Common Structural Rules for Bulk Carriers and Oil Tankers, 1 January 2022, Rule Change Notice 1

Amended Rules

Rules for the Survey and Construction of Steel Ships Part CSR-B&T

Reason for Amendment

Rule Change Notice 1 related to the 1 January 2022 edition of the Common Structural Rules for Bulk Carriers and Oil Tankers were published by IACS in December 2022. The relevant requirements are amended in accordance with the Rule Change Notice 1.

Outline of Amendment

Relevant requirements are amended in accordance with the Rule Change Notice 1.

"Rules for the survey and construction of steel ships" has been partly amended as follows:

Part CSR-B&T COMMON STRUCTURAL RULES FOR BULK CARRIERS AND OIL TANKERS

Part 1 GENERAL HULL REQUIREMENTS

Chapter 1 RULE GENERAL PRINCIPLES

Section 1 APPLICATION

1. Scope of Application

1.2 Scope of Application for Bulk Carriers

Paragraph 1.2.1 has been amended as follows.

1.2.1

These Rules apply to the hull structures of single side skin and double side skin bulk carriers having a freeboard length ~~L_{CSR}~~ L_{LL} of 90 *m* or above.

Bulk carriers are ships which are constructed generally with single deck, double bottom, hopper side tanks and topside tanks and with single or double side skin construction in cargo hold region and intended primarily to carry dry cargoes in bulk. Typical arrangements of bulk carriers are shown in **Fig. 1.**

Hybrid bulk carriers, where at least one cargo hold is constructed with hopper tank and topside tank, see typical arrangements in **Fig. 1**, and other cargo holds are constructed without hopper tank and/or topside tanks, see examples of a transverse section in **Fig. 2**, are to comply with the strength criteria defined in these Rules.

These Rules are not applicable to the following ship types:

- Ore carriers.
- Combination carrier.
- Woodchip carrier.
- Cement, fly ash and sugar carriers provided that loading and unloading is not carried out by grabs heavier than 10 *tons*, power shovels and other means which may damage cargo hold structure.
- Ships with inner bottom construction adapted for self-unloading.

1.3 Scope of Application for Oil Tankers

Paragraph 1.3.1 has been amended as follows.

1.3.1 Length and structural arrangement application

These Rules apply to the hull structures of double hull oil tankers having a freeboard length ~~L_{CSR}~~ L_{LL} of 150 *m* or above. Oil tanker is defined as a ship which has to comply with *Annex I of MARPOL73/78*.

The typical arrangements of oil tankers covered by the rules are shown in **Fig. 3** and assume that the structural arrangements include:

- Double side structure with breadth in accordance with statutory requirements.
- Side longitudinal, centreline longitudinal or transverse bulkheads of plane, corrugated or double skin construction.
- Single deck structure.

The cross sections shown in **Fig. 3** are typical examples only and other variations of cross tie and web frame arrangements are also covered.

3. Class Notations

3.2 Class Notation for Bulk Carriers

Paragraph 3.2.1 has been amended as follows.

3.2.1 Additional service features *BC-A*, *BC-B* and *BC-C*

The following requirements apply to ships, as defined in **1.2.1**, having <u>a freeboard</u> length ~~L_{CSR}~~ <u>L_{LL}</u> of 150 *m* or above.

Bulk carriers are to be assigned one of the following additional service features:

(a) *BC-A*: For bulk carriers designed to carry dry bulk cargoes of cargo density 1.0 t/m^3 and above with specified holds empty at maximum draught in addition to *BC-B* conditions.

(b) *BC-B*: For bulk carriers designed to carry dry bulk cargoes of cargo density of 1.0 t/m^3 and above with all cargo holds loaded in addition to *BC-C* conditions.

(c) *BC-C*: For bulk carriers designed to carry dry bulk cargoes of cargo density less than 1.0 t/m^3.

The following additional service features are to be provided giving further detailed description of limitations to be observed during operation as a consequence of the design loading condition applied during the design in the following cases:

- {*Maximum cargo density in* t/m^3} for additional service features *BC-A* and *BC-B* if the maximum cargo density is less than 3.0 t/m^3, see also **Ch 4, Sec 8, 4.1**.
- {*No MP*} for all additional service features when the ship has not been designed for loading and unloading in multiple ports in accordance with the conditions specified in **Ch 4, Sec 8, 4.2.2**.
- {*Holds a, b, … may be empty*} for additional service feature *BC-A*, see also **Ch 4, Sec 8, 4.1**.
- {*Block loading*} for additional service feature *BC-A*, when the ship is intended to operate in alternate block load condition, see also **Ch 4, Sec 8, 4.2.3 (d)**.

Section 2 RULE PRINCIPLES

3. Design Basis

3.1 General

Paragraphs 3.1.3 to 3.1.5 have been amended as follows.

3.1.3 Residual strength

Ships having a freeboard length ~~L_{CSR}~~ L_{LL} of 150 *m* or above are to be designed to have sufficient reserve strength to withstand the loads in damaged conditions, e.g. collision, grounding or flooded scenarios. Residual strength calculations are to take into account the ultimate reserve capacity of the hull girder, considering permanent deformation and post-buckling behaviour as specified in **Ch 5, Sec 3**.

3.1.4 Finite element analysis

The scantling of the structural members within the cargo hold region of ships having a freeboard length ~~L_{CSR}~~ L_{LL} of 150*m* or above is to be assessed according to the requirements specified in **Pt 1, Ch 7**.

3.1.5 Fatigue life

Ships having a freeboard length ~~L_{CSR}~~ L_{LL} of 150*m* or above are to be assessed according to the design fatigue life for structural details specified in **Pt 1, Ch 9**.

Section 5 LOADING MANUAL AND LOADING INSTRUMENTS

4. Loading Specific to Bulk Carriers

4.1 Guidance for Loading/Unloading Sequences

Paragraph 4.1.1 has been amended as follows.

4.1.1 Scope of application

The requirements given in **4** are applicable to bulk carriers having a freeboard length L_{LL} of 150*m* ~~in length and~~ or above.

Chapter 2 GENERAL ARRANGEMENT DESIGN

Section 2 SUBDIVISION ARRANGEMENT

1. Watertight Bulkhead Arrangement

1.1 Number and Disposition of Watertight Bulkheads

Paragraph 1.1.4 has been amended as follows.

1.1.4

For bulk carriers with freeboard length L_{LL} less than 150 *m* ~~in length~~ not required to comply with subdivision requirements, bulkheads not less in number than indicated in **Table 1** are to be fitted.

Table 1 has been amended as follows.

Table 1 Number of Bulkheads for Bulk Carriers with freeboard length L_{LL} less than 150 *m* ~~in Length~~

~~Length~~ Freeboard length in *m*	Number of bulkheads for ships with aft machinery (1)
90 ≤ ~~L_{CSR}~~ L_{LL} < 105	4
105 ≤ ~~L_{CSR}~~ L_{LL} < 120	5
120 ≤ ~~L_{CSR}~~ L_{LL} < 145	6
145 ≤ ~~L_{CSR}~~ L_{LL} < 150	7
(1) Aft peak bulkhead and aft machinery bulkhead are the same.	

Chapter 3 STRUCTURAL DESIGN PRINCIPLES

Section 3 CORROSION ADDITIONS

1. General

1.2 Corrosion Addition Determination

Table 1 has been amended as follows.

Table 1 Corrosion Addition for One Side of a Structural Member

<table>
<tr><th rowspan="2">Compartment type</th><th rowspan="2" colspan="2">Structural member</th><th colspan="3">t_{c1} or t_{c2}</th></tr>
<tr><th>Oil tankers</th><th>BC-A or BC-B ships with ~~L_{CSR}~~ L_{LL} ≥150m</th><th>Other BC ships</th></tr>
<tr><td rowspan="4">Ballast water tank, bilge tank, drain storage tank, chain locker (1)</td><td rowspan="2">Face plate of PSM</td><td>Within 3 m below top of tank (4)</td><td colspan="3">2.0</td></tr>
<tr><td>Elsewhere</td><td colspan="3">1.5</td></tr>
<tr><td rowspan="2">Other members (2) (3)</td><td>Within 3 m below top of tank (4)</td><td colspan="3">1.7</td></tr>
<tr><td>Elsewhere</td><td colspan="3">1.2</td></tr>
<tr><td rowspan="5">Cargo oil tank, slop tank</td><td rowspan="2">Face plate of PSM</td><td>Within 3 m below top of tank (4)</td><td>1.7</td><td rowspan="5" colspan="2">N/A</td></tr>
<tr><td>Elsewhere</td><td>1.4</td></tr>
<tr><td colspan="2">Inner-bottom plating/bottom of tank</td><td>2.1</td></tr>
<tr><td rowspan="2">Other members</td><td>Within 3 m below top of tank (4)</td><td>1.7</td></tr>
<tr><td>Elsewhere</td><td>1.0</td></tr>
<tr><td rowspan="8">Dry bulk cargo hold (5)</td><td rowspan="3">Transverse bulkhead</td><td>Upper part (6)</td><td rowspan="8">N/A</td><td>2.4</td><td>1.0</td></tr>
<tr><td>Lower stool: sloping plate, vertical plate and top plate (7)</td><td>5.2</td><td>2.6</td></tr>
<tr><td>Other parts</td><td>3.0</td><td>1.5</td></tr>
<tr><td colspan="2">Sloped plating of hopper tank, inner bottom plating</td><td>3.7</td><td>2.4</td></tr>
<tr><td rowspan="4">Other members</td><td>Upper part (6)</td><td rowspan="2">1.8</td><td rowspan="2">1.0</td></tr>
<tr><td>Webs and flanges of the upper end brackets of side frames of single side bulk carriers</td></tr>
<tr><td>Webs and flanges of lower brackets of side frames of single side bulk carriers</td><td>2.2</td><td>1.2</td></tr>
<tr><td>Other parts</td><td>2.0</td><td>1.2</td></tr>
<tr><td>Exposed to</td><td colspan="2">Weather deck plating</td><td colspan="3">1.7</td></tr>
</table>

atmosphere	Other members	1.0
Exposed to seawater	Shell plating between the minimum design ballast draught waterline and the scantling draught waterline	1.5
	Shell plating elsewhere	1.0
Fuel and lube oil tank		0.7
Fresh water tank		0.7
Void spaces [8]	Spaces not normally accessed, e.g. access only via bolted manhole openings, pipe tunnels, inner surface of stool space not common with a dry bulk cargo hold or ballast cargo hold, etc.	0.7
Dry spaces	Internals of machinery spaces, pump room, store rooms, steering gear space, etc.	0.5

(1) 1.0 *mm* is to be added to the plate surface within 3 *m* above the upper surface of the chain locker bottom.

(2) 0.5 *mm* is to be added to the plate surface exposed to ballast for the plate boundary between water ballast and heated cargo oil tanks/slop tanks. 0.3 *mm* is to be added to each surface of the web and face plate of a stiffener in a ballast tank and attached to the boundary between water ballast and heated cargo oil tanks or heated fuel/lube oil tanks/slop tanks. Heated oil tanks are defined as tanks/slop tanks arranged with any form of heating capability (the most common type is heating coils).

(3) 0.7 *mm* is to be added to the plate surface exposed to ballast for the plate boundary between water ballast and heated fuel oil or lube oil tanks.

(4) Only applicable to cargo tanks/slop tanks and ballast tanks with weather deck as the tank top. The 3 *m* distance is measured vertically from and parallel to the top of the tank.

(5) Dry bulk cargo hold includes holds intended for the carriage of dry bulk cargoes, which may carry water ballast.

(6) Upper part of the cargo holds correspond to an area above the connection between the topside and the inner hull or side shell. If there is no topside, the upper part corresponds to the upper one third of the cargo hold height (where a plane bulkhead is fitted in way of a dry bulk cargo hold, the upper part of the bulkhead is defined in the same manner).

(7) If there is no lower stool fitted (i.e. engine room bulkhead or fore peak bulkhead) or if a plane bulkhead is fitted, then this corrosion addition should be applied up to a height level with the opposing bulkhead stool in that hold. In the case where a stool is not fitted on the opposing bulkhead, the vertical extent of this zone is to be from the inner bottom to a height level with the top of the adjacent hopper sloping plate, but need not be taken as more than 3 *m*.

(8) For the determination of the corrosion addition of the outer shell plating, the pipe tunnel is considered as for a water ballast tank.

Section 6 STRUCTURAL DETAIL PRINCIPLES

4. Primary Supporting Members (PSM)

4.3 Tripping Bracket Arrangement

Paragraph 4.3.4 has been amended as follows.

4.3.4 Arm length

The arm length of tripping brackets is not to be less than the greater of the following values, in *m*:

$$d = 0.38b$$

$$d = 0.85b\sqrt{\frac{s_t}{t}}$$

where:

b : Height, in m, of tripping brackets, shown in **Fig. 4**.

s_t : Spacing, in *m*, of tripping brackets.

t : Net thickness, in *mm*, of tripping brackets.

For tripping brackets in way of superstructures or deckhouses, only $d = 0.38b$ is to be applied.

Section 7 STRUCTURAL IDEALISATION

1. Structural Idealisation of Stiffeners and Primary Supporting Members

1.4 Geometrical Properties of Stiffeners and Primary Supporting Members

Paragraph 1.4.9 has been added as follows.

1.4.9 Stiffener flange width

In case the stiffener flange thickness requirement in **Ch 8, Sec 2, 3.1.1(b)** is not fulfilled, the effective free flange outstand, used in strength assessment including the calculation of actual net section modulus, is to be taken as $b_{f-out-max}$ defined in **Ch 8, Sec 2, 3.1.1**.

Chapter 4 LOADS

Section 6 INTERNAL LOADS

Symbols have been amended as follows.

Symbols

For symbols not defined in this section, refer to **Ch 1, Sec 4**
(Omitted)

K_C : Coefficient taken equal to:

$K_C = \cos^2\alpha + (1 - \sin\psi)\sin^2\alpha$ ~~for inner bottom, hopper tank, transverse and longitudinal bulkheads, lower stool, vertical upper stool, inner side and side shell.~~ for $\alpha \le 90°$

~~$K_C = 0$ for topside tank, main deck and sloped upper stool.~~

$K_C = (1 - \sin\psi)\sin^2\alpha$ for $90° < \alpha \le 120°$

$K_C = 0.75(1 - \sin\psi)[1 - (\alpha - 120)/(60 - \psi)]$ for $\alpha > 120°$ and $\alpha + \psi < 180°$

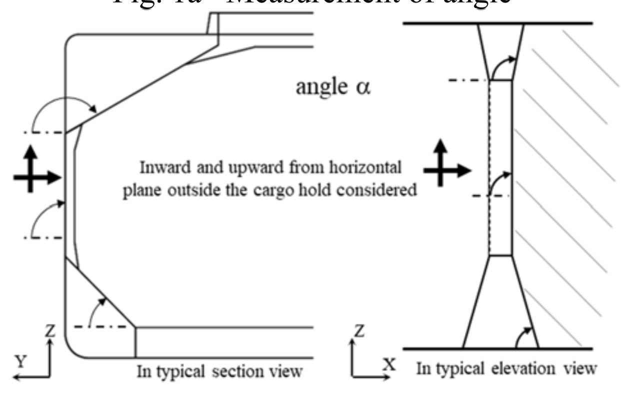
$K_C = 0$ when $\alpha + \psi \ge 180°$

(Omitted)

α : Angle, in *deg*, between panel considered and the horizontal plane. The angle is to be measured inward and upward from horizontal plane outside cargo hold, between 0 and 180 *deg*, as shown in **Fig. 1a**.
(Omitted)

Fig.1a has been added as follows.

Fig. 1a Measurement of angle



Section 7 DESIGN LOAD SCENARIOS

2. Design Load Scenarios for Strength Assessment

2.1 Principal Design Load Scenarios

2.1.1

The principal design load scenarios are given in **Table 1**.

Table 1 has been amended as follows.

Table 1 Principal Design Load Scenarios

Design load scenario			Harbour and sheltered water and testing	Seagoing conditions with extreme sea loads	Ballast water exchange (4)	Accidental flooded conditions (4)	
Load components			Static (S)	Static + Dynamic ($S+D$)	Static + dynamic ($S+D$)	Static (A: S)	Static + dynamic (A: $S+D$)
Hull Girder	VBM		M_{sw-p}	$M_{sw} + M_{wv-LC}$	$M_{sw} + M_{wv-LC}$	M_{sw-f} (2)	$M_{sw-f} + M_{wv-LC}$ (3)
	HBM		-	M_{wh-LC}	M_{wh-LC}	-	M_{wh-LC} (3)
	VSF		Q_{sw-p}	$Q_{sw} + Q_{wv-LC}$	$Q_{sw} + Q_{wv-LC}$	-	$Q_{sw-f} + Q_{wv-LC}$ (3)
	TM		-	M_{wt-LC}	M_{wt-LC}	-	-
Local Loads	P_{ex}	External deck for green sea	-	P_D	-	-	-
		Hull envelope	P_S	$P_S + P_W$	$P_S + P_W$	-	-
	P_{in}	Ballast tanks (1)	$Max\ (P_{ls}, P_{ST})$	$P_{ls} + P_{ld}$	$P_{ls} + P_{ld}$	-	-
		Liquid cargo tanks			-	-	
		Other tanks			-	-	
		Watertight boundaries	-	-	-	P_{fs}	$P_{fs} + P_{fd}$
		Cargo holds	P_{bs}	$P_{bs} + P_{bd}$	-		
	P_{dk}	Internal decks for dry spaces	P_{dl-s}	$P_{dl-s} + P_{dl-d}$	-	-	-
		External deck for distributed loads	P_{dl-s}	$P_{dl-s} + P_{dl-d}$	-	-	-
		External deck for heavy units	F_{U-s}	$F_{U-s} + F_{U-d}$	-	-	-

(1) WB cargo hold is considered as ballast tank except for design load scenario 'ballast water exchange'.

(2) M_{swf} used for hull local scantling of watertight bulkhead

(3) Hull girder strength check is performed according to **Ch 5, Sec 1** for bulk carriers having a freeboard length ~~L_{CSR}~~ L_{LL} of 150 m or above

(4) Applicable to prescriptive assessment only

Section 8 LOADING CONDITIONS

1. Application

Title of Paragraph 1.1 has been amended as follows.

1.1 Ships Having a Freeboard Length ~~L_{CSR}~~ L_{LL} of 150*m* or above

Paragraph 1.1.1 has been amended as follows.

1.1.1

The requirements in **2** to **5** are applicable to ships having a freeboard length ~~L_{CSR}~~ L_{LL} of 150*m* or above.

Title of Paragraph 1.2 has been amended as follows.

1.2 Bulk Carriers Having a Freeboard Length ~~L_{CSR}~~ L_{LL} less than 150*m*

Paragraph 1.2.1 has been amended as follows.

1.2.1

The severest loading condition from the loading manual, midship section drawing or otherwise specified by the Designer are to be considered for the longitudinal strength given in **Ch 5** and for local strength check of plating, ordinary stiffeners and primary supporting members given in **Ch 6** and **Pt 2**, **Ch 1**, **Sec 3** and **Pt 2**, **Ch 1**, **Sec 4**.

The requirements in **2** are applicable to ships having a freeboard length ~~L_{CSR}~~ L_{LL} less than 150*m*.

2. Common Design Loading Conditions

2.1 Definitions

Paragraph 2.1.2 has been amended as follows.

2.1.2 Departure conditions

The departure conditions are to be based on bunker tanks not taken less than 95*%* full and other consumables taken at 100*%* capacity. In case of liquefied gas fuel tank, the filling level is to be based on the definition in *International Code of Safety for Ships Using Gases or other Low-Flashpoint Fuels (IGF code) 6.8*.

2.2 Partially Filled Ballast Tanks

Paragraph 2.2.1 has been amended as follows.

2.2.1 Partially filled ballast tanks in ballast loading conditions

Ballast loading conditions involving partially filled peak and/or other ballast tanks in any departure, arrival or intermediate condition are not permitted to be used as design loading conditions unless:

- Longitudinal strength of hull girder given in **Ch 5, Sec 1** and **Ch 8, Sec 3** is to comply with loading conditions with the considered tanks full, empty and partially filled at intended level in any departure, arrival or intermediate condition.

- For bulk carriers having a freeboard length ~~L_{CSR}~~ L_{LL} of 150 *m* or above, longitudinal strength of hull girder in flooded condition given in **Ch 5**, **Sec 1** is to comply with loading conditions with the considered tanks full, empty and partially filled at intended level in any departure, arrival or intermediate condition.

The corresponding full, empty and partially filled tank conditions are to be considered as design conditions for calculation of the still water bending moment and shear force, but these do not need to comply with propeller immersion and trim requirements as specified in **2.3.1**, **3.1.1** or **4.1.1**.

Where multiple tanks are intended to be partially filled, all combinations of empty, full and partially filled at intended levels for those tanks are to be investigated. These requirements are not applicable to ballast water exchange using the sequential method.

Appendix 1 HOLD MASS CURVES

1. General

1.1 Application

Paragraph 1.1.1 has been amended as follows.

1.1.1

The requirements of this appendix apply to bulk carriers having a freeboard length L_{LL} of 150 *m* ~~in length L_{CSR} and~~ or above.

Chapter 5 HULL GIRDER STRENGTH

Section 1 HULL GIRDER YIELDING STRENGTH

2. Hull Girder Bending Assessment

2.2 Normal Stresses

Tables 1 and 2 have been amended as follows.

Table 1 Permissible Hull Girder Bending Stress σ_{perm}

Operation	Design load	Permissible hull girder bending stress, σ_{perm}				
		$\frac{x}{L_{CSR}} \leq 0.1$	$0.1 < \frac{x}{L_{CSR}} < 0.3$	$0.3 \leq \frac{x}{L_{CSR}} \leq 0.7$	$0.7 < \frac{x}{L_{CSR}} < 0.9$	$\frac{x}{L_{CSR}} \geq 0.9$
Seagoing	(*S*+*D*)	140/*k*	Linear interpolation	190/*k*	Linear interpolation	140/*k*
Harbour/sheltered water	(*S*)	105/*k*	Linear interpolation	143/*k*	Linear interpolation	105/*k*
Flooded condition at sea for bulk carriers having a freeboard length ~~L_{CSR}~~ L_{LL} of 150*m* or above	(*A*:*S*+*D*)	140/*k*	Linear interpolation	190/*k*	Linear interpolation	140/*k*

Table 2 Normal Stress, σ_L

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

Table 3 has been amended as follows.

Table 3 Hull Girder Stresses at Baseline and Moulded Deck Line

Operation	At baseline	At moulded deck line
Seagoing	$\sigma_{bl} = \frac{\lvert M_{SW} + f_\beta M_{WV} \rvert}{I_{y-n50}} z_n 10^{-3}$	$\sigma_{dk} = \frac{\lvert M_{SW} + f_\beta M_{WV} \rvert}{I_{y-n50}} (z_{dk-S} - z_n) 10^{-3}$
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 freeboard length ~~L_{CSR}~~ L_{LL} 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. Hull Girder Shear Strength Assessment

3.2 Hull Girder Shear Capacity

Table 4 has been amended as follows.

Table 4 Permissible Hull Girder Shear Stress

Operation	Design load	Permissible hull girder shear, τ_{i-perm}
Seagoing	(*S*+*D*)	120/*k*
Harbour/sheltered water	(*S*)	105/*k*
Flooded condition at sea of bulk carriers having a freeboard length ~~L_{CSR}~~ L_{LL} of 150 *m* or above	(*A*:*S*+*D*)	120/*k*

3.3 Acceptance Criteria

Paragraphs 3.3.1 and 3.3.2 have been amended as follows.

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:

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

- For harbour/sheltered water operation:

  $$|Q_{SW-p}| \le Q_R$$

- For flooded condition at sea of bulk carriers having a freeboard length ~~L_{CSR}~~ L_{LL} of 150*m* or above:

  $$|Q_{SW-f}| \le Q_R - |Q_{WV}|$$

where:

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

The shear force Q_{wv}, used in **2** above criteria is to be taken with the same sign as the considered shear forces Q_{sw}, and Q_{sw-f} respectively.

3.3.2 Vertical still water shear force

The vertical still water shear forces, in kN, for all loading conditions are to comply with the following criteria:

- For seagoing operation:

$$\left|Q_{SW-Lcd} - \Delta Q_{mdf}\right| \leq |Q_{SW}|$$

- For harbour/sheltered water operation:

$$\left|Q_{SW-Lcd-p} - \Delta Q_{mdf}\right| \leq \left|Q_{SW-p}\right|$$

- For flooded condition at sea of bulk carriers having a freeboard length ~~L_{CSR}~~ L_{LL} of 150m or above:

$$\left|Q_{SW-Lcd-f} - \Delta Q_{mdf}\right| \leq \left|Q_{SW-f}\right|$$

where:

ΔQ_{mdf}: Shear force correction at the transverse section considered, in kN, taken as:

- For bulk carriers, the value defined in **3.6.1**.
- For oil tankers, $\Delta Q_{mdf} = 0$

The permissible shear forces Q_{sw}, Q_{sw-p} and Q_{sw-f} are to be taken with the same sign as the considered shear forces Q_{sw-Lcd}, $Q_{sw-Lcd-p}$ and $Q_{sw-Lcd-f}$ respectively.

3.4 Effective Net Thickness for Longitudinal Bulkheads between Cargo Tanks of Oil Tankers

Paragraph 3.4.1 has been amended as follows.

3.4.1

For longitudinal bulkheads between cargo tanks, the effective net thickness of the plating above the inner bottom, $t_{sfi-n50}$ for plate i, in mm is given by:

$$t_{sfi-n50} = t_{i-n50} - t_{\Delta i}$$

where:

$t_{\Delta i}$: Thickness deduction for plate i, in mm, as defined in **3.4.2**.

3.5 Effective Net Thickness for Longitudinal Bulkheads between Cargo Tanks of Oil Tankers - Correction due to Loads from Transverse Bulkhead Stringers

Paragraph 3.5.1 has been amended as follows.

3.5.1

In way of transverse bulkhead stringer connections, within areas as specified in **Fig. 8**, the equivalent net thickness of plate, $t_{sti-k-n50}$ in mm, where the index k refers to the identification number of the stringer, is not to be taken greater than:

$$t_{sti-k-n50} = t_{sfi-n50}\left(1 - \frac{\tau_{sti-k}}{\tau_{i-perm}}\right)$$

where:

τ_{sti-k}: Shear stress in plate *i*, in N/mm^2, in the longitudinal bulkhead due to the stringer force in way of stringer *k*, taken as:

$$\tau_{sti-k} = \frac{Q_{st-k}}{l_{st-k} \, \cancel{t_{sfi-n50}} \, t_{sfi-k-n50}}$$

~~$t_{sfi-n50}$~~ $t_{sfi-k-n50}$: Effective net plating thickness as defined in **3.4.1**, in *mm*, calculated at the transverse bulkhead for the height corresponding to the level of the stringer.

$t_{sfi-n50}$: Effective net plating thickness as defined in **3.4.1**, calculated at the lower edge of plate *i* connecting to the stringer.

τ_{t-perm}: Permissible hull girder shear stress, in N/mm^2, for the plate *i*.

$$\tau_{i-perm} = 120/k$$

ℓ_{st-k}: Connection length of stringer *k*, in *m*, as defined in **Fig. 7**.

Q_{st-k}: Shear force on the longitudinal bulkhead from the stringer in loaded condition with tanks abreast full in *kN*, taken as:

$$Q_{st-k} = 0.8F_{st-k}\left(1 - \frac{Z_{st-k} - h_{db}}{h_{blk}}\right)$$

F_{st-k}: Total stringer supporting force in way of a longitudinal bulkhead, in *kN*, taken as:

$$F_{st-k} = \frac{P_{st-k} b_{st-k}(h_k + h_{k-1})}{2}$$

h_{db}: Double bottom height, in *m*.

h_{blk}: Height of bulkhead, in *m*, defined as the distance from inner bottom to the deck at the top of the bulkhead.

z_{st-k}: *Z* coordinate of the stringer *k*, in *m*.

P_{st-k}: Pressure on stringer *k*, in kN/m^2, taken as:

$$P_{st-k} = g\rho_L h_{tt-k}$$

ρ_L: Density of the liquid in cargo tank, in t/m^3, ad defined in **Ch 4, Sec 6**.

h_{tt-k}: Height from the top of the tank to the midpoint of the load area between $h_k/2$ below and $h_{k-1}/2$ above the stringer *k*, in *m*.

h_k: Vertical distance from the considered stringer *k* to the stringer *k*+1 below. For the lowermost stringer, it is to be taken as 80% of the average vertical distance to the inner bottom, in *m*.

h_{k-1}: Vertical distance from the considered stringer *k* to the stringer *k*-1 above. For the uppermost stringer, it is to be taken as 80% of the average vertical distance to the upper deck, in *m*.

b_{st-k}: Load breadth acting on stringer *k*, in *m*, as defined in **Fig.9** and **Fig.10**.

Section 2 HULL GIRDER ULTIMATE STRENGTH

1. Application

1.1 General

Paragraph 1.1.1 has been amended as follows.

1.1.1

The requirements of this section apply to ships with freeboard length L_{LL} equal to or greater than 150 *m* ~~in length L_{CSR}~~.

Section 3 HULL GIRDER RESIDUAL STRENGTH

1. Application

1.1 General

Paragraph 1.1.1 has been amended as follows.

1.1.1

The requirements of this section apply to ships with freeboard length L_{LL} equal to or greater than 150 *m* ~~in length L_{CSR}~~.

Chapter 6 HULL LOCAL SCANTLING

Section 2 LOAD APPLICATION

2. Design Load Sets

2.1 Application of Load Components

Paragraph 2.1.3 has been amended as follows.

2.1.3 Design load sets for plating, stiffeners and PSM

Design load sets for plating, stiffeners and primary supporting members are given in **Table 1**.

In addition, the design load sets for primary supporting members of bulk carriers with freeboard length ~~L_{CSR}~~ L_{LL} less than 150 *m* and of oil tankers within the cargo hold region are given respectively in **Pt 2, Ch 1, Sec 4, 4.2** and in **Pt 2, Ch 2, Sec 3, 1.2**.

Section 6 PRIMARY SUPPORTING MEMBERS AND PILLARS

2. Primary Supporting Members within Cargo Hold Region

2.2 Bulk Carriers

Paragraphs 2.2.1 and 2.2.2 have been amended as follows.

2.2.1 Bulk carriers having a freeboard length ~~L_{CSR}~~ L_{LL} of 150 *m* and above

The scantlings of primary supporting members within the cargo hold region are to be verified by FE structural analysis as defined in **Ch 7**.

2.2.2 Bulk carriers having a freeboard length ~~L_{CSR}~~ L_{LL} less than 150 *m*

The scantlings of primary supporting members within the cargo hold region are to comply with the requirements given in **Pt 2, Ch 1, Sec 4, 4**. Alternatively, the scantlings of such members may be verified by direct strength assessment as deemed appropriate by the Society.

Chapter 7 DIRECT STRENGTH ANALYSIS

Section 1 STRENGTH ASSESSMENT

1. General

1.1 Application

Paragraph 1.1.1 has been amended as follows.

1.1.1

This chapter provides requirements applicable to ships having ~~rule~~ a freeboard length ~~L_{CSR}~~ L_{LL} of 150 *m* or above to assess the scantlings of the hull structure using finite element analysis.

Chapter 8 BUCKLING

Section 2 SLENDERNESS REQUIREMENTS

1. Structural Elements

1.1 General

Paragraph 1.1.1 has been amended as follows.

1.1.1

All structural elements are to comply with the applicable slenderness and proportion requirements given in **2** to **~~4.~~6**, except for the ones listed below:

- Bilge plates within the cylindrical part of the ship and radius gunwale
- Corrugation
- Structure members in superstructures and deck houses, if the structural members do not contribute to the longitudinal strength.

Pillars in superstructures and deckhouses are to comply with the applicable slenderness and proportion requirements given in **6.1**.

2. Plates

2.1 Net Thickness of Plate Panels

Paragraph 2.1.1 has been amended as follows.

2.1.1

The net thickness of plate panels is to satisfy the following criteria:

$$t_p \geq \frac{b}{C}\sqrt{\frac{R_{eH}}{235}}$$

where:

C : Slenderness coefficient taken as:

$C = 100$ for hull envelope and cargo and tank boundaries.

$C = 125$ for other structures.

R_{eH} : Specified minimum yield stress of the plate material, in N/mm^2.

A lower specified minimum yield stress may be used in this slenderness criterion provided the requirements specified in **Sec 3** and **Sec 4** are satisfied for the strake assumed in the same lower specified minimum yield stress value.

~~This requirement does not apply to the bilge plates within the cylindrical part of the ship and radius gunwale.~~

3. Stiffeners

3.1 Proportions of Stiffeners

Paragraph 3.1.1 has been amended as follows.

3.1.1 Net thickness of all stiffener types

The net thickness of stiffeners is to satisfy the following criteria:

(a) Stiffener web plate:

$$t_w \geq \frac{h_w}{C_w}\sqrt{\frac{R_{eH}}{235}}$$

(b) Flange:

$$t_f \geq \frac{b_{f-out}}{C_f}\sqrt{\frac{R_{eH}}{235}}$$

where:

C_w, C_f : Slenderness coefficients given in **Table 1**.

If requirement **(b)** is not fulfilled, the effective free flange outstand, in *mm*, used in strength assessment including the calculation of actual net section modulus, is to be taken as:

$$b_{f-out-max} = C_f t_f \sqrt{\frac{235}{R_{eH}}}$$

Table 1 Slenderness Coefficients

Type of Stiffener	C_w	C_f
Angle and L2 bars	75	12
T-bars	75	12
Bulb bars	45	-
Flat bars	22	-

For built-up profile where the relevant yielding strength defined in **Ch 6** and **Ch 7** for the web of built-up profile without the edge stiffener is acceptable, as an alternative the web can be assessed according to the web requirements of Angle and L2 in **Ch 8, Sec 2, Table 1** and the edge stiffener can be assessed as a flat bar stiffener according to **3.1.1**. The requirement to flange in **3.1.2** shall still apply.

4. Primary Supporting Members

4.1 Proportions and Stiffness

Paragraph 4.1.1 has been amended as follows.

4.1.1 Proportions of web plate and flange

The net thicknesses of the web plates and flanges of primary supporting members are to satisfy the following criteria:

(a) Web plate:

$$t_w \geq \frac{s_w}{C_w}\sqrt{\frac{R_{eH}}{235}}$$

(b) Flange:

$$t_f \geq \frac{b_{f-out}}{C_f}\sqrt{\frac{R_{eH}}{235}}$$

where:

s_w : Plate breadth, in *mm*, taken as the spacing of the web stiffeners.

C_w : Slenderness coefficient for the web plate taken as:

$C_w = 100$

C_f : Slenderness coefficient for the flange taken as:

$C_f = 12$

If requirement **(b)** is not fulfilled, the effective free flange outstand, in *mm*, used in strength assessment including the calculation of actual net section modulus, is to be taken as:

$$b_{f-out-max} = C_f t_f \sqrt{\frac{235}{R_{eH}}}$$

Section 3 PRESCRIPTIVE BUCKLING REQUIREMENTS

2. Hull Girder Stress

2.1 General

Paragraph 2.1.2 has been amended as follows.

2.1.2

The hull girder shear stresses, τ_{hg}, in N/mm^2, in the plate i are determined as follows:

$$\tau_{hg} = \frac{Q_{Tot}(x) q_{vi}}{t_{i-n50}} 10^3$$

where:

$Q_{Tot}(x)$: Total vertical shear force, in kN, at the ship longitudinal location x, taken as follows:

- For the design load combination $S+D$
  - For seagoing operations:

    $Q_{Tot}(x) = |Q_{sw} + Q_{wv-LC}|$
  - For flooded conditions at sea for bulk carriers having a freeboard length ~~L_{CSR}~~ L_{LL} of 150 m or above:

    $Q_{Tot}(x) = |Q_{sw-f} + Q_{wv-LC}|$
- For the design load combination S
  - For harbour/sheltered water operations:

    $Q_{Tot}(x) = |Q_{sw-p}|$

q_{vi} : Contribution ratio in way of the plate i, as defined in **Ch 5**, **Sec 1**, **3.2.1**.

t_{i-n50} : Net thickness of the plate i, in mm as defined in **Ch 5**, **Sec 1**, **3.2.1**, used for shear stress calculation.

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 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-LC} : Vertical wave shear force in seagoing condition, in kN, in intact or flooded conditions at the hull transverse section considered for the considered dynamic load case, defined in **Ch 4**, **Sec 4**, **3.5.3**.

Section 5 BUCKLING CAPACITY

2. Buckling Capacity of Plates and Stiffeners

2.1 Overall Stiffened Panel Capacity

Paragraph 2.1.2 has been amended as follows.

2.1.2

The stress multiplier factor $\gamma_{GEB,bi}$ for the stiffened panel subjected to biaxial loads is taken as:

$$\gamma_{GEB,bi} = \frac{\pi^2}{L_{B1}^2 L_{B2}^2} \frac{[D_{11}L_{B2}^4 + 2(D_{12} + D_{33})n^2 L_{B1}^2 L_{B2}^2 + n^4 D_{22} L_{B1}^4]}{L_{B2}^2 N_x + n^2 L_{B1}^2 \cancel{K_{tran}} N_y}$$

where:

(Omitted)

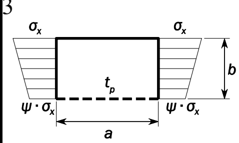
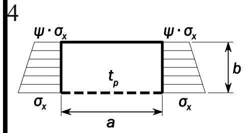
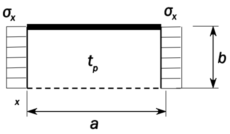
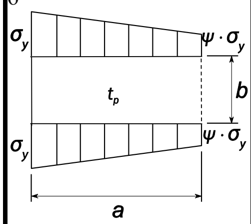
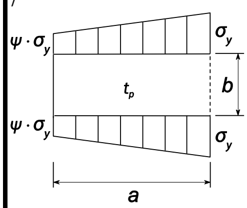
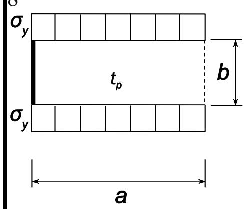
~~K_{tran}: Coefficient taken as 0.9.~~

(Omitted)

2.2 Plate capacity

Table 3 has been amended as follows.

Table 3 Buckling Factor and Reduction Factor for Plane Plate Panels

Case	Stress ratio ψ	Aspect ratio α	Buckling factor K	Reduction factor C
(Omitted)				
3 	$1 \geq \psi \geq 0$		$K_x = \frac{4(0.425 + 1/\alpha^2)}{3\psi + 1}$	For UP-A: $C_x = 1$ for $\lambda \leq 0.75$; $C_x = \frac{0.75}{\lambda}$ for $\lambda > 0.75$. For UP-B: $C_x = 1$ for $\lambda \leq 0.7$; $C_x = \frac{1}{\lambda^2 + 0.51}$ for $\lambda > 0.7$
	$0 > \psi \geq -1$		$K_x = 4(0.425 + 1/\alpha^2)(1 + \psi) - 5\psi(1 - 3.42\psi)$	
4 	$1 \geq \psi \geq -1$		$K_x = \left(0.425 + \frac{1}{\alpha^2}\right)\frac{3 - \psi}{2}$	
5 	–	$\alpha \geq 1.64$	$K_x = 1.28$	
		$\alpha < 1.64$	$K_x = \frac{1}{\alpha^2} + 0.56 + 0.13\alpha^2$	
6 	$1 \geq \psi \geq 0$		$K_y = \frac{4(0.425 + \alpha^2)}{(3\psi + 1)\alpha^2}$	For UP-A: $C_x = 1$ for $\lambda \leq 0.75$; $C_x = \frac{0.75}{\lambda}$ for $\lambda > 0.75$. For UP-B: $C_y = 1$ for $\lambda \leq 0.7$; $C_y = \frac{1}{\lambda^2 + 0.51}$ for $\lambda > 0.7$
	$0 > \psi \geq -1$		$K_y = 4(0.425 + \alpha^2)(1 + \psi)\frac{1}{\alpha^2} - 5\psi(1 - 3.42\psi)\frac{1}{\alpha^2}$	
7 	$1 \geq \psi \geq -1$		$K_y = 4(0.425 + \alpha^2)\frac{(3 - \psi)}{2\alpha^2}$	
8 	–		$K_y = 1 + \frac{0.56}{\alpha^2} + \frac{0.13}{\alpha^4}$	
(Omitted)				

2.3 Stiffeners

Paragraph 2.3.4 has been amended as follows.

2.3.4 Ultimate buckling capacity

When $\sigma_a + \sigma_b + \sigma_w > 0$ while initially setting $\gamma = 1$, the ultimate buckling capacity for stiffeners is to be checked according to the following interaction formula:

$$\frac{\gamma_c \sigma_a + \sigma_b + \sigma_w}{R_{eH}} S = 1$$

(Omitted)

σ_b: Bending stress in the stiffener, in *N/mm*^{2}:

$$\sigma_b = \frac{M_0 + M_1}{1000Z}$$

$$\sigma_b = \frac{M_0 + M_1 + M_2}{1000Z}$$

(Omitted)

M_2: Bending moment, in *Nmm*, due to eccentricity of sniped stiffeners, to be taken as

$M_2 = 0$ for continuous stiffener

$M_2 = C_{snip} w_{na} \gamma \sigma_x (A_p + A_s)$ for stiffener sniped at one or both ends

C_{snip}: Coefficient to account for the end effect of the stiffener sniped at one or both ends, to be taken as

$C_{snip} = -1.2$ for stiffener induced failure (*SI*).

$C_{snip} = 1.2$ for plate induced failure (*PI*).

M_0: Bending moment, in *Nmm*, due to the lateral deformation w of stiffener:

$M_0 = F_E \frac{\gamma}{\gamma_{GEB} - \gamma} w_0$ $M_0 = F_E C_{sl} \left(\frac{\gamma}{\gamma_{GEB} - \gamma}\right) w_0$ with precondition $\gamma_{GEB} - \gamma > 0$

where γ_{GEB} is the stress multiplier factor of global elastic buckling capacity as defined in **2.1**.

C_{sl}: Deformation reduction factor to account for global slenderness, to be taken as:

$C_{sl} = 1 - \frac{1}{12} \lambda_G^4$ for $\lambda_G \leq 1.56$

$C_{sl} = 3 / \lambda_G^4$ for $\lambda_G > 1.56$

λ_G: The reference degree of global slenderness of the stiffened panel, to be taken as

$$\lambda_G = \sqrt{\frac{\gamma_{ReH}}{\gamma_{GEB}}}$$

$$\gamma_{ReH} = \frac{\min(R_{eH\_P}, R_{eH\_S})}{\sqrt{\sigma_{x,av}^2 + \sigma_y^2 - \sigma_{x,av}\sigma_y + 3\tau_{xy}^2}}$$

(Omitted)

w_0: Assumed imperfection, in mm, to be taken as:

$w_0 = \ell / 1000$ in general.

$w_0 = -w_{na}$ for stiffeners sniped at one or both ends considering stiffener induced failure (*SI*).

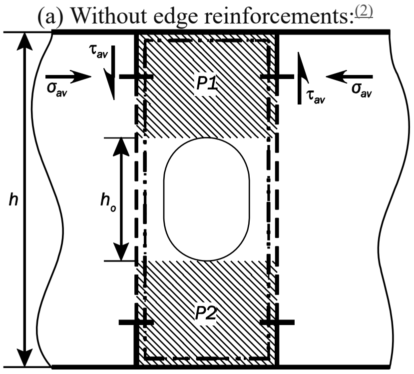
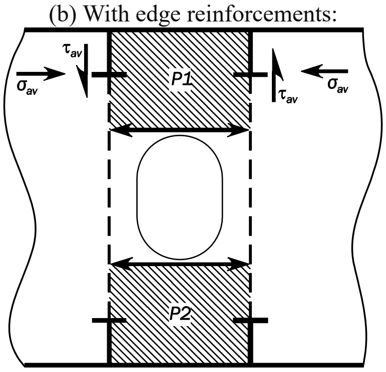
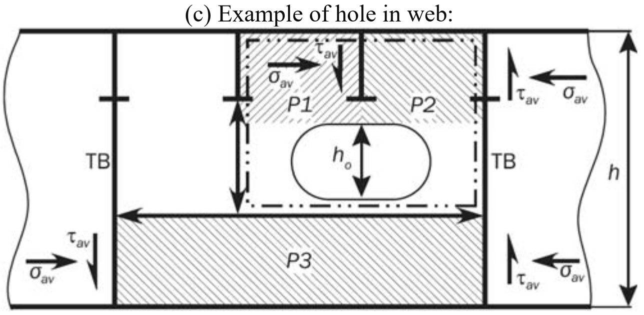
$w_0 = w_{na}$ for stiffeners sniped at one or both ends considering plate induced failure (*PI*).

(Omitted)

2.4 Primary Supporting Members

Table 6 has been amended as follows.

Table 6 Reduction Factors

<table>
<tr><th rowspan="2">Configuration[(1)]</th><th rowspan="2">C_x, C_y</th><th colspan="2">C_τ</th></tr>
<tr><th>Opening modelled in PSM</th><th>Opening not modelled in PSM</th></tr>
<tr><td rowspan="2">(a) Without edge reinforcements:[(2)]

</td><td rowspan="2">Separate reduction factors are to be applied to areas P1 and P2 using case 3 or case 6 in Table 3, with edge stress ratio:
$\psi = 1.0$</td><td rowspan="2">Separate reduction factors are to be applied to areas P1 and P2 using case 18 or case 19 in Table 3</td><td>When case 17 of Table 3 is applicable:
A common reduction factor is to be applied to areas P1 and P2 using case 17 in Table 3 with:
$\tau_{av} = \tau_{av}\ (web)$</td></tr>
<tr><td>When case 17 of Table 3 is not applicable:
Separate reduction factors are to be applied to areas P1 and P2 using case 18 or case 19 in Table 3 with:
$\tau_{av} = \tau_{av}\ (web)\ h/(h-h_0)$</td></tr>
<tr><td>(b) With edge reinforcements:

</td><td>Separate reduction factors are to be applied for areas P1 and P2 using C_x for case 1 or C_y for case 2 in Table 3 with stress ratio:
$\psi = 1.0$</td><td>Separate reduction factors are to be applied for areas P1 and P2 using case 15 in Table 3.</td><td>Separate reduction factors are to be applied to areas P1 and P2 using case 15 in Table 3 with:
$\tau_{av} = \tau_{av}\ (web)\ h/(h-h_0)$</td></tr>
<tr><td colspan="2">(c) Example of hole in web:

</td><td colspan="2">Panels P1 and P2 are to be evaluated in accordance with (a). Panel P3 is to be evaluated in accordance with (b).</td></tr>
<tr><td colspan="4">Where:
h : Height, in m, of the web of the primary supporting member in way of the opening.
h_0: Height in m, of the opening measured in the depth of the web.</td></tr>
</table>

τ_{av} *(web)*:	Weighted average shear stress, in N/mm^2, over the web height h of the primary supporting member.
Note (1):	Web panels to be considered for buckling in way of openings are shown shaded and numbered $P1$, $P2$, etc.
Note (2):	For a PSM web panel with opening and without edge reinforcements as shown in configuration (a), the applicable buckling assessment method depends on its specific boundary conditions. If one of the long edges along the face plate or along the attached plating is not subject to "inline support", i.e. the edge is free to pull in, Method B should be applied. In other cases, typically such as when the short plate edge is attached to the plate flanges, Method A is applicable.

Chapter 9 FATIGUE

Section 1 GENERAL CONSIDERATIONS

1. Rule Application for Fatigue Requirements

1.1 Scope

Paragraph 1.1.1 has been amended as follows.

1.1.1 General

This chapter provides requirements applicable to ships having ~~rule~~ a freeboard length ~~L_{CSR}~~ L_{LL} between 150*m* and 500*m* to evaluate fatigue strength of the ship's structural details considering an operation time in North Atlantic environment equal to the design fatigue life, T_{DF}.

Chapter 10 OTHER STRUCTURES

Section 1 FORE PART

4. Additional Scantling Requirements

4.1 Plate Stem

Paragraph 4.1.1 has been amended as follows.

4.1.1

The net thickness, t_{Stm} in mm, from keel line above to T_{SC} + 0.6 m is not to be less than：

$t_{Stm} = (0.6 + 0.4S_B)(0.08L_{CSR} + 2.7)\sqrt{k}$ but need not be greater than $22\sqrt{k} - 1$

where：

S_B : Spacing, in m, between horizontal stringers (partial or not), breasthooks, or equivalent horizontal stiffening members.

Starting from 0.6 m above the summer load waterline up to $T_{SC} + C_w$, the net thickness may gradually be reduced to $0.8t_{Stm}$.

Chapter 11 SUPERSTRUCTURES, DECKHOUSES AND HULL OUTFITTING

Title of Section 1 has been amended as follows.

Section 1 SUPERSTRUCTURES~~,~~ AND DECKHOUSES ~~AND COMPANIONWAYS~~

Symbols has been amended as follows.

Symbols

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

P: Pressure applied on the considered superstructure side or deck, in kN/m^2

$P = P_D$ for ~~external~~ exposed decks,

$P = P_{dl}$ for unexposed deck,

$P = P_{SI}$ for superstructure side.

(Omitted)

1. General

1.1 Application

Paragraph 1.1.1 has been amended as follows.

1.1.1

The requirements of this section ~~are~~ applicable to superstructures~~,~~ and deckhouses ~~and companionways,~~ made of steel.

The scantling requirements are listed in **Table 1**.

~~The requirements of **Pt 1, Ch 6** apply in addition to those of this section for exposed decks of superstructure and the side of superstructure or deckhouse when this side is part of the side shell.~~

Table 1 has been added as follows.

Table 1 Applicable requirements

Item	Superstructure	Deckhouse
Exposed decks	**3.1.1**	**3.2**
Unexposed decks	**3.2.2 to 3.2.5**	**3.2**
Side walls	**3.1.1**	**3.3**
End bulkheads (fore and aft)	**3.3**	**3.3**

1.2 Gross Scantlings

Paragraph 1.2.1 has been amended as follows.

1.2.1

With reference to **Ch 3, Sec 2, 1.1.3**, all scantlings and dimensions referred to in **3** are gross, unless otherwise specified.

2. Structural Arrangement

2.1 Structural Continuity

Paragraph 2.1.1 has been amended as follows.

2.1.1 Bulkheads and sides of deckhouses

The aft, front and side bulkheads are to be effectively supported by under deck structures such as bulkheads, girders and pillars.

Sides and main longitudinal and transverse bulkheads are to be in line in the various tiers of deckhouses. Where such arrangement in line is not possible, other effective support is to be provided.

Arrangements are to be made to ~~minimise~~ minimize the effect of discontinuities in erections. All openings cut in the sides are to be framed and have well-rounded corners. Continuous coamings or girders are to be fitted below and above doors and similar openings.

2.2 End Connections

Paragraph 2.2.1 has been amended as follows.

2.2.1 Deck stiffeners

Transverse beams are to be connected to side frames by brackets according to **Ch 3, Sec 6, ~~3.2~~3.2.1, 3.2.2 and 3.2.3**. Beams crossing longitudinal walls and girders may be attached to the stiffeners of longitudinal walls and the webs of girders respectively by welding without brackets.

3. Scantlings

3.1 Superstructures Sides and Decks

Paragraph 3.1.1 has been amended as follows.

3.1.1 Exposed sides and exposed decks ~~plating~~

When the side of superstructure is part of the side shell, the net scantlings of ~~E~~exposed sides and exposed decks plating ~~inclusive their supporting structure~~, stiffeners and primary supporting members are to comply with the applicable requirements ~~given in 3.2.1 to 3.2.5 and bow impact requirements in Ch 10, Sec 1, 3.3, if applicable~~ of **Ch 6, Sec 3, Ch 6, Sec 4, Ch 6, Sec 5** and **Ch 6, Sec 6**, respectively, with the pressure P_D , P_{dl} and P_{SI} defined in this Section. The net scantling approach defined in **Ch 3, Sec 2** and the corrosion additions defined in **Ch 3, Sec 3**, are to be considered.

When the side of superstructure is not part of the side shell, the exposed sides and exposed deck plating inclusive their supporting structure are to comply with the requirements given in **3.3, 3.2.1** and 3.2.3 to 3.2.5, respectively.

Paragraph 3.1.2 has been deleted.

~~3.1.2 Deck plating of unexposed decks~~

~~The deck plating and supporting structures of unexposed decks of superstructures are to comply with requirements given in 3.2.2 to 3.2.5.~~

Title of Paragraph 3.2 has been amended as follows.

3.2 Deckhouses Decks

Paragraphs 3.2.1 to 3.2.4 have been amended as follows.

3.2.1 Exposed deck ~~P~~plating

The gross thickness of the deckhouses exposed deck plating, t_{gr-exp}, in *mm*, is not to be less than

$$t_{gr-\exp} = 7.5\sqrt{\frac{ks}{s_{std}}}$$, on first tier.

$$t_{gr-\exp} = 7.0\sqrt{\frac{ks}{s_{std}}}$$, on second tier.

$$t_{gr-\exp} = 6.5\sqrt{\frac{ks}{s_{std}}}$$, on third tier and above.

where:

s_{std}: Standard reference spacing of stiffeners or beams, in *mm*, taken as:

$$s_{std} = 470 + 1.67L_1$$

Where deck is protected by sheathing, the gross thickness of the deck plating may be reduced by 1.5*mm*, without being less than 5*mm*.

Where sheathing other than wood is used, attention is to be paid that the sheathing does not affect the steel. The sheathing is to be effectively fitted to the deck.

3.2.2 Unexposed ~~D~~deck plating ~~of unexposed decks~~

The gross thickness of the deckhouses unexposed deck plating, $t_{gr-unexp}$, in *mm*, is not to be less than the greater value of:

$$t_{gr-unexp} = 0.9t_{gr-\exp}$$ at the tier considered, and

$$t_{gr-unexp} = \left(5.8\frac{s}{1000} + 1\right)\sqrt{k}$$ but not less than 5.5 *mm*.

3.2.3 Beams and stiffeners

The gross section modulus Z_{gr}, in cm^3, and the gross shear area A_{gr-sh}, in cm^2, of deckhouses deck transverse beams and of stiffeners are not to be less than:

$$Z_{gr} = ckP\frac{s}{1000}\ell_{bdg}^2$$

$$A_{gr-sh} = 0.05(1 - 0.817m_a)kP\frac{s}{1000}\ell_{shr}$$

3.2.4 Girders and transverses

The gross section modulus Z_{gr}, in cm^3, and the gross shear area A_{gr-sh}, in cm^2, of deckhouses deck girders and transverses are not to be less than:

$$Z_{gr} = ckPS\ell_{bdg}^2$$

$$A_{gr-sh} = 0.05kPS\ell_{shr}$$

The girder depth is not to be less than $\ell/25$. The web depth of girders scalloped for continuous deck beams is to be at least 1.5 times the depth of the deck beams.

Title of Paragraph 3.3 has been amended as follows.

3.3 Deckhouses Walls and End Bulkheads of Superstructures

Paragraph 3.4 has been deleted.

~~3.4 Companionways~~

~~3.4.1~~

~~The scantlings of companionways are to be determined in accordance with **3.2** and **3.3**.~~

Chapter 12 CONSTRUCTION

Section 3 DESIGN OF WELD JOINTS

2. Tee or Cross Joint

2.5 Weld Size Criteria

Paragraph 2.5.2 has been amended as follows.

2.5.2

The leg length, ℓ_{leg} in *mm*, of continuous, lapped or intermittent fillet welds is not to be taken less than the greater of the following values:

$\ell_{leg} = f_1 f_2 t_{as-built}$

$\ell_{leg} = f_{yd} f_{weld} f_2 f_3 t_{as-built} + t_{gap}$

ℓ_{leg} as given in **Table 1**.

where:

f_1: Coefficient depending on welding type:

$f_1 = 0.30$ for double continuous welding.

$f_1 = 0.38$ for intermittent welding.

f_2: Coefficient depending on the edge preparation:

$f_2 = 1.0$ for welds without bevelling.

$f_2 = 0.70$ for welds with one/both side bevelling and $f = t_{as\text{-}built}/3$.

f_{yd}: Coefficient not to be taken less than the following:

$$f_{yd} = \left(\frac{1}{k}\right)^{0.5} \left(\frac{235}{R_{eH\_weld}}\right)^{0.75}$$

$$f_{yd} = 0.71$$

R_{eH_weld} : Specified minimum yield stress for the weld deposit in N/mm^2, not to be less than:

$R_{eH\_weld} = 305$ N/mm^2 for welding of normal strength steel with $R_{eH} = 235$ N/mm^2.

$R_{eH\_weld} = 375$ N/mm^2 for welding of higher strength steels with R_{eH} from 265 to 355 N/mm^2.

$R_{eH\_weld} = 400$ N/mm^2 for welding of higher strength steel with $R_{eH} = 390$ N/mm^2.

f_{weld}: Weld factor dependent on the type of the structural member, see **Table 2**, **Table 3** and **Table 4**.

k: Material factor of the abutting member.

f_3: Correction factor for the type of weld:

$f_3 = 1.0$ for double continuous weld.

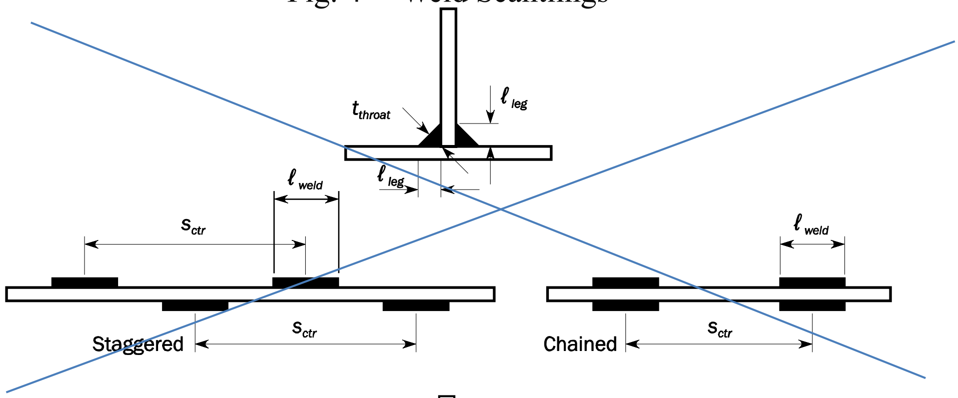
$f_3 = s_{ctr}/\ell_{\mathrm{weld}}$ for intermittent or chain welding.

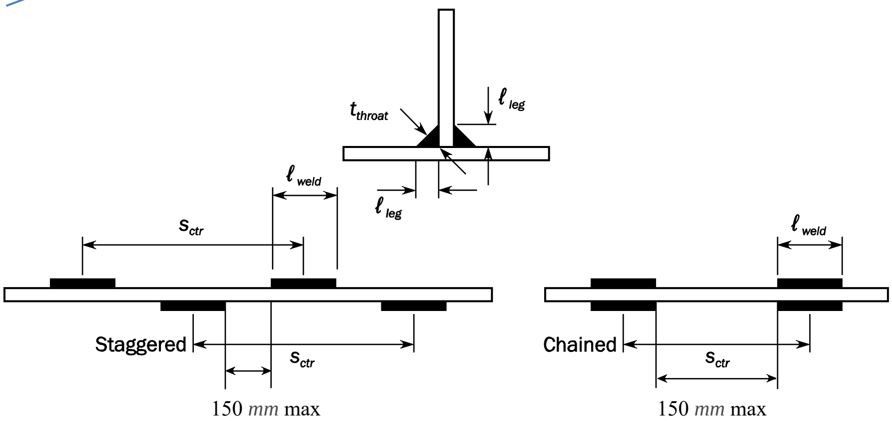
s_{ctr}: Distance between successive fillet welds, in *mm*.

Leg length for intermittent welding is not to exceed the greater of 6.5 *mm* or $0.62 t_{as-built}$

Fig.4 has been amended as follows.

Fig. 4 Weld Scantlings





ℓ_{weld} not to be less than 75 *mm*

Part 2 SHIP TYPES

Chapter 1 BULK CARRIERS

Section 2 STRUCTURAL DESIGN PRINCIPLES

3. Structural Detail Principles

3.1 Double Bottom Structure

Paragraph 3.1.1 has been amended as follows.

3.1.1 Application

In addition to the requirements provided in **Pt 1**, **Ch 2**, **Sec 3**, **2**, the requirements of this sub-article are applicable to the following ships:

- All bulk carriers ~~of~~ with freeboard length L_{LL} less than 150 *m* ~~in length~~,
- Bulk carriers ~~with~~ having a freeboard length L_{LL} of 150 *m* or above, with one or more cargo holds arranged for carriage of water ballast.

3.3 Deck Structures

Paragraph 3.3.1 has been amended as follows.

3.3.1 Web frame spacing in topside tanks

For bulk carriers with freeboard length L_{LL} less than 150 *m* ~~in length~~, the spacing of web frames in topside tanks is generally not to be greater than 6 frame spaces.

Paragraph 3.3.4 has been amended as follows.

3.3.4 Openings in strength deck - Corner of hatchways

(a) Within the cargo hold region

For cargo hatchways located within the cargo hold region, insert plates, the thicknesses of which are to be determined according to the formula given after, are to be fitted in way of corners where the plating cut-out has a circular profile.

The radius of circular corners is not to be less than 5% of the hatch width, where a continuous longitudinal deck girder is fitted below the hatch coaming.

Corner radius, in the case of the arrangement of two or more hatchways athwartship, is considered by the Society on a case-by-case basis.

For hatchways located within the cargo hold region, insert plates are, in general, not required in way of corners where the plating cut-out has an elliptical or parabolic profile and the half axes of elliptical openings, or the half lengths of the parabolic arch, are not less than:

- 1/20 of the hatchway width or 600 *mm*, whichever is the lesser, in the transverse direction.
- Twice the transverse dimension, in the fore and aft direction.

Where insert plates are required, their net thickness is to be obtained, in *mm*, from the following formula:

$$t_{INS} = \left(0.8 + 0.4\frac{b}{\ell}\right) t_{off}$$

without being taken less than t_{off} or greater than 1.6 t_{off}.

where:

ℓ: Width, in *m*, in way of the corner considered, of the cross deck strip between two consecutive hatchways, measured in the longitudinal direction, see **Pt 1**, **Ch 3**, **Sec 6**, **Fig. 15**.

b: Width, in *m*, of the hatchway considered, measured in the transverse direction, see **Pt 1**, **Ch 3**, **Sec 6**, **Fig. 15**.

t_{off}: Offered net thickness, in *mm*, of the deck at the side of the hatchways.

For the extreme corners of end hatchways, insert plates are required. The net thickness of these insert plates is to be 60% greater than the net offered thickness of the adjacent deck plating. A lower thickness may be accepted by the Society on the basis of calculations showing that stresses at hatch corners are lower than permissible values.

Where insert plates are required, the arrangement is shown in **Pt 1**, **Ch 9**, **Sec 6**, **Table 15**, in which d_1, d_2, d_3 and d_4 are to be greater than the stiffener spacing.

For ships having a freeboard length ~~L_{CSR}~~ L_{LL} of 150 *m* or above, the corner radius, the thickness and the extent of insert plate may be determined by the results of a direct strength assessment according to **Pt 1**, **Ch 7**, including buckling check and fatigue strength assessment of hatch corners according to **Pt 1**, **Ch 8** and **Pt 1**, **Ch 9** respectively. For such type of ships it is recommended to arrange circular hatch corners.

(b) Outside the cargo hold region

For hatchways located outside the cargo hold region, a reduction in the thickness of the insert plates in way of corners may be considered by the Society on a case-by-case basis.

Title of Section 4 has been amended as follows.

Section 4 HULL LOCAL SCANTLINGS FOR BULK CARRIERS ~~L_{CSR}~~ L_{LL} <150*M*

1. General

1.1 Application

Paragraph 1.1.1 has been amended as follows.

1.1.1

Unless otherwise defined, the requirements of this section define the strength criteria applicable to bulk carriers ~~of~~ with freeboard length L_{LL} less than 150 *m* ~~in length~~.

4. Primary Supporting Members

4.1 Application

Paragraph 4.1.1 has been amended as follows.

4.1.1

The requirements of this section apply to the strength check of primary supporting members in cargo hold structures, subjected to lateral pressure for ships having a freeboard length ~~L_{CSR}~~ L_{LL} less than 150 *m*.

4.2 Design Load Sets

Paragraph 4.2.1 has been amended as follows.

4.2.1 Application

Design load sets as given in **Table 3** are to be considered for primary supporting members on cargo hold boundaries of bulk carriers with freeboard length L_{LL} less than 150 *m* ~~in length~~.