Polski Rejestr Statków

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.

PRS/AW, 06/2010

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

   L i g h t w e i g h t , [t] – the displacement without cargo, fuel, lubricating oil, ballast water, fresh water and feed water, consumable stores and passengers and crew and their effects.
   D e a d w e i g h t , [t] – the difference between the displacement, at the summer draught in sea water of density ρ = 1.025 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
Material classes and grades for ships in general

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

C5 Strength deck plating at corners of cargo hatch openings	– Class III within 0.6L amidships – Class II within rest of cargo region
C6 Bilge strake in ships with double bottom over the full breadth and length less than 150m [(1)]	– Class II within 0.6L amidships – Class I outside 0.6L amidships
C7 Bilge strake in other ships [(1)]	– Class III within 0.4L amidships – Class II outside 0.4L amidships – Class I outside 0.6L amidships
C8 Longitudinal hatch coamings of length greater than 0.15L C9 End brackets and deck house transition of longitudinal cargo hatch coamings [(2)]	– Class III within 0.4L amidships – Class II outside 0.4L amidships – Class I outside 0.6L amidships – Not to be less than Grade *D/DH*

(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 3.1.2.3.1-2
Minimum material grades for ships with ship's length *L* exceeding 150m and single strength deck

Structural member category	Material Grade
Longitudinal strength members of strength deck plating	Grade *B/AH* within 0.4L amidships
Continuous longitudinal strength members above strength deck	Grade *B/AH* within 0.4L amidships
Single side strakes for ships without inner continuous longitudinal bulkheads between bottom and the strength deck	Grade *B/AH* within cargo region

Table 3.1.2.3.1-3
Minimum material grades for ships with ship's length *L* exceeding 250m

Structural member category	Material Grade
Sheer strake at strength deck (1)	Grade *E/EH* within 0.4*L* amidships
Stringer plate in strength deck (1)	Grade *E/EH* within 0.4*L* amidships
Bilge strake (1)	Grade *D/DH* within 0.4*L* amidships
(1) Single strakes required to be of class III within 0.4*L* amidships are to have breadths not less than 800 + 5*L* [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

Structural member category	Material Grade
Lower bracket of ordinary side frame (1), (2)	Grade *D/DH*
Side shell strakes included totally or partially between the two points located to 0.125 ℓ above and below the intersection of side shell and bilge hopper sloping plate or inner bottom plate (2)	Grade *D/DH*
(1) Single strakes required to be of class III within 0.4*L* amidships are to have breadths not less than 800 + 5*L* [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 ℓ 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 0.6*L* 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 3.1.2.3.5-1
Material grade requirements for classes I, II and III

Class	**I**		**II**		**III**	
As-built thickness, [mm]	NSS	HSS	NSS	HSS	NSS	HSS
$t \le 15$	*A*	*AH*	*A*	*AH*	*A*	*AH*
$15 < t \le 20$	*A*	*AH*	*A*	*AH*	*B*	*AH*
$20 < t \le 25$	*A*	*AH*	*B*	*AH*	*D*	*DH*
$25 < t \le 30$	*A*	*AH*	*D*	*DH*	*D*	*DH*
$30 < t \le 35$	*B*	*AH*	*D*	*DH*	*E*	*EH*
$35 < t \le 40$	*B*	*AH*	*D*	*DH*	*E*	*EH*
$40 < t \le 50$	*D*	*DH*	*E*	*EH*	*E*	*EH*

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 0.4*L* 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 0.4*L* 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 0.15*L* 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:

$$t_C = Roundup_{0.5}\,(t_{C1} + t_{C2}) + t_{reserve}\text{, [mm]} \qquad (3.3.1.2.1\text{-}1)$$

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

$$t_C = Roundup_{0.5}\,(2t_{C1}) + t_{reserve}\text{, [mm]} \qquad (3.3.1.2.1\text{-}2)$$

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:

$$M_{WH} = \left(0.3 + \frac{L}{2000}\right) F_M\, f_P C L^2 T_{LC} C_B\text{, [kNm]} \qquad (4.3.3.3.1)$$

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;
Λ – 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];

B_i – moulded breadth at the waterline in the considered cross section, [m];
x, y, z – X, Y and Z co-ordinates of the load point with respect to the reference co-ordinate system defined in 1.4, [m].
For symbols not defined in 4.5, refer to 1.4.

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:

$$p_{W,C} = p_{W,WL} + \rho g (T_{LCi} - z), \text{ [kN/m}^2\text{]} \quad \text{for } T_{Lci} \le z \le h_W + T_{Lci} \quad (4.5.1.6.1\text{-}1)$$

$$p_{W,C} = 0 \quad \text{for } z \ge h_W + T_{Lci} \quad (4.5.1.6.1\text{-}2)$$

where:
$p_{W,WL}$ – positive hydrodynamic pressure at the waterline for the considered load case, [kN/m^2];

$$h_W = \frac{p_{W,WL}}{\rho g}, \text{ [m]}.$$

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:

$$p_D = \varphi p_W, \text{ [kN/m}^2\text{]} \quad (4.5.2.2.1)$$

where:
p_W – pressure obtained from the formulae in Table 4.5.2.2.1-1, [kN/m^2];
φ – 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

Location	Pressure p_W, [kN/m^2]	
	$L_{LL} \ge 100$ m	$L_{LL} < 100$ m
$0 \le x_{LL}/L_{LL} \le 0.75$	34.3	$14.9 + 0.195\,L_{LL}$
$0.75 < x_{LL}/L_{LL} < 1$	$34.3 + (14.8 + \alpha(L_{LL} - 100))\left(4\frac{x_{LL}}{L_{LL}} - 3\right)$	$12.2 + \frac{L_{LL}}{9}\left(5\frac{x_{LL}}{L_{LL}} - 2\right) + 3.6\frac{x_{LL}}{L_{LL}}$
where: α – 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 4.5.2.2.1-2
Coefficient for pressure on exposed decks

Exposed deck location	φ
Freeboard deck	1.00
Superstructure deck, including forecastle deck	0.75
1st tier of deckhouse	0.56
2nd tier of deckhouse	0.42
3rd tier of deckhouse	0.32
4th tier of deckhouse	0.25
5th tier of deckhouse	0.20
6th tier of deckhouse	0.15
7th tier of deckhouse and above	0.10

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

4.5.3.3.1 The lateral pressure p_{SI} for sides of superstructures is to be obtained from the following formula:

$$p_{SI} = 2.1 c f_p c_F \left(C_B + 0.7\right) \frac{20}{10 + z - T}, \text{ [kN/m}^2\text{]} \qquad (4.5.3.3.1)$$

f_p – probability factor, taken equal to:
f = 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:

$$p_A = nc\left[bC - (z - T)\right], \text{ [kN/m}^2\text{]} \qquad (4.5.3.4.1\text{-}1)$$

$$p_A = p_{Amin}, \text{ [kN/m}^2\text{]} \qquad (4.5.3.4.1\text{-}2)$$

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 2nd tier and the tier above as the 3rd tier;

c – coefficient taken equal to:

$$c = 0.3 + 0.7\frac{b_1}{B_1} \qquad (4.5.3.4.1\text{-}3)$$

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_{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_{Full} is in no case to be less than M_H.

M_{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_{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_{HB} – deepest ballast draught, [m].

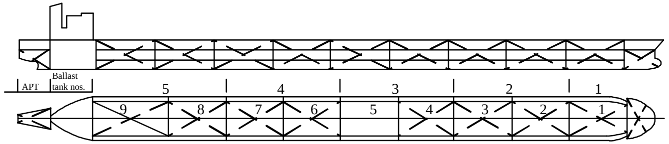
14. ***Table*** **4.8.5.1.6** *has been amended to read:*

Table 4.8.5.1.6 Guidance on Typical Loading Sequence Summary Form

LOADING/UNLOADING SEQUENCE SUMMARY FORM

Vessel name	Voyage No.	Condition	Yard	Id. Number

Port (specific or typical)	Condition at commencement of loading/discharging	
Total mass of cargo to be loaded/discharged:	Condition at end of loading/discharging	
Dock water density [L/m^3]:	Maximum Loading/discharging rate:	Average Loading/discharging rate
Number of loaders/dischargers:	Maximum Ballasting/Deballasting rate:	Average Loading/discharging rate:



Hold No.			7	6	5	4	3	2	1
Volume of hold Vh [m^2]									
Height of hold h [m]									

Note: 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/discharging operations may have to paused to allow for ballasting/deballasting in order to keep actual values within limits.

Hold content at commencement of loading/discharging

Cargo mass									
Density [t/m^3]									
Grade									

Ballasting contents at commencement of loading/discharging

Wings or peaks	APT	No. B.T.	No. B.T.	No. B.T.	No. B.T.	No. B.T.	No. B.T.	No. B.T.	FPT
Upper									
Lower/Peaks									

Commencement of loading/discharging (sea)

Taft [m]	Trim [m]	Tfwd [m]	Maximum S.F. [%]	Maximum B.M. [%]

CARGO OPERATIONS

BALLASTING OPERATIONS

Pour No./Grade	Hold	Hold	Hold 7	Hold 6	Hold 5	Hold 4	Hold 3	Hold 2	Hold 1	Upper Lower/Peak	APT	No. B.T.	No. B.T.	No. B.T.	No. B.T.	No. B.T.	No. B.T.	No. B.T.	FPT
1										Upper									
										Lower/Peak									
2										Upper									
										Lower/Peak									
3										Upper									
										Lower/Peak									
4										Upper									
										Lower/Peak									
5										Upper									
										Lower/Peak									
6										Upper									
										Lower/Peak									
7										Upper									
										Lower/Peak									
8										Upper									
										Lower/Peak									
										Upper									
										Lower/Peak									

Values at end of pour (from harbour to sea)

Taft [m]	Trim [m]	Tfwd [m]	Maximum S.F. [%]	Maximum B.M. [%]

Total cargo onboard [t]: Remaining cargo to be loaded [t] Total amount of bunkers onboard [t]

Draft Survey n 1										Upper									
										Lower/Peak									
Draft Survey n										Upper									
										Lower/Peak									

Hold content at end of loading/discharging

Cargo mass									

Total mass loaded/ discharged [t]		

Ballasting contents at end of loading/discharging

Wings or peaks	APT	Ball. no.5	Ball. no.4	Ball. no.6	Ball. no.3	Ball. no.4	Ball. no.2	Ball. no.1	FPT
Upper									
Lower/Peak									

Values at end of loading/discharging (sea)

Taft [m]	Trim [m]	Tfwd [m]	Maximum S.F. [%]	Maximum B.M. [%]

Maximum occuring values among all conditions above

Net load on Double Bottom										tons/m^2
Net load in two adjacent holds										tons

Net load on double bottom = (Mh/V) h T [t/m^2]
where: Mh = Mass in hold + mass in DB [t]
V = Total volume of hold [m^2]
h = height of hold from inner bottom to top of coaming [m]
T = draught [m]

Approved by: ____________________

Date : ____________________

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];

$\sum$ – 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_{max} (T_i) at various draughts T_i is obtained by the following formulae:

$$W_{\max}(T_i) = M_{HD} + 0.1M_H - 1.025V_H \frac{(T_S - T_i)}{h}, \text{ [t]} \quad (4.9.2.1.2.1\text{-}1)$$

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

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

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

$$W_{\min}(T_i) = 1.025V_H \frac{(T_S - T_i)}{h}, \text{ [t], for } T_S \ge T_i \ge 0.83\ T_S \quad (4.9.2.1.2.1\text{-}3)$$

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

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

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

$$W_{\max}(T_i) = M_{Full} - 1.025V_H \frac{(0.67T_S - T_i)}{h}, \text{ [t]} \quad (4.9.2.1.2.2\text{-}2)$$

for $T_i < 0.67\ T_S$

The minimum required mass $W_{min}(T_i)$ is obtained by the following formula:

$$W_{\min}(T_i) = 0\text{, [t] for } T_i \le T_S \qquad (4.9.2.1.2.2\text{-}3)$$

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.

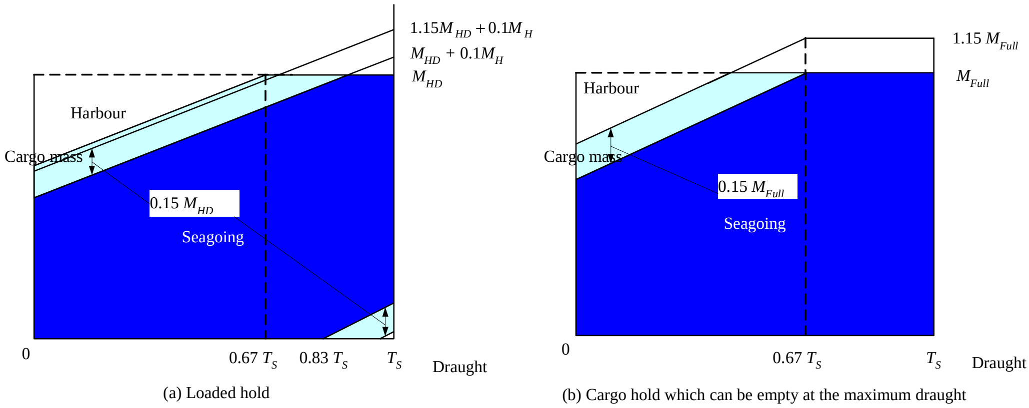


Figure 4.9.2.1.2.2 Example of mass curve for BC-A ships not having {No MP}assigned

4.9.2.1.3 BC-A ship having {No MP} assigned

.1 for loaded holds:

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

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

$$W_{\min}(T_i) = 0\text{, [t] for } T_i \le T_{HB} \qquad (4.9.2.1.3.1\text{-}1)$$

$$W_{\min}(T_i) = 1.025 V_H \frac{(T_i - T_{HB})}{h}\text{, [t] for } T_S \ge T_i \ge T_{HB} \qquad (4.9.2.1.3.1\text{-}2)$$

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

(4.9.2.1.3.1-3)

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

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

$$W_{\max}(T_i) = M_{Full} - 1.025 V_H \frac{(T_S - T_i)}{h}\text{, [t]} \qquad (4.9.2.1.3.2\text{-}1)$$

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

$$W_{\min}(T_i) = 0 \text{, [t] for } T_i \le T_S \qquad (4.9.2.1.3.2\text{-}2)$$

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

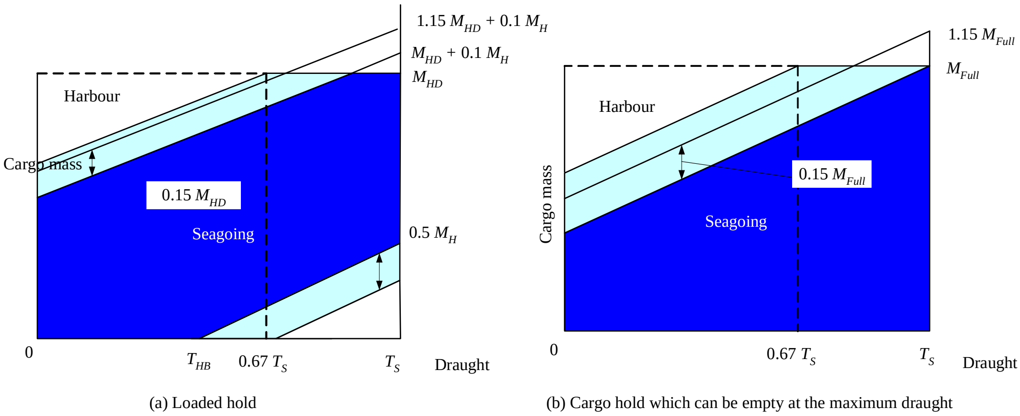


Figure 4.9.2.1.2.2 Example of mass curve for BC-A ships having {No MP}assigned

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

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

$$W_{\max}(T_i) = M_{Full} \text{, [t] for } T_S \ge T_i \ge 0.67T_S \qquad (4.9.2.1.4\text{-}1)$$

$$W_{\max}(T_i) = M_{Full} - 1.025V_H \frac{(0.67T_S - T_i)}{h} \text{,[t] for } T_i < 0.6 \qquad (4.9.2.1.4\text{-}2)$$

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

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

$$W_{\min}(T_i) = 1.025V_H \frac{(T_i - 0.83T_S)}{h} \text{, [t], for } T_S \ge T_i > 0.83T_S \qquad (4.9.2.1.4\text{-}4)$$

Example for mass curve of cargo hold for **BC-B** or **BC-C** ships is shown in Fig 4.9.2.1.4.

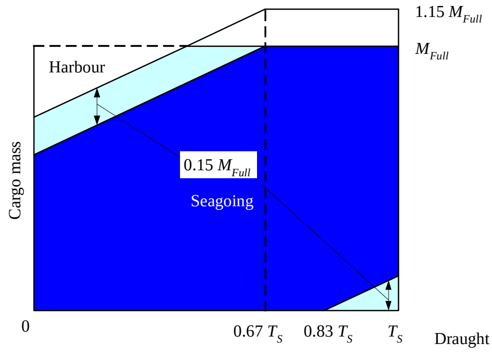


Figure 4.9.2.1.4 Example of mass curve for BC-B or BC-C ships

4.9.2.1.5 BC-B and BC-C ships having {No MP} assigned

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

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

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

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

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

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

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

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.

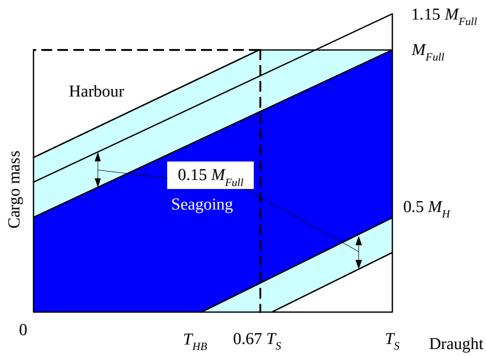


Figure 4.9.2.1.5 Example of mass curve for BC-B or BC-C ships having {No MP} assigned

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 4.9.2.2.2. 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: $W_{max}(T_i) = M_{HD}$ for $T_i \geq 0.67T_S$ (4.9.2.2.3-1)

$$W_{\max}(T_i) = M_{HD} + 0.1M_H - 1.025V_H \frac{(0.67T_S - T_i)}{h} \quad \text{for } T_i < 0.67T_S \quad (4.9.2.2.3\text{-}2)$$

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:

$$W_{max}(T_i) = M_{Full} \quad \text{for } T_S \geq T_i \geq 0.67T_S \quad (4.9.2.2.4\text{-}1)$$

$$W_{\max}(T_i) = M_{Full} - 1.025V_H \frac{(0.67T_S - T_i)}{h} \quad \text{for } T_i < 0.67T_S \quad (4.9.2.2.4\text{-}2)$$

4.9.2.2.5 BC-B and BC-C 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 4.9.2.2.2:

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

$$W_{\max}(T_i) = M_{Full} - 1.025V_H \frac{(0.67T_S - T_i)}{h} \text{ for } T_i < 0.67T_S \qquad (4.9.2.2.5\text{-}2)$$

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 $W_{max}(T_i)$ at various draughts is obtained as the greater result of the following formulae:

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

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

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

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

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

$$W_{\min}(T_i) = 1.025\left(\frac{V_f}{h_f} + \frac{V_a}{h_a}\right)(Ti - 0.75T_S), \text{ [t] for } T_S \geq T_i \geq 0.75T_S \qquad (4.9.3.1.2\text{-}3)$$

4.9.3.1.3 BC-A ships with "Block loading" and having {No MP} assigned

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

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

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

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

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

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

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

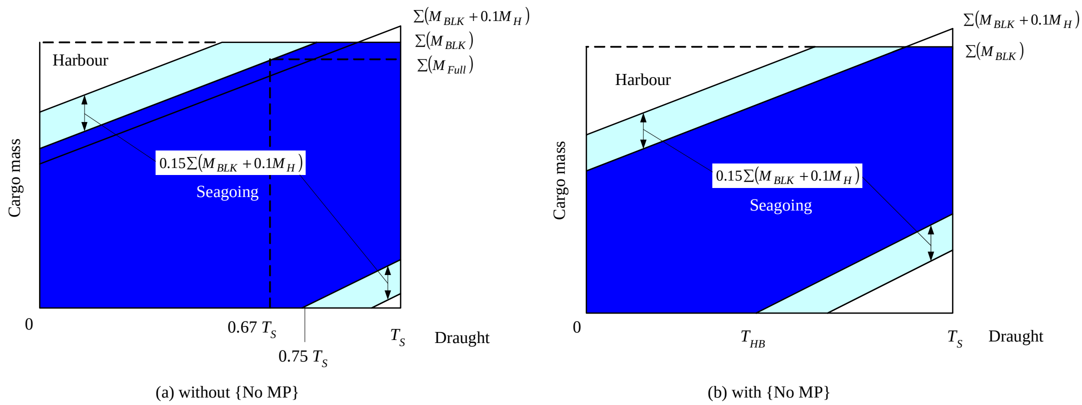


Figure 4.9.3.1.3 Example of mass curve for BC-A ships with "Block loading"

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 $W_{max}(T_i)$ at various draughts T_i is obtained by the following formulae:

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

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

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

$$W_{\min}(T_i) = 0\text{, [t] for } T_i \le 0.75T_S \quad (4.9.3.1.4\text{-}3)$$

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

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 $W_{max}(T_i)$ at various draughts T_i is obtained by the following formulae:

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

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

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

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

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.

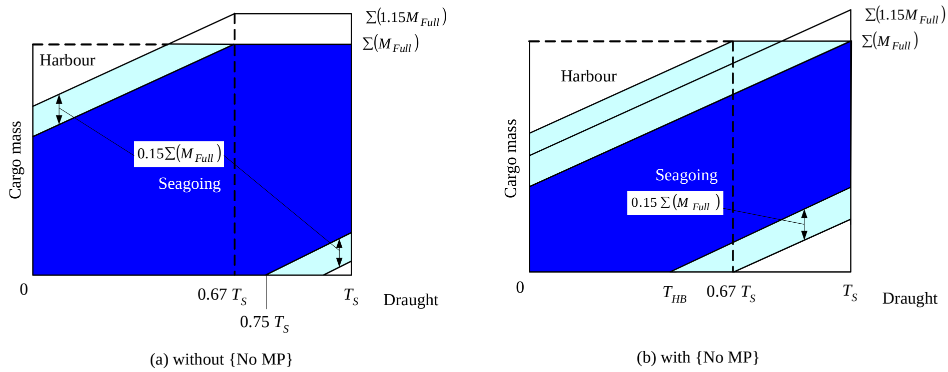


Figure 4.9.3.1.5 Example of mass curve for **BC-A** ship without block loading and **BC-B** or **BC-C** ships

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_{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:

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

$$W_{\max}(T_i) \le \sum M_{BLK} \quad (4.9.3.2.3\text{-}2)$$

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

The maximum permissible mass W_{max} (T_i)ay 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:

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

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

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:

$$x_{G-sc} = 0.75\ell_H \quad (6.1.2.7.2\text{-}1)$$

forward of aft bulkhead, where the hold of which the mid position is located forward from 0,45L from A.E;

$$x_{G-sc} = 0.75\ell_H \quad (6.1.2.7.2\text{-}2)$$

afterward of fore bulkhead, where the hold of which the mid position is located afterward from 0,45L from A.E;

$$y_{G-sc} = \varepsilon \frac{B_h}{4} \qquad (6.1.2.7.2\text{-}3)$$

$$z_{G-sc} = h_{DB} + \left\{1 + (n_1 - 1)\frac{\sqrt{3}}{2}\right\}\frac{d_{sc}}{2} \qquad (6.1.2.7.2\text{-}4)$$

where:

ε = 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];

ℓ_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:

$$a_R = \theta \frac{\pi}{180}\left(\frac{2\pi}{T_R}\right)^2 \sqrt{y_{G\_sc}{}^2 + R^2}\text{, [m/s}^2\text{]} \qquad (6.1.2.7.2\text{-}5)$$

θ, 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:*

$$K_2 = -\frac{s}{\ell} + \sqrt{\left(\frac{s}{\ell}\right)^2 + 1.37\left(\frac{\ell}{s}\right)^2\left(1 - \frac{\ell'}{\ell}\right)^2 + 2.33} \qquad (6.1.2.7.3\text{-}5)$$

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 σ_X between sagging and hogging conditions, when applicable, obtained from the following formula:

$$\sigma_X = C_\ell\left[C_{SW}\left|\frac{M_{SW}}{I_Y}\right|(z-N) + C_{WV}\left|\frac{M_{WV}}{I_Y}\right|(z-N) - C_{WH}\left|\frac{M_{WH}}{I_Z}\right|y\right]\cdot 10^{-3}\text{, [N/mm}^2\text{]} \qquad (6.1.3.1.5\text{-}1)$$

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

$$\left(\frac{|\sigma_x|S}{\kappa_x R_{eH}}\right)^{e1} + \left(\frac{|\tau|S\sqrt{3}}{\kappa_\tau R_{eH}}\right)^{e3} \le 1.0 \qquad (6.3.3.1.2\text{-}1)$$

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

$$\left(\frac{|\sigma_x|S}{\kappa_x R_{eH}}\right)^{e1} + \left(\frac{|\tau|S\sqrt{3}}{\kappa_\tau R_{eH}}\right)^{e3} \le 1.0 \qquad (6.3.3.1.2\text{-}2)$$

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

ii) transversely framed plating

$$\left(\frac{|\sigma_y|S}{\kappa_y R_{eH}}\right)^{e2} + \left(\frac{|\tau|S\sqrt{3}}{\kappa_\tau R_{eH}}\right)^{e3} \le 1.0 \qquad (6.3.3.1.2\text{-}3)$$

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

$$\left(\frac{|\sigma_y|S}{\kappa_y R_{eH}}\right)^{e2} + \left(\frac{|\tau|S\sqrt{3}}{\kappa_\tau R_{eH}}\right)^{e3} \le 1.0 \qquad (6.3.3.1.2\text{-}4)$$

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 κ_x and κ_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 $e3$, κ_y is to be taken equal to 1 in case of longitudinally framed plating and κ_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/m^2], is to be taken equal to:

i) the external pressure p_D defined in 4.5.2.1 for exposed decks,

ii) 5 kN/m^2 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:

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

where:

S_s – spacing of securing devices, [m];

α – coefficient taken equal to:

$\alpha = 0.75$ for $R_{eH} > 235$ N/mm^2

$\alpha = 1.0$ for $R_{eH} \leq 235$ N/mm^2

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

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:

$$Q_{R1} = C_{R1}\, r_{1,} \text{ [Nm]} \qquad (10.1.2.2.2\text{-}1)$$

$$Q_{R2} = C_{R2}\, r_2 \text{, [Nm]} \qquad (10.1.2.2.2\text{-}2)$$

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];

μ_1 – frictional coefficient between nut and rudder body, normally $\mu_1 = 0.3$;

d_1 – 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/mm^2].

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:

$$\Delta\ell_1 = \frac{p_{reg} d_m}{E\left(\frac{1-\alpha^2}{2}\right)c} + \frac{0.8R_{tm}}{c}, \text{ [mm]} \qquad (10.1.4.5.5\text{-}1)$$

R_{tm} – mean roughness, taken equal to about 0.01, [mm];
c – taper on diameter according to 10.1.4.5.1.
α – as defined in 10.1.2.1.2

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

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

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

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

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

$$t_H = 0.045\frac{d_S^2}{s_H}, \text{ [mm]} \qquad (10.1.5.3.4\text{-}1b)$$

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:*

Equipment number *EN* *A*< *EN* ≤*B*		Towline [(1)]		Mooring lines		
A	*B*	Minimum length, [m]	Breaking load, [kN]	*N* [(2)]	Length of each line, [m]	Breaking load, [kN]
3600	3800	300	1471	6	200	612
3800	4000	300	1471	6	200	647
4000	4200	300	1471	7	200	647
4200	4400	300	1471	7	200	657
4400	4600	300	1471	7	200	667
4600	4800	300	1471	7	200	677
4800	5000	300	1471	7	200	686
5000	5200	300	1471	8	200	686
5200	5500	300	1471	8	200	696
5500	5800	300	1471	8	200	706
5800	6100	300	1471	9	200	706
6100	6500			9	200	716
6500	6900			9	200	726
6900	7400			10	200	726
7400	7900			11	200	726
7900	8400			11	200	735
8400	8900			12	200	735
8900	9400			13	200	735
9400	10000			14	200	735
10000	10700			15	200	735
10700	11500			16	200	735
11500	12400			17	200	735
12400	13400			18	200	735
13400	14600			19	200	735
14600	16000			21	200	735

[(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 2*t* (*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

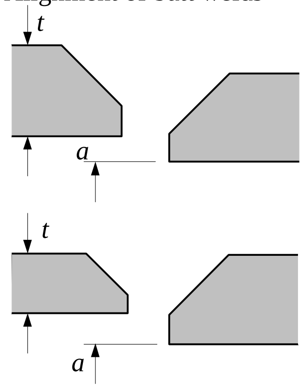
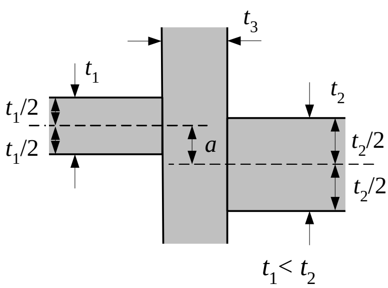
and, in particular, the ends of bends (plate edges) are to be examined for cracks. Except in cases where edge cracks are negligible, all cracked components are to be rejected. Repair welding is not permissible.*31. Sub-chapter* **11.1.1.3** *has been amended to read:*

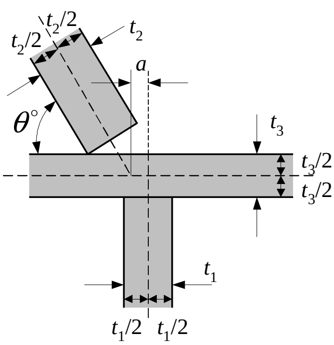
11.1.1.3 Assembly, alignment

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.

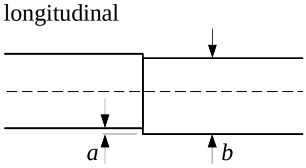
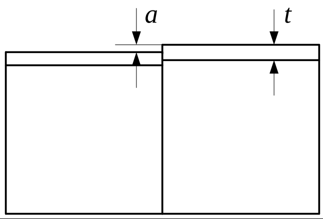
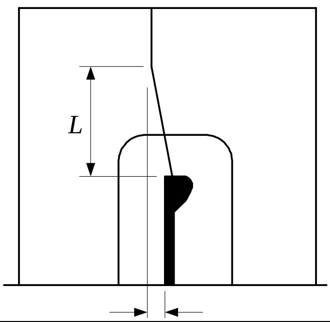
After completion of welding, straightening and aligning shall be carried out in such a manner that the material properties are not influenced significantly. In case of doubt, PRS may require a procedure test or a working test to be carried out.

Table 11.1.1.3.1
Alignment (t, t_1 and t_2: as built thickness)

<table>
<tr><th>Detail</th><th>Standard</th><th>Limit</th><th>Remarks</th></tr>
<tr><td>Alignment of butt welds

</td><td></td><td>$a \le 0.15t$ strength member
$a \le 0.2t$ other
but maximum 4.0mm</td><td>t is the lesser plate thickness</td></tr>
<tr><td>Alignment of fillet welds

</td><td></td><td>Strength member and higher stress member:
$a \le t_1/3$
Other:
$a \le t_1/2$</td><td>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.</td></tr>
<tr><td>Alignment of fillet welds

</td><td></td><td>Strength member and higher stress member:
$a \le t_1/3$
Other:
$a \le t_1/2$</td><td>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.</td></tr>
<tr><td colspan="4">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.</td></tr>
</table>

Detail	Standard	Limit	Remarks
Alignment of face plates of T longitudinal  *b* [mm]	Strength member: $a \leq 0.04b$h	a = 8.0 mm	
Alignment of height of T-bar, L-angle bar or bulb 	Strength member: $a \leq 0.15t$ Other: $a \leq 0.2t$	a = 3.0 mm	
Alignment of panel stiffener 	$d \leq L/50$		

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 0.44*t* and 0.4*t*, where *t* is as-built thickness of the thinner of two connected members.

Table 11.2.6.1-1
Categories of fillet welds

Category	Kinds of fillet welds	As-built thickness of abutting plate, t, [mm] [(1)]	Leg length of fillet weld, [mm] [(2), (3)]	Length of fillet welds, [mm]	Pitch, [mm]
F0	Double continuous weld	t	$0.7t$	–	–
F1	Double continuous weld	$t \le 10$	$0.5t + 1.0$	–	–
		$10 \le t < 20$	$0.4t + 2.0$	–	–
		$20 \le t$	$0.3t + 4.0$	–	–
F2	Double continuous weld	$t \le 10$	$0.4\,t + 1.0$	–	–
		$10 \le t < 20$	$0.3\,t + 2.0$	–	–
		$20 \le t$	$0.2\,t + 4.0$	–	–
F3	Double continuous weld	$t \le 10$	$0.3\,t + 1.0$	–	–
		$10 \le t < 20$	$0.2\,t + 2.0$		
		$20 \le t$	$0.1\,t + 4.0$		
F4	Intermittent weld	$t \le 10$	$0.5\,t + 1.0$	75	300
		$10 \le t < 20$	$0.4\,t + 2.0$		
		$20 \le t$	$0.3\,t + 4.0$		

(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 $5 \ge t_c > 4$
+ 0.0 mm for $4 \ge t_c > 3$
– 0.5 mm for $t_c \le 3$.

(3) Leg length shall be rounded to the nearest half millimetre.

Table 11.2.6.1-2
Application of fillet welds

Hull area	Connection			Category
	Of	To		
General, unless otherwise specified in the table [(1)]	Watertight plate	Boundary plating		F1
	Brackets at ends of members			F1
	Ordinary stiffener and collar plates	Deep tank bulkheads		F3
		Web of primary supporting members and collar plates		F2
	Web of ordinary stiffener	Plating (Except deep tank bulkhead)		F4
		Face plates of built-up stiffeners	At ends (15% of span)	F2
			Elsewhere	F4
	End of primary supporting members and ordinary stiffeners without brackets	Deck plate, shell plate, inner bottom plate, bulkhead plate, bulkhead plate		F0
	End of primary supporting members and ordinary stiffeners with brackets	Deck plate, shell plate, inner bottom plate, bulkhead plate, bulkhead plate		F1
Bottom and double bottom	Ordinary stiffener	Bottom and inner bottom plating		F3
	Center girder	Shell plates in strengthened bottom forward		F1
		Inner bottom plate and shell plate except the above		F2
	Side girder including intercostal plate	Bottom and inner bottom plating		F3
	Floor	Shell plates and inner bottom plates	At ends, on a length equal to two frame spaces	F2
		Center girder and side girders in way of hopper tanks		F2
		Elsewhere		F3
	Bracket on center girder	Center girder, inner bottom and shell plates		F2
	Web stiffener	Floor and girder		F3

Side and inner side in double side structure	Web of primary supporting members		Side plating, inner side plating and web of primary supporting members		F2
Side frame of single side structure	Side frame and end bracket		Side shell plate		See Fig 3.6.8.3.1
	Tripping bracket		Side shell plate and side frame		F1
Deck	Strength deck	$t > 13$	Side shell plating within 0.6L midship		Deep penetration
			Elsewhere		F1
		$t < 13$	Side shell plating		F1
	Other deck		Side shell plating		F2
			Ordinary stiffeners		F4
	Ordinary stiffener and intercostal girder		Deck plating		F3
	Hatch coamings		Deck plating	At corners of hatchways for 15% of the hatch length	F1
				Elsewhere	F2
	Web stiffeners		Coaming webs		F4
Bulkheads	Non-watertight bulkhead structure		Boundaries	Swash bulkheads	F3
	Ordinary stiffener		Bulkhead plating	At ends (25% of span), where no end brackets are fitted	F1
Primary supporting members [(1)]	Web plate		Shell plating, deck plating, inner bottom plating, bulkhead	At end (15% of span)	F1
				Elsewhere	F2
			Face plate	In tanks, and located within 0.125L from fore peak	F2
				Face area exceeds 65 cm^2	F2
				Elsewhere	F3

After peak	Internal members	Boundaries and each other		F2
Seating	Girder and bracket	Bed plate	In way of main engine, thrust bearing, boiler bearers and main generator engines	F1
		Girder plate	In way of main engine and thrust bearing	F1
		Inner bottom plate and shell	In way of main engine and thrust bearing	F2
Superstructure and deckhouses	External bulkhead	Deck		F1
	Ordinary stiffeners	Side wall and deck plate	At end (15% of span)	F3
			Elsewhere	F4(2)
	End section of ordinary stiffener and primary supporting member	Without brackets	Side wall and web of primary supporting members	F1
		With brackets		F2
Pillar	Pillar	Heel and head		F1
Ventilator	Coaming	Deck		F1
Rudder	Rudder frame	Vertical frames forming main piece		F1
		Rudder plate		F3
		Rudder frames except above		F2

(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:

$$t_{GR} = 0.28(M_{GR} + 42)\sqrt{sk}\text{ , [mm]} \qquad (12.1.2.1.3)$$
