requirements Concerning the Construction and Strength of the Hull and Hull Equipment of Sea-going Bulk Carriers of 90m in Length and above – 2009*, were approved by PRS Board on 24 June 2010 and enter into force on 1 July 2010.

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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 90m in Length and above – 2009, have been introduced:

1. **Paragraph 1.3.2.5.1 has been amended to read:**

   **1.3.2.5.1** Ship structures subject to overall and close-up inspection and thickness measurements are to be provided with means capable of ensuring safe access to the structures. The means of access are to be described in a Ship Structure Access Manual for bulk carriers of 20,000 gross tonnage and over. Reference is made to SOLAS, Chapter II-1, Regulation 3-6.

2. **Paragraph 1.4.3.3 has been amended to read:**

   **1.4.3.3** Ship’s light- and deadweight

   **Lightweight, [t]** – the displacement without cargo, fuel, lubricating oil, ballast water, fresh water and feed water, consumable stores and passengers and crew and their effects.

   **Deadweight, [t]** – the difference between the displacement, at the summer draught in sea water of density $\rho = 1.025 \, \text{t/m}^3$, and the lightweight.

3. **The beginning of sub-chapter 2.3 has been amended to read:**

   **2.3** Access arrangement

   **2.3.1** General

   **2.3.1.0** Application

   **2.3.1.0.1** This section applies to ships of 20,000 gross tonnage and over.

   **2.3.1.1** Means of access to cargo and other spaces

   **2.3.1.1.1** Each space is to be provided with means of access to enable, throughout the life of a ship, overall and close-up inspections and thickness measurements of the ship’s structures. Such means of access are to comply with 2.3.1.3 and 2.3.2.

   **2.3.1.1.2** Where a permanent means of access may be susceptible to damage during normal cargo loading and unloading operations or where it is impracticable to fit permanent means of access, the Administration may allow, in lieu thereof, the provision of movable or portable means of access, as specified in 2.3.2, provided that the means of attaching, rigging, suspending or supporting the portable means of access forms a permanent part of the ship’s structure. All portable equipment are to be capable of being readily erected or deployed by ship’s personnel.
2.3.1.1.3 The construction and materials of all means of access and their attachment to the ship’s structure are to be to the satisfaction of PRS

4. *Sub-chapter 3.1.2.3 has been amended to read:*

3.1.2.3 Grades of steel

3.1.2.3.1 Steel materials in the various strength members are not to be of lower grade than those corresponding to classes I, II and III, as given in Table 3.1.2.3.5-1 for the material classes and grades given in Table 3.1.2.3.1-1 while additional requirements for ships with length $L$ exceeding 150m and 250m, BC-A and BC-B ships are given in Tables 3.1.2.3.1-2 to 3.1.2.3.1-4. For strength members not mentioned in Tables 3.1.2.3.1-1 to 3.1.2.3.1-4, grade $A/AH$ may be used.

**Table 3.1.2.3.1-1**

<table>
<thead>
<tr>
<th>Structural member category</th>
<th>Material class/grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>SECONDARY</td>
<td></td>
</tr>
<tr>
<td>A1 Longitudinal bulkhead strakes, other than that belonging to the Primary category</td>
<td>– Class I within $0.4L$ amidships</td>
</tr>
<tr>
<td>A2 Deck plating exposed to weather, other than that belonging to the Primary or Special category</td>
<td>– Grade $A/AH$ outside $0.4L$ amidships</td>
</tr>
<tr>
<td>A3 Side plating</td>
<td></td>
</tr>
<tr>
<td>PRIMARY</td>
<td></td>
</tr>
<tr>
<td>B1 Bottom plating, including keel plate</td>
<td>– Class I within $0.4L$ amidships</td>
</tr>
<tr>
<td>B2 Strength deck plating, excluding that belonging to the Special category</td>
<td>– Grade $A/AH$ outside $0.4L$ amidships</td>
</tr>
<tr>
<td>B3 Continuous longitudinal members above strength deck, excluding hatch coamings</td>
<td></td>
</tr>
<tr>
<td>B4 Uppermost strake in longitudinal bulkhead</td>
<td></td>
</tr>
<tr>
<td>B5 Vertical strake (hatch side girder) and uppermost sloped strake in top wing tank</td>
<td></td>
</tr>
<tr>
<td>SPECIAL</td>
<td></td>
</tr>
<tr>
<td>C1 Sheer strake at strength deck $^{(1)}$</td>
<td>– Class III within $0.4L$ amidships</td>
</tr>
<tr>
<td>C2 Stringer plate in strength deck $^{(1)}$</td>
<td>– Class II outside $0.4L$ amidships</td>
</tr>
<tr>
<td>C3 Deck strake at longitudinal bulkhead, excluding deck plating in way of inner-skin bulkhead of double-hull ships $^{(1)}$</td>
<td>– Class I outside $0.6L$ amidships</td>
</tr>
</tbody>
</table>
C5 Strength deck plating at corners of cargo hatch openings

C6 Bilge strake in ships with double bottom over the full breadth and length less than 150m \(^{(1)}\)

C7 Bilge strake in other ships \(^{(1)}\)

C8 Longitudinal hatch coamings of length greater than 0.15L

C9 End brackets and deck house transition of longitudinal cargo hatch coamings \(^{(2)}\)

(1) Single strakes required to be of class III within 0.4L amidships are to have breadths not less than 800 + 5L [mm], and need not be greater than 1800 mm, unless limited by the geometry of the ship’s design.

(2) Applicable to bulk carriers having the longitudinal hatch coaming of length greater than 0.15L.

<table>
<thead>
<tr>
<th>Structural member category</th>
<th>Material Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Longitudinal strength members of strength deck plating</td>
<td>Grade B/AH within 0.4L amidships</td>
</tr>
<tr>
<td>Continuous longitudinal strength members above strength deck</td>
<td>Grade B/AH within 0.4L amidships</td>
</tr>
<tr>
<td>Single side strakes for ships without inner continuous longitudinal bulkheads between bottom and the strength deck</td>
<td>Grade B/AH within cargo region</td>
</tr>
</tbody>
</table>
Table 3.1.2.3.1-3
Minimum material grades for ships with ship’s length $L$ exceeding 250m

<table>
<thead>
<tr>
<th>Structural member category</th>
<th>Material Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sheer strake at strength deck (1)</td>
<td>Grade $E/EH$ within $0.4L$ amidships</td>
</tr>
<tr>
<td>Stringer plate in strength deck (1)</td>
<td>Grade $E/EH$ within $0.4L$ amidships</td>
</tr>
<tr>
<td>Bilge strake (1)</td>
<td>Grade $D/DH$ within $0.4L$ amidships</td>
</tr>
</tbody>
</table>

(1) Single strakes required to be of class III within $0.4L$ amidships are to have breadths not less than $800 + 5L$ [mm], and need not be greater than $1800$ mm, unless limited by the geometry of the ship’s design.

Table 3.1.2.3.1-4
Minimum material grades for BC-A and BC-B ships

<table>
<thead>
<tr>
<th>Structural member category</th>
<th>Material Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower bracket of ordinary side frame (1), (2)</td>
<td>Grade $D/DH$</td>
</tr>
<tr>
<td>Side shell strakes included totally or partially between the two points located to $0.125 \ell$ above and below the intersection of side shell and bilge hopper sloping plate or inner bottom plate (2)</td>
<td>Grade $D/DH$</td>
</tr>
</tbody>
</table>

(1) Single strakes required to be of class III within $0.4L$ amidships are to have breadths not less than $800 + 5L$ [mm], and need not be greater than $1800$ mm, unless limited by the geometry of the ship’s design.

(2) The span of the side frame $\ell$ is defined as the distance between the supporting structure (see Fig 3.6.8.3.1).

3.1.2.3.2 Plating materials for stern frames, rudders, rudder horns and shaft brackets are in general not to be of lower grades than corresponding to class II. For rudder and rudder body plates subjected to stress concentrations (e.g. in way of lower support of semi-spade rudders or at upper part of spade rudders) class III is to be applied.

3.1.2.3.3 Bedplates of seats for propulsion and auxiliary engines inserted in the inner bottom within $0.6L$ amidships are to be of class I. In other cases, the steel is to be at least of grade $A/AH$.

3.1.2.3.4 (void)
3.1.2.3.5 The steel grade is to correspond to the as-built thickness.

<table>
<thead>
<tr>
<th>Class</th>
<th>I</th>
<th>II</th>
<th>III</th>
</tr>
</thead>
<tbody>
<tr>
<td>As-built thickness, [mm]</td>
<td>NSS</td>
<td>HSS</td>
<td>NSS</td>
</tr>
<tr>
<td>$t \leq 15$</td>
<td>$A$</td>
<td>$AH$</td>
<td>$A$</td>
</tr>
<tr>
<td>$15 &lt; t \leq 20$</td>
<td>$A$</td>
<td>$AH$</td>
<td>$A$</td>
</tr>
<tr>
<td>$20 &lt; t \leq 25$</td>
<td>$A$</td>
<td>$AH$</td>
<td>$B$</td>
</tr>
<tr>
<td>$25 &lt; t \leq 30$</td>
<td>$A$</td>
<td>$AH$</td>
<td>$D$</td>
</tr>
<tr>
<td>$30 &lt; t \leq 35$</td>
<td>$B$</td>
<td>$AH$</td>
<td>$D$</td>
</tr>
<tr>
<td>$35 &lt; t \leq 40$</td>
<td>$B$</td>
<td>$AH$</td>
<td>$D$</td>
</tr>
<tr>
<td>$40 &lt; t \leq 50$</td>
<td>$D$</td>
<td>$DH$</td>
<td>$E$</td>
</tr>
</tbody>
</table>

Notes: NSS : Normal strength steel
HSS : Higher strength steel

Table 3.1.2.3.5-2 (void)

3.1.2.3.6 Steel grades of plates or sections of as-built thickness greater than the limiting thicknesses in Table 3.1.2.3.5-1 are considered by PRS on a case by case basis.

3.1.2.3.7 In specific cases, such as 3.1.2.3.8, with regard to stress distribution along the hull girder, the classes required within $0.4L$ amidships may be extended beyond that zone, on a case by case basis.

3.1.2.3.8 The material classes required for the strength deck plating, the sheerstrake and the upper strake of longitudinal bulkheads within $0.4L$ amidships are to be maintained for an adequate length across the poop front and at the ends of the bridge, where fitted.

3.1.2.3.9 Rolled products used for welded attachments of length greater than $0.15L$ on hull plating, such as gutter bars, are to be of the same grade as that used for the hull plating in way.

3.1.2.3.10 In the case of full penetration welded joints located in positions where high local stresses may occur perpendicular to the continuous plating, PRS may, on a case by case basis, require the use of rolled products having adequate ductility properties in the through thickness direction, such as to prevent the risk of lamellar tearing (Z type steel).
5. The beginning of paragraph 3.3.1.2.1 has been amended to read:

3.3.1.2.1 Corrosion additions for steel

The corrosion addition for each of the two sides of a structural member, \( t_{C1} \) or \( t_{C2} \), is specified in Table 3.3.1.2.1.

The total corrosion addition \( t_C \) for both sides of the structural member is obtained by the following formula:

\[
t_C = \text{Roundup}_{0.5} (t_{C1} + t_{C2}) + t_{\text{reserve}}, \text{[mm]} \quad (3.3.1.2.1-1)
\]

For an internal member within a given compartment, the total corrosion addition \( t_C \) is obtained from the following formula:

\[
t_C = \text{Roundup}_{0.5} (2t_{C1}) + t_{\text{reserve}}, \text{[mm]} \quad (3.3.1.2.1-2)
\]

where \( t_{C1} \) is the value specified in Table 3.3.1.2.1 for one side exposure to that compartment.

6. Paragraph 3.6.9.5.4 has been amended to read:

3.6.9.5.4. For ships with holds designed for loading/discharging by grabs and having the additional class notation CG, wire rope grooving in way of cargo holds openings is to be prevented by fitting suitable protection such as half-round bar on the hatch side girders (i.e. upper portion of top side tank plates)/hatch end beams in cargo hold and upper portion of hatch coamings.

7. Paragraph 4.3.3.3.1 has been amended to read:

4.3.3.3.1 The horizontal wave bending moment \( M_{WH} \) at any hull transverse section is given by:

\[
M_{WH} = \left( 0.3 + \frac{L}{2000} \right) F_M f_p C L^2 T_{Lci} C_R, \text{[kNm]} \quad (4.3.3.3.1)
\]

where \( F_M \) is the distribution factor defined in 4.3.3.1.1.

8. Paragraph 4.5.0 has been amended to read:

4.5.0 Symbols

- \( L_2 \) – rule length \( L \), [m], but to be taken not greater than 300 m;
- \( C \) – wave coefficient, as defined in 1.4.2.3.1;
- \( \Lambda \) – wave length corresponding to the load case defined in 4.5.1.3.1, 4.5.1.4.1,
- \( f_p \) – coefficient corresponding to the probability, defined in 4.2;
- \( T_{Lci} \) – draught in the considered cross section in the considered loading condition, [m];
9. **Paragraph 4.5.1.6.1 has been amended to read:**

4.5.1.6.1 For the positive hydrodynamic pressure at the waterline (in load cases H1, H2, F2, R1, R2 and P1), the hydrodynamic pressure $P_{W,C}$ at the side above waterline is given (see Fig 4.5.1.6.2) by:

\[
p_{W,C} = p_{W, WL} + \rho g (T_{Lci} - z), \quad [\text{kN/m}^2]
\]

for $T_{Lci} \leq z \leq h_w + T_{Lci}$ \hspace{1cm} (4.5.1.6.1-1)

\[
p_{W,C} = 0
\]

for $z \geq h_w + T_{Lci}$ \hspace{1cm} (4.5.1.6.1-2)

where:

- $p_{W, WL}$ – positive hydrodynamic pressure at the waterline for the considered load case, [kN/m²];
- $h_w = \frac{p_{W, WL}}{\rho g}$, [m].

10. **Sub-chapter 4.5.2.2 has been amended to read:**

4.5.2.2 Load cases H1, H2, F1 and F2

4.5.2.2.1 The external pressure $p_D$, for load cases H1, H2, F1 and F2, at any point of an exposed deck is to be obtained from the following formula:

\[
p_D = \varphi p_W, \quad [\text{kN/m}^2]
\]

(4.5.2.2.1)

where:

- $p_W$ – pressure obtained from the formulae in Table 4.5.2.2.1-1, [kN/m²];
- $\varphi$ – coefficient defined in Table 4.5.2.2.1-2

**Table 4.5.2.2.1-1**

Pressures on exposed decks for H1, H2, F1 and F2

<table>
<thead>
<tr>
<th>Location</th>
<th>Pressure $p_W$, [kN/m²]</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$L_{LL} \geq 100$ m</td>
</tr>
<tr>
<td>0 \leq x_{LL}/L_{LL} \leq 0.75</td>
<td>34.3</td>
</tr>
<tr>
<td>0.75 &lt; x_{LL}/L_{LL} &lt; 1</td>
<td>$34.3 + (14.8 + \alpha (L_{LL} - 100))\left(4 \frac{x_{LL}}{L_{LL}} - 3\right)$</td>
</tr>
</tbody>
</table>

where:

- $\alpha$ – coefficient taken equal to:
  - $\alpha = 0.0726$ for Type B freeboard ships
  - $\alpha = 0.356$ for Type B-60 or Type B-100 freeboard ships.
- $X_{LL}$ – X coordinate of the load point measured from the aft end of the freeboard length.
### Table 4.5.2.1-2

<table>
<thead>
<tr>
<th>Exposed deck location</th>
<th>( \varphi )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freeboard deck</td>
<td>1.00</td>
</tr>
<tr>
<td>Superstructure deck, including forecastle deck</td>
<td>0.75</td>
</tr>
<tr>
<td>1st tier of deckhouse</td>
<td>0.56</td>
</tr>
<tr>
<td>2nd tier of deckhouse</td>
<td>0.42</td>
</tr>
<tr>
<td>3rd tier of deckhouse</td>
<td>0.32</td>
</tr>
<tr>
<td>4th tier of deckhouse</td>
<td>0.25</td>
</tr>
<tr>
<td>5th tier of deckhouse</td>
<td>0.20</td>
</tr>
<tr>
<td>6th tier of deckhouse</td>
<td>0.15</td>
</tr>
<tr>
<td>7th tier of deckhouse and above</td>
<td>0.10</td>
</tr>
</tbody>
</table>

11. *The beginning of paragraph 4.5.3.3.1 has been amended to read:*

**4.5.3.3.1** The lateral pressure \( p_{sl} \) for sides of superstructures is to be obtained from the following formula:

\[
p_{sl} = 2.1 c_f \varphi \left( C_B + 0.7 \right) \frac{20}{10 + z - T}, \text{[kN/m}^2\text{]} \tag{4.5.3.3.1}
\]

\( f_p \) – probability factor, taken equal to:

\( f_p = 1.0 \) for plate panels

\( f_p = 0.75 \) for ordinary stiffeners and primary supporting members

\( C_f \) – distribution factor according to Table 4.5.3.3.1.

12. *The beginning of paragraph 4.5.3.4.1 has been amended to read:*

**4.5.3.4.1** The lateral pressure for determining the scantlings is to be obtained from the greater of the following formulae:

\[
p_A = n c \left[ b C - (z - T) \right], \text{[kN/m}^2\text{]} \tag{4.5.3.4.1-1}
\]

\[
p_A = p_{Amin}, \text{[kN/m}^2\text{]} \tag{4.5.3.4.1-2}
\]

where:

\( n \) – coefficient defined in Table 4.5.3.4.1-1, depending on the tier level;

The lowest tier is normally that tier which is directly situated above the uppermost continuous deck to which the depth \( D \) is to be measured. However, where the actual distance \((D - T)\) exceeds the minimum non-corrected tabular freeboard according to ILLC as amended by at least one standard superstructure height as defined in 1.4.3.18.1, this tier may be defined as the 2\textsuperscript{nd} tier and the tier above as the 3\textsuperscript{rd} tier;
\( c \) – coefficient taken equal to:

\[
c = 0.3 + 0.7 \frac{b_1}{B_1}
\]  \hspace{1cm} (4.5.3.4.1-3)

For exposed parts of machinery casing, \( c \) is not to be taken less than 1.0;

13. **Paragraph 4.7.0 has been amended to read:**

4.7.0 **Symbols**

- \( M_H \) – the actual cargo mass in a cargo hold corresponding to a homogeneously loaded condition at maximum draught, [t];
- \( M_{\text{Full}} \) – the cargo mass in a cargo hold corresponding to cargo with virtual density (homogenous mass/hold cubic capacity, minimum 1.0 t/m\(^3\)) filled to the top of the hatch coaming, [t];
  \( M_{\text{Full}} \) is in no case to be less than \( M_H \);
- \( M_{\text{HD}} \) – the maximum cargo mass allowed to be carried in a cargo hold according to design loading condition(s) with specified holds empty at maximum draught, [t];
- \( V_{\text{Full}} \) – volume of the cargo hold including the volume enclosed by the hatch coaming, [m\(^3\)];
- \( V_H \) – volume defined in 4.6, [m\(^3\)];
- \( T_{\text{HB}} \) – deepest ballast draught, [m].

14. **Table 4.8.5.1.6 has been amended to read:**
## Table 4.8.5.1.6 Guidance on Typical Loading Sequence Summary Form

**LOADING/UNLOADING SEQUENCE SUMMARY FORM**

<table>
<thead>
<tr>
<th>Vessel name</th>
<th>Voyage No.</th>
<th>Condition</th>
<th>Yard</th>
<th>Id. Number</th>
</tr>
</thead>
</table>

### Ballast tank nos.

<table>
<thead>
<tr>
<th>Hold No.</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Vessel name</th>
<th>Voyage No.</th>
<th>Condition</th>
<th>Yard</th>
<th>Id. Number</th>
</tr>
</thead>
</table>

### Load/unload sequence summary form

<table>
<thead>
<tr>
<th>Column or hold No.</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Height of hold h (m)</th>
<th>7</th>
<th>6</th>
<th>5</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
</table>

### Conditions

- **Condition at commencement of loading/unloading**
- **Condition at end of loading/unloading**

### Notes

- During each pour it has to be controlled that allowable limits for hull girder shear force, bending moments and mass in holds are not exceeded.
- Loading/unloading operations may have to be paused to allow for ballasting/deballasting in order to keep actual values within limits.

### Cargo mass

<table>
<thead>
<tr>
<th>Grade</th>
<th>Total cargo onboard [t]:</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Cargo mass</th>
<th>Draft Survey n, l</th>
<th>Draft Survey n, m</th>
</tr>
</thead>
</table>

### Ballasting

- **Ballasting contents at commencement of loading/unloading**
- **Ballasting contents at end of loading/unloading**

### Values at end of loading/unloading

<table>
<thead>
<tr>
<th>Draft Survey n, l</th>
<th>Ballasting contents at end of loading/unloading</th>
</tr>
</thead>
</table>

### Notes on typical loading sequence summary form

- **Net load on double bottom**

\[
\text{Net load on double bottom} = \left(\text{M}_h + V \cdot \text{h} \right) / \text{T} \ [\text{t} / \text{m}^3]
\]

where:
- \(\text{M}_h\) = Mass in hold + mass in DB [t]
- \(V\) = Total volume of hold [m^3]
- \(h\) = Height of hold from inner bottom to top of coaming [m]
- \(T\) = Draft [m]

- **Net load in two adjacent holds**

\[
\text{Net load in two adjacent holds} = \left(2 \times \text{M}_h + 2 \times V \cdot \text{h} \right) / \text{T} \ [\text{t} / \text{m}^3]
\]

### Approved by

<table>
<thead>
<tr>
<th>Date</th>
</tr>
</thead>
</table>

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---
15. *Sub-chapter 4.9 has been amended to read:*

4.9 Hold mass curves

4.9.0 Symbols

- $h$ – vertical distance from the top of inner bottom plating to upper deck plating at the ship’s centreline, [m];
- $h_a$ – vertical distance from the top of inner bottom plating to the lowest point of the upper deck plating at the ship’s centerline of the aft cargo hold in a block loading, [m];
- $h_f$ – vertical distance from the top of inner bottom plating to the lowest point of the upper deck plating at the ship’s centerline of the fore cargo hold in a block loading, [m];
- $M_H$ – as defined in 4.7;
- $M_{Full}$ – as defined in 4.7;
- $M_{HD}$ – as defined in 4.7;
- $M_D$ – the maximum cargo mass given for each cargo hold, [t];
- $M_{BLK}$ – maximum cargo mass in a cargo hold according to the block loading condition in the loading manual, [t];
- $T_{HB}$ – as defined in 4.7;
- $T_i$ – draught in loading condition No. $i$, at mid-hold position of cargo hold length $l_H$, [m];
- $V_H$ – as defined in 4.6;
- $V_f$ and $V_a$ – volume of the forward and after cargo hold excluding volume of the hatchway part, [m$^3$] ;
- $T_{min}$ – $0.75T_S$ or draught in ballast conditions with the two adjacent cargo holds empty, whichever is greater, [m];
- $\Sigma$ – sum of masses of two adjacent cargo holds.

4.9.1 General

4.9.1.1 Application

4.9.1.1.1 The requirements of this Appendix apply to ships of 150 m in length $L$ and above.

4.9.1.1.2 This Appendix describes the procedure to be used for determination of:

- the maximum and minimum mass of cargo in each cargo hold as a function of the draught at mid-hold position of cargo hold,
- the maximum and minimum mass of cargo in any two adjacent holds as a function of the mean draught in way of these holds.

4.9.1.1.3 Results of these calculations are to be included in the reviewed loading manual which has also to indicate the maximum permissible mass of
cargo at scantling draught in each hold or in any two adjacent holds, as obtained from the design review.

4.9.1.1.4 The following notice on referring to the maximum permissible and the minimum required mass of cargo is to be described in loading manual.

Where ship engages in a service to carry such hot coils or heavy cargoes that have some adverse effect on the local strength of the double bottom and that the loading is not described as cargo in loading manual, the maximum permissible and the minimum required mass of cargo are to be considered specially.

4.9.2 Maximum and minimum masses of cargo in each hold

4.9.2.1 Maximum permissible mass and minimum required masses of single cargo hold in seagoing condition

4.9.2.1.1 General

The cargo mass curves of single cargo hold in seagoing condition are defined in 4.9.2.1.2 to 4.9.2.1.5. However if the ship structure is checked for more severe loading conditions than the ones considered in 4.7.3.7.1, the minimum required cargo mass and the maximum allowable cargo mass can be based on those corresponding loading conditions.

4.9.2.1.2 BC-A ships not having {No MP} assigned

.1 for loaded holds:

i) the maximum permissible mass \( W_{\text{max}} (T_i) \) at various draughts \( T_i \) is obtained by the following formulae:

\[
W_{\text{max}} (T_i) = M_{\text{HD}} + 0.1M_{H} - 1.025V_{H} \left( T_{S} - T_{i} \right) \frac{h}{ \text{[t]}} 
\]

However, in no case \( W_{\text{max}} (T_i) \) shall be greater than \( M_{\text{HD}} \).

ii) the minimum required cargo mass \( W_{\text{min}} (T_i) \) at various draughts \( T_i \) is obtained by the following formulae:

\[
W_{\text{min}} (T_i) = 0 \text{, [t], for } T_i \leq 0.83 T_S, \quad (4.9.2.1.2.1-2)
\]

\[
W_{\text{min}} (T_i) = 1.025V_{H} \left( T_{S} - T_{i} \right) \frac{h}{ \text{[t]}} , \text{ for } T_S \geq T_i \geq 0.83 T_S \quad (4.9.2.1.2.1-3)
\]

.2 for empty holds which can be empty at the maximum draught:

the maximum permissible mass \( W_{\text{min}} (T_i) \) at various draughts \( T_i \) is obtained by the following formulae:

\[
W_{\text{min}} (T_i) = M_{\text{Full}}, \text{ [t] for } T_S \geq T_i \geq 0.67 T_S \quad (4.9.2.1.2.2-1)
\]

\[
W_{\text{max}} (T_i) = M_{\text{Full}} - 1.025V_{H} \left( 0.67T_{S} - T_{i} \right) \frac{h}{ \text{[t]}} \quad (4.9.2.1.2.2-2)
\]
The minimum required mass \( W_{\text{min}}(T_i) \) is obtained by the following formula:

\[
W_{\text{min}}(T_i) = 0, \ [t] \quad \text{for } T_i \leq T_S
\]  

(4.9.2.1.2.2-3)

Examples for mass curve of loaded cargo hold and cargo hold which can be empty at the maximum draught for **BC-A** ships are shown in Fig 4.9.2.1.2.2.

The minimum required mass \( W_{\text{min}}(T_i) \) at various draughts \( T_i \) is obtained by the following formula:

\[
W_{\text{min}}(T_i) = 0, \ [t] \quad \text{for } T_i < 0.67 \ T_S
\]

\[
W_{\text{min}}(T_i) = T_i \ W, \ [t] \quad \text{for } T_i \leq T_S
\]

(4.9.2.1.2.2-1)

(4.9.2.1.2.2-2)

\[
W_{\text{min}}(T_i) = 0.15 \ M_{\text{HD}} + 0.15 \ M_{\text{HD}}, \ [t] \quad \text{for } T_S \geq T_i \geq T_{\text{HB}}
\]

(4.9.2.1.2.2-3)

\[
W_{\text{min}}(T_i) = 0.15 \ M_{\text{HD}} + 0.15 \ M_{\text{HD}}, \ [t] \quad \text{for } T_S \geq T_i \geq T_{\text{HB}}
\]

4.9.2.1.3 **BC-A** ship having {No MP} assigned

.1 for loaded holds:

the maximum permissible mass \( W_{\text{max}}(T_i) \) at various draughts \( T_i \) is the same specified in 4.9.2.1.2.

The minimum required mass \( W_{\text{min}}(T_i) \) is obtained by the following formulae:

\[
W_{\text{min}}(T_i) = 0, \ [t] \quad \text{for } T_i \leq T_{\text{HB}}
\]

(4.9.2.1.3.1-1)

\[
W_{\text{min}}(T_i) = 1.025 V_H \frac{(T_i - T_{\text{HB}})}{h}, \ [t] \quad \text{for } T_S \geq T_i \geq T_{\text{HB}}
\]

(4.9.2.1.3.1-2)

or \( W_{\text{min}}(T_i) = 0.5 \ M_H - 1.025 V_H \frac{(T_S - T_i)}{h} \geq 0, \ [t] \quad \text{for } T_S \geq T_i \)

(4.9.2.1.3.1-3)

.2 for empty hold which can be empty at the maximum draught:

the maximum permissible mass \( W_{\text{max}}(T_i) \) at various draughts \( T_i \) is obtained by the following formula:

\[
W_{\text{max}}(T_i) = M_{\text{Full}} - 1.025 V_H \frac{(T_S - T_i)}{h}, \ [t]
\]

(4.9.2.1.3.2-1)

The minimum required cargo mass \( W_{\text{min}}(T_i) \) at various draughts \( T_i \) is obtained by the following formula:
\[ W_{\text{min}}(T_i) = 0, \ [t] \text{ for } T_i \leq T_S \] (4.9.2.1.3.2-2)

Examples for mass curve of loaded cargo hold for \textbf{BC-A} ships having \{No MP\} assigned are shown in Fig 4.9.2.1.3.2.

4.9.2.1.4 BC-B and BC-C ships not having \{No MP\} assigned

The maximum permissible mass \( W_{\text{max}}(T_i) \) at various draughts \( T_i \) is obtained by the following formulae:

\[ W_{\text{max}}(T_i) = M_{\text{Full}} \cdot [t] \text{ for } T_S \geq T_i \geq 0.67T_S \] (4.9.2.1.4-1)

\[ W_{\text{max}}(T_i) = M_{\text{Full}} - 1.025V_{\text{H}} \left( \frac{0.67T_S - T_i}{h} \right), [t] \text{ for } T_i < 0.6 \] (4.9.2.1.4-2)

The minimum required mass \( W_{\text{min}}(T_i) \) is obtained by the following formulae:

\[ W_{\text{min}}(T_i) = 0, \ [t] \text{ for } T_i \leq 0.83T_S \] (4.9.2.1.4-3)

\[ W_{\text{min}}(T_i) = 1.025V_{\text{H}} \left( \frac{T_i - 0.83T_S}{h} \right), [t], \text{ for } T_S \geq T_i > 0.83T_S \] (4.9.2.1.4-4)

Example for mass curve of cargo hold for \textbf{BC-B} or \textbf{BC-C} ships is shown in Fig 4.9.2.1.4.
4.9.2.1.5 BC-B and BC-C ships having {No MP} assigned

The maximum permissible mass $W_{\text{max}}(T_i)$ at various draughts $T_i$ is obtained by the following formula:

$$W_{\text{max}}(T_i) = M_{\text{Full}} - 1.025V_H \frac{(T_S - T_i)}{h}, \text{ [t]} \quad (4.9.2.1.5-1)$$

The minimum required cargo mass $W_{\text{min}}(T_i)$ at various draughts $T_i$ is obtained by the following formulae:

$$W_{\text{min}}(T_i) = 0, \text{ [t]} \quad \text{for } T_i \leq T_{\text{HB}} \quad (4.9.2.1.5-2)$$

$$W_{\text{min}}(T_i) = 1.025V_H \frac{(T_i - T_{\text{HB}})}{h}, \text{ [t]}, \quad \text{for } T_S \geq T_i > T_{\text{HB}} \quad (4.9.2.1.5-3)$$

or

$$W_{\text{min}}(T_i) = 0.5M_{H} - 1.025V_H \frac{(T_S - T_i)}{h} \geq 0, \text{ [t]} \quad \text{for } T_S \geq T_i \quad (4.9.2.1.5-4)$$

$$W_{\text{min}}(T_i) \geq 0$$

Example for mass curve of cargo hold for BC-B or BC-C ships with {No MP} is shown in Fig 4.9.2.1.5.
4.9.2.2 Maximum permissible mass and minimum required masses of single cargo hold in harbour condition

4.9.2.2.1 General

The cargo mass curves of single cargo hold in harbour condition are defined in 4.9.2.2. However if the ship structure is checked for more severe loading conditions than ones considered in 4.7.3.7.1, the minimum required cargo mass and the maximum allowable cargo mass can be based on those corresponding loading conditions.

4.9.2.2.2 All ships

The maximum permissible cargo mass and the minimum required cargo mass corresponding to draught for loading/unloading conditions in harbour may be increased or decreased by 15% of the maximum permissible mass at the maximum draught for the cargo hold in seagoing condition. However, maximum permissible mass is in no case to be greater than the maximum permissible cargo mass at designed maximum load draught for each cargo hold.

4.9.2.2.3 BC-A ship not having {No MP} assigned

The maximum permissible mass \( W_{max} (T_i) \) in various draughts \( T_i \) in harbour condition shall also be checked by the following formulae in addition to the requirements in 4.9.2.1.2:

For loaded hold:
\[
W_{max} (T_i) = M_{HD} \quad \text{for } T_i \geq 0.67T_S \\
W_{max} (T_i) = M_{HD} + 0.1M_H - 1.025V_H \frac{(0.67T_S - T_i)}{h} \quad \text{for } T_i < 0.67T_S
\]

4.9.2.2.4 BC-A ships having {No MP} assigned

The maximum permissible mass \( W_{max} (T_i) \) in various draughts \( T_i \) in harbour condition shall also be checked by the following formulae in addition to the requirements in 4.9.2.1.3:

For empty hold which can be empty at the maximum draught:
\[
W_{max} (T_i) = M_{Full} \quad \text{for } T_S \geq T_i \geq 0.67T_S \\
W_{max} (T_i) = M_{Full} - 1.025V_H \frac{(0.67T_S - T_i)}{h} \quad \text{for } T_i < 0.67T_S
\]
4.9.2.2.5 BC-B and BC-C ships having {No MP} assigned

The maximum permissible mass $W_{\text{max}}(T_i)$ in various draughts $T_i$ in harbour condition shall also be checked by the following formulae in addition to the requirements in 4.9.2.2.2:

$$W_{\text{max}}(T_i) = M_{\text{Full}} \text{ for } T_S \geq T_i \geq 0.67T_S$$  \hspace{1cm} (4.9.2.2.5-1)

$$W_{\text{max}}(T_i) = M_{\text{Full}} - 1.025V_h \left( \frac{0.67T_S - T_i}{h} \right) \text{ for } T_i < 0.67T_S$$  \hspace{1cm} (4.9.2.2.5-2)

4.9.3 Maximum and minimum masses of cargo of two adjacent holds

4.9.3.1 Maximum permissible mass and minimum required masses of two adjacent holds in seagoing condition

4.9.3.1.1 General

The cargo mass curves of two adjacent cargo holds in seagoing condition are defined in 4.9.3.1.2 and 4.9.3.1.3.

However if the ship structure is checked for more severe loading conditions than ones considered in 4.7.3.7.1, the minimum required cargo mass and the maximum allowable cargo mass can be based on those corresponding loading conditions.

4.9.3.1.2 BC-A ships with “Block loading” and not having {No MP} assigned

The maximum permissible mass $W_{\text{max}}(T_i)$ at various draughts is obtained as the greater result of the following formulae:

$$W_{\text{max}}(T_i) = \sum (M_{\text{BLK}} + 0.1M_H) - 1.025 \left( \frac{V_f}{h_f} + \frac{V_a}{h_a} \right) (T_S - T_i)$$  \hspace{1cm} (4.9.3.1.2-1a)

$$W_{\text{max}}(T_i) = \sum M_{\text{Full}} - 1.025 \left( \frac{V_f}{h_f} + \frac{V_a}{h_a} \right) (0.67T_S - T_i)$$  \hspace{1cm} (4.9.3.1.2-1b)

However, $W_{\text{max}}(T_i)$ shall be greater than $\sum M_{\text{BLK}}$ in no case.

The minimum required cargo mass $W_{\text{min}}(T_i)$ at various draughts $T_i$ is obtained by the following formulae:

$$W_{\text{min}}(T_i) = 0, \text{ [t]} \text{ for } T_i \leq 0.75T_S$$  \hspace{1cm} (4.9.3.1.2-2)

$$W_{\text{min}}(T_i) = 1.025 \left( \frac{V_f}{h_f} + \frac{V_a}{h_a} \right) (T_i - 0.75T_S), \text{ [t]} \text{ for } T_S \geq T_i \geq 0.75T_S$$  \hspace{1cm} (4.9.3.1.2-3)
4.9.3.1.3 BC-A ships with “Block loading” and having {No MP} assigned

The maximum permissible mass $W_{\text{max}}(T_i)$ and the minimum required mass $W_{\text{min}}(T_i)$ at various draughts $T_i$ are obtained by the following formula:

$$W_{\text{max}}(T_i) = \sum (M_{BLK} + 0.1M_H) - 1.025 \left( \frac{V_f}{h_f} + \frac{V_a}{h_a} \right) (T_S - T_i) \quad (4.9.3.1.3-1)$$

However, $W_{\text{max}}(T_i)$ shall be greater than $\sum M_{BLK}$ in no case.

The minimum required cargo mass $W_{\text{min}}(T_i)$ at various draughts $T_i$ is obtained by the following formulae:

$$W_{\text{min}}(T_i) = 0 \quad \text{for} \quad T_i \leq T_{HB} \quad (4.9.3.1.3-2)$$

$$W_{\text{min}}(T_i) = 1.025 \left( \frac{V_f}{h_f} + \frac{V_a}{h_a} \right) (T_i - T_{HB}) \quad \text{for} \quad T_S \geq T_i \geq 0.75 T_S \quad (4.9.3.1.3-3)$$

Examples for mass curve of cargo hold for BC-A ships with block loading ships are shown in Fig 4.9.3.1.3.

![Mass curve for BC-A ships with block loading](image)

Figure 4.9.3.1.3 Example of mass curve for BC-A ships with “Block loading”

4.9.3.1.4 BC-A ships without “Block loading” and BC-B, BC-C ships, not having {No MP} assigned

The maximum permissible mass $W_{\text{max}}(T_i)$ at various draughts $T_i$ is obtained by the following formulae:

$$W_{\text{max}}(T_i) = \sum M_{\text{Full}}, \ [t] \text{ for } T_S \geq T_i \geq 0.67 T_S \quad (4.9.3.1.4-1)$$

$$W_{\text{max}}(T_i) = \sum M_{\text{Full}} - 1.025 \left( \frac{V_f}{h_f} + \frac{V_a}{h_a} \right) (0.67T_S - T_i), \ [t] \text{ for } T_i < 0.67 T_S \quad (4.9.3.1.4-2)$$

The minimum required cargo mass $W_{\text{min}}(T_i)$ at various draughts $T_i$ is obtained by the following formulae:
\[ W_{\text{max}}(T_i) = 0 \text{ , } [\text{t} \text{ for } T_i \leq 0.75T_s \quad (4.9.3.1.4-3) \]

\[ W_{\text{min}}(T_i) = 1.025 \left( \frac{V_f}{h_f} + \frac{V_a}{h_a} \right)(T_i - 0.75T_s), [\text{t} \text{ for } T_s \geq T_i \geq 0.75T_s \quad (4.9.3.1.4-4) \]

4.9.3.1.5 BC-A ships without “Block loading” and BC-B, BC-C ships, having \{No MP\} assigned

The maximum permissible mass \( W_{\text{max}}(T_i) \) at various draughts \( T_i \) is obtained by the following formulae:

\[ W_{\text{max}}(T_i) = \sum M_{\text{full}} - 1.025 \left( \frac{V_f}{h_f} + \frac{V_a}{h_a} \right)(T_s - T_i), [\text{t} \text{ for } T_i < T_s \quad (4.9.3.1.5-1) \]

The minimum required cargo mass \( W_{\text{min}}(T_i) \) at various draughts \( T_i \) is obtained by the following formulae:

\[ W_{\text{min}}(T_i) = 0 \text{ for } T_i \leq T_{HB} \quad (4.9.3.1.3-2) \]

\[ W_{\text{min}}(T_i) = 1.025 \left( \frac{V_f}{h_f} + \frac{V_a}{h_a} \right)(T_s - T_{HB}) \text{ for } T_s \geq T_i > 0.75 T_{HB} \quad (4.9.3.1.3-3) \]

Examples for mass curve of cargo hold for BC-A ships without block loading and BC-B or BC-C are shown in Fig 4.9.3.1.5.

Figure 4.9.3.1.5 Example of mass curve for BC-A ship without block loading and BC-B or BC-C ships

4.9.3.2 Maximum permissible mass and minimum required masses of two adjacent cargo holds in harbour condition

4.9.3.2.1 General

The cargo mass curves of two adjacent cargo holds in harbour condition are defined in 4.9.3.2.2. However if the ship structure is checked for more severe loading conditions than ones considered in 4.7.3.7.1, the minimum required cargo mass can be based on those corresponding loading conditions.
4.9.3.2.2 All ships

The maximum permissible cargo mass and minimum required cargo mass corresponding to draught for loading/unloading conditions in harbour may be increased or decreased by 15% of the maximum permissible mass at the maximum draught for the cargo hold in seagoing condition. However, maximum permissible mass is in no case to be greater than the maximum permissible cargo mass at designed maximum load draught for each cargo hold.

4.9.3.2.3 BC-A ships with “Block loading” and having {No MP} assigned

The maximum permissible mass \( W_{\text{max}}(T_i) \) in various draughts \( T_i \) in harbour condition shall also be checked by the following formulae in addition to the requirements in 4.9.3.1.3:

\[
W_{\text{max}}(T_i) = \sum M_{\text{Full}} - 1.025 \left( \frac{V_f}{h_f} + \frac{V_a}{h_a} \right) (0.67T_S - T_i), \ [\text{t}] \quad (4.9.3.2.3-1)
\]

\[
W_{\text{max}}(T_i) \leq \sum M_{\text{BLK}} \quad (4.9.3.2.3-2)
\]

4.9.3.2.4 BC-A ships without “Block loading” and BC-B ships having {No MP} assigned

The maximum permissible mass \( W_{\text{max}}(T_i) \) at various draughts \( T_i \) in harbour condition shall also be checked by the following formulae in addition to the requirements in 4.9.3.1.5:

\[
W_{\text{max}}(T_i) = \sum M_{\text{Full}} \quad \text{for } T_S \geq T_i \geq 0.67T_S \quad (4.9.3.2.4-1)
\]

\[
W_{\text{max}}(T_i) = \sum M_{\text{Full}} - 1.025 \left( \frac{V_f}{h_f} + \frac{V_a}{h_a} \right) (0.67T_S - T_i) \quad \text{for } T_i < 0.75T_S \quad (4.9.3.2.4-2)
\]

16. Paragraph 6.1.2.7.2 has been amended to read:

6.1.2.7.2 Accelerations

In order to calculate the accelerations the following coordinates are to be used for the centre of gravity:

\[
x_{G-sc} = 0.75\ell_H \quad (6.1.2.7.2-1)
\]

forward of aft bulkhead, where the hold of which the mid position is located forward from 0.45L from A.E;

\[
x_{G-sc} = 0.75\ell_H \quad (6.1.2.7.2-2)
\]

afterward of fore bulkhead, where the hold of which the mid position is located afterward from 0.45L from A.E;
where:

- $\varepsilon$ = 1.0 when a port side structural member is considered, or -1.0 when a starboard side structural member is considered;
- $B_h$ – breadth at the mid of the hold, of the cargo hold at the level of connection of bilge hopper plate with side shell or inner hull, [m];
- $d_{sc}$ – diameter of steel coils, [m];
- $h_{DB}$ – height of inner bottom, [m];
- $\ell_H$ – cargo hold length, [m];

Vertical acceleration $a_Z$, [m/s$^2$], is to be calculated by the formulae defined in 4.2.3.2 and tangential acceleration $a_R$ due to roll is to be calculated by the following formula:

$$a_R = \theta \frac{\pi}{180} \left( \frac{2\pi}{T_R} \right)^2 \sqrt{y_{G-sc}^2 + R^2}, \text{[m/s}^2\text{]}$$

(6.1.2.7.2-5)

$\theta, T_R$ and $R$ – as defined in 4.2.2.1 and 4.2.3.2.

17. **Formula 6.1.2.7.3-5 has been amended to read:**

$$K_2 = -\frac{s}{\ell} + \sqrt{\left(\frac{s}{\ell}\right)^2 + 1.37\left(\frac{\ell}{s}\right)^2 \left(1 - \frac{\ell}{s}\right)^2 + 2.33}$$

(6.1.2.7.3-5)

18. **The beginning of paragraph 6.1.3.1.5 has been amended to read:**

**6.1.3.1.5 Normal stresses**

The normal stress to be considered for the strength check of plating contributing to the hull girder longitudinal strength is the maximum value of $\sigma_x$ between sagging and hogging conditions, when applicable, obtained from the following formula:

$$\sigma_x = C_x \left[ C_{sw} \frac{M_{sw}}{I_y} (z - N) + C_{wy} \frac{M_{wy}}{I_y} (z - N) - C_{wy} \frac{M_{wy}}{I_z} \right] \cdot 10^{-3}, \text{[N/mm}^2\text{]}$$

(6.1.3.1.5-1)

19. **Paragraph 6.3.3.1.2 has been amended to read:**

**6.3.3.1.2 Verification of elementary plate panel in a transverse section analysis**

Each elementary plate panel is to comply with the following criteria, taking into account the loads defined in 6.3.2.1:
i) longitudinally framed plating

\[
\left( \frac{|\sigma_x|S}{\kappa_x R_{eh}} \right)^{e1} + \left( \frac{|\tau|S^{\frac{1}{2}}}{\kappa_x R_{eh}} \right)^{e3} \leq 1.0 \quad (6.3.3.1.2-1)
\]

for stress combination 1 with \( \sigma_x = \sigma_n \) and \( \tau = 0.7 \tau_{SF} \)

\[
\left( \frac{|\sigma_x|S}{\kappa_x R_{eh}} \right)^{e2} + \left( \frac{|\tau|S^{\frac{1}{2}}}{\kappa_x R_{eh}} \right)^{e3} \leq 1.0 \quad (6.3.3.1.2-2)
\]

for stress combination 2 with \( \sigma_x = 0.7 \sigma_n \) and \( \tau = \tau_{SF} \)

ii) transversely framed plating

\[
\left( \frac{|\sigma_y|S}{\kappa_y R_{eh}} \right)^{e1} + \left( \frac{|\tau|S^{\frac{1}{2}}}{\kappa_y R_{eh}} \right)^{e3} \leq 1.0 \quad (6.3.3.1.2-3)
\]

for stress combination 1 with \( \sigma_y = \sigma_n \) and \( \tau = 0.7 \tau_{SF} \)

\[
\left( \frac{|\sigma_y|S}{\kappa_y R_{eh}} \right)^{e2} + \left( \frac{|\tau|S^{\frac{1}{2}}}{\kappa_y R_{eh}} \right)^{e3} \leq 1.0 \quad (6.3.3.1.2-4)
\]

for stress combination 2 with \( \sigma_y = 0.7 \sigma_n \) and \( \tau = \tau_{SF} \)

Each term of the above conditions must be less than 1.0.

The reduction factors \( \kappa_x \) and \( \kappa_y \) are given in Table 6.3.2.2.1-1 and/or Table 6.3.2.2.1-2.

The coefficients \( e1, e2 \) and \( e3 \) are defined in Table 6.3.3.2.4.

For the determination of \( e3 \), \( \kappa_y \) is to be taken equal to 1 in case of longitudinally framed plating and \( \kappa_x \) is to be taken equal to 1 in case of transversely framed plating.

20. Paragraph 9.4.3.2.1 has been amended to read:

9.4.3.2.1 Lateral pressure for decks

The lateral pressure for decks of superstructures and deckhouses, [kN/m²], is to be taken equal to:

i) the external pressure \( p_d \) defined in 4.5.2.1 for exposed decks,

ii) 5 kN/m² for unexposed decks.

21. Paragraph 9.5.1.1.1 has been amended to read:

9.5.1.1.1 The requirements in 9.5.1 to 9.5.8 apply to steel hatch covers in positions 1 and 2 on weather decks, defined in 1.4.3.6.
The requirements in 9.5.9 apply to steel hatch covers of small hatches fitted on the exposed fore deck over the forward 0.25\(L\).

22. **Paragraph 9.5.7.3.5 has been amended to read:**

9.5.7.3.5 **Area of securing devices**

The net cross area of each securing device is to be not less than the value obtained from the following formula:

\[
A = 1.4S_s \left( \frac{235}{R_{eH}} \right)^\alpha, \text{ [cm}^2\text{]} \tag{9.5.7.3.5}
\]

where:

- \(S_s\) – spacing of securing devices, [m];
- \(\alpha\) – coefficient taken equal to:
  - \(\alpha = 0.75\) for \(R_{eH} > 235\text{ N/mm}^2\)
  - \(\alpha = 1.0\) for \(R_{eH} \leq 235\text{ N/mm}^2\)

In the above calculations, \(R_{eH}\) may not be taken greater than 0.7\(R_m\).

Between hatch cover and coaming and at cross-joints, a packing line pressure sufficient to obtain weathertightness is to be maintained by securing devices. For packing line pressures exceeding 5 N/mm, the net cross area \(A\) is to be increased in direct proportion. The packing line pressure is to be specified.

In the case of securing arrangements which are particularly stressed due to the unusual width of the hatchway, the net cross area \(A\) of the above securing arrangements is to be determined through direct calculations.

23. **Paragraph 10.1.1.1.1 has been amended to read:**

**10.1.1.1.1** The manoeuvring arrangement includes all parts from the rudder and steering gear to the steering position necessary for steering the ship.

24. **Paragraph 10.1.1.3 has been amended to read:**

**10.1.1.3** (void)

25. **The beginning of paragraph 10.1.2.2.2 has been amended to read:**

**10.1.2.2.2** The resulting torque of each part is to be taken as:

\[
Q_{R1} = C_{R1} r_1, \text{ [Nm]} \tag{10.1.2.2.2-1}
\]

\[
Q_{R2} = C_{R2} r_2, \text{ [Nm]} \tag{10.1.2.2.2-2}
\]

26. **The last part of paragraph 10.1.4.5.2 has been amended to read:**

- \(P_e\) – push-up force according to 10.1.4.5.5, [N];
- \(\mu_1\) – frictional coefficient between nut and rudder body, normally \(\mu_1 = 0.3\);
\( d_i \) – mean diameter of the frictional area between nut and rudder body, [mm];
\( d_g \) – thread diameter of the nut, [mm];
\( R_{eH} \) – minimum yield stress of the securing flat bar material, [N/mm²].

27. The beginning of paragraph 10.1.4.5.5 has been amended to read:

**10.1.4.5.5 Push-up length**

The push-up length is not to be less than:

\[
\Delta \ell_1 = \frac{p_{reg} d_m}{E} + \frac{0.8 R_{rm}}{c}, \text{[mm]} \quad (10.1.4.5.5-1)
\]

\( R_{rm} \) – mean roughness, taken equal to about 0.01, [mm];
\( c \) – taper on diameter according to 10.1.4.5.1.
\( \alpha \) – as defined in 10.1.2.1.2

The push length is, however, not to be taken greater than:

\[
\Delta \ell_2 = \frac{1.6 R_{eH} d_m}{Ec \sqrt{3 + \alpha^4}} + \frac{0.8 R_{rm}}{c}, \text{[mm]} \quad (10.1.4.5.5-2)
\]

**Note:** In case of hydraulic pressure connections the required push-up force \( P_e \) for the cone may be determined by the following formula:

\[
P_e = p_{reg} d_m \pi \cdot \left( \frac{c}{2} + 0.02 \right), \text{[N]} \quad (10.1.4.5.5-3)
\]

28. Formula 10.1.5.3.4-1b has been amended to read:

\[
t_h = 0.045 \frac{d_s^2}{s_H}, \text{[mm]} \quad (10.1.5.3.4-1b)
\]

29. Paragraph 10.1.9.2.5 has been amended to read:

**10.1.9.2.5** When determining the thickness of the rudder horn plating the provisions of 10.1.5.2 to 10.1.5.4 are to be complied with. The thickness is, however, not to be less than \( 2.4\sqrt{Lk} \) mm.
30. **Table 10.3.3.5.3-1** has been complemented by the following part at its end:

<table>
<thead>
<tr>
<th>Equipment number $A &lt; EN &lt; B$</th>
<th>Towline $^{(1)}$</th>
<th>Mooring lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>$A$</td>
<td>$B$</td>
<td>Minimum length, [m]</td>
</tr>
<tr>
<td>3600</td>
<td>3800</td>
<td>300</td>
</tr>
<tr>
<td>3800</td>
<td>4000</td>
<td>300</td>
</tr>
<tr>
<td>4000</td>
<td>4200</td>
<td>300</td>
</tr>
<tr>
<td>4200</td>
<td>4400</td>
<td>300</td>
</tr>
<tr>
<td>4400</td>
<td>4600</td>
<td>300</td>
</tr>
<tr>
<td>4600</td>
<td>4800</td>
<td>300</td>
</tr>
<tr>
<td>4800</td>
<td>5000</td>
<td>300</td>
</tr>
<tr>
<td>5000</td>
<td>5200</td>
<td>300</td>
</tr>
<tr>
<td>5200</td>
<td>5500</td>
<td>300</td>
</tr>
<tr>
<td>5500</td>
<td>5800</td>
<td>300</td>
</tr>
<tr>
<td>5800</td>
<td>6100</td>
<td>300</td>
</tr>
<tr>
<td>6100</td>
<td>6500</td>
<td>300</td>
</tr>
<tr>
<td>6500</td>
<td>6900</td>
<td>300</td>
</tr>
<tr>
<td>6900</td>
<td>7400</td>
<td>300</td>
</tr>
<tr>
<td>7400</td>
<td>7900</td>
<td>300</td>
</tr>
<tr>
<td>7900</td>
<td>8400</td>
<td>300</td>
</tr>
<tr>
<td>8400</td>
<td>8900</td>
<td>300</td>
</tr>
<tr>
<td>8900</td>
<td>9400</td>
<td>300</td>
</tr>
<tr>
<td>9400</td>
<td>10000</td>
<td>300</td>
</tr>
<tr>
<td>10000</td>
<td>10700</td>
<td>300</td>
</tr>
<tr>
<td>10700</td>
<td>11500</td>
<td>300</td>
</tr>
<tr>
<td>11500</td>
<td>12400</td>
<td>300</td>
</tr>
<tr>
<td>12400</td>
<td>13400</td>
<td>300</td>
</tr>
<tr>
<td>13400</td>
<td>14600</td>
<td>300</td>
</tr>
<tr>
<td>14600</td>
<td>16000</td>
<td>300</td>
</tr>
</tbody>
</table>

$^{(1)}$ The towline is not compulsory. It is recommended for ships having length not greater than 180 m.

$^{(2)}$ See 10.3.5.4.

31. **Paragraph 11.1.1.2 has been amended to read:**

**11.1.1.2 Cold forming**

**11.1.1.2.1** For cold forming (bending, flanging, beading) of corrugated bulkhead the inside bending radius is to be not less than $2t$ ($t =$ as-built thickness).

In order to prevent cracking, flame cutting flash or sheering burrs are to be removed before cold forming. After cold forming all structural components
and, in particular, the ends of bends (plate edges) are to be examined for cracks. Except in cases where edge cracks are negligible, all cracked components are to be rejected. Repair welding is not permissible.

**11.1.1.3** has been amended to read:

**11.1.1.3 Assembly, alignment**

**11.1.1.3.1** The use of excessive force is to be avoided during the assembly of individual structural components or during the erection of sections. As far as possible, major distortions of individual structural components shall be corrected before further assembly. Structural members are to be aligned following the IACS recommendation No.47 provisions given in Table 11.1.1.3.1 or according to the requirements of a recognised fabrication standard that has been accepted by PRS. In the case of critical components, control drillings shall be made where necessary, which shall then be welded up again on completion.

After completion of welding, straightening and aligning shall be carried out in such a manner that the material properties are not influenced significantly. In case of doubt, PRS may require a procedure test or a working test to be carried out.
Table 11.1.3.1
Alignment (t, t₁ and t₂: as built thickness)

<table>
<thead>
<tr>
<th>Detail</th>
<th>Standard Limit</th>
<th>Remarks</th>
</tr>
</thead>
</table>
| Alignment of butt welds                     | \( a \leq 0.15t \) strength member  
\( a \leq 0.2t \) other but maximum 4.0mm                                      | \( t \) is the lesser plate thickness                                    |
| Alignment of fillet welds                   | \( t_1 < t_2 \)  
Strength member and higher stress member:  
\( a \leq t_1/3 \)  
Other: \( a \leq t_1/2 \)                                                                 | Alternatively, heel line can be used to check the alignment.  
Where \( t_3 \) is less than \( t_1 \), then \( t_3 \) shall be substituted for \( t_1 \). |
| Alignment of fillet welds                   | \( t_1 < t_2 \)  
Strength member and higher stress member:  
\( a \leq t_1/3 \)  
Other: \( a \leq t_1/2 \)                                                                 | Alternatively, heel line can be used to check the alignment.  
Where \( t_3 \) is less than \( t_1 \), then \( t_3 \) shall be substituted for \( t_1 \). |

Note:  
“strength” means the following elements: strength deck, inner bottom, bottom, lower stool, lower part of transverse bulkhead, bilge hopper and side frames of single side bulk carriers.
<table>
<thead>
<tr>
<th>Detail</th>
<th>Standard</th>
<th>Limit</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alignment of face plates of T longitudinal</td>
<td>Strength member:</td>
<td>$a = 8.0 \text{ mm}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$a \leq 0.04bh</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$b \text{ [mm]}$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alignment of height of T-bar, L-angle bar or bulb</td>
<td>Strength member:</td>
<td>$a = 3.0 \text{ mm}$</td>
<td></td>
</tr>
<tr>
<td></td>
<td>$a \leq 0.15t</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Other:</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>$a \leq 0.2t</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alignment of panel stiffener</td>
<td>$d \leq L/50</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note:
“strength” means the following elements: strength deck, inner bottom, bottom, lower stool, lower part of transverse bulkhead, bilge hopper and side frames of single side bulk carriers.

32. **Paragraph 11.2.2.6.1 has been amended to read:**

**11.2.2.6.1 Kinds and size of fillet welds and their applications**

Kinds and size of fillet welds for as-built thickness of abutting plating up to 50 mm are classed into 5 categories as given in Table 2.6.1-1 and their application to hull construction is to be as required by Table 2.6.1-2.

In addition, for zones “$a$” and “$b$” of side frames as shown in Fig 3.6.8.3.1 the weld throats are to be respectively $0.44t$ and $0.4t$, where $t$ is as-built thickness of the thinner of two connected members.
Table 11.2.6.1-1  
Categories of fillet welds

<table>
<thead>
<tr>
<th>Category</th>
<th>Kinds of fillet welds</th>
<th>As-built thickness of abutting plate, $t$, [mm] $^{(1)}$</th>
<th>Leg length of fillet weld, [mm] $^{(2),(3)}$</th>
<th>Length of fillet welds, [mm]</th>
<th>Pitch, [mm]</th>
</tr>
</thead>
<tbody>
<tr>
<td>F0</td>
<td>Double continuous weld</td>
<td>$t$</td>
<td>$0.7t$</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>F1</td>
<td>Double continuous weld</td>
<td>$t \leq 10$</td>
<td>$0.5t + 1.0$</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$10 \leq t &lt; 20$</td>
<td>$0.4t + 2.0$</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$20 \leq t$</td>
<td>$0.3t + 4.0$</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>F2</td>
<td>Double continuous weld</td>
<td>$t \leq 10$</td>
<td>$0.4t + 1.0$</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$10 \leq t &lt; 20$</td>
<td>$0.3t + 2.0$</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$20 \leq t$</td>
<td>$0.2t + 4.0$</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>F3</td>
<td>Double continuous weld</td>
<td>$t \leq 10$</td>
<td>$0.3t + 1.0$</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$10 \leq t &lt; 20$</td>
<td>$0.2t + 2.0$</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$20 \leq t$</td>
<td>$0.1t + 4.0$</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>F4</td>
<td>Intermittent weld</td>
<td>$t \leq 10$</td>
<td>$0.5t + 1.0$</td>
<td>75</td>
<td>300</td>
</tr>
<tr>
<td></td>
<td></td>
<td>$10 \leq t &lt; 20$</td>
<td>$0.4t + 2.0$</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>$20 \leq t$</td>
<td>$0.3t + 4.0$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^{(1)} t$ – as-built thickness of the abutting plate, [mm]. In case of cross joint as specified in Fig.11.2.2.3.1, $t$ is the thinner thickness of the continuous member and the abutting plate, to be considered independently for each abutting plate.

$^{(2)}$ Leg length of fillet welds is made fine adjustments corresponding to the corrosion addition $t_c$ specified in Table 3.3.1.2.1 as follows:
+ 1.0 mm for $t_c > 5$
+ 0.5 mm for $5 \geq t_c > 4$
+ 0.0 mm for $4 \geq t_c > 3$
$- 0.5$ mm for $t_c \leq 3$.

$^{(3)}$ Leg length shall be rounded to the nearest half millimetre.
## Table 11.2.6.1-2
Application of fillet welds

<table>
<thead>
<tr>
<th>Hull area</th>
<th>Connection</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>General, unless otherwise specified in the table (1)</td>
<td>Of Watertight plate</td>
<td>To Boundary plating</td>
</tr>
<tr>
<td>Brackets at ends of members</td>
<td>Of Ordinary stiffener and collar plates</td>
<td>To Deep tank bulkheads</td>
</tr>
<tr>
<td></td>
<td></td>
<td>To Web of primary supporting members and collar plates</td>
</tr>
<tr>
<td>Web of ordinary stiffener</td>
<td>Of Plating (Except deep tank bulkhead)</td>
<td>To Face plates of built-up stiffeners at ends (15% of span)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elsewhere</td>
</tr>
<tr>
<td>End of primary supporting members and ordinary stiffeners without brackets</td>
<td>Of Deck plate, shell plate, inner bottom plate, bulkhead plate, bulkhead plate</td>
<td>To Web of ordinary stiffener</td>
</tr>
<tr>
<td>End of primary supporting members and ordinary stiffeners with brackets</td>
<td>Of Bottom and inner bottom plating</td>
<td>To Ordinary stiffener</td>
</tr>
<tr>
<td>Bottom and double bottom</td>
<td>Of Center girder</td>
<td>To Shell plates in strengthened bottom forward</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Inner bottom plate and shell plate except the above</td>
</tr>
<tr>
<td>Side girder including intercostal plate</td>
<td>Of Bottom and inner bottom plating</td>
<td>To Center girder and side girders in way of hopper tanks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elsewhere</td>
</tr>
<tr>
<td>Floor</td>
<td>Of Shell plates and inner bottom plates</td>
<td>To At ends, on a length equal to two frame spaces</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Center girder and side girders in way of hopper tanks</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elsewhere</td>
</tr>
<tr>
<td>Bracket on center girder</td>
<td>Of Center girder, inner bottom and shell plates</td>
<td>To Web stiffener</td>
</tr>
<tr>
<td>Web stiffener</td>
<td>Of Floor and girder</td>
<td>To</td>
</tr>
<tr>
<td>Side and inner side in double side structure</td>
<td>Web of primary supporting members</td>
<td>Side plating, inner side plating and web of primary supporting members</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Side frame of single side structure</td>
<td>Side frame and end bracket</td>
<td>Side shell plate</td>
</tr>
<tr>
<td>Tripping bracket</td>
<td>Side shell plate and side frame</td>
<td>F1</td>
</tr>
<tr>
<td>Deck</td>
<td>Strength deck</td>
<td>Side shell plating within 0.6L midship</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elsewhere</td>
</tr>
<tr>
<td></td>
<td>$t &gt; 13$</td>
<td>Side shell plating</td>
</tr>
<tr>
<td></td>
<td>$t &lt; 13$</td>
<td>Side shell plating</td>
</tr>
<tr>
<td>Other deck</td>
<td>Side shell plating</td>
<td>F2</td>
</tr>
<tr>
<td>Ordinary stiffener and intercostal girder</td>
<td>Deck plating</td>
<td>F3</td>
</tr>
<tr>
<td>Hatch coamings</td>
<td>Deck plating</td>
<td>At corners of hatchways for 15% of the hatch length</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elsewhere</td>
</tr>
<tr>
<td>Web stiffeners</td>
<td>Coaming webs</td>
<td>F4</td>
</tr>
<tr>
<td>Bulkheads</td>
<td>Non-watertight bulkhead structure</td>
<td>Boundaries</td>
</tr>
<tr>
<td>Ordinary stiffener</td>
<td>Bulkhead plating</td>
<td>At ends (25% of span), where no end brackets are fitted</td>
</tr>
<tr>
<td>Primary supporting members$^{(1)}$</td>
<td>Web plate</td>
<td>Shell plating, deck plating, inner bottom plating, bulkhead</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elsewhere</td>
</tr>
<tr>
<td></td>
<td>Face plate</td>
<td>In tanks, and located within 0.125L from fore peak</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Face area exceeds 65 cm$^2$</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Elsewhere</td>
</tr>
<tr>
<td>After peak</td>
<td>Internal members</td>
<td>Boundaries and each other</td>
</tr>
<tr>
<td>------------</td>
<td>------------------</td>
<td>---------------------------</td>
</tr>
<tr>
<td>Seating</td>
<td>Girder and bracket</td>
<td>Bed plate</td>
</tr>
<tr>
<td></td>
<td>Girder plate</td>
<td>In way of main engine and thrust bearing</td>
</tr>
<tr>
<td></td>
<td>Inner bottom plate and shell</td>
<td>In way of main engine and thrust bearing</td>
</tr>
<tr>
<td>Superstructure and deckhouses</td>
<td>External bulkhead</td>
<td>Deck</td>
</tr>
<tr>
<td></td>
<td>Ordinary stiffeners</td>
<td>Side wall and deck plate</td>
</tr>
<tr>
<td></td>
<td>End section of ordinary stiffener and primary supporting member</td>
<td>Without brackets</td>
</tr>
<tr>
<td></td>
<td></td>
<td>With brackets</td>
</tr>
<tr>
<td>Pillar</td>
<td>Pillar</td>
<td>Heel and head</td>
</tr>
<tr>
<td>Ventilator</td>
<td>Coaming</td>
<td>Deck</td>
</tr>
<tr>
<td>Rudder</td>
<td>Rudder frame</td>
<td>Vertical frames forming main piece</td>
</tr>
<tr>
<td></td>
<td>Rudder plate</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Rudder frames except above</td>
<td></td>
</tr>
</tbody>
</table>

(1) For hatch covers, weld sizes F1, F2 and F3 instead of F0, F1 and F2 respectively, are to be used.
(2) Where the one side continuous welding is applied, the weld size F3 is to be applied.
(3) The interior bulkheads are not included in this category. The welding of the interior bulkheads is to be subjected to the discretion of PRS

33. **Paragraph 12.1.2.1.3 has been amended to read:**

**12.1.2.1.3** The net thickness $t_{GR}$ of hopper tank sloping plate, transverse lower stool, transverse bulkhead plating and inner hull up to a height of 3.0m above the lowest point of the inner bottom, excluding bilge wells, is to be obtained from the following formula:

$$t_{GR} = 0.28(M_{GR} + 42)\sqrt{s/k}, \text{ [mm]}$$

(12.1.2.1.3)