Common Structural Rules for Bulk Carriers and Oil Tankers

Urgent Rule Change Notice 1 to 01 JAN 2015 version

Notes: (1) These Rule Changes enter into force on 1st July 2017.

COMMON STRUCTURAL RULES FOR BULK CARRIERS AND OIL TANKERS

URGENT RULE CHANGE NOTICE 1

This document contains amendments within the following Parts and chapters of the Common Structural Rules for Bulk Carriers and Oil Tankers, 1 January 2015. The amendments are effective on 1 July 2017.

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

Part	Chapter	Section	Paragraph/Figure/Table	Effective Date
1	4	4	Symbols	1st July 2017
1	4	5	1.3.2	1st July 2017
1	4	5	1.3.4	1st July 2017
1	5	1	Symbols	1st July 2017
1	5	1	Table 2, Table3, 3.3.1	1st July 2017
1	5	2	2.2.1	1st July 2017
1	9	1	Table 3	1st July 2017
1	9	3	Table 5	1st July 2017

PART 1
GENERAL HULL REQUIREMENTS

CHAPTER 4
LOADS

SECTION 4
HULL GIRDER LOADS

SYMBOLS

For symbols not defined in this section, refer to Ch 1, Sec 4.

x : X coordinate, in m, of the calculation point with respect to the reference coordinate system defined in Ch 4, Sec 1, 1.2.1.

C_w : Wave coefficient, in m, to be taken as:

$$C_w = 10.75 - \left(\frac{300 - L}{100}\right)^{1.5} \quad \text{for } 90 \le L \le 300$$

$$C_w = 10.75 \quad \text{for } 300 < L \le 350$$

$$C_w = 10.75 - \left(\frac{L - 350}{150}\right)^{1.5} \quad \text{for } 350 < L \le 500$$

f_β : Heading correction factor, to be taken as:

- For strength assessment:

  f_β = 1.05 for HSM and FSM load cases for the extreme sea loads design load scenario.

  f_β = 0.8 for BSR and BSP load cases for the extreme sea loads design load scenario.

  f_β = 1.0 for ~~HSM~~, HSA, ~~FSM~~, OST and OSA load cases for the extreme sea loads design load scenario.

  f_β = 1.0 for ballast water exchange at sea, harbour/sheltered water and accidental flooded design load scenarios.

- For fatigue assessment:

  f_β = 1.0.

f_{ps} : Coefficient, as defined in Ch 4, Sec 3.

BSR, *BSP*, *HSM*, *HSA*, *FSM*, *OST*, *OSA*: Dynamic load cases, as defined in Ch 4, Sec 2.

SECTION 5
EXTERNAL LOADS

1 SEA PRESSURE

1.3 External dynamic pressures for strength assessment

1.3.2 Hydrodynamic pressures for HSM load cases

The hydrodynamic pressures, P_W, for HSM-1 and HSM-2 load cases, at any load point, in kN/m2, are to be obtained from Table 2. See also Figure 2 and Figure 3.

Table 2 : Hydrodynamic pressures for HSM load cases

	Wave pressure, in kN/m²		
Load case	$z \le T_{LC}$	$T_{LC} < z \le h_W + T_{LC}$	$z > h_W + T_{LC}$
HSM-1	$P_W = \max(-P_{HS}, \rho g(z - T_{LC}))$	$P_W = P_{W,WL} - \rho g(z - T_{LC})$	$P_W = 0.0$
HSM-2	$P_W = \max(P_{HS}, \rho g(z - T_{LC}))$		

where:

$$\sout{P_{HS} = f_{ps}\, f_{nl}\, f_h\, k_a\, k_p\, f_{yz}\, C_w \sqrt{\frac{L_0 + \lambda - 125}{L}}}$$

$$P_{HS} = f_\beta\, f_{ps}\, f_{nl}\, f_h\, k_a\, k_p\, f_{yz}\, C_w \sqrt{\frac{L_0 + \lambda - 125}{L}}$$

1.3.4 Hydrodynamic pressures for FSM load cases

The hydrodynamic pressures, P_W, for FSM-1 and FSM-2 load cases, at any load point, in kN/m2, are to be obtained from Table 6. See also Figure 2 and Figure 3.

Table 6 : Hydrodynamic pressures for FSM load cases

	Wave pressure, in kN/m²		
Load case	$z \le T_{LC}$	$T_{LC} < z \le h_W + T_{LC}$	$z > h_W + T_{LC}$
FSM-1	$P_W = \max(-P_{FS}, \rho g(z - T_{LC}))$	$P_W = P_{W,WL} - \rho g(z - T_{LC})$	$P_W = 0.0$
FSM-2	$P_W = \max(P_{FS}, \rho g(z - T_{LC}))$		

where:

$$\sout{P_{FS} = f_{ps}\, f_{nl}\, f_h\, k_a\, k_p\, f_{yz}\, C_w \sqrt{\frac{L_0 + \lambda - 125}{L}}}$$

$$P_{FS} = f_\beta\, f_{ps}\, f_{nl}\, f_h\, k_a\, k_p\, f_{yz}\, C_w \sqrt{\frac{L_0 + \lambda - 125}{L}}$$

CHAPTER 5
HULL GIRDER STRENGTH

SECTION 1
HULL GIRDER YIELDING STRENGTH

SYMBOLS

For symbols not defined in this section, refer to Ch 1, Sec 4.

M_{sw} : Permissible hogging and sagging vertical still water bending moment in intact seagoing condition, in kNm, at the hull transverse section considered, defined in Ch 4, Sec 4, [2.2.2].

M_{sw-p} : Permissible hogging and sagging vertical still water bending moment for harbour/sheltered water operation, in kNm, at the hull transverse section considered, as defined in Ch 4, Sec 4, [2.2.3].

M_{sw-f} : Permissible hogging and sagging vertical still water bending moment in flooded condition at sea, in *kNm*, at the hull transverse section considered, as defined in Ch 4, Sec 4, [2.2.4].

M_{wv} : Vertical wave bending moment in seagoing condition, in kNm, in intact or flooded conditions at the hull transverse section considered, defined in Ch 4, Sec 4, [3.1.1].

M_{wh} : Horizontal wave bending moment, in kNm, at the hull transverse section considered, defined in Ch 4, Sec 4, [3.3.1]

Q_{sw} : Permissible positive or negative still water shear force for seagoing operation, in kN, at the hull transverse section considered, as defined in Ch 4, Sec 4, [2.3.3].

Q_{sw-p} : Permissible positive or negative still water shear force for harbour/sheltered operation, in kN, at the hull transverse section considered, as defined in Ch 4, Sec 4,[2.3.4].

Q_{sw-f} : Permissible positive or negative still water shear force for in flooded condition at sea, in kN, at the hull transverse section considered, as defined in Ch 4, Sec 4, [2.3.5].

Q_{wv} : Vertical wave shear force in seagoing condition, in kN, in intact or flooded conditions at the hull transverse section considered, defined in Ch 4, Sec 4, [3.2.1].

Q_{sw-Lcd} : Vertical still water shear force for the considered loading condition in seagoing operation, in *kN*, at the hull transverse section considered.

$Q_{sw-Lcd-p}$:Vertical still water shear force for the considered loading condition in harbour/sheltered operation, in kN, at the hull transverse section considered.

$Q_{sw-Lcd-f}$:Vertical still water shear force for the considered flooded condition in seagoing operation, in kN, at the hull transverse section considered.

x : X coordinate, in m, of the calculation point with respect to the reference coordinate system defined in Ch 1, Sec 4, [3.6].

V_D : Vertical distance to the equivalent deck line, in *m*, as defined in [1.4.3].

z : Z coordinate, in m, of the calculation point with respect to the reference coordinate system defined in Ch 1, Sec 4, [3.6].

z_n : Z coordinate, in m, of horizontal neutral axis of the hull transverse section with net scantling defined in 1.2, with respect to the reference coordinate system defined in Ch 1, Sec 4, [3.6].

I_{y-n50} : Net moment of inertia, in m^4, of the hull transverse section about its horizontal neutral axis, to be calculated according to [1.5].

I_{z-n50} : Net moment of inertia, in m^4, of the hull transverse section about its vertical neutral axis, to be calculated according to [1.5].

Z_{A-n50} : Net section modulus, in m^3, at any point of the hull transverse section, to be calculated according [1.4.1].

Z_{B-n50}, Z_{D-n50}: Net section moduli, in m^3, at bottom and deck, respectively, to be calculated according to [1.4.2] and [1.4.3]

Z_{VD} : Z coordinate, in m, taken equal to $V_D + z_n$.
C_w : Wave parameter defined in Ch 4, Sec 4.
ρ : Seawater density, taken equal to 1.025 t/m³.
f_β : Heading correction factor, to be taken as:

f_β = 1.05 for seagoing conditions.

f_β = 1.0 for ballast water exchange at sea, harbour/sheltered water and accidental flooded design load scenarios.

2 HULL GIRDER BENDING ASSESSMENT

2.2 Normal Stresses

2.2.2

The normal stresses, σ_L in N/mm2, induced by vertical bending moments are given in Table 2:

Table 2: Normal stress, σL

Operation	**Normal stress, σ_L**		
	At any point located below Z_{VD}	**At bottom(1)**	**At deck(1)**
Seagoing	~~$\sigma_L = \frac{M_{SW} + M_{WV}}{Z_{A-n50}} 10^{-3}$~~ $\sigma_L = \frac{M_{SW} + f_\beta M_{WV}}{Z_{A-n50}} 10^{-3}$	~~$\sigma_L = \frac{M_{SW} + M_{WV}}{Z_{B-n50}} 10^{-3}$~~ $\sigma_L = \frac{M_{SW} + f_\beta M_{WV}}{Z_{B-n50}} 10^{-3}$	~~$\sigma_L = \frac{M_{SW} + M_{WV}}{Z_{D-n50}} 10^{-3}$~~ $\sigma_L = \frac{M_{SW} + f_\beta M_{WV}}{Z_{D-n50}} 10^{-3}$
Harbour/sheltered waters	$\sigma_L = \frac{M_{sw-p}}{Z_{A-n50}} 10^{-3}$	$\sigma_L = \frac{M_{sw-p}}{Z_{B-n50}} 10^{-3}$	$\sigma_L = \frac{M_{sw-p}}{Z_{D-n50}} 10^{-3}$
Flooded condition at sea for bulk carriers having a length *L* of 150m or above	$\sigma_L = \frac{M_{sw-f} + M_{wv}}{Z_{A-n50}} 10^{-3}$	$\sigma_L = \frac{M_{sw-f} + M_{wv}}{Z_{B-n50}} 10^{-3}$	$\sigma_L = \frac{M_{sw-f} + M_{wv}}{Z_{D-n50}} 10^{-3}$

(1) The **σ_L** values at bottom and deck, correspond to the application of formula given for any point, calculated at equivalent deck line and at baseline.

2.4 Extent of high tensile steel

2.4.1 Vertical extent

The vertical extent of higher strength steel, $Z_{hts,i}$, in m, used in the deck zone or bottom zone and measured respectively from the moulded deck line at side or baseline is not to be taken less the value obtained from the following formula, see Figure 3:

$$Z_{hts,i} = z_1 \left(1 - \frac{\sigma_{perm,i}}{\sigma_L} \right)$$

where:

Z_1 : Distance from horizontal neutral axis to moulded deck line or baseline respectively, in m.

$\sigma_{perm,i}$: Permissible hull girder bending stress of the considered steel, in N/mm2, as given in Table 1 and Figure 3.

σ_L : Hull girder bending stress, at moulded deck line or at baseline respectively, in N/mm2 given in Table 3.

Table 3 : Hull girder stresses at baseline and moulded deck line

Operation	At baseline	At moulded deck line
Seagoing	~~$\sigma_{bl} = \frac{\lvert M_{SW} + M_{WV} \rvert}{I_{y-n50}} z_n 10^{-3}$~~ $\sigma_{bl} = \frac{\lvert M_{SW} + f_\beta M_{WV} \rvert}{I_{y-n50}} z_n 10^{-3}$	~~$\sigma_{dk} = \frac{\lvert M_{SW} + M_{WV} \rvert}{I_{y-n50}} (z_{dk-S} - z_n) 10^{-3}$~~ $\sigma_{dk} = \frac{\lvert M_{SW} + f_\beta M_{WV} \rvert}{I_{y-n50}} (z_{dk-S} - z_n) 10^{-3}$
Harbour/sheltered water	$\sigma_{bl} = \frac{\lvert M_{SW-p} \rvert}{I_{y-n50}} z_n 10^{-3}$	$\sigma_{dk} = \frac{\lvert M_{SW-p} \rvert}{I_{y-n50}} (z_{dk-S} - z_n) 10^{-3}$
Flooded condition at sea for bulk carriers having a length *L* of 150*m* or above	$\sigma_{bl} = \frac{\lvert M_{SW-f} + M_{WV} \rvert}{I_{y-n50}} z_n 10^{-3}$	$\sigma_{dk} = \frac{\lvert M_{SW-f} + M_{WV} \rvert}{I_{y-n50}} (z_{dk-S} - z_n) 10^{-3}$
z_{dk-s} : Distance from baseline to moulded deck line at side, in *m*.		

3.3 Acceptance criteria

3.3.1 Permissible vertical shear force

The positive and negative permissible vertical shear forces are to comply with the following criteria:

- For seagoing operation:

  ~~$\lvert Q_{SW} \rvert \le Q_R - \lvert Q_{WV} \rvert$~~

  $$\lvert Q_{SW} \rvert \le Q_R - \lvert f_\beta Q_{WV} \rvert$$

- For harbour/sheltered water operation:

  $$\lvert Q_{SW-p} \rvert \le Q_R$$

- For flooded condition at sea of bulk carriers having a length *L* of 150*m* or above:

  $$\lvert Q_{SW-f} \rvert \le Q_R - \lvert Q_{WV} \rvert$$

where:

Q_R: Total vertical hull girder shear capacity, in *kN*, as defined in [3.2.1].

SECTION 2
HULL GIRDER ULTIMATE STRENGTH

2 CHECKING CRITERIA

2.2 Hull girder ultimate bending loads

2.2.1

The vertical hull girder bending moment, M in hogging and sagging conditions, to be considered in the ultimate strength check is to be taken as:

~~$M = \gamma_S M_{sw-U} + \gamma_W M_{wv}$~~

$$M = \gamma_S M_{sw-U} + \gamma_W f_\beta M_{wv}$$

where:

M_{sw-U} : Permissible still water bending moment, in kNm, in hogging and sagging conditions at the hull transverse section considered as defined in Table 1.

M_{wv} : Vertical wave bending moment, in kNm, in hogging and sagging conditions at the hull transverse section considered as defined in Ch 4, Sec 4, [3.1].

γ_s : Partial safety factor for the still water bending moment, as defined in Table 2.

γ_w : Partial safety factor for the vertical wave bending moment, as defined in Table 2.

f_β : Heading correction factor, as defined in Sec 1, Hull Girder Yielding Strength, SYMBOLS

CHAPTER 9
FATIGUE

SECTION 1
GENERAL CONSIDERATIONS

7 LOAD CASES

Table 3: Fraction of time for each loading condition of bulk carriers

Ship length	Loading conditions	$a_{(j)}$	
		BC-A	BC-B, BC-C
L < 200 m	Homogeneous	0.60	0.70
	Alternate	0.10	-
	Normal Ballast	0.15	~~0.15~~0.05
	Heavy Ballast(1)	0.15	~~0.15~~0.25
L > 200 m	Homogeneous	0.25	0.50
	Alternate	0.25	-
	Normal Ballast	0.20	0.20
	Heavy Ballast	0.30	0.30

(1) For BC-B and BC-C without heavy ballast cargo hold, fraction of time for normal ballast is 30% and for heavy ballast 0%.

SECTION 3
FATIGUE EVALUATION

5 FATIGUE DAMAGE CALCULATION

Table 5: Time in corrosive environment, T_c

Location of weld joint or structural detail	**Time in corrosive environment T_c, in years**
Water ballast tank	~~5~~10
Oil cargo tank	
Lower part(1) of bulk cargo hold and water ballast cargo hold	
Bulk cargo hold and water ballast cargo hold except lower part(1)	~~2~~5
Void space Other areas	

(1) Lower part means cargo hold below a horizontal level located at a distance of 300 mm below the frame end brackets for hols of single side skin construction or 300 mm below the hopper tank upper end for holds of double side skin construction (see Pt 2, Ch 1, Sec 2, Figure 1).