RULES FOR CLASSIFICATION(STEEL SHIPS)

Part 14 Structural Rules for Container Ships

KOREAN REGISTER

2020. 10.

Hull Rule Development Team

- Main Amendments -

(1) Enter into force on 1 July 2021 (the contract date for ship construction)

◉ To reflect Request for Establishment/Revision of Classification Technical Rules (HUC4100-2649-2019)

⚓

Present	Amendment	Reason
Chapter 1 General Principles	**Chapter 1 General Principles**	
Section 1 Application	**Section 1 Application**	
1. Scope of application	**1. Scope of application**	
1.2 Scope of application for container ships	**1.2 Scope of application for container ships**	
1.2.1	**1.2.1**	
These Rules apply to double bottom ships of double side skin construction, intended to carry containers in holds or on deck. The requirements of container ships with a length less than 90 m are generally to comply with those in **Pt 4** and **Pt 10**.	These Rules apply to double bottom ships of double side skin construction, intended to carry containers in holds or on deck. The requirements of hull equipment are generally to comply with those in **Pt 4**. The requirements of container ships with a length less than 90 m are generally to comply with those in **Pt 4** and **Pt 10**.	
The ship's structure is to be longitudinally and transversely framed with full transverse bulkheads and intermediate web frames. Typical midship sections are shown in **Figure 1**.	The ship's structure is to be longitudinally and transversely framed with full transverse bulkheads and intermediate web frames. Typical midship sections are shown in **Figure 1**.	
〈Figure 1 omitted〉	〈Figure 1 same as the present〉	
2. Rule application	**2. Rule application**	
2.1 ~ 2.3 〈omitted〉	**2.1 ~ 2.3 〈same as the present〉**	
2.4 Ship parts	**2.4 Ship parts**	
2.4.1 ~ 2.4.2 〈omitted〉	**2.4.1 ~ 2.4.2 〈same as the present〉**	
2.4.3 Cargo hold region	**2.4.3 Cargo hold region**	
The cargo hold region is the part of the ship that contains cargo holds. It includes the full breadth and depth of the ship, the collision bulkhead and the transverse bulkhead at its aft end. ~~The cargo hold region does not include the pump room, if any.~~	The cargo hold region is the part of the ship that contains cargo holds. It includes the full breadth and depth of the ship, the collision bulkhead and the transverse bulkhead at its aft end.	

Present	Amendment	Reason
2.4.4 Machinery space The machinery space is the part of the ship between the aft peak bulkhead and the transverse bulkhead at the aft end of the cargo hold region ~~and includes the pump room, if any~~. 〈omitted〉	**2.4.4 Machinery space** The machinery space is the part of the ship between the aft peak bulkhead and the transverse bulkhead at the aft end of the cargo hold region. 〈same as the present〉	

Present	Amendment	Reason
Section 2 Rule Principles	**Section 2 Rule Principles**	
1. 〈omitted〉	**1. 〈same as the present〉**	
2. Design basis	**2. Design basis**	
2.1 〈omitted〉	**2.1 〈same as the present〉**	
2.2 Hull form limit	**2.2 Hull form limit**	
2.2.1 The Rules assume the following hull form with respect to environmental loading: 90 m ≤ L ≤ 400 m 5 ≤ L / B ≤ 9 〈omitted〉 For ships ~~over 400 m in length or~~ except above mentioned hull form, the wave loads are to be in accordance with **Pt 13, Annex 13-1**.	**2.2.1** The Rules assume the following hull form with respect to environmental loading: 90 m ≤ L ≤ 500 m 5 ≤ L / B ≤ 9 〈same as the present〉 For ships except above mentioned hull form, the wave loads are to be in accordance with **Pt 13, Annex 13-1**.	
2.3 〈omitted〉	**2.3 〈same as the present〉**	
2.4 Environmental conditions	**2.4 Environmental conditions**	
2.4.1 North Atlantic wave environment The rule requirements are based on a ship trading in the North Atlantic wave environment for its entire design life. 〈omitted〉	**2.4.1 North Atlantic wave environment** The rule requirements are based on a ship trading in the North Atlantic wave environment for its entire design life. The wave environment for fatigue strength is to be in accordance with **Ch 9**. 〈same as the present〉	

Present	Amendment	Reason
2.5 〈omitted〉 **2.6 Operating draughts** **2.6.1** The design operating draughts are to be specified by the builder/designer subject to acceptance by the owner and are to be used to derive the appropriate structural scantlings. All operational loading conditions in the loading manual are to comply with the specified design operating draughts. The following design operating draughts are as a minimum to be considered: • Scantling draught for the assessment of structure. • Minimum ballast draught at midship for assessment of structure. • Minimum forward draughts for the assessment of bottom structure forward subjected to slamming loads, as defined in **Ch 4, Sec 5, [3.2.1]**. 〈omitted〉 **3. Design principles** **3.2 Loads** **3.2.1 Design load scenarios** The structural assessment of the structure is based on the design load scenarios encountered by the ship. Refer to **Ch 4**, **Sec 7**. 〈omitted〉 • Accidental design load scenario (A): Covers application of some loads not occurring during normal operations. 〈newly added〉	**2.5 〈same as the present〉** **2.6 Operating draughts** **2.2.1** The design operating draughts are to be specified by the builder / designer subject to acceptance by the owner and are to be used to derive the appropriate structural scantlings. All operational loading conditions in the loading manual are to comply with the specified design operating draughts. The following design operating draughts are as a minimum to be considered: • Scantling draught for the assessment of structure. • Minimum ballast draught at midship for assessment of structure. • Minimum draughts at forward perpendicular and aft end for the assessment of forward and stern bottom structure subjected to slamming loads, as defined in **Ch 4, Sec 5**. 〈same as the present〉 **3. Design principles** **3.2 Loads** **3.2.1 Design load scenarios** The structural assessment of the structure is based on the design load scenarios encountered by the ship. Refer to **Ch 4**, **Sec 7**. 〈omitted〉 • Accidental design load scenario (A): Covers application of some loads not occurring during normal operations. • Tank testing design load scenario (T): Covers application of maximum loads during tank testing	

Present	Amendment	Reason

Present

4. Rule design method

4.3 Load-capacity based requirements

4.3.1~4.3.2 <omitted>

Table 1 : Load scenarios and corresponding rule requirements

Operation	Load type	Design load scenario	Acceptance criteria
Seagoing operations			
Transit	Static and dynamic loads in heavy weather	S+D	AC-SD
	Impact loads in heavy weather	Impact (I)	AC-I
	Internal sloshing loads	Sloshing (SL)	AC-S
	Cyclic wave loads	Fatigue (F)	-
BWE by flow through or sequential methods	Static and dynamic loads in heavy weather	S+D	AC-SD
Harbour and sheltered operations			
Loading, unloading and ballasting	Typical maximum loads during loading, unloading and ballasting operations	S	AC-S
Special conditions in harbour	Typical maximum loads during special operations in harbour, e.g. propeller inspection afloat	S	AC-S
Accidental condition			
~~Tank testing~~	~~Typical maximum loads during tank testing operations~~	~~A~~	~~AC-A~~
Flooded conditions	Typically maximum loads on internal watertight subdivision structure in accidental flooded conditions	A	AC-A

Amendment

4. Rule design method

4.3 Load-capacity based requirements

4.3.1~4.3.2 <same as the present>

Table 1 : Load scenarios and corresponding rule requirements

Operation	Load type	Design load scenario	Acceptance criteria
Seagoing operations			
Transit	Static and dynamic loads in heavy weather	S+D	AC-SD
	Impact loads in heavy weather	Impact (I)	AC-I
	Internal sloshing loads	Sloshing (SL)	AC-S
	Cyclic wave loads	Fatigue (F)	-
BWE by flow through or sequential methods	Static and dynamic loads in heavy weather	S+D	AC-SD
Harbour and sheltered operations			
Loading, unloading and ballasting	Typical maximum loads during loading, unloading and ballasting operations	S	AC-S
Special conditions in harbour	Typical maximum loads during special operations in harbour, e.g. propeller inspection afloat	S	AC-S
Accidental condition			
<del>	<del>	<del>	<del>
Flooded conditions	Typically maximum loads on internal watertight subdivision structure in accidental flooded conditions	A	AC-A
Testing condition			
Tank testing	Typical maximum loads during tank testing operations	T	AC-T

Reason

Present

4.4. Acceptance criteria

4.4.1 General

The acceptance criteria are categorised into three acceptance criteria sets. These are explained below and shown in **Table 2** and **Table 3**. The specific acceptance criteria set that is applied in the rule requirements is dependent on the probability level of the characteristic combined load.

〈omitted〉

c) The acceptance criteria set AC-I is typically applied for impact loads, such as bottom slamming and bow impact loads.

d) 〈newly added〉

e) 〈newly added〉

4.4.2 〈omitted〉

Table 2 : Acceptance criteria – prescriptive requirements

Acceptance criteria	Plate panels and local support members(1)		Primary supporting members(1)		Hull girder members	
	Yield	Buckling	Yield	Buckling	Yield	Buckling
AC-S AC-SD AC-A	Permissible stress: Ch 6, Sec 4 Ch 6, Sec 5	Control of stiffness and proportions: Ch 8 Sec 2	Permissible stress: Ch 6, Sec 6	Control of stiffness and proportions: Ch 8, Sec 1, 2 Pillar buckling	Permissible stress: Ch 5, Sec 1	Allowable buckling utilisation factor: Ch 8 Sec 1 [3]
AC-I	Plastic criteria: Ch 10 Sec 1 [3]	Control of stiffness and proportions: Ch 8, Sec 2 Ch 10 Sec 1 [3]	Plastic criteria: Ch 10 Sec 1 [3]	Control of stiffness and proportions: Ch 8, Sec 2 Ch 10 Sec 1 [3]	N/A	N/A

(1) Refer to **Ch 10** for Other structures and to **Ch 11** for Superstructure, deckhouses and hull outfitting

Amendment

4.4. Acceptance criteria

4.4.1 General

The acceptance criteria are categorised into five acceptance criteria sets. These are explained below and shown in **Table 2** and **Table 3**. The specific acceptance criteria set that is applied in the rule requirements is dependent on the probability level of the characteristic combined load.

〈same as the present〉

c) The acceptance criteria set AC-I is typically applied for impact loads, such as bottom slamming and bow impact loads.

d) The acceptance criteria set AC-A is applied for the static design loads in accidental flooded condition

e) The acceptance criteria set AC-T is applied for the design loads in tank testing condition.

4.4.2 〈same as the present〉

Table 2 : Acceptance criteria – prescriptive requirements

Acceptance criteria	Plate panels and local support members(1)		Primary supporting members(1)		Hull girder members	
	Yield	Buckling	Yield	Buckling	Yield	Buckling
AC-S AC-SD AC-A AC-T	Permissible stress: Ch 6, Sec 4 Ch 6, Sec 5	Control of stiffness and proportions: Ch 8 Sec 2	Permissible stress: Ch 6, Sec 6	Control of stiffness and proportions: Ch 8, Sec 1, 2 Pillar buckling	Permissible stress: Ch 5, Sec 1	Allowable buckling utilisation factor: Ch 8 Sec 1 [3]
AC-I	Plastic criteria: Ch 10 Sec 1 [3] Ch 10 Sec 3 [5]	Control of stiffness and proportions: Ch 8, Sec 2 Ch 10 Sec 1 [3] Ch 10 Sec 3 [5]	Plastic criteria: Ch 10 Sec 1 [3] Ch 10 Sec 3 [5]	Control of stiffness and proportions: Ch 8, Sec 2 Ch 10 Sec 1 [3] Ch 10 Sec 3 [5]	N/A	N/A

(1) Refer to **Ch 10** for Other structures and to **Ch 11** for Superstructure, deckhouses and hull outfitting

Reason

<table>
<tr><th>Present</th><th>Amendment</th><th>Reason</th></tr>
<tr>
<td>

Table 3 : Acceptance criteria – FE analysis

<table>
<tr><th rowspan="2">Acceptance criteria</th><th colspan="2">Cargo hold analysis</th><th>Fine mesh analysis</th></tr>
<tr><th>Yield</th><th>Buckling</th><th>Yield</th></tr>
<tr><td>AC-S, AC-SD, AC-A</td><td>Permissible stress: Ch 7, Sec 2, [5]</td><td>Allowable buckling utilisation factor: Ch 8, Sec 1, [3]</td><td>Permissible Von Mises stress: Ch 7, Sec 3, [6]
Screening criteria: Ch 7, Sec 3, [3.3]</td></tr>
</table>

</td>
<td>

Table 3 : Acceptance criteria – FE analysis

<table>
<tr><th rowspan="2">Acceptance criteria</th><th colspan="2">Cargo hold analysis</th><th>Fine mesh analysis</th></tr>
<tr><th>Yield</th><th>Buckling</th><th>Yield</th></tr>
<tr><td>AC-S, AC-SD, AC-A, AC-T</td><td>Permissible stress: Ch 7, Sec 2, [5]</td><td>Allowable buckling utilisation factor: Ch 8, Sec 1, [3]</td><td>Permissible Von Mises stress: Ch 7, Sec 3, [6]
Screening criteria: Ch 7, Sec 3, [3.3]</td></tr>
</table>

</td>
<td></td>
</tr>
</table>

Present	Amendment	Reason
Section 3 Verification of Compliance	**Section 3 Verification of Compliance**	
1. General	**1. General**	
1.1 Newbuilding	**1.1 Newbuilding**	
1.1.1~1.1.4 〈omitted〉	**1.1.1~1.1.4 〈same as the present〉**	
1.1.5 Through all stages of ship construction, it is the builder's responsibility to inform promptly the Society of the modifications or departures from approved arrangements and to deal with as necessary. The builder is to ensure that deviations from the requirements of the Rules or approved plans, other than those of a minor nature not affecting the structural strength of the vessel, are, in any case, accepted by the Society's approval office.	**1.1.5** Through all stages of ship construction, it is the builder's responsibility to promptly inform the Society of modifications or departures from approved plans. The builder is to ensure that deviations from the requirements of the Rules or approved plans are accepted by the Society.	
2. Document to be submitted	**2. Document to be submitted**	
2.1 〈omitted〉	**2.1 〈same as the present〉**	
2.2 Submission of plans and supporting calculations	**2.2 Submission of plans and supporting calculations**	
2.2.1 Plans and supporting calculations are to be submitted for approval	**2.2.1 Plans and supporting calculations are to be submitted for approval**	
〈omitted〉 Structural plans are to show scantling, details of connection of the various parts and are to specify the design materials including, in general, their grades, manufacturing processes, welding procedures and heat treatments, ~~and are to include information related to the renewal thickness as specified in **Ch 13**.~~	〈same as the present〉 Structural plans are to show scantling, details of connection of the various parts and are to specify the design materials including, in general, their grades, manufacturing processes, welding procedures and heat treatments.	
For welding requirements, see **Ch 12**, **Sec 2** and **Ch 12**, **Sec 3**. In case there are deviations from the design basis, then these are to be documented and submitted to the Society.	For welding requirements, see **Ch 12**, **Sec 2** and **Ch 12**, **Sec 3**. In case there are deviations from the design basis, then these are to be documented and submitted to the Society.	

Present	Amendment	Reason
2.2.3 Plans and instruments to be supplied onboard the ship As a minimum, the following plans and instrument are to be supplied onboard: a) One copy of the following plans indicating the newbuilding ~~and renewal~~ thickness for each structural item is to be supplied onboard the ship: plans of midship sections, construction profiles, shell expansion, transverse bulkheads, aft and fore part structures, machinery space structures. ~~One copy of the following plans indicating the newbuilding thickness for each structural item is to be supplied onboard the ship:~~ plans of superstructures, deckhouses and casing. b) One copy of the final approved loading manual, see **[2.1.1]**. c) One copy of the final approved loading instrument, see **[2.1.1]**. d) Welding. e) Details of the extent and location of higher tensile steel together with details of the specification and mechanical properties, and any recommendations for welding, working and treatment of these steels. f) Details and information on use of special materials, such as an aluminium alloy, used in the hull construction. g) Towing and mooring arrangements plan, see **Ch 11, Sec 3**. h) Structural details for which post weld treatment methods are applied, showing the description of the details and their locations. Other plans or instrument may be required by the Society.	**2.2.3 Plans and instruments to be supplied onboard the ship** As a minimum, the following plans and instrument are to be supplied onboard: a) One copy of the following plans indicating the newbuilding thickness for each structural item is to be supplied onboard the ship: plans of midship sections, construction profiles, shell expansion, transverse bulkheads, aft and fore part structures, machinery space structures, superstructures, deckhouses and casing. b) One copy of the final approved loading manual, see **[2.1.1]**. c) One copy of the final approved loading instrument, see **[2.1.1]**. d) Welding. e) Details of the extent and location of higher tensile steel together with details of the specification and mechanical properties, and any recommendations for welding, working and treatment of these steels. f) Details and information on use of special materials, such as an aluminium alloy, used in the hull construction. g) Towing and mooring arrangements plan, see **Ch 11, Sec 3**. h) Structural details for which post weld treatment methods are applied, showing the description of the details and their locations. Other plans or instrument may be required by the Society.	

Present	Amendment	Reason

Present

Section 4 Symbols and Definitions

2. Symbols

2.1 Ship's main data

2.1.1

Unless otherwise specified, symbols regarding ship's main data and their units used in these Rules are those defined in **Table 2**.

Table 2 : Ship's main data

Symbols	Meaning	Units
L	Rule length	m
〈omitted〉		
T_{FD}	Deepest equilibrium waterline in damage condition	m
T_{F-f}, T_{F-e}	Minimum draught at forward perpendicular for bottom slamming, with respectively all ballast tanks full or with any tank empty in bottom slamming area	m
Δ	Moulded displacement at draught T_{SC}	t
〈omitted〉		
x, y, z	X, Y, Z coordinates of the calculation point with respect to the reference coordinate system	m

2.2 〈omitted〉

2.3 Loads

2.3.1

Unless otherwise specified, symbols regarding loads and their units used in these Rules are those defined in **Table 4**.

Amendment

Section 4 Symbols and Definitions

2. Symbols

2.1 Ship's main data

2.1.1

Unless otherwise specified, symbols regarding ship's main data and their units used in these Rules are those defined in **Table 2**.

Table 2 : Ship's main data

Symbols	Meaning	Units
L	Rule length	m
〈same as the present〉		
T_{FD}	Deepest equilibrium waterline in damage condition	m
T_F	Minimum draught at forward perpendicular for bottom slamming	m
T_{AE}	Minimum draught at aft end for stern slamming	m
Δ	Moulded displacement at draught T_{SC}	t
〈same as the present〉		
x, y, z	X, Y, Z coordinates of the calculation point with respect to the reference coordinate system	m

2.2 〈same as the present〉

2.3 Loads

2.3.1

Unless otherwise specified, symbols regarding loads and their units used in these Rules are those defined in **Table 4**.

<table>
<tr><th>Present</th><th>Amendment</th><th>Reason</th></tr>
<tr>
<td>

Table 4 : Loads

<table>
<tr><th>Symbols</th><th>Meaning</th><th>Units</th></tr>
<tr><td>C_W</td><td>Wave coefficient</td><td>-</td></tr>
<tr><td colspan="3">〈omitted〉</td></tr>
<tr><td>P_{SL}</td><td>Bottom slamming pressure</td><td>kN/m^2</td></tr>
<tr><td>P_{FB}</td><td>Bow impact pressure</td><td>kN/m^2</td></tr>
<tr><td colspan="3">〈newly added〉</td></tr>
<tr><td>P_{fs}</td><td>Static pressure in flooded conditions</td><td>kN/m^2</td></tr>
<tr><td colspan="3">〈omitted〉</td></tr>
<tr><td>M_{wh}</td><td>Horizontal wave bending moment</td><td>kNm</td></tr>
</table>

〈omitted〉

</td>
<td>

Table 4 : Loads

<table>
<tr><th>Symbols</th><th>Meaning</th><th>Units</th></tr>
<tr><td>C_W</td><td>Wave coefficient</td><td>-</td></tr>
<tr><td colspan="3">〈same as the present〉</td></tr>
<tr><td>P_{FB}</td><td>Bow impact pressure</td><td>kN/m^2</td></tr>
<tr><td>P_{FB}</td><td>Bow impact pressure</td><td>kN/m^2</td></tr>
<tr><td>P_{SS}</td><td>Stern slamming pressure</td><td>kN/m^2</td></tr>
<tr><td>P_{fs}</td><td>Static pressure in flooded conditions</td><td>kN/m^2</td></tr>
<tr><td colspan="3">〈same as the present〉</td></tr>
<tr><td>M_{wh}</td><td>Horizontal wave bending moment</td><td>kNm</td></tr>
</table>

〈same as the present〉

</td>
<td></td>
</tr>
</table>

Present

3. Definition

3.1 ~ 3.6 〈omitted〉

3.7 Glossary

3.7.1 Definitions of terms

Table 7 : Definition of terms

Terms	Definition
〈omitted〉	
~~Confined space~~	~~Space identified by one of the following characteristics: limited openings for entry and exit, unfavourable natural ventilation or not designed for continuous worker occupancy~~
〈newly added〉	
〈omitted〉	
〈newly added〉	
〈omitted〉	

Amendment

3. Definition

3.1 ~ 3.6 〈same as the present〉

3.7 Glossary

3.7.1 Definitions of terms

Table 7 : Definition of terms

Terms	Definition
〈same as the present〉	
〈del〉	
Continually manned space	A space in which the continuous or prolonged presence of seafarers is necessary for normal operational periods. This includes spaces routinely occupied for a period of 20 minutes or more during normal operational periods.
〈same as the present〉	
Normally unmanned space	A space not normally manned (without the continuous or prolonged presence of seafarers) during normal operational periods This includes spaces routinely occupied for a period of less than 20 minutes during normal operational periods.
〈same as the present〉	

Reason

Present

Chapter 3 Structural Design Principles

Section 2 Net Scantling Approach

1. General

1.3 Scantling compliance

1.3.1 〈omitted〉

1.3.2

〈omitted〉

Table 1 : Assessment for corrosion applied to the gross scantlings

Structural requirement	Property/analysis type	Applied corrosion addition
〈omitted〉		
〈omitted〉		
〈omitted〉		
Strength assessment by FEM	Cargo hold (stress determination)	0.5 t_c
	Buckling capacity	t_c
	Local fine mesh	0.5 t_c
〈omitted〉		
〈omitted〉		
〈omitted〉		
Fatigue assessment (FE Stress analysis)	Coarse mesh FE model Very fine mesh portion	0.5 t_c

Amendment

Chapter 3 Structural Design Principles

Section 2 Net Scantling Approach

1. General

1.3 Scantling compliance

1.3.1 〈same as the present〉

1.3.2

〈same as the present〉

Table 1 : Assessment for corrosion applied to the gross scantlings

Structural requirement	Property/analysis type	Applied corrosion addition
〈same as the present〉		
〈same as the present〉		
〈same as the present〉		
Strength assessment by FEM	Cargo hold (stress determination)	0.0
	Buckling capacity	t_c (1)
	Local fine mesh	0.0
〈same as the present〉		
〈same as the present〉		
〈same as the present〉		
Fatigue assessment (FE Stress analysis)	Coarse mesh FE model Very fine mesh portion	0.5 t_c
1) $t_c = t_{c1} + t_{c2}$		

Reason

Present	Amendment	Reason

Present

Section 3 Corrosion Additions

1. General

1.2 Corrosion addition determination

1.2.1

The corrosion addition for each of the two sides of a structural member, t_{c1} or t_{c2}, is specified in **Table 1**.

〈omitted〉

Table 1 : Corrosion addition for one side of a structural member

Compartment type	t_{c1} or t_{c2}
Ballast water tank, bilge tank, drain storage tank, chain locker(1)	1.0
Exposed to atmosphere	1.0
Exposed to sea water	1.0
Fuel oil and lube oil tank	0.5
Fresh water tank	0.5
Void spaces and dry spaces(2)(3)(4)	0.0
Container holds(5)	0.5
Accommodation spaces	0.0
Compartments other than those mentioned above	0.5

(1) 1.0 mm is to be added to the plate surface within 3.0 m above the upper surface of the chain locker bottom.

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

(3) For bottom plate of void spaces and dry spaces, t_{c1} or t_{c2} is to be taken equal to 0.5 mm.

(4) For the hull girder strength assessment according to **Ch 5**, t_{c1} or t_{c2} is to be taken equal to 0.5 mm.

(5) For the hull girder strength assessment according to **Ch 5**, t_{c1} or t_{c2} is to be taken equal to 1.0 mm.

Amendment

Section 3 Corrosion Additions

1. General

1.2 Corrosion addition determination

1.2.1

The corrosion addition for each of the two sides of a structural member, t_{c1} or t_{c2}, is specified in **Table 1**.

〈same as the present〉

Table 1 : Corrosion addition for one side of a structural member

Compartment type	t_{c1} or t_{c2}
Ballast water tank, bilge tank, drain storage tank, chain locker(1)	1.0
Exposed to atmosphere(5)	0.5
Exposed to sea water(5)	0.5
Fuel oil and lube oil tank	0.5
Fresh water tank	0.5
Void spaces and dry spaces(2)(3)(4)	0.0
Container holds(5)	0.5
Accommodation spaces	0.0
Compartments other than those mentioned above	0.5

(1) 1.0 mm is to be added to the plate surface within 3.0 m above the upper surface of the chain locker bottom.

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

(3) For bottom plate of void spaces and dry spaces, t_{c1} or t_{c2} is to be taken equal to 0.5 mm.

(4) For the hull girder strength assessment according to **Ch 5**, t_{c1} or t_{c2} is to be taken equal to 0.5 mm.

(5) For the hull girder strength assessment according to **Ch 5**, t_{c1} or t_{c2} is to be taken equal to 1.0 mm.

Present	Amendment	Reason
1.2.2 Stiffener The corrosion addition of a stiffener is determined according to the location of its connection to the attached plating. **1.2.3** When a local structural member/plate is affected by more than one value of corrosion addition, the most onerous value is to be applied to the entire strake. **1.2.4 〈newly added〉**	**1.2.2 Stiffener** The corrosion addition of a stiffener is determined according to the location of its connection to the attached plating. **1.2.3** When a local structural member / plate is affected by more than one value of corrosion addition, the most onerous value is to be applied to the entire strake. **1.2.4 Maximum of corrosion addition** Considering the renewal criteria specified in **Ch 13, Sec 2**, the corrosion addition satisfy the following condition: $t_c \le 0.2\, t_{gr\_off}$ with nearest half millimetre For examples; 0.75 ≤ t 〈 1.25mm, the corrosion addition, t_c, is 1.0mm. 1.25 ≤ t 〈 1.75mm, the corrosion addition, t_c, is 1.5mm.	

Present	Amendment	Reason
Section 5 Limit States	**Section 5 Limit States**	
1. 〈omitted〉	**1. 〈same as the present〉**	
2. Criteria	**2. Criteria**	
2.1 ~ 2.4 〈omitted〉	**2.1 ~ 2.4 〈same as the present〉**	
2.5 Accidental limit state	**2.5 Accidental limit state**	
2.5.1 Plating, stiffeners and PSM	**2.5.1 Plating, stiffeners and PSM**	
The plating, stiffeners and PSM are to be assessed in flooded conditions in accordance with **Ch 6** for yielding criteria.	The plating, stiffeners and PSM are to be assessed in flooded conditions in accordance with **Ch 6** and **Ch 7** for yielding criteria.	
〈omitted〉	〈same as the present〉	

Present	Amendment	Reason
Section 6 Structural Detail Principles	**Section 6 Structural Detail Principles**	
3. Stiffeners	**3. Stiffeners**	
3.4 Sniped ends	**3.4 Sniped ends**	
3.4.1	**3.4.1**	
Sniped ends may be used where dynamic loads are small, provided the net thickness of plating supported by the stiffener, tp, is not less than:	Sniped ends may be used where dynamic loads are small, provided the net thickness of plating supported by the stiffener, tp in mm, is not less than:	
$t_p = c_1\sqrt{(1000\,l - \frac{s}{2})\frac{sPk}{10^6}}$ (mm)	$t_p = c_1\sqrt{(1000\,\ell - \frac{s}{2})\frac{sPk}{10^6}}$	
where:	where:	
P : Design pressure for the stiffener for the design load set being considered, in kN/m^2.	*P* : Design pressure for the stiffener for the design load set being considered, in kN/m^2.	
c1 : Coefficient for the design load set being considered, to be taken as:	c1 : Coefficient for the design load set being considered, to be taken as:	
• c1 = 1.2 for acceptance criteria set AC-S.	• c1 = 1.2 for acceptance criteria set AC-S.	
• c1 = 1.1 for acceptance criteria set AC-SD and tank test.	• c1 = 1.1 for acceptance criteria set AC-SD and AC-T.	
Sniped stiffeners are not to be used on structures in the vicinity of engines or generators in the machinery space, propeller impulse zone in the stern area nor on the shell envelope.	Sniped stiffeners are not to be used on structures in the vicinity of engines or generators in the machinery space, propeller impulse zone in the stern area nor on the shell envelope.	

Present	Amendment	Reason
5. Intersection of stiffeners and primary supporting members	**5. Intersection of stiffeners and primary supporting members**	
5.2 Connection of stiffeners to PSM	**5.2 Connection of stiffeners to PSM**	
5.2.1 General	**5.2.1 General**	
For connection of stiffeners to PSM a) in case of lateral pressure other than bottom slamming, stern slamming and bow impact loads, **[5.2.2]** and **[5.2.3]** are to be applied. b) in case of bottom slamming or bow impact loads, **[5.2.4]** is to be applied.	For connection of stiffeners to PSM in case of lateral pressure, **[5.2.2]** and **[5.2.3]** are to be applied.	
The cross sectional areas of the connections are to be determined from the proportion of load transmitted through each component in association with its appropriate permissible stress.	The cross sectional areas of the connections are to be determined from the proportion of load transmitted through each component in association with its appropriate permissible stress.	
5.2.2	**5.2.2**	
The load, W_1, in kN, transmitted through the shear connection is to be taken as follows.	The load, W_1 in kN, transmitted through the shear connection is to be taken as follows.	
a) If the web stiffener is connected to the intersecting stiffener: $W_1 = W\left(\alpha_a + \frac{A_1}{4f_cA_w + A_1}\right)$	a) If the web stiffener is connected to the intersecting stiffener: $W_1 = W\left(\alpha_a + \frac{A_1}{4\,f_c\,A_w + A_1}\right)$	
b) If the web stiffener is not connected to the intersecting stiffener: $W_1 = W$	b) If the web stiffener is not connected to the intersecting stiffener: $W_1 = W$	
where:	where:	
W : Total load, in kN, transmitted through the stiffener connection to the PSM taken equal to: $W = \frac{P_1 s_1\left(S_1 - \frac{s_1}{2000}\right) + P_2 s_2\left(S_2 - \frac{s_2}{2000}\right)}{2} 10^{-3}$	W : Total load, in kN, transmitted through the stiffener connection to the PSM taken equal to: $W = \frac{P_1\,s_1\left(S_1 - \frac{s_1}{2000}\right) + P_2\,s_2\left(S_2 - \frac{s_2}{2000}\right)}{2\,\sin\varphi_{w1}\,\sin\varphi_{w2}}\,10^{-3}$	
P_1, P_2 : Design pressure applied on the stiffener for the design load set being considered, in kN/m^2, on each side of the considered connection.	P_1, P_2 : Design pressure applied on the stiffener for the design load set being considered, in $\mathrm{kN/m^2}$, on each side of the considered connection. For bottom slamming or bow impact loads, P_1 and P_2 are 50 % of the design pressure as defined in **Ch 4, Sec 5, [3.2]**, **[3.3]** and **[3.4]** respectively.	

Present	Amendment	Reason
S_1, S_2 : 〈omitted〉	S_1, S_2 : 〈same as the present〉	
s_1, s_2 : 〈omitted〉	s_1, s_2 : 〈same as the present〉	
α_a : 〈omitted〉	α_a : 〈same as the present〉	
φ_{w1} : 〈newly added〉	φ_{w1} : Angle between primary supporting member and attached plating, in $\deg$, as defined in **Ch 3, Sec 7, Symbols** and **Ch 10, Sec 1, Figure 4**.	
φ_{w2} : 〈newly added〉	φ_{w2} : Angle between stiffener and attached plating, in $\deg$, as defined in **Ch 3, Sec 7, Symbols** and **Ch 3, Sec 7, Figure 12**.	
A_1 : 〈omitted〉	A_1 : 〈same as the present〉	
A_{1d} : 〈omitted〉	A_{1d} : 〈same as the present〉	
〈omitted〉	〈same as the present〉	
f_c : Collar load factor taken equal to: For intersecting stiffeners of symmetrical cross section: $f_c = 1.85$ for $A_w \le 14$ $f_c = 1.85 - 0.0441(A_w - 14)$ for $14 < A_w \le 31$ $f_c = 1.1 - 0.013(A_w - 31)$ for $31 < A_w \le 58$ $f_c = 1.85$ for $A_w > 58$ For intersecting stiffeners of asymmetrical cross section: $f_c = 0.68 + 0.0172 \dfrac{\ell_s}{A_w}$	f_c : Collar load factor taken equal to: For intersecting stiffeners of symmetrical cross section: $f_c = 1.85$ for $A_w \le 14$ $f_c = 1.85 - 0.0441(A_w - 14)$ for $14 < A_w \le 31$ $f_c = 1.1 - 0.013(A_w - 31)$ for $31 < A_w \le 58$ $f_c = 0.75$ for $A_w > 58$ For intersecting stiffeners of asymmetrical cross section: $f_c = 0.68 + 0.0172 \dfrac{\ell_s}{A_w}$	
ℓ_s : 〈omitted〉	ℓ_s : 〈same as the present〉	
5.2.3	**5.2.3**	
〈omitted〉	〈same as the present〉	
A_{wc} : Effective net area, in cm^2, of the PSM web stiffener in way of the weld as shown in **Figure 8**.	A_{wc} : Effective net area, in cm^2, of the PSM web stiffener in way of the weld as shown in **Figure 8**.	
σ_{perm} : Permissible direct stress given in **Table 1** for AC-S, AC-SD and tank test, in N/mm^2.	σ_{perm} : Permissible direct stress given in **Table 1** for AC-S, AC-SD, AC-I and AC-T, in N/mm^2.	
τ_{perm} : Permissible shear stress given in **Table 1** for AC-S, AC-SD and tank test, in N/mm^2.	τ_{perm} : Permissible shear stress given in **Table 1** for AC-S, AC-SD, AC-I and AC-T, in N/mm^2.	

Present

Table 1 : Permissible stresses for connection between stiffeners and PSMs

Item	Direct stress, σ_{perm}, in N/mm^2			shear stress, τ_{perm}, in N/mm^2		
	Acceptance criteria set			Acceptance criteria set		
	AC-S	AC-SD and tank test	AC-I	AC-S	AC-SD and tank test	AC-I
PSM web stiffener	$0.83R_{eH}^{(2)}$	R_{eH}	R_{eH}	-	-	-
PSM web stiffener to intersecting stiffener in way of weld connection: • Double continuous fillet • Partial penetration weld	$0.58R_{eH}^{(2)}$ $0.83R_{eH}^{(1)(2)}$	$0.70R_{eH}^{(2)}$ R_{eH}	R_{eH} R_{eH}	- -	- -	- -
PSM stiffener to intersecting stiffener in way of lapped welding	$0.50R_{eH}$	$0.60R_{eH}$	R_{eH}	-	-	-
Shear connection including lugs or collar plates: • Single sided connection • Double sided connection	- -	- -	- -	$0.71\tau_{eH}$ $0.83\tau_{eH}$	$0.85\tau_{eH}$ τ_{eH}	τ_{eH} τ_{eH}
⟨omitted⟩						

~~5.2.4 Bottom slamming and bow impact loads~~

~~For bottom slamming or bow impact loads, the load W, in kN, transmitted through the PSM web stiffener is to comply with the following criteria instead of those defined in [5.2.2] and [5.2.3]:~~

$$\cancel{0.9W \le \frac{A_1\tau_{perm}+A_w\sigma_{perm}}{10}}$$

~~where:~~

~~W : Load, in kN, as defined in [5.2.2].~~

~~A_1 : Effective net shear area, in cm2, as defined in [5.2.2].~~

~~A_w : Effective net cross sectional area, in cm2, as defined in [5.2.2].~~

~~σ_{perm} : Permissible direct stress given in Table 1 for AC-I, in N/mm2.~~

~~τ_{perm} : Permissible shear stress given in Table 1 for AC-I, in N/mm2.~~

Amendment

Table 1 : Permissible stresses for connection between stiffeners and PSMs

Item	Direct stress, σ_{perm}, in N/mm^2			shear stress, τ_{perm}, in N/mm^2		
	Acceptance criteria set			Acceptance criteria set		
	AC-S	AC-SD and AC-T	AC-I	AC-S	AC-SD and AC-T	AC-I
PSM web stiffener	$0.83R_{eH}^{(2)}$	R_{eH}	R_{eH}	-	-	-
PSM web stiffener to intersecting stiffener in way of weld connection: • Double continuous fillet • Partial penetration weld	$0.58R_{eH}^{(2)}$ $0.83R_{eH}^{(1)(2)}$	$0.70R_{eH}^{(2)}$ R_{eH}	R_{eH} R_{eH}	- -	- -	- -
PSM stiffener to intersecting stiffener in way of lapped welding	$0.50R_{eH}$	$0.60R_{eH}$	R_{eH}	-	-	-
Shear connection including lugs or collar plates: • Single sided connection • Double sided connection	- -	- -	- -	$0.71\tau_{eH}$ $0.83\tau_{eH}$	$0.85\tau_{eH}$ τ_{eH}	τ_{eH} τ_{eH}
⟨same as the present⟩						

5.2.4 ⟨del⟩

Reason

Present

5.2.5 〈omitted〉

5.2.6 〈omitted〉

5.2.7 〈omitted〉

5.2.8 〈omitted〉

5.2.9

The size of the fillet welds is to be calculated according to **Ch 12, Sec 3, [2.5]** based on the weld factors given in **Table 2.** For the welding in way of the shear connection the size is not to be less than that required for the PSM web plate for the location under consideration.

Table 2 : Weld factors for connection between stiffeners and PSMs

Item	Acceptance criteria	Weld factor
PSM stiffener to intersecting stiffener	AC-S, AC-SD and tank test	$0.6\sigma_{wc}/\sigma_{perm}$ not to be less than 0.38
Shear connection inclusive of lug or collar plate	AC-S, AC-SD and tank test	0.38
Shear connection inclusive of lug or collar plate, where the web stiffener of the PSM is not connected to the intersection stiffener	AC-S, AC-SD and tank test	$0.6\tau_w/\tau_{perm}$ not to be less than 0.44
PSM stiffener to intersecting stiffener Shear connection inclusive of lug or collar plate	AC-I	$0.6\dfrac{9W}{A_1\tau_{perm}+A_w\sigma_{perm}}$
〈omitted〉		

Amendment

5.2.4 〈same as the present〉

5.2.5 〈same as the present〉

5.2.6 〈same as the present〉

5.2.7 〈same as the present〉

5.2.8

The size of the fillet welds is to be calculated according to **Ch 12, Sec 3, [2.5]** based on the weld factors given in **Table 2.** For the welding in way of the shear connection the size is not to be less than that required for the PSM web plate for the location under consideration.

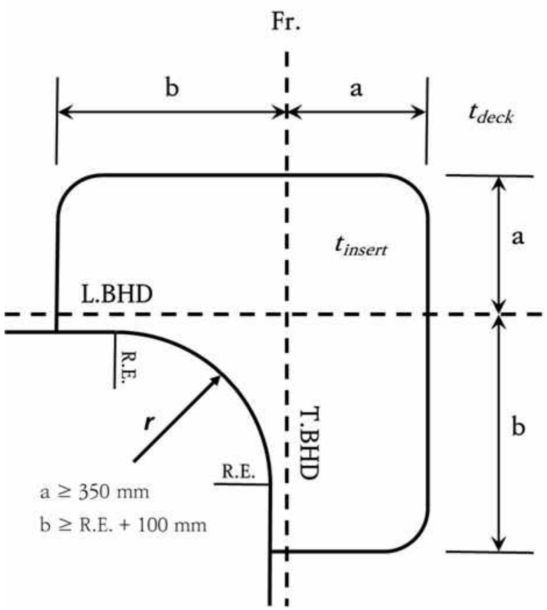
Table 2 : Weld factors for connection between stiffeners and PSMs

Item	Acceptance criteria	Weld factor
PSM stiffener to intersecting stiffener	AC-S, AC-SD, AC-I and AC-T	$0.6\,\sigma_{wc}\,/\,\sigma_{perm}$ not to be less than 0.38
Shear connection inclusive of lug or collar plate	AC-S, AC-SD, AC-I and AC-T	0.38
Shear connection inclusive of lug or collar plate, where the web stiffener of the PSM is not connected to the intersection stiffener	AC-S, AC-SD, AC-I and AC-T	$0.6\,\tau_w\,/\,\tau_{perm}$ not to be less than 0.44
〈del〉	〈del〉	〈del〉
〈same as the present〉		

Reason

Present	Amendment	Reason
9. Deck structure **9.1 〈omitted〉** **9.2 Deck scantlings** **9.2.1 〈omitted〉** **9.2.2 Hatch corners** The stress concentrations in way of the hatch corners are to be checked, in particular in the top part (hatch coaming, upper deck and stringers under deck). **9.2.3 〈newly added〉**	**9. Deck structure** **9.1 〈same as the present〉** **9.2 Deck scantlings** **9.2.1 〈same as the present〉** **9.2.2 Hatch corners** The stress concentrations in way of the hatch corners are to be checked, in particular in the top part (hatch coaming, upper deck and stringers under deck). **9.2.3 Hatch corner curvature radii** The hatch corner curvature radius, r in mm, as shown in Figure 20 is not to be taken less than: $r = C_{\sec} C_{thick} C_{material} C_{L2} C_{location} 10^3$ with $r \geq r_{\min}$ where: $r_{\min}$: minimum curvature radius of hatch corner $r_{\min} = 250$ for $0.25 \leq x/L \leq 0.75$ $r_{\min} = 200$ for other cases $C_{\sec}$: Coefficient of section property in longitudinal direction $C_{\sec} = \dfrac{M_{sw} + M_{wv}}{Z_{deck} \dfrac{235}{1.24k} 10^3} \cdot \dfrac{1}{C_{dis}}$ M_{sw} : Permissible hogging and sagging vertical still water bending moment in seagoing operation, in kNm, at the hull transverse section considered, M_{wv} : Vertical wave bending moment in seagoing condition, in kNm, in seagoing operation at the hull transverse section considered Z_{deck} : Section modulus at strength deck, in m^3	

Present	Amendment	Reason
〈newly added〉	C_{dis} : Correction factor in longitudinal direction $C_{dis} = 0.5$ for $x/L = 0.0$ $C_{dis} = 1.0$ for $0.25 \le x/L \le 0.75$ $C_{dis} = 0.5$ for $x/L = 1.0$ Intermediate values are obtained by linear interpolation. C_{thick} : Correction factor for plate thickness effect $C_{thick} = \frac{t_{deck}}{t_{insert}}$ with $0.667 \le C_{thick} \le 1.0$ t_{deck} : Gross thickness of the strength deck plate, in mm, see Figure 20 t_{insert} : Gross thickness of the insert plate, in mm, see Figure 20 $C_{material}$: Correction factor of material $C_{material} = \sqrt{\frac{R_{eH-deck}}{R_{eH-insert}}}$ $R_{eH-deck}$: Specified minimum yield stress of strength deck plate, in $\mathrm{N/mm^2}$ $R_{eH-insert}$: Specified minimum yield stress of insert plate, in $\mathrm{N/mm^2}$ C_{L2} : Correction factor along the ship length $C_{L2} = \sqrt{\frac{\mathrm{L}_2}{2000}}$ $C_{location}$: Correction factor of hatch corner location $C_{location} = 1.0 + \frac{\sqrt{b_{hatch}}}{\ell_{hatch}}$ b_{hatch} : Breadth of hatch opening at considered location, in m ℓ_{hatch} : Length of hatch opening at considered location, in m	

Present	Amendment	Reason
〈newly added〉	The size of insert plates, in mm, at hatch corner as defined in Figure 20 is not to be taken less than: $a \geq a_{\min}$ $b \geq b_{\min}$ where: $a_{\min}$= 350 $b_{\min}$: End of curvature radius of hatch corner(R.E.) + 100 mm  Figure 20 : Curvature radius of hatch corner	

Present	Amendment	Reason
Section 7 Structural Idealisation	**Section 7 Structural Idealisation**	
Symbols	Symbols	
For symbols not defined in this section, refer to **Ch 1, Sec 4**.	For symbols not defined in this section, refer to **Ch 1, Sec 4**.	
φ_w : Angle, in deg, between the stiffener or primary supporting member web and the attached plating, see **Figure 12**. φ_w is to be taken equal to 90 deg if the angle is greater than or equal to 75 deg.	φ_w : Angle, in $\deg$, between the stiffener or primary supporting member web and the attached plating, see **Figure 12** for stiffener and **Ch 10, Sec 1, Figure 4** for primary supporting member. φ_w is to be taken equal to 90 $\deg$ if the angle is greater than or equal to 75 $\deg$.	
ℓ_{bdg} : Effective bending span, in m, as defined in **[1.1.2]** for stiffeners and **[1.1.6]** for primary supporting members.	ℓ_{bdg} : Effective bending span, in m, as defined in **[1.1.2]** for stiffeners and **[1.1.6]** for primary supporting members.	
⟨omitted⟩	⟨same as the present⟩	
1. Structural idealisation of stiffeners and primary support members	**1. Structural idealisation of stiffeners and primary support members**	
1.3 Effective breadth	**1.3 Effective breadth**	
1.3.3 Effective area of curved face plate and attached plating of primary supporting members	**1.3.3 Effective area of curved face plate and attached plating of primary supporting members**	
⟨omitted⟩	⟨same as the present⟩	
a) The effective net area, $A_{eff-n50}$, in mm^2, is to be taken as:	a) The effective net area, $A_{eff-n50}$, in mm^2, is to be taken as:	
$A_{eff-n50} = C_f t_{f-n50} b_f$	$A_{eff-n50} = C_f t_{f-n50} b_f$	

Present	Amendment	Reason
C_f : Flange efficiency coefficient taken equal to: $C_f = C_{f1}\frac{\sqrt{r_f t_{f-n50}}}{b_1}$ but not to be taken greater than 1.0. C_{f1} : Coefficient taken equal to: • For symmetrical and unsymmetrical face plates, $C_{f1} = \frac{0.643\,(\sinh\beta\,\cosh\beta + \sin\beta\,\cos\beta)}{(\sinh\beta)^2 + \sin^2\beta}$ • For attached plating of box girders with two webs, $C_{f1} = \frac{0.78\,(\sinh\beta + \sin\beta)(\cosh\beta - \cos\beta)}{(\sinh\beta)^2 + \sin^2\beta}$ • For attached plating of box girders with multiple webs, $C_{f1} = \frac{1.56\,(\cosh\beta - \cos\beta)}{\sinh\beta + \sin\beta}$ β : Coefficient calculated as: $\beta = \frac{1.285\,b_1}{\sqrt{r_f t_{f-n50}}}$, in rad. 〈omitted〉	C_f : Flange efficiency coefficient is to be obtained from the following formula but not to be greater than 1.0: • $C_f = C_{f1}\frac{1.285}{\beta k_1}$ for symmetrical face plates • $C_f = 0.18 + \frac{0.08}{\beta^2}$ for unsymmetrical face plate, • $C_f = C_{f1}\frac{1.285}{\beta}$ for attached plating of box girders, C_{f1} : Coefficient taken equal to: • For symmetrical face plates, $C_{f1} = \frac{(\sinh k_1\beta\,\cosh k_1\beta + \sin k_1\beta\,\cos k_1\beta)}{(\cosh k_1\beta)^2 + (\cos k_1\beta)^2}$ • For attached plating of box girders with two webs, $C_{f1} = \frac{0.78\,(\sinh\beta + \sin\beta)(\cosh\beta - \cos\beta)}{(\sinh\beta)^2 + \sin^2\beta}$ • For attached plating of box girders with multiple webs, $C_{f1} = \frac{1.56\,(\cosh\beta - \cos\beta)}{\sinh\beta + \sin\beta}$ k_1 : Coefficient calculated as: • For $\beta < 1.4$ $k_1 = 1.4 + 1.25(1.4 - \beta)^3$ • For $\beta \geq 1.4,$ $k_1 = 1.4$ β : Coefficient calculated as: $\beta = \frac{1.285\,b_1}{\sqrt{r_f t_{f-n50}}}$, in rad. 〈same as the present〉	

Present	Amendment	Reason
Chapter 4 Loads	**Chapter 4 Loads**	
Section 2 Dynamic load cases	**Section 2 Dynamic load cases**	
Symbols	Symbols	
For symbols not defined in this section, refer to **Ch 1, Sec 4.**	For symbols not defined in this section, refer to **Ch 1, Sec 4.**	
a_{surge}, $a_{pitch-x}$, a_{sway}, a_{roll-y}, a_{heave}, a_{roll-z}, $a_{pitch-z}$: Acceleration components, as defined in **Ch 4, Sec 3.**	a_{surge}, $a_{pitch-x}$, a_{sway}, a_{roll-y}, a_{heave}, a_{roll-z}, $a_{pitch-z}$: Acceleration components, as defined in **Ch 4, Sec 3.**	
f_{xL} : ⟨omitted⟩	f_{xL} : ⟨same as the present⟩	
f_T : ⟨omitted⟩	f_T : ⟨same as the present⟩	
f_{lp} : ⟨omitted⟩	f_{lp} : ⟨same as the present⟩	
~~f_{lp-BSR} : Factor for the longitudinal distribution of the torsional moment for the BSR load case, to be taken as:~~ ~~$f_{lp-BSR} = 1.2 f_{xL} - 0.2$ for $x/L \leq 0.5$~~ ~~$f_{lp-BSR} = 0.4$ for $0.5 < x/L \leq 0.75$~~ ~~$f_{lp-BSR} = -1.6 f_{xL} + 1.6$ for $0.75 < x/L$~~	f_{lp-BSR} : ⟨del⟩	
~~f_{lp-BSP} : Factor for the longitudinal distribution of the torsional moment for the BSP load case, to be taken as:~~ ~~$f_{lp-BSP} = 0.8 f_{xL}$ for $x/L \leq 0.5$~~ ~~$f_{lp-BSP} = 0.4$ for $0.5 < x/L \leq 0.75$~~ ~~$f_{lp-BSP} = -1.6 f_{xL} + 1.6$ for $0.75 < x/L$~~	f_{lp-BSP} : ⟨del⟩	
f_{lp-OST} : ⟨omitted⟩	f_{lp-OST} : ⟨same as the present⟩	
⟨omitted⟩	⟨same as the present⟩	

Present	Amendment	Reason
1. General **1.1 Definition of dynamic load cases** **1.1.1** The following Equivalent Design Waves (EDW) are to be used to generate the dynamic load cases for structural assessment: 〈omitted〉 e) BSP load cases: BSP-1P and BSP-2P: Beam sea EDWs that minimise and maximise the hydrodynamic pressure at the waterline amidships on the port side respectively. BSP-1S and BSP-2S: Beam sea EDWs that minimise and maximise the hydrodynamic pressure at the waterline amidships on the starboard side respectively. 〈omitted〉	**1. General** **1.1 Definition of dynamic load cases** **1.1.1** The following Equivalent Design Waves (EDW) are to be used to generate the dynamic load cases for structural assessment: 〈same as the present〉 e) BSP load cases: BSP-1P and BSP-2P: Beam sea EDWs that maximise and minimise the hydrodynamic pressure at the waterline amidships on the port side respectively. BSP-1S and BSP-2S: Beam sea EDWs that maximise and minimise the hydrodynamic pressure at the waterline amidships on the starboard side respectively. 〈same as the present〉	

Present

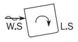
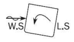
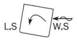
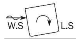
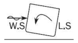
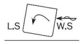
2. Dynamic load cases

2.1 Description of dynamic load cases

2.1.1

〈omitted〉

Table 2 : Ship responses for BSR and BSP load cases

Load case	BSR-1P	BSR-2P	BSR-1S	BSR-2S	BSP-1P	BSP-2P	BSP-1S	BSP-2S
EDW	BSR		BSR		BSP		BSP	
Heading	Beam				Beam			
Effect	Max. roll				Max. pressure at waterline			
VWBM	-	-	-	-	Hogging	Sagging	Hogging	Sagging
VWSF	-	-	-	-	Positive-aft Negative-fore	Negative-aft Positive-fore	Positive-aft Negative-fore	Negative-aft Positive-fore
HWBM	Stbd tensile	Port tensile	Port tensile	Stbd tensile	Port tensile	Stbd tensile	Stbd tensile	Port tensile
HWSF	Negative-aft Positive-fore	Positive-aft Negative-fore	Positive-aft Negative-fore	Negative-aft Positive-fore	Positive-aft Negative-fore	Negative-aft Positive-fore	Negative-aft Positive-fore	Positive-aft Negative-fore
TM	Negative	Positive	Positive	Negative	-	-	-	-
〈omitted〉								
Roll	Portside down	Portside up	Starboard down	Starboard up	Portside up	Portside down	Starboard up	Starboard down
a_{roll}								
〈omitted〉								

〈omitted〉

Amendment

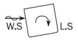
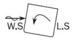
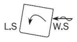
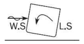
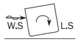
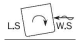
2. Dynamic load cases

2.1 Description of dynamic load cases

2.1.1

〈same as the present〉

Table 2 : Ship responses for BSR and BSP load cases

Load case	BSR-1P	BSR-2P	BSR-1S	BSR-2S	BSP-1P	BSP-2P	BSP-1S	BSP-2S
EDW	BSR		BSR		BSP		BSP	
Heading	Beam				Beam			
Effect	Max. roll				Max. pressure at waterline			
VWBM	-	-	-	-	Sagging	Hogging	Sagging	Hogging
VWSF	-	-	-	-	Negative-aft Positive-fore	Positive-aft Negative-fore	Negative-aft Positive-fore	Positive-aft Negative-fore
HWBM	Stbd tensile	Port tensile	Port tensile	Stbd tensile	Stbd tensile	Port tensile	Port tensile	Stbd tensile
HWSF	-	-	-	-	Negative-aft Positive-fore	Positive-aft Negative-fore	Positive-aft Negative-fore	Negative-aft Positive-fore
TM	-	-	-	-	-	-	-	-
〈same as the present〉								
Roll	Portside down	Portside up	Starboard down	Starboard up	Portside up	Portside down	Starboard up	Starboard down
a_{roll}								
〈same as the present〉								

〈same as the present〉

Reason

Present

2.2 Load combination factors

2.2.1

The load combinations factors, LCFs for the global loads and inertia load components are defined in:

〈omitted〉

Table 5 : Load combination factors, LCFs for BSR and BSP load cases

Load component		LCF	BSR-1P	BSR-2P	BSR-1S	BSR-2S
Hull girder loads	M_{WV}	C_{WV}	0.0	0.0	0.0	0.0
	Q_{WV}	C_{QW}	0.0	0.0	0.0	0.0
	M_{WH}	C_{WH}	0.05	-0.05	-0.05	0.05
	Q_{WH}	C_{QH}	0.0	0.0	0.0	0.0
	M_{WT}	C_{WT}	$\underline{-f_{lp-BSR}}$	$\underline{f_{lp-BSR}}$	$\underline{f_{lp-BSR}}$	$\underline{-f_{lp-BSR}}$
Longitudinal accelerations	a_{surge}	C_{XS}	0.0	0.0	0.0	0.0
	a_{pitch-}	C_{XP}	0.0	0.0	0.0	0.0
	$gsin\varphi$	C_{XG}	0.0	0.0	0.0	0.0
Transverse accelerations	a_{sway}	C_{YS}	$0.6-0.7f_T$	$-0.6+0.7f_T$	$-0.6+0.7f_T$	$0.6-0.7f_T$
	a_{roll-}	C_{YR}	1.0	-1.0	-1.0	1.0
	$gsin\theta$	C_{YG}	-1.0	1.0	1.0	-1.0
Vertical accelerations	a_{heave}	C_{ZH}	$0.9-0.8f_T$	$-0.9+0.8f_T$	$0.9-0.8f_T$	$-0.9+0.8f_T$
	a_{roll-}	C_{ZR}	$\underline{1.5-f_T}$	$\underline{-1.5+f_T}$	$\underline{-1.5+f_T}$	$\underline{1.5-f_T}$
	a_{pitch-}	C_{ZP}	0.0	0.0	0.0	0.0

(continued)

Amendment

2.2 Load combination factors

2.2.1

The load combinations factors, LCFs for the global loads and inertia load components are defined in:

〈same as the present〉

Table 5 : Load combination factors, LCFs for BSR and BSP load cases

Load component		LCF	BSR-1P	BSR-2P	BSR-1S	BSR-2S
Hull girder loads	M_{WV}	C_{WV}	0.0	0.0	0.0	0.0
	Q_{WV}	C_{QW}	0.0	0.0	0.0	0.0
	M_{WH}	C_{WH}	0.05	-0.05	-0.05	0.05
	Q_{WH}	C_{QH}	0.0	0.0	0.0	0.0
	M_{WT}	C_{WT}	$\underline{0.0}$	$\underline{0.0}$	$\underline{0.0}$	$\underline{0.0}$
Longitudinal accelerations	a_{surge}	C_{XS}	0.0	0.0	0.0	0.0
	a_{pitch-}	C_{XP}	0.0	0.0	0.0	0.0
	$gsin\varphi$	C_{XG}	0.0	0.0	0.0	0.0
Transverse accelerations	a_{sway}	C_{YS}	$0.6-0.7f_T$	$-0.6+0.7f_T$	$-0.6+0.7f_T$	$0.6-0.7f_T$
	a_{roll-}	C_{YR}	1.0	-1.0	-1.0	1.0
	$gsin\theta$	C_{YG}	-1.0	1.0	1.0	-1.0
Vertical accelerations	a_{heave}	C_{ZH}	$0.9-0.8f_T$	$-0.9+0.8f_T$	$0.9-0.8f_T$	$-0.9+0.8f_T$
	a_{roll-}	C_{ZR}	$\underline{1.0}$	$\underline{-1.0}$	$\underline{-1.0}$	$\underline{1.0}$
	a_{pitch-}	C_{ZP}	0.0	0.0	0.0	0.0

(continued)

Reason

Present	Amendment	Reason

Present

Table 5 : Load combination factors, LCFs for BSR and BSP load cases

Load component		LCF	BSP-1P	BSP-2P	BSP-1S	BSP-2S
Hull girder loads	M_{WV}	C_{WV}	$-0.25+0.5f_T$	$0.25-0.5f_T$	$-0.25+0.5f_T$	$0.25-0.5f_T$
	Q_{WV}	C_{QW}	$(-0.25f_T+0.5)f_{lp}$	$(0.25f_T-0.5)f_{lp}$	$(-0.25f_T+0.5)f_{lp}$	$(0.25f_T-0.5)f_{lp}$
	M_{WH}	C_{WH}	$\underline{-0.15}$	$\underline{0.15}$	$\underline{0.15}$	$\underline{-0.15}$
	Q_{WH}	C_{QH}	$\underline{0.1f_{lp}}$	$\underline{-0.1f_{lp}}$	$\underline{-0.1f_{lp}}$	$\underline{0.1f_{lp}}$
	M_{WT}	C_{WT}	$\underline{f_{lp-BSP}}$	$\underline{-f_{lp-BSP}}$	$\underline{-f_{lp-BSP}}$	$\underline{f_{lp-BSP}}$
Longitudinal accelerations	a_{surge}	C_{XS}	$\underline{0.1}$	$\underline{-0.1}$	$\underline{0.1}$	$\underline{-0.1}$
	a_{pitch-}	C_{XP}	0.0	0.0	0.0	0.0
	$gsin\varphi$	C_{XG}	0.0	0.0	0.0	0.0
Transverse accelerations	a_{sway}	C_{YS}	$\underline{1.0}$	$\underline{-1.0}$	$\underline{-1.0}$	$\underline{1.0}$
	a_{roll-}	C_{YR}	$\underline{0.58f_T-0.18}$	$\underline{-0.58f_T+0.18}$	$\underline{-0.58f_T+0.18}$	$\underline{0.58f_T-0.18}$
	$gsin\theta$	C_{YG}	$\underline{-0.1}$	$\underline{0.1}$	$\underline{0.1}$	$\underline{-0.1}$
Vertical accelerations	a_{heave}	C_{ZH}	$\underline{-0.5f_T-0.4}$	$\underline{0.5f_T+0.4}$	$\underline{-0.5f_T-0.4}$	$\underline{0.5f_T+0.4}$
	a_{roll-}	C_{ZR}	$\underline{0.58f_T-0.18}$	$\underline{-0.58f_T+0.18}$	$\underline{-0.58f_T+0.18}$	$\underline{0.58f_T-0.18}$
	a_{pitch-}	C_{ZP}	0.0	0.0	0.0	0.0

Amendment

Table 5 : Load combination factors, LCFs for BSR and BSP load cases

Load component		LCF	BSP-1P	BSP-2P	BSP-1S	BSP-2S
Hull girder loads	M_{WV}	C_{WV}	$-0.25+0.5f_T$	$0.25-0.5f_T$	$-0.25+0.5f_T$	$0.25-0.5f_T$
	Q_{WV}	C_{QW}	$(-0.25f_T+0.5)f_{lp}$	$(0.25f_T-0.5)f_{lp}$	$(-0.25f_T+0.5)f_{lp}$	$(0.25f_T-0.5)f_{lp}$
	M_{WH}	C_{WH}	$\underline{0.15}$	$\underline{-0.15}$	$\underline{-0.15}$	$\underline{0.15}$
	Q_{WH}	C_{QH}	$\underline{-0.1f_{lp}}$	$\underline{0.1f_{lp}}$	$\underline{0.1f_{lp}}$	$\underline{-0.1f_{lp}}$
	M_{WT}	C_{WT}	$\underline{0}$	$\underline{0}$	$\underline{0}$	$\underline{0}$
Longitudinal accelerations	a_{surge}	C_{XS}	$\underline{-0.1}$	$\underline{0.1}$	$\underline{-0.1}$	$\underline{0.1}$
	a_{pitch-}	C_{XP}	0.0	0.0	0.0	0.0
	$gsin\varphi$	C_{XG}	0.0	0.0	0.0	0.0
Transverse accelerations	a_{sway}	C_{YS}	$\underline{-1.0}$	$\underline{1.0}$	$\underline{1.0}$	$\underline{-1.0}$
	a_{roll-}	C_{YR}	$\underline{-0.58f_T+0.18}$	$\underline{0.58f_T-0.18}$	$\underline{0.58f_T-0.18}$	$\underline{-0.58f_T+0.18}$
	$gsin\theta$	C_{YG}	$\underline{0.1}$	$\underline{-0.1}$	$\underline{-0.1}$	$\underline{0.1}$
Vertical accelerations	a_{heave}	C_{ZH}	$\underline{0.5f_T+0.4}$	$\underline{-0.5f_T-0.4}$	$\underline{0.5f_T+0.4}$	$\underline{-0.5f_T-0.4}$
	a_{roll-}	C_{ZR}	$\underline{-0.58f_T+0.18}$	$\underline{0.58f_T-0.18}$	$\underline{0.58f_T-0.18}$	$\underline{-0.58f_T+0.18}$
	a_{pitch-}	C_{ZP}	0.0	0.0	0.0	0.0

Reason

Present	Amendment	Reason
Section 3 Ship motions and accelerations	**Section 3 Ship motions and accelerations**	
Symbols	Symbols	
For symbols not defined in this section, refer to **Ch 1, Sec 4.**	For symbols not defined in this section, refer to **Ch 1, Sec 4.**	
a_0 : Acceleration parameter, to be taken as:	a_0 : Acceleration parameter, to be taken as:	
$a_0 = (1.58 - 0.47C_B)\left(\frac{2.4}{\sqrt{L}} + \frac{100}{L} - \frac{600}{L^2}\right)$	$a_0 = (1.31 - 0.43C_B)\left(\frac{4.2}{\sqrt{L}} + \frac{16}{L} - \frac{150}{L^2}\right)$	
〈omitted〉	〈same as the present〉	
f_{ps} : Coefficient for strength assessments which is dependant on the applicable design load scenario specified in **Ch 4, Sec 7,** and to be taken as:	f_{ps} : Coefficient for strength assessments which is dependant on the applicable design load scenario specified in **Ch 4, Sec 7,** and to be taken as:	
$f_{ps} = 1.0$ for extreme sea loads design load scenario.	$f_{ps} = 1.0$ for extreme sea loads design load scenario.	
$f_{ps} = 0.8$ for the ballast water exchange design load scenario.	$f_{ps} = 0.8$ for the ballast water exchange design load scenario.	
$f_{ps} = 0.8$ for the accidental design load scenario at sea.	$f_{ps} = 0.8$ for the accidental design load scenario at sea.	
$f_{ps} = 0.4$ for the harbour/sheltered water design load scenario.	$f_{ps} = 0.4$ for the harbour/sheltered water design load scenario.	
	f_R : Coefficient related to the operational profile, to be taken as: $f_R = 0.85$	

Present

1. 〈omitted〉

2. Ship motions and accelerations

2.1 Ship motions

2.1.1 Roll motion

The roll period, T_θ in s, to be taken as:

〈omitted〉

GM : Metacentric height, in m, in the considered loading condition. The values in **Table 1** is to be adopted unless provided in the loading manual.

Table 1 : k_r and GM values

Loading condition[(1)]	T_{LC}	k_r	GM
Full load condition	T_{SC}	$0.35B$	$0.06B$
Ballast condition	T_{BAL}	$0.45B$	$\underline{0.25B}$

(1) For flooded loading conditions, the values of k_r and GM, unless provided in the loading manual, are to be taken as those for the full load condition.

2.1.2 Pitch motion

The pitch period T_ϕ, in s, is to be taken as:

$$T_\phi = \sqrt{\frac{2\pi L}{g}}$$

where:

The pitch angle ϕ, in deg, is to be taken as:

$$\underline{\phi = 1350 f_p L^{-0.94}\left\{1.0 + \left(\frac{15}{\sqrt{gL}}\right)^{1.6}\right\}}$$

f_p : Coefficient to be taken as:

$f_p = f_{ps}$ for strength assessment.

$f_p = 0.9[(0.27 - 0.02f_T) - (13 - 5f_T)L \times 10^{-5}]$ for fatigue assessment.

Amendment

1. 〈same as the present〉

2. Ship motions and accelerations

2.1 Ship motions

2.1.1 Roll motion

The roll period, T_θ in s, to be taken as:

〈omitted〉

GM : Metacentric height, in m, in the considered loading condition. The values in **Table 1** is to be adopted unless provided in the loading manual.

Table 1 : k_r and GM values

Loading condition[(1)]	T_{LC}	k_r	GM
Full load condition	T_{SC}	$0.35B$	$0.06B$
Ballast condition	T_{BAL}	$0.45B$	$\underline{0.16B}$

(1) For flooded loading conditions, the values of k_r and GM, unless provided in the loading manual, are to be taken as those for the full load condition.

2.1.2 Pitch motion

The pitch period T_ϕ, in s, is to be taken as:

$$T_\phi = \sqrt{\frac{2\pi L}{g}}$$

where:

The pitch angle ϕ, in deg, is to be taken as:

$$\underline{\phi = 1350 f_R f_p L^{-0.94}\left\{1.0 + \left(\frac{15}{\sqrt{gL}}\right)^{1.6}\right\}}$$

f_p : Coefficient to be taken as:

$f_p = f_{ps}$ for strength assessment.

$f_p = 0.9[(0.27 - 0.02f_T) - (13 - 5f_T)L \times 10^{-5}]$ for fatigue assessment.

Reason

Present	Amendment	Reason
2.2 Ship accelerations at the centre of gravity **2.2.1 Surge acceleration** The longitudinal acceleration due to surge, in $\mathrm{m/s^2}$, is to be taken as: $\underline{a_{surge} = 0.18 f_p a_0 g}$ where: f_p : Coefficient to be taken as: $f_p = f_{ps}$ for strength assessment. $f_p = 0.9[0.27-(15+4f_T)L \times 10^{-5}]$ for fatigue assessment. **2.2.2 Sway acceleration** The transverse acceleration due to sway, in $\mathrm{m/s^2}$, is to be taken as: $\underline{a_{sway} = 0.29 f_p a_0 g}$ where: f_p : Coefficient to be taken as: $f_p = f_{ps}$ for strength assessment. $f_p = 0.9[0.24-(6-2f_T)B \times 10^{-4}]$ for fatigue assessment. **2.2.3 Heave acceleration** The vertical acceleration due to heave, in $\mathrm{m/s^2}$, is to be taken as: $\underline{a_{heave} = 0.5 f_p a_0 g}$ where: f_p : Coefficient to be taken as: $f_p = f_{ps}$ for strength assessment. $f_p = 0.9[(0.27+0.02f_T)-17L \times 10^{-5}]$ for fatigue assessment.	**2.2 Ship accelerations at the centre of gravity** **2.2.1 Surge acceleration** The longitudinal acceleration due to surge, in $\mathrm{m/s^2}$, is to be taken as: $\underline{a_{surge} = 0.32 f_R f_p a_0 g}$ where: f_p : Coefficient to be taken as: $f_p = f_{ps}$ for strength assessment. $f_p = 0.9[0.27-(15+4f_T)L \times 10^{-5}]$ for fatigue assessment. **2.2.2 Sway acceleration** The transverse acceleration due to sway, in $\mathrm{m/s^2}$, is to be taken as: $\underline{a_{sway} = 0.56 f_R f_p a_0 g}$ where: f_p : Coefficient to be taken as: $f_p = f_{ps}$ for strength assessment. $f_p = 0.9[0.24-(6-2f_T)B \times 10^{-4}]$ for fatigue assessment. **2.2.3 Heave acceleration** The vertical acceleration due to heave, in $\mathrm{m/s^2}$, is to be taken as: $\underline{a_{heave} = f_R f_p a_0 g}$ where: f_p : Coefficient to be taken as: $f_p = f_{ps}$ for strength assessment. $f_p = 0.9[(0.27+0.02f_T)-17L \times 10^{-5}]$ for fatigue assessment.	

Present	Amendment	Reason
2.2.4 Roll acceleration The roll acceleration, a_{roll}, in $\mathrm{rad/s^2}$, is to be taken as: $a_{roll} = f_p \theta \frac{\pi}{180}\left(\frac{2\pi}{T_\theta}\right)^2$ where: f_p : Coefficient to be taken as: $f_p = f_{ps}$ for strength assessment. $f_p = 0.9[0.23 - 4 f_T B \times 10^{-4}]$ for fatigue assessment. **2.2.5 Pitch acceleration** The pitch acceleration, a_{pitch}, in $\mathrm{rad/s^2}$, is to be taken as: $a_{pitch} = f_p \left(\frac{3.1}{\sqrt{gL}} + 1.4\right) \phi \frac{\pi}{180}\left(\frac{2\pi}{T_\phi}\right)^2$ where: f_p : Coefficient to be taken as: $f_p = f_{ps}$ for strength assessment. $f_p = 0.9[0.28 - (5 + 6 f_T) L \times 10^{-5}]$ for fatigue assessment. ⟨omitted⟩	**2.2.4 Roll acceleration** The roll acceleration, a_{roll}, in $\mathrm{rad/s^2}$, is to be taken as: $a_{roll} = f_p \theta \frac{\pi}{180}\left(\frac{2\pi}{T_\theta}\right)^2$ where: θ : Roll angle using f_p equal to 1.0 f_p : Coefficient to be taken as: $f_p = f_{ps}$ for strength assessment. $f_p = 0.9[0.23 - 4 f_T B \times 10^{-4}]$ for fatigue assessment. **2.2.5 Pitch acceleration** The pitch acceleration, a_{pitch}, in $\mathrm{rad/s^2}$, is to be taken as: $a_{pitch} = f_p \left(\frac{3.1}{\sqrt{gL}} + 1.4\right) \phi \frac{\pi}{180}\left(\frac{2\pi}{T_\phi}\right)^2$ where: ϕ : Pitch angle using f_p equal to 1.0 f_p : Coefficient to be taken as: $f_p = f_{ps}$ for strength assessment. $f_p = 0.9[0.28 - (5 + 6 f_T) L \times 10^{-5}]$ for fatigue assessment. ⟨same as the present⟩	

Present	Amendment	Reason
Section 4 Hull girder loads	**Section 4 Hull girder loads**	
Symbols	**Symbols**	
For symbols not defined in this section, refer to **Ch 1, Sec 4.**	For symbols not defined in this section, refer to **Ch 1, Sec 4.**	
〈omitted〉	〈same as the present〉	
f_β : Heading correction factor, to be taken as: a) For strength assessment: $f_\beta = 0.8$ for BSR and BSP load cases for the extreme sea loads design load scenario. $f_\beta = 1.0$ for HSM, HSA, FSM, OST and OSA load cases for the extreme sea loads design load scenario. $f_\beta = 1.0$ for ballast water exchange at sea, harbour/sheltered water and accidental flooded design load scenarios. b) For fatigue assessment: $f_\beta = 1.0$	f_β : Heading correction factor, to be taken as: a) For strength assessment: 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. b) For fatigue assessment: f_β = 1.0	
〈newly added〉	f_{ps} : Coefficient, as defined in **Ch 4, Sec 3.** f_R : Coefficient, as defined in **Ch 4, Sec 3.**	
C_w : Wave coefficient, in m, to be taken as: $C_w = 10.75 - \left(\frac{300-L}{100}\right)^{1.5}$ for $90 \leq L \leq 300$ $C_w = 10.75$ for $300 < L \leq 350$ $C_w = 10.75 - \left(\frac{L-350}{150}\right)^{1.5}$ for $350 < L \leq 500$	C_w : Wave coefficient, in m, to be taken as: $C_w = 10.75 - \left(\frac{300-L}{100}\right)^{1.5}$ for $90 \leq L \leq 300$ $C_w = 10.75$ for $300 < L \leq 350$ $C_w = 10.75 - \left(\frac{L-350}{150}\right)^{1.5}$ for $350 < L \leq 500$	
〈omitted〉	〈same as the present〉	

Present	Amendment	Reason
1. 〈omitted〉	**1. 〈same as the present〉**	
2. Vertical still water hull girder loads	**2. Vertical still water hull girder loads**	
2.1 〈omitted〉	**2.1 〈same as the present〉**	
2.2 Vertical still water bending moment	**2.2 Vertical still water bending moment**	
2.2.1 ~ 2.2.2 〈omitted〉	**2.2.1 ~ 2.2.2 〈same as the present〉**	
2.2.3 Permissible vertical still water bending moment in harbour/sheltered water and ~~tank testing condition~~ The permissible vertical still water bending moments in the harbour / sheltered water and tank testing condition M_{sw-p-h} and M_{sw-p-s} at any longitudinal position are to envelop: a) The most severe still water bending moments, in hogging and sagging conditions, respectively, for the harbour/sheltered water loading conditions defined in **Ch 4, Sec 8**. b) The most severe still water bending moments for the harbour / sheltered water loading conditions defined in the loading manual. c) The permissible still water bending moment defined in **[2.2.2]**.	**2.2.3 Permissible vertical still water bending moment in harbour / sheltered water** The permissible vertical still water bending moments in the harbour / sheltered water and tank testing condition M_{sw-p-h} and M_{sw-p-s} at any longitudinal position are to envelop: a) The most severe still water bending moments, in hogging and sagging conditions, respectively, for the harbour/sheltered water loading conditions defined in **Ch 4, Sec 8**. b) The most severe still water bending moments for the harbour / sheltered water loading conditions defined in the loading manual. c) The permissible still water bending moment defined in **[2.2.2]**.	
2.2.4 Permissible vertical still water bending moment in flooded condition at sea 〈omitted〉	**2.2.4 Permissible vertical still water bending moment in flooded condition at sea** 〈same as the present〉	
2.2.5 〈newly added〉	**2.2.5 Permissible vertical still water bending moment in tank testing condition** The permissible vertical still water bending moments in tank testing condition M_{sw-t} at any longitudinal position are to envelop: a) The most severe still water bending moments for the tank testing conditions defined in the tank testing procedure. b) When the still water bending moments are not defined in the tank testing procedure, the permissible still water bending moment may be taken the values as defined in **[2.2.2]**.	

Present	Amendment	Reason
3. Dynamic hull girder loads **3.1 〈omitted〉** **3.2 Vertical wave bending moment** **3.2.1** The distribution of the vertical wave induced bending moments, M_{wv} in kNm, along the ship length is given in Figure 2, where: $M_{wv-Hog} = 1.5 f_R f_p L^3 C C_{wp} \left(\frac{B}{L}\right)^{0.8} f_{NL-Hog}$ $M_{wv-Sag} = -1.5 f_R f_p L^3 C C_{wp} \left(\frac{B}{L}\right)^{0.8} f_{NL-Sag}$ where: ~~f_R : Factor related to the operational profile, to be taken as:~~ ~~$f_R = 0.85$~~ f_p : Coefficient to be taken as: $f_p = f_{ps}$ for strength assessment. $f_p = 0.9[0.27 - (6 + 4 f_T) L \times 10^{-5}]$ for fatigue assessment. 〈omitted〉	**3. Dynamic hull girder loads** **3.1 〈same as the present〉** **3.2 Vertical wave bending moment** **3.2.1** The distribution of the vertical wave induced bending moments, M_{wv} in kNm, along the ship length is given in Figure 2, where: $M_{wv-Hog} = 1.5 f_R f_p L^3 C C_{wp} \left(\frac{B}{L}\right)^{0.8} f_{NL-Hog}$ $M_{wv-Sag} = -1.5 f_R f_p L^3 C C_{wp} \left(\frac{B}{L}\right)^{0.8} f_{NL-Sag}$ where: f_p : Coefficient to be taken as: $f_p = f_{ps}$ for strength assessment. $f_p = 0.9[0.27 - (6 + 4 f_T) L \times 10^{-5}]$ for fatigue assessment. 〈same as the present〉	

Present	Amendment	Reason
Section 5 External loads	**Section 5 External loads**	
Symbols	Symbols	
For symbols not defined in this section, refer to **Ch 1, Sec 4.**	For symbols not defined in this section, refer to **Ch 1, Sec 4.**	
〈omitted〉	〈same as the present〉	
f_T : Ratio as defined in **Ch 4, Sec 3.**	f_T : Ratio as defined in **Ch 4, Sec 3.**	
〈newly added〉	f_{zT} : Ratio between Z-coordinate of the load point and f_T, to be taken as: $f_{zT} = \frac{z}{T_{LC}}$, but not greater than 1.0.	
h_W : Water head equivalent to the pressure at waterline, in m, to be taken as: $h_w = \frac{P_{W,WL}}{\rho g}$	h_W : Water head equivalent to the pressure at waterline, in m, to be taken as: $h_w = \frac{P_{W,WL}}{\rho g}$	
$P_{W,WL}$: Wave pressure at the waterline, $\mathrm{kN/m^2}$, for the considered dynamic load case. $P_{W,WL} = P_W$ for $y = B_x/2$ and $z = T_{LC}$	$P_{W,WL}$: Wave pressure at the waterline, $\mathrm{kN/m^2}$, for the considered dynamic load case. $P_{W,WL} = P_W$ for $y = B_x/2$ and $z = T_{LC}$	
f_{ps} : Coefficient for strength assessment, as defined in **Ch 4, Sec 3.**	f_{ps} : Coefficient for strength assessment, as defined in **Ch 4, Sec 3.**	
	f_R : Coefficient, as defined in **Ch 4, Sec 3.**	
T_θ : Roll period, in s, as defined in **Ch 4, Sec 3, [2.1.1].**	T_θ : Roll period, in s, as defined in **Ch 4, Sec 3, [2.1.1].**	
θ : Roll angle, in deg, as defined in **Ch 4, Sec 3, [2.1.1].**	θ : Roll angle, in deg, as defined in **Ch 4, Sec 3, [2.1.1].**	
	f_β : Coefficient defined in **Ch 4, Sec 4.**	
	C_w : Coefficient defined in **Ch 4, Sec 4.**	
z_{SD} : Z coordinate, in m, of the midpoint of stiffener span, or of the middle of the plate field.	z_{SD} : Z coordinate, in m, of the midpoint of stiffener span, or of the middle of the plate field.	

Present	Amendment	Reason
1. Sea pressure **1.1 ~ 1.2 〈omitted〉** **1.3 External dynamic pressures** **1.3.1 〈omitted〉** **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 $\mathrm{kN/m^2}$, are to be obtained from **Table 2.** 〈omitted〉 where: $P_{HSM} = f_R f_p f_{nl} f_\beta f_{yz} P_a f_a f_{p-HSM}$ f_p : Coefficient to be taken as: $f_p = f_{ps}$ for strength assessment. $f_p = 0.9[(0.21+0.02f_T)+(6-4f_T)L\times10^{-5}]$ for fatigue assessment. f_{nl} : Coefficient considering non-linear effects, to be taken as: a) For extreme sea loads design load scenario for strength assessment : $f_{nl}=0.7$ at $f_{xL}=0$ $f_{nl}=0.9$ at $0.3\le f_{xL}<0.7$ $f_{nl}=0.6$ at $f_{xL}=1$ b) For ballast water exchange design load scenario for strength assessment : $f_{nl}=0.85$ at $f_{xL}=0$ $f_{nl}=0.95$ at $0.3\le f_{xL}<0.7$ $f_{nl}=0.80$ at $f_{xL}=1$ Intermediate values are obtained by linear interpolation. $f_{nl}=1.0$ for fatigue assessment.	**1. Sea pressure** **1.1 ~ 1.2 〈same as the present〉** **1.3 External dynamic pressures** **1.3.1 〈same as the present〉** **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 $\mathrm{kN/m^2}$, are to be obtained from **Table 2.** 〈same as the present〉 where: $P_{HSM} = f_R f_p f_{nl} f_\beta f_{yz} P_a f_a f_{p-HSM}$ f_p : Coefficient to be taken as: $f_p = f_{ps}$ for strength assessment. $f_p = 0.9[(0.21+0.02f_T)+(6-4f_T)L\times10^{-5}]$ for fatigue assessment. f_{nl} : Coefficient considering non-linear effects, to be taken as: a) For extreme sea loads design load scenario for strength assessment : $f_{nl}=0.7$ at $f_{xL}=0$ $f_{nl}=0.9$ at $0.3\le f_{xL}<0.7$ $f_{nl}=0.6$ at $f_{xL}=1$ b) For ballast water exchange design load scenario for strength assessment : $f_{nl}=0.85$ at $f_{xL}=0$ $f_{nl}=0.95$ at $0.3\le f_{xL}<0.7$ $f_{nl}=0.80$ at $f_{xL}=1$ Intermediate values are obtained by linear interpolation. $f_{nl}=1.0$ for fatigue assessment.	

Present	Amendment	Reason
f_{yz} : Girth distribution coefficient, to be taken as: $f_{yz}=\frac{1}{3}\left(0.5f_{yB}+1.4\frac{z}{T_{LC}}+1.1\right)$	f_{yz} : Girth distribution coefficient, to be taken as: $f_{yz}=\frac{1}{3}\left(0.5f_{yB}f_{BG}+1.4\frac{z}{T_{LC}}f_{WL}+1.1f_{CL}\right)$	
〈newly added〉	f_{WL} : Pressure amplitude coefficient at water line, but not less than 1.0 a) For full load condition and $B>35\text{m}$: $f_{WL}=2.59-0.15P_a$ b) For ballast load condition or $B\leq 35\text{m}$: $f_{WL}=2.0-0.085P_a$	
〈newly added〉	f_{BG} : Pressure amplitude coefficient at bilge, but not less than 1.0 a) For full load condition and $B>35\text{m}$: $f_{BG}=2.5-0.15P_a$ b) For ballast load condition or $B\leq 35\text{m}$: $f_{BG}=2.22-0.13P_a$	
〈newly added〉	f_{CL} : Pressure amplitude coefficient at bottom centerline, but not less than 1.0 a) For full load condition and $B>35\text{m}$: $f_{CL}=2.21-0.13P_a$ b) For ballast load condition or $B\leq 35\text{m}$: $f_{CL}=1.75-0.08P_a$	

Present	Amendment	Reason
P_a : Pressure amplitude coefficient in mid-ship position, to be taken as: a) For full load condition and $B > 35\text{m}$: $P_a = \frac{B}{10} + \frac{L}{80}$ b) For ballast load condition or $B \le 35\text{m}$: $P_a = \frac{L}{B} + \frac{200}{L}$ f_a : Wave amplitude coefficient to be taken as: $f_a = 0.85 C_w \sqrt{\frac{\lambda + 25}{L}}$ λ : Wave length of the dynamic load case, in m, to be taken as: $\lambda = 0.5(1 + f_T)L$ f_{p-HSM} : Pressure distribution coefficient in the longitudinal direction of the ship, to be taken as: ~~a) For full load condition:~~ ~~$f_{p-HSM} = \left(0.8\sin\left(\frac{2\pi}{0.8}(f_{xL} - 0.25)\right) + 0.2\right)$ for $f_{xL} < 0.4$~~ ~~$f_{p-HSM} = \left(5.8\sin\left(\frac{2\pi}{2.65}(f_{xL} - 2.4)\right) - 4.7\right)f_{yB} + \left(7\sin\left(\frac{2\pi}{2.65}(f_{xL} - 2.4)\right) - 5.9\right)(1 - f_{yB})$~~ ~~for $0.5 \le f_{xL}$~~ ~~b) For ballast load condition:~~ ~~$f_{p-HSM} = \left(0.8\sin\left(\frac{2\pi}{0.75}(f_{xL} - 0.35)\right) + 0.3\right)$ for $f_{xL} < 0.4$~~ ~~$f_{p-HSM} = \left(2\sin\left(\frac{2\pi}{1.2}(f_{xL} - 0.2)\right) - 1\right)f_{yB} + \left(6\sin\left(\frac{2\pi}{2}f_{xL}\right) - 5\right)(1 - f_{yB})$~~ ~~for $0.5 \le f_{xL}$~~ ~~Intermediate values are obtained by linear interpolation.~~	P_a : Pressure amplitude coefficient in mid-ship position, to be taken as: a) For full load condition and $B > 35\text{m}$: $P_a = \frac{B}{10} + \frac{L}{80}$ b) For ballast load condition or $B \le 35\text{m}$: $P_a = \frac{L}{B} + \frac{200}{L}$ f_a : Wave amplitude coefficient to be taken as: $f_a = 0.85 C_w \sqrt{\frac{\lambda + 25}{L}}$ λ : Wave length of the dynamic load case, in m, to be taken as: $\lambda = 0.5(1 + f_T)L$ f_{p-HSM} : Pressure distribution coefficient in the longitudinal direction of the ship, to be taken as: $\underline{f_{p-HSM} = k_a k_p}$	

<table>
<tr><th>Present</th><th>Amendment</th><th>Reason</th></tr>
<tr>
<td>⟨newly added⟩</td>
<td>
k_a : Amplitude coefficient in the longitudinal direction of the ship, to be taken as:
$k_a = k_{a-WL} f_{zT} + k_{a-CL}(1 - f_{zT})$
Table 3 : k_{a-WL} values for HSM load case
<table>
<tr><td>f_{xL}</td><td>0.0</td><td>$-\frac{1}{9}f_T+\frac{47}{180}$</td><td>$-\frac{1}{9}f_T+\frac{37}{90}$</td><td>$-\frac{1}{9}f_T+\frac{32}{45}$</td><td>$-\frac{1}{45}f_T+\frac{158}{225}$</td><td>$1.0$</td></tr>
<tr><td>k_{a-WL}</td><td>$-\frac{20}{9}f_T+\frac{29}{9}$</td><td>$0.3$</td><td>$1.0$</td><td>$1.0$</td><td>$0.3$</td><td>$\frac{20}{9}f_T+\frac{16}{9}$</td></tr>
</table>
Table 4 : k_{a-CL} values for HSM load case
<table>
<tr><td>f_{xL}</td><td>0.0</td><td>$-\frac{1}{9}f_T+\frac{14}{45}$</td><td>$-\frac{1}{9}f_T+\frac{37}{90}$</td><td>$-\frac{1}{9}f_T+\frac{32}{45}$</td><td>$-\frac{4}{45}f_T+\frac{173}{225}$</td><td>$1.0$</td></tr>
<tr><td>k_{a-CL}</td><td>$-\frac{34}{9}f_T+\frac{547}{90}$</td><td>$0.3$</td><td>$1.0$</td><td>$1.0$</td><td>$0.5$</td><td>$\frac{40}{9}f_T+\frac{347}{90}$</td></tr>
</table>
</td>
<td></td>
</tr>
</table>

<table>
<tr><th>Present</th><th>Amendment</th><th>Reason</th></tr>
<tr>
<td>〈newly added〉</td>
<td>

k_p : Phase coefficient tin the longitudinal direction of the ship, to be taken as:

$$k_p = k_{p-WL} f_{zT} + k_{p-CL}(1 - f_{zT})$$

Intermediate values are obtained by linear interpolation.

Table 5 : k_{p-WL} values for HSM load case

<table>
<tr><td>f_{xL}</td><td>0.0</td><td>0.15</td><td>0.22</td><td>0.25</td><td>$-\frac{1}{9}f_T+\frac{37}{90}$</td></tr>
<tr><td>k_{p-WL}</td><td>$-2f_T+\frac{3}{2}$</td><td>$-f_T$</td><td>$\frac{8}{3}f_T-\frac{37}{15}$</td><td>$\frac{10}{3}f_T-\frac{79}{30}$</td><td>$1.0$</td></tr>
<tr><td>f_{xL}</td><td>0.65</td><td>0.7</td><td>$\frac{1}{9}f_T+\frac{31}{45}$</td><td>$1.0$</td><td></td></tr>
<tr><td>k_{p-WL}</td><td>1.0</td><td>$-\frac{26}{9}f_T+\frac{17}{9}$</td><td>$-1.0$</td><td>$-0.8$</td><td></td></tr>
</table>

Table 6 : k_{p-CL} values for HSM load case

<table>
<tr><td>f_{xL}</td><td>0.0</td><td>$-\frac{8}{45}f_T+\frac{313}{900}$</td><td>$-\frac{1}{9}f_T+\frac{37}{90}$</td><td>$-\frac{1}{9}f_T+\frac{32}{45}$</td><td>$-\frac{1}{9}f_T+\frac{73}{90}$</td><td>$1.0$</td></tr>
<tr><td>k_{p-CL}</td><td>$-\frac{10}{9}f_T+\frac{10}{9}$</td><td>$-1.0$</td><td>$1.0$</td><td>$1.0$</td><td>$-1.0$</td><td>$-0.75$</td></tr>
</table>

</td>
<td></td>
</tr>
</table>

Present	Amendment	Reason
1.3.3 Hydrodynamic pressure for HSA load cases The hydrodynamic pressures, P_W, for HSA-1 and HSA-2 load cases at any load point, in $\mathrm{kN/m^2}$, are to be obtained from **Table 3.** ⟨omitted⟩ where: $P_{HSA} = f_R f_p f_{nl} f_\beta f_{yz} P_a f_a f_{p-HSA}$ f_p : Coefficient to be taken as: $f_p = f_{ps}$ for strength assessment. f_{nl} : Coefficient considering non-linear effects, to be taken as: a) For extreme sea loads design load scenario for strength assessment : $f_{nl} = 0.7$ at $f_{xL} = 0$ $f_{nl} = 0.9$ at $0.3 \le f_{xL} < 0.7$ $f_{nl} = 0.6$ at $f_{xL} = 1$ b) For ballast water exchange design load scenario for strength assessment : $f_{nl} = 0.85$ at $f_{xL} = 0$ $f_{nl} = 0.95$ at $0.3 \le f_{xL} < 0.7$ $f_{nl} = 0.80$ at $f_{xL} = 1$ Intermediate values are obtained by linear interpolation. ~~$f_{nl} = 1.0$ for fatigue assessment.~~ f_{yz} : Girth distribution coefficient, to be taken as: $f_{yz} = \frac{1}{3}\left(0.5 f_{yB} + 1.4\frac{z}{T_{LC}} + 1.1\right)$	**1.3.3 Hydrodynamic pressure for HSA load cases** The hydrodynamic pressures, P_W, for HSA-1 and HSA-2 load cases at any load point, in $\mathrm{kN/m^2}$, are to be obtained from **Table 3.** ⟨same as the present⟩ where: $P_{HSA} = f_R f_p f_{nl} f_\beta f_{yz} P_a f_a f_{p-HSA}$ f_p : Coefficient to be taken as: $f_p = f_{ps}$ for strength assessment. f_{nl} : Coefficient considering non-linear effects, to be taken as: a) For extreme sea loads design load scenario for strength assessment : $f_{nl} = 0.7$ at $f_{xL} = 0$ $f_{nl} = 0.9$ at $0.3 \le f_{xL} < 0.7$ $f_{nl} = 0.6$ at $f_{xL} = 1$ b) For ballast water exchange design load scenario for strength assessment : $f_{nl} = 0.85$ at $f_{xL} = 0$ $f_{nl} = 0.95$ at $0.3 \le f_{xL} < 0.7$ $f_{nl} = 0.80$ at $f_{xL} = 1$ Intermediate values are obtained by linear interpolation. f_{yz} : Girth distribution coefficient, to be taken as: $f_{yz} = \frac{1}{3}\left(0.5 f_{yB} + 1.4\frac{z}{T_{LC}} + 1.1\right)$	

Present	Amendment	Reason
P_a : Pressure amplitude coefficient in mid-ship position, to be taken as: a) For full load condition and $B > 35\text{m}$: $P_a = \frac{B}{10} + \frac{L}{80}$ b) For ballast load condition or $B \leq 35\text{m}$: $P_a = \frac{L}{B} + \frac{200}{L}$	P_a : Pressure amplitude coefficient in mid-ship position, to be taken as: a) For full load condition and $B > 35\text{m}$: $P_a = \frac{B}{10} + \frac{L}{80}$ b) For ballast load condition or $B \leq 35\text{m}$: $P_a = \frac{L}{B} + \frac{200}{L}$	
f_a : Wave amplitude coefficient to be taken as: $f_a = 0.8C_w\sqrt{\frac{L+\lambda-125}{L}}$	f_a : Wave amplitude coefficient to be taken as: $f_a = 0.8C_w\sqrt{\frac{L+\lambda-125}{L}}$	
λ : Wave length of the dynamic load case, in m, to be taken as: $\lambda = 0.5(1+f_T)L$	λ : Wave length of the dynamic load case, in m, to be taken as: $\lambda = 0.5(1+f_T)L$	
f_{p-HSA} : Pressure distribution coefficient in the longitudinal direction of the ship, to be taken as: ~~a) For full load condition:~~ ~~$f_{p-HSA} = \left(0.8\sin\left(\frac{2\pi}{0.8}(f_{xL}+0.05)\right)-0.5\right)f_{yB} + \left(\sin\left(\frac{2\pi}{0.9}f_{xL}\right)-0.9\right)(1-f_{yB})$~~ ~~for $f_{xL} < 0.4$~~ ~~$f_{p-HSA} = \left(5.8\sin\left(\frac{2\pi}{2.5}(f_{xL}-3.6)\right)+5.1\right)f_{yB} + \left(6\sin\left(\frac{2\pi}{2}(f_{xL}-3)\right)+5.1\right)(1-f_{yB})$~~ ~~for $0.5 \leq f_{xL}$~~ ~~b) For ballast load condition:~~ ~~$f_{p-HSA} = \left(0.8\sin\left(\frac{2\pi}{0.6}(f_{xL}-0.1)\right)-0.5\right)f_{yB} + (3\sin(2\pi f_{xL})-2.5)(1-f_{yB})$~~ ~~for $f_{xL} < 0.3$~~ ~~$f_{p-HSA} = \left(5.8\sin\left(\frac{2\pi}{2.3}(f_{xL}-3.4)\right)+5.1\right)f_{yB} + \left(8\sin\left(\frac{2\pi}{2.2}(f_{xL}-1.1)\right)+7\right)(1-f_{yB})$~~ ~~for $0.4 \leq f_{xL}$~~ ~~Intermediate values are obtained by linear interpolation.~~	f_{p-HSA} : Pressure distribution coefficient in the longitudinal direction of the ship, to be taken as: $f_{p-HSA} = k_a k_p$	

<table>
<tr><th>Present</th><th>Amendment</th><th>Reason</th></tr>
<tr>
<td>〈newly added〉</td>
<td>
<p>k_a : Amplitude coefficient in the longitudinal direction of the ship, to be taken as:</p>
<p>$k_a = k_{a-WL} f_{zT} + k_{a-CL}(1 - f_{zT})$</p>
<p>Intermediate values are obtained by linear interpolation.</p>
<p>Table 8 : k_{a-WL} values for HSA load case</p>
<table>
<tr><td>f_{xL}</td><td>0.0</td><td>$-\frac{2}{9}f_T+\frac{67}{180}$</td><td>$-\frac{2}{9}f_T+\frac{47}{90}$</td><td>0.6</td><td>$-\frac{1}{9}f_T+\frac{73}{90}$</td><td>1.0</td></tr>
<tr><td>k_{a-WL}</td><td>$-\frac{8}{3}f_T+\frac{11}{3}$</td><td>0.3</td><td>1.0</td><td>1.0</td><td>0.25</td><td>$\frac{10}{9}f_T+\frac{26}{9}$</td></tr>
</table>
<p>Table 9 : k_{a-CL} values for HSA load case</p>
<table>
<tr><td>f_{xL}</td><td>0.0</td><td>$-\frac{1}{9}f_T+\frac{14}{45}$</td><td>$-\frac{2}{9}f_T+\frac{47}{90}$</td><td>0.6</td><td>$-\frac{1}{9}f_T+\frac{73}{90}$</td><td>1.0</td></tr>
<tr><td>k_{a-CL}</td><td>$-4f_T+\frac{31}{5}$</td><td>0.3</td><td>1.0</td><td>1.0</td><td>0.45</td><td>$\frac{10}{9}f_T+\frac{62}{9}$</td></tr>
</table>
<p>k_p : Phase coefficient tin the longitudinal direction of the ship, to be taken as:</p>
<p>$k_p = k_{p-WL} f_{zT} + k_{p-CL}(1 - f_{zT})$</p>
<p>Intermediate values are obtained by linear interpolation.</p>
<p>Table 10 : k_{p-WL} values for HSA load case</p>
<table>
<tr><td>f_{xL}</td><td>0.0</td><td>$-\frac{2}{9}f_T+\frac{353}{900}$</td><td>$-\frac{2}{9}f_T+\frac{47}{90}$</td><td>$-\frac{4}{45}f_T+\frac{133}{180}$</td><td>$-\frac{2}{9}f_T+\frac{83}{90}$</td><td>1.0</td></tr>
<tr><td>k_{p-WL}</td><td>$\frac{10}{9}f_T-\frac{68}{45}$</td><td>1.0</td><td>$-0.7$</td><td>$-0.7$</td><td>0.9</td><td>1.0</td></tr>
</table>
<p>Table 11 : k_{p-CL} values for HSA load case</p>
<table>
<tr><td>f_{xL}</td><td>0.0</td><td>0.15</td><td>$-\frac{2}{9}f_T+\frac{19}{45}$</td><td>$-\frac{2}{9}f_T+\frac{47}{90}$</td><td>$-\frac{4}{45}f_T+\frac{13}{18}$</td><td>$-\frac{2}{9}f_T+\frac{83}{90}$</td><td>1.0</td></tr>
<tr><td>k_{p-CL}</td><td>$\frac{4}{9}f_T-\frac{103}{90}$</td><td>$\frac{8}{9}f_T-\frac{8}{9}$</td><td>1.0</td><td>$-0.7$</td><td>$-0.7$</td><td>0.9</td><td>1.0</td></tr>
</table>
</td>
<td></td>
</tr>
</table>

Present	Amendment	Reason
1.3.4 Hydrodynamic pressure for FSM load cases The hydrodynamic pressures, P_W, for FSM-1 and FSM-2 load cases, at any load point, in $\mathrm{kN/m^2}$, are to be obtained from **Table 12.** 〈omitted〉 where: $P_{FSM}=f_R f_p f_{nl} f_\beta f_{yz} P_a f_a f_{p-FSM}$ f_p : Coefficient to be taken as: $f_p=f_{ps}$ for strength assessment. $f_p=0.9[(0.21+0.02f_T)+(6-4f_T)L\times10^{-5}]$ for fatigue assessment. f_{nl} : Coefficient considering non-linear effects, to be taken as: a) For extreme sea loads design load scenario for strength assessment : $f_{nl}=0.9$ b) For ballast water exchange design load scenario for strength assessment : $f_{nl}=0.95$ $f_{nl}=1.0$ for fatigue assessment. f_{yz} : Girth distribution coefficient, to be taken as: $f_{yz}=\frac{1}{3}\left(0.5f_{yB}+1.2\frac{z}{T_{LC}}+1.3\right)$ P_a : Pressure amplitude coefficient in mid-ship position, to be taken as: $P_a=0.5\frac{L}{B}+\frac{50}{L}+2.3$ f_a : Wave amplitude coefficient to be taken as: $f_a=0.85C_w\sqrt{\frac{\lambda+25}{L}}$ λ : Wave length of the dynamic load case, in m, to be taken as: $\lambda=0.5(1+1.5f_T)L$	**1.3.4 Hydrodynamic pressure for FSM load cases** The hydrodynamic pressures, P_W, for FSM-1 and FSM-2 load cases, at any load point, in $\mathrm{kN/m^2}$, are to be obtained from **Table 12.** 〈same as the present〉 where: $P_{FSM}=f_R f_p f_{nl} f_\beta f_{yz} P_a f_a f_{p-FSM}$ f_p : Coefficient to be taken as: $f_p=f_{ps}$ for strength assessment. $f_p=0.9[(0.21+0.02f_T)+(6-4f_T)L\times10^{-5}]$ for fatigue assessment. f_{nl} : Coefficient considering non-linear effects, to be taken as: a) For extreme sea loads design load scenario for strength assessment : $f_{nl}=0.9$ b) For ballast water exchange design load scenario for strength assessment : $f_{nl}=0.95$ c) For fatigue assessment $f_{nl}=1.0$ f_{yz} : Girth distribution coefficient, to be taken as: $f_{yz}=\frac{1}{3}\left(0.5f_{yB}+1.2\frac{z}{T_{LC}}+1.3\right)$ P_a : Pressure amplitude coefficient in mid-ship position, to be taken as: $P_a=0.5\frac{L}{B}+\frac{50}{L}+2.3$ f_a : Wave amplitude coefficient to be taken as: $f_a=0.85C_w\sqrt{\frac{\lambda+25}{L}}$ λ : Wave length of the dynamic load case, in m, to be taken as: $\lambda=0.5(1+1.5f_T)L$	

Present

f_{p-FSM} : Pressure distribution coefficient in the longitudinal direction of the ship, to be taken as:

~~a) For full load condition:~~

~~$f_{p-FSM}=(5.5f_{xL}-1)f_{yB}+(7f_{xL}-1.5)(1-f_{yB})$ for $f_{xL}<0.3$~~

~~$f_{p-FSM}=\left(1.3\sin\left(\frac{2\pi}{1.2}(f_{xL}-0.13)\right)-0.3\right)f_{yB}+\left(1.8\sin\left(\frac{2\pi}{1.2}(f_{xL}-2.55)\right)-0.8\right)(1-f_{yB}$~~

~~for $0.4\le f_{xL}$~~

~~b) For ballast load condition:~~

~~$f_{p-FSM}=(6f_{xL}-1.5)f_{yB}+(7f_{xL}-2)(1-f_{yB})$ for $f_{xL}<0.3$~~

~~$f_{p-FSM}=\left(1.3\sin\left(\frac{2\pi}{1.1}(f_{xL}-0.2)\right)-0.3\right)f_{yB}+\left(1.6\sin\left(\frac{2\pi}{1.1}(f_{xL}-0.2)\right)-0.6\right)(1-f_{yB})$~~

~~for $0.4\le f_{xL}$~~

~~Intermediate values are obtained by linear interpolation.~~

⟨newly added⟩

Amendment

f_{p-FSM} : Pressure distribution coefficient in the longitudinal direction of the ship, to be taken as:

$$f_{p-FSM}=k_a k_p$$

k_a : Amplitude coefficient in the longitudinal direction of the ship, to be taken as:

$$k_a=k_{a-WL}f_{zT}+k_{a-CL}(1-f_{zT})$$

Intermediate values are obtained by linear interpolation.

Table 13 : k_{a-WL} values for FSM load case

f_{xL}	0.0	$-\frac{2}{9}f_T+\frac{67}{180}$	$-\frac{2}{9}f_T+\frac{17}{36}$	$-\frac{1}{9}f_T+\frac{32}{45}$	$-\frac{1}{9}f_T+\frac{73}{90}$	1.0
k_{a-WL}	$-\frac{20}{9}f_T+\frac{67}{18}$	0.4	1.0	1.0	0.5	$\frac{4}{9}f_T+\frac{106}{45}$

Table 14 : k_{a-CL} values for FSM load case

f_{xL}	0.0	$-\frac{7}{45}f_T+\frac{16}{45}$	$-\frac{2}{9}f_T+\frac{17}{36}$	$-\frac{1}{9}f_T+\frac{32}{45}$	$-\frac{4}{45}f_T+\frac{683}{900}$	1.0
k_{a-CL}	$-\frac{40}{9}f_T+\frac{125}{18}$	0.2	1.0	1.0	0.4	5.0

Reason

Present	Amendment	Reason

Present

⟨newly added⟩

1.3.5 Hydrodynamic pressure for BSR load cases

The wave pressures, P_W, for BSR-1 and BSR-2 load cases, at any load point, in $\mathrm{kN/m^2}$, are to be obtained from **Table 5.**

⟨omitted⟩

~~Table 6 : Factor application for BSR load cases~~

~~Transverse position~~	~~BSR-1P, BSR-2P~~	~~BSR-1S, BSR-2S~~
~~$y \geq 0$~~	~~(S)~~	~~(P)~~
~~$y < 0$~~	~~(P)~~	~~(S)~~

~~$P_{BSR} = f_R f_p f_{nl} f_\beta f_{yz} P_a f_a f_{p-BSR}$~~

Amendment

k_p : Phase coefficient tin the longitudinal direction of the ship, to be taken as:

$$k_p = k_{p-WL} f_{zT} + k_{p-CL}(1 - f_{zT})$$

Intermediate values are obtained by linear interpolation.

Table 15 : k_{p-WL} values for FSM load case

f_{xL}	0.0	$-\frac{8}{45}f_T + \frac{67}{225}$	$-\frac{2}{9}f_T + \frac{17}{36}$	$-\frac{1}{9}f_T + \frac{32}{45}$	$-\frac{1}{9}f_T + \frac{31}{36}$	1.0
k_{p-WL}	$-\frac{5}{9}f_T - \frac{7}{36}$	-1.0	1.0	1.0	-1.0	-0.7

Table 16 : k_{p-CL} values for FSM load case

f_{xL}	0.0	$-\frac{8}{45}f_T + \frac{161}{450}$	$-\frac{2}{9}f_T + \frac{19}{45}$	0.65	$-\frac{1}{9}f_T + \frac{73}{90}$	1.0
k_{p-CL}	-0.6	-1.0	1.0	1.0	-1.0	-0.7

1.3.5 Hydrodynamic pressure for BSR load cases

The wave pressures, P_W, for BSR-1 and BSR-2 load cases, at any load point, in $\mathrm{kN/m^2}$, are to be obtained from **Table 17.**

⟨same as the present⟩

⟨del⟩

where:

For BSR-1P and BSR-2P load cases, to be taken as:

$$P_{BSR} = f_\beta f_{nl}\left(10 y sin\theta + 0.48 f_p C_W \sqrt{\frac{L_0 + \lambda - 125}{L}}\,(f_{yB1} + 1)\right)$$

Present	Amendment	Reason
f_p : Coefficient to be taken as: $f_p = f_{ps}$ for strength assessment. $f_p = 0.9[(0.21+0.04f_T)-(12f_T-2)B \times 10^{-4}]$ for fatigue assessment. f_{nl} : Coefficient considering non-linear effects, to be taken as: $f_{nl} = 1.0$ ~~f_{yz} : Girth distribution coefficient, to be taken as:~~ ~~a) For full load condition:~~ ~~$f_{yz}(P) = \frac{1}{4.6}\left(4f_{yB}+0.5\frac{z}{T_{LC}}+0.1\right)$~~ ~~$f_{yz}(S) = \frac{1}{4.7}(4.5f_{yB}+0.2)$~~ ~~b) For ballast load condition:~~ ~~$f_{yz}(P) = \frac{1}{6}\left(\left(0.5\frac{z}{T_{LC}}+f_{yB}\right)(2f_{yB}+2)\right)$~~ ~~$f_{yz}(S) = \frac{1}{5.6}\left(\left(0.4\frac{z}{T_{LC}}+f_{yB}\right)(2f_{yB}+2)\right)$~~ ~~$P_a$: Pressure amplitude coefficient in mid-ship position, to be taken as:~~ ~~a) For full load condition:~~ ~~$P_a = 13-0.03L+\frac{35GM}{B}$~~ ~~b) For ballast condition:~~ ~~$P_a(P) = 7(GM-0.2B)+10(-C_w+10.75)$~~ ~~$P_a(S) = 10(GM-0.2B-C_w+10.75)$~~	For BSR-1S and BSR-2S load cases, to be taken as: $P_{BSR} = f_\beta f_{nl}\left(-10y\sin\theta+0.48f_pC_W\sqrt{\frac{L_0+\lambda-125}{L}}(f_{yB1}+1)\right)$ f_p : Coefficient to be taken as: $f_p = f_{ps}$ for strength assessment. $f_p = 0.9[(0.21+0.04f_T)-(12f_T-2)B \times 10^{-4}]$ for fatigue assessment. f_{nl} : Coefficient considering non-linear effects, to be taken as: $f_{nl} = 1.0$	

Present	Amendment	Reason
~~f_a : Wave amplitude coefficient to be taken as:~~ ~~$f_a = 0.25 C_w \sqrt{\frac{L+\lambda-125}{L}}$~~ λ : Wave length of the dynamic load case, in m, to be taken as: $\lambda = \frac{gT_\theta^2}{2\pi}$ ~~f_{p-BSR} : Pressure distribution coefficient in the longitudinal direction of the ship, to be taken as:~~ ~~a) For full load condition:~~ ~~$f_{p-BSR}(P) = -(\sin(2\pi(f_{xL}+0.05)))f_{yB}$ for $f_{xL} < 0.2$~~ ~~$f_{p-BSR}(P) = -f_{yB}$ for $0.2 \le f_{xL} < 0.6$~~ ~~$f_{p-BSR}(P) = -\left(0.5\sin\left(\frac{2\pi}{0.8}(f_{xL}-0.45)\right)+0.5\right)f_{yB}$ for $0.7 \le f_{xL}$~~ ~~$f_{p-BSR}(S) = (\sin(2\pi(f_{xL}+0.05)))f_{yB}$ for $f_{xL} < 0.2$~~ ~~$f_{p-BSR}(S) = f_{yB}+0.8(1-f_{yB})$ for $0.2 \le f_{xL} < 0.6$~~ ~~$f_{p-BSR}(S) = \left(0.5\sin\left(\frac{2\pi}{0.8}(f_{xL}-0.45)\right)+0.5\right)f_{yB}$ for $0.7 \le f_{xL}$~~ ~~b) For ballast load condition:~~ ~~$f_{p-BSR}(P) = -\left(\sin\left(\frac{2\pi}{1.5}f_{xL}\right)\right)f_{yB}$ for $f_{xL} < 0.4$~~ ~~$f_{p-BSR}(P) = -\left(0.5\sin\left(\frac{2\pi}{1.4}(f_{xL}-0.1)\right)+0.5\right)f_{yB}$ for $0.5 \le f_{xL}$~~ ~~$f_{p-BSR}(S) = \left(\sin\left(\frac{2\pi}{1.5}f_{xL}\right)\right)f_{yB}$ for $f_{xL} < 0.4$~~ ~~$f_{p-BSR}(S) = \left(0.5\sin\left(\frac{2\pi}{1.4}(f_{xL}-0.1)\right)+0.5\right)f_{yB}$ for $0.5 \le f_{xL}$~~ ~~Intermediate values are obtained by linear interpolation.~~	λ : Wave length of the dynamic load case, in m, to be taken as: $\lambda = \frac{gT_\theta^2}{2\pi}$ ⟨del⟩	

Present

1.3.6 Hydrodynamic pressure for BSP load cases

The wave pressure, P_W, for BSP-1 and BSP-2 load cases, at any load point, in $\mathrm{kN/m^2}$, are to be obtained from **Table 7.**

Table 7 : Hydrodynamic pressures for BSP load cases

	Wave pressure, in $\mathrm{kN/m^2}$		
Load case	$z \le T_{LC}$	$T_{LC} < z \le h_W + T_{LC}$	$z > h_W + T_{LC}$
BSP-1P	$P_W = \max(-P_{BSP}, \rho g(z - T_{LC}))$	$P_W = P_{W,WL} - \rho g(z - T_{LC}$	$P_W = 0.0$
BSP-2P	$P_W = \max(P_{BSP}, \rho g(z - T_{LC}))$		
BSP-1S	$P_W = \max(-P_{BSP}, \rho g(z - T_{LC}))$		
BSP-2S	$P_W = \max(P_{BSP}, \rho g(z - T_{LC}))$		

〈omitted〉

where:

$P_{BSP} = f_R f_p f_{nl} f_\beta f_{yz} P_a f_a f_{p-BSP}$

〈omitted〉

f_{yz} : Girth distribution coefficient, to be taken as:

$$f_{yz}(P) = \left(f_{yB} + 0.55\frac{z}{T_{LC}} + 0.2\right)(f_{yB} - 0.6) + 0.3$$

$$f_{yz}(S) = \left(0.4 f_{yB} + 0.5\frac{z}{T_{LC}}\right) f_{yB} + 0.1$$

P_a : Pressure amplitude coefficient in mid-ship position, to be taken as:

$P_a(P) = 11$

$P_a(S) = 25$

Amendment

1.3.6 Hydrodynamic pressure for BSP load cases

The wave pressure, P_W, for BSP-1 and BSP-2 load cases, at any load point, in $\mathrm{kN/m^2}$, are to be obtained from **Table 18.**

Table 18 : Hydrodynamic pressures for BSP load cases

	Wave pressure, in $\mathrm{kN/m^2}$		
Load case	$z \le T_{LC}$	$T_{LC} < z \le h_W + T_{LC}$	$z > h_W + T_{LC}$
BSP-1P	$P_W = \max(P_{BSP}, \rho g(z - T_{LC}))$	$P_W = P_{W,WL} - \rho g(z - T_{LC}$	$P_W = 0.0$
BSP-2P	$P_W = \max(-P_{BSP}, \rho g(z - T_{LC}))$		
BSP-1S	$P_W = \max(P_{BSP}, \rho g(z - T_{LC}))$		
BSP-2S	$P_W = \max(-P_{BSP}, \rho g(z - T_{LC}))$		

〈same as the present〉

where:

$P_{BSP} = f_R f_p f_{nl} f_\beta f_{yz} P_a f_a f_{p-BSP}$

〈same as the present〉

f_{yz} : Girth distribution coefficient, to be taken as:

$$f_{yz}(P) = 0.25\frac{z}{T_{LC}} + 0.6 f_{yB1} + 0.15$$

$$f_{yz}(S) = 0.5\frac{z}{T_{LC}} + 0.35 f_{yB1} + 0.15$$

P_a : Pressure amplitude coefficient in mid-ship position, to be taken as:

$P_a(P) = 11$

$P_a(S) = 25$

Reason

Present	Amendment	Reason
f_a : Wave amplitude coefficient to be taken as: $f_a=\left(0.8C_w\sqrt{\frac{L+\lambda-125}{L}}\right)\left(\frac{L}{600(2-f_T)}\right)+5C_b$ λ : Wave length of the dynamic load case, in m, to be taken as: $\lambda=90+0.3B$ f_{p-BSP} : Pressure distribution coefficient in the longitudinal direction of the ship, to be taken as: ~~$f_{p-BSP}(P)=\left(0.5\sin\left(\frac{2\pi}{0.8}(f_{xL}-0.2)\right)+0.5\right)f_{yB}+(2\sin(2\pi(f_{xL}+0.25))+3)(1-f_{yB})$~~ ~~for $f_{xL}<0.4$~~ ~~$f_{p-BSP}(P)=(-0.5f_{xL}+1.2)f_{yB}+\left(3\sin\left(\frac{2\pi}{0.9}(f_{xL}-0.75)\right)+4\right)(1-f_{yB})$~~ ~~for $0.5\le f_{xL}<0.8$~~ ~~$f_{p-BSP}(P)=(-2f_{xL}+2.4)f_{yB}+\left(3\sin\left(\frac{2\pi}{0.9}(f_{xL}-0.75)\right)+4\right)(1-f_{yB})$~~ ~~for $0.8\le f_{xL}$~~ ~~$f_{p-BSR}(S)=\left(0.3\sin\left(\frac{2\pi}{0.8}(f_{xL}-0.2)\right)+0.7\right)f_{yB}+(2\sin(2\pi(f_{xL}+0.25))+3)(1-f_{yB})$~~ ~~for $f_{xL}<0.4$~~ ~~$f_{p-BSR}(S)=f_{yB}+\left(3\sin\left(\frac{2\pi}{0.9}(f_{xL}-0.75)\right)+4\right)(1-f_{yB})$ for $0.5\le f_{xL}<0.6$~~ ~~$f_{p-BSR}(S)=(-1.25f_{xL}+1.75)f_{yB}+\left(3\sin\left(\frac{2\pi}{0.9}(f_{xL}-0.75)\right)+4\right)(1-f_{yB})$~~ ~~for $0.6\le f_{xL}<0.8$~~ ~~$f_{p-BSR}(S)=\left(0.6\sin\left(\frac{2\pi}{1.1}(f_{xL}-0.5)\right)+0.16\right)f_{yB}+\left(3\sin\left(\frac{2\pi}{0.9}(f_{xL}-0.75)\right)+4\right)(1-f_{y}$~~ ~~for $0.8\le f_{xL}$~~ ~~Intermediate values are obtained by linear interpolation.~~	f_a : Wave amplitude coefficient to be taken as: $f_a=\left(0.8C_w\sqrt{\frac{L+\lambda-125}{L}}\right)\left(\frac{L}{600(2-f_T)}\right)+5C_b$ λ : Wave length of the dynamic load case, in m, to be taken as: $\lambda=90+0.3B$ f_{p-BSP} : Pressure distribution coefficient in the longitudinal direction of the ship, to be taken as: $\underline{f_{p-BSP}=1}$	

Present	Amendment	Reason
1.3.7 Hydrodynamic pressure for OST load cases The wave pressures, P_W, for OST-1 and OST-2 load cases, at any load point are to be obtained, in $\mathrm{kN/m^2}$, from Table 9. 〈omitted〉 where: $P_{OST}=f_R f_p f_{nl} f_\beta f_{yz} P_a f_a f_{p-OST}$ f_p : Coefficient to be taken as: $f_p=f_{ps}$ for strength assessment. $f_p=0.9[(0.25-0.02f_T)+(12f_T-9)B\times10^{-4}]$ for fatigue assessment. f_{nl} : Coefficient considering non-linear effects, to be taken as: $f_{nl}=0.8$ for strength assessment. $f_{nl}=1.0$ for fatigue assessment. f_{yz} : Girth distribution coefficient, to be taken as: $\underline{f_{yz}(P)=\frac{1}{8}\left(\left(5f_{yB}+3\frac{z}{T_{LC}}\right)(f_{yB}-0.5)+4\right)}$ $\underline{f_{yz}(S)=\frac{1}{8}\left(2f_{yB}+5\frac{z}{T_{LC}}+1\right)}$ P_a : Pressure amplitude coefficient in mid-ship position, to be taken as: $\underline{P_a(P)=10(3^{-\frac{L}{500}})}$ $\underline{P_a(S)=10(3^{-\frac{L}{500}})+17}$ f_a : Wave amplitude coefficient to be taken as: $f_a=0.6C_w\sqrt{\frac{L+\lambda-125}{L}}$ λ : Wave length of the dynamic load case, in m, to be taken as: $\lambda=0.45L$	**1.3.7 Hydrodynamic pressure for OST load cases** The wave pressures, P_W, for OST-1 and OST-2 load cases, at any load point are to be obtained, in $\mathrm{kN/m^2}$, from Table 20. 〈same as the present〉 where: $P_{OST}=f_R f_p f_{nl} f_\beta f_{yz} P_a f_a f_{p-OST}$ f_p : Coefficient to be taken as: $f_p=f_{ps}$ for strength assessment. $f_p=0.9[(0.25-0.02f_T)+(12f_T-9)B\times10^{-4}]$ for fatigue assessment. f_{nl} : Coefficient considering non-linear effects, to be taken as: $f_{nl}=0.8$ for strength assessment. $f_{nl}=1.0$ for fatigue assessment. f_{yz} : Girth distribution coefficient, to be taken as: $\underline{f_{yz}(P)=0.06\frac{z}{T_{LC}}+0.09f_{yB}+0.15}$ $\underline{f_{yz}(S)=0.72\frac{z}{T_{LC}}+0.28f_{yB}+0.15}$ P_a : Pressure amplitude coefficient in mid-ship position, to be taken as: $\underline{P_a=20}$ f_a : Wave amplitude coefficient to be taken as: $f_a=0.6C_w\sqrt{\frac{L+\lambda-125}{L}}$ λ : Wave length of the dynamic load case, in m, to be taken as: $\lambda=0.45L$	

Present	Amendment	Reason
f_{p-OST} : Pressure distribution coefficient in the longitudinal direction of the ship, to be taken as: ~~a) For full load condition:~~ ~~$f_{p-OST}(P)=\left(-\sin\left(\frac{2\pi}{0.6}f_{xL}\right)+0.5\right)f_{yB}+\left(-1.5\sin\left(\frac{2\pi}{1.3}(f_{xL}-0.2)\right)+0.4\right)(1-f_{yB})$~~ ~~for $f_{xL}<0.2$~~ ~~$f_{p-OST}(P)=\left(0.5\sin\left(\frac{2\pi}{0.6}(f_{xL}-0.15)\right)-0.5\right)f_{yB}+\left(-1.5\sin\left(\frac{2\pi}{1.3}(f_{xL}-0.2)\right)+0.4\right)(1-f_{yB})$~~ ~~for $0.3\le f_{xL}<0.6$~~ ~~$f_{p-OST}(P)=-f_{yB}+(1.5\sin(2\pi(f_{xL}-0.5))-2)(1-f_{yB})$~~ ~~for $0.7\le f_{xL}<0.8$~~ ~~$f_{p-OST}(P)=(-10f_{xL}+7)f_{yB}+(1.5\sin(2\pi(f_{xL}-0.5))-2)(1-f_{yB})$~~ ~~for $0.8\le f_{xL}$~~ ~~$f_{p-OST}(S)=0.5f_{yB}+\left(-1.5\sin\left(\frac{2\pi}{1.3}(f_{xL}-0.2)\right)+0.4\right)(1-f_{yB})$~~ ~~for $f_{xL}<0.2$~~ ~~$f_{p-OST}(S)=\left(0.75\sin\left(\frac{2\pi}{0.7}f_{xL}\right)-0.25\right)f_{yB}+\left(-1.5\sin\left(\frac{2\pi}{1.3}(f_{xL}-0.2)\right)+0.4\right)(1-f_{yB})$~~ ~~for $0.3\le f_{xL}<0.6$~~ ~~$f_{p-OST}(S)=\left(0.6\sin\left(\frac{2\pi}{0.6}(f_{xL}-0.1)-0.25\right)f_{yB}+(1.5\sin(2\pi(f_{xL}-0.5))-2)(1-f_{yB})$~~ ~~for $0.7\le f_{xL}$~~	f_{p-OST} : Pressure distribution coefficient in the longitudinal direction of the ship, to be taken as:. $f_{p-OST}=k_ak_p$	

Present	Amendment	Reason
~~b) For ballast load condition:~~ ~~$f_{p-OST}(P)=\left(-2\sin\left(\frac{2\pi}{0.6}f_{xL}\right)+2.1\right)f_{yB}+\left(-4\sin\left(\frac{2\pi}{1.9}(f_{xL}-0.1)\right)+3\right)(1-f_{yB})$~~ ~~for $f_{xL}<0.2$~~ ~~$f_{p-OST}(P)=(-1.2\sin(2\pi(f_{xL}+0.35)))f_{yB}+\left(-4\sin\left(\frac{2\pi}{1.9}(f_{xL}-0.1)\right)+3\right)(1-f_{yB})$~~ ~~for $0.2\le f_{xL}<0.6$~~ ~~$f_{p-OST}(P)=(-11f_{xL}+9)f_{yB}+\left(3\sin\left(\frac{2\pi}{0.6}(f_{xL}-0.1)\right)-1.5\right)(1-f_{yB})$~~ ~~for $0.8\le f_{xL}$~~ ~~$f_{p-OST}(S)=0.6f_{yB}+\left(-4\sin\left(\frac{2\pi}{1.9}(f_{xL}-0.1)\right)+3\right)(1-f_{yB})$ for $f_{xL}\le 0.2$~~ ~~$f_{p-OST}(S)=\left(0.8\sin\left(\frac{2\pi}{0.65}(f_{xL}-0.05)\right)-0.2\right)f_{yB}+\left(-4\sin\left(\frac{2\pi}{1.9}(f_{xL}-0.1)\right)+3\right)(1-f_{yB})$~~ ~~for $0.2\le f_{xL}<0.6$~~ ~~$f_{p-OST}(S)=\left(0.8\sin\left(\frac{2\pi}{0.65}(f_{xL}-0.05)\right)-0.2\right)f_{yB}+(10f_{xL}-7)(1-f_{yB})$~~ ~~for $0.6\le f_{xL}<0.8$~~ ~~$f_{p-OST}(S)=\left(0.8\sin\left(\frac{2\pi}{0.65}(f_{xL}-0.05)\right)-0.2\right)f_{yB}+\left(3\sin\left(\frac{2\pi}{0.6}(f_{xL}-0.1)-1.5\right)(1-f_{yB}\right)$~~ ~~for $0.8\le f_{xL}$~~ ~~Intermediate values are obtained by linear interpolation.~~		
⟨newly added⟩	k_a : Amplitude coefficient in the longitudinal direction of the ship, to be taken as: $k_a=k_{a-WL}f_{zT}+k_{a-CL}(1-f_{zT})$ Intermediate values are obtained by linear interpolation.	

Present	Amendment	Reason
〈newly added〉		

Table 22 : k_{a-WL} values for OST load case

Transverse position	OST-1P, OST-2P		OST-1S, OST-2S	
	f_{xL}	k_{a-WL}	f_{xL}	k_{a-WL}
$y \geq 0$	0.0	1.0	0.0	$3-2f_T$
	0.2	$0.6f_T+0.4$	0.15	f_T
	0.4	$0.4f_T+0.6$	0.3	$2-f_T$
	0.5	1.0	0.5	1.0
	0.6	1.0	0.65	$1.4f_T-0.4$
	0.8	f_T	0.8	f_T
	1.0	$1.4-0.4f_T$	1.0	3.0
$y < 0$	0.0	$3-2f_T$	0.0	1.0
	0.15	f_T	0.2	$0.6f_T+0.4$
	0.3	$2-f_T$	0.4	$0.4f_T+0.6$
	0.5	1.0	0.5	1.0
	0.65	$1.4f_T-0.4$	0.6	1.0
	0.8	f_T	0.8	f_T
	1.0	3.0	1.0	$1.4-0.4f_T$

Table 23 : k_{a-CL} values for OST load case

f_{xL}	0.0	0.2	0.8	1.0
k_{a-CL}	$7-5f_T$	1.0	1.0	$6-2f_T$

Present	Amendment	Reason
〈newly added〉	k_p : Phase coefficient tin the longitudinal direction of the ship, to be taken as: $k_p = k_{p-WL} f_{zT} + k_{p-CL}(1 - f_{zT})$ Intermediate values are obtained by linear interpolation.	

Present	Amendment	Reason
〈newly added〉	**Table 24 : k_{p-WL} values for OST load case**	

Transverse position	OST-1P, OST-2P		OST-1S, OST-2S	
	f_{xL}	k_{p-WL}	f_{xL}	k_{p-WL}
$y \geq 0$	0.0	1.0	0.0	$1.5-f_T$
			0.1	$2.5-3f_T$
	0.2	1.0	0.15	$2.4-2.8f_T$
	0.4	-1.0	0.2	$1.1-1.4f_T$
			0.4	$2.06-2.36f_T$
	$0.1f_T+0.55$	-1.0	0.45	$2.53-3.06f_T$
	$0.1f_T+0.75$	1.0	0.55	$3-4f_T$
			0.65	$3-4f_T$
	1.0	$0.5-f_T$	0.8	$2-3f_T$
			1.0	$-0.6f_T-0.4$
$y<0$	0.0	$1.5-f_T$	0.0	1.0
	0.1	$2.5-3f_T$		
	0.15	$2.4-2.8f_T$	0.2	1.0
	0.2	$1.1-1.4f_T$	0.4	-1.0
	0.4	$2.06-2.36f_T$		
	0.45	$2.53-3.06f_T$	$0.1f_T+0.55$	-1.0
	0.55	$3-4f_T$		
	0.65	$3-4f_T$	$0.1f_T+0.75$	1.0
	0.8	$2-3f_T$	1.0	$0.5-f_T$
	1.0	$-0.6f_T-0.4$		

Present

〈newly added〉

1.3.8 Hydrodynamic pressure for OSA load cases

The wave pressures, P_W, for OSA-1 and OSA-2 load cases, at any load point, in $\mathrm{kN/m^2}$, are to be obtained from **Table 11.**

〈omitted〉

f_{nl} : Coefficient considering non-linear effects, to be taken as:

a) For extreme sea loads design load scenario for strength assessment :

$f_{nl}=0.5$ at $f_{xL}=0$

$f_{nl}=0.8$ at $0.3 \le f_{xL} < 0.7$

$f_{nl}=0.6$ at $f_{xL}=1$

b) For ballast water exchange design load scenario for strength assessment :

$f_{nl}=0.75$ at $f_{xL}=0$

$f_{nl}=0.90$ at $0.3 \le f_{xL} < 0.7$

$f_{nl}=0.80$ at $f_{xL}=1$

Intermediate values are obtained by linear interpolation.

~~$f_{nl}=1.0$ for fatigue assessment.~~

Amendment

Table 25 : k_{p-CL} values for OST load case

f_{xL}	0.0	$0.35-0.1f_T$	$0.5-0.2f_T$	$0.2f_T+0.55$	0.8	1.0
k_{p-CL}	1.0	$1.4-0.8f_T$	-1.0	-1.0	$2.5-3f_T$	-0.5

1.3.8 Hydrodynamic pressure for OSA load cases

The wave pressures, P_W, for OSA-1 and OSA-2 load cases, at any load point, in $\mathrm{kN/m^2}$, are to be obtained from **Table 26.**

〈same as the present〉

f_{nl} : Coefficient considering non-linear effects, to be taken as:

a) For extreme sea loads design load scenario for strength assessment :

$f_{nl}=0.5$ at $f_{xL}=0$

$f_{nl}=0.8$ at $0.3 \le f_{xL} < 0.7$

$f_{nl}=0.6$ at $f_{xL}=1$

b) For ballast water exchange design load scenario for strength assessment :

$f_{nl}=0.75$ at $f_{xL}=0$

$f_{nl}=0.90$ at $0.3 \le f_{xL} < 0.7$

$f_{nl}=0.80$ at $f_{xL}=1$

Intermediate values are obtained by linear interpolation.

〈del〉

Reason

Present	Amendment	Reason
f_{yz} : Girth distribution coefficient, to be taken as: $f_{yz}(S)=\frac{1}{4.5}\left(f_{yB}+3\frac{z}{T_{LC}}+0.5\right)$ a) For full load condition: $f_{yz}(P)=\left(1.1f_{yB}+0.8\frac{z}{T_{LC}}\right)(f_{yB}-0.6)+0.24$ b) For ballast load condition: $f_{yz}(P)=\left(0.5f_{yB}+2.5\frac{z}{T_{LC}}\right)(0.95f_{yB}-0.7)+0.25$	f_{yz} : Girth distribution coefficient, to be taken as: $f_{yz}(P)=0.6\frac{z}{T_{LC}}+(0.32f_T-0.16)f_{yB}+0.24$ $f_{yz}(S)=0.85\frac{z}{T_{LC}}+0.21f_{yB}+0.24$	
P_a : Pressure amplitude coefficient in mid-ship position, to be taken as: a) For full load condition: $P_a(P)=\frac{1500}{L}+\frac{L^{0.3}}{10}$ $P_a(S)=\frac{3000}{L}+\frac{L^{0.3}}{2}$ b) For ballast load condition: $P_a(P)=7$ $P_a(S)=15$	P_a : Pressure amplitude coefficient in mid-ship position, to be taken as: $P_a=\left(\frac{2300}{L}+0.4L^{0.3}\right)(2f_T-1)+12(1-f_T)$	
f_a : Wave amplitude coefficient to be taken as: $f_a=0.6C_w\sqrt{\frac{L+\lambda-125}{L}}$	f_a : Wave amplitude coefficient to be taken as: $f_a=0.6C_w\sqrt{\frac{L+\lambda-125}{L}}$	
λ : Wave length of the dynamic load case, in m, to be taken as: $\lambda=0.3(f_T+1)L$	λ : Wave length of the dynamic load case, in m, to be taken as: $\lambda=0.3(f_T+1)L$	

Present	Amendment	Reason
f_{p-OSA} : Pressure distribution coefficient in the longitudinal direction of the ship, to be taken as: ~~a) For full load condition:~~ ~~$f_{p-OSA}(P) = f_{yB} + \left(0.5\sin\left(\frac{2\pi}{0.5}(f_{xL} - 0.3)\right) + 1.5\right)(1 - f_{yB})$ for $f_{xL} < 0.2$~~ ~~$f_{p-OSA}(P) = f_{yB} + \left(8\sin\left(\frac{2\pi}{2.5}(f_{xL} + 0.3)\right) - 6.6\right)(1 - f_{yB})$ for $0.2 \le f_{xL} < 0.3$~~ ~~$f_{p-OSA}(P) = \left(1.5\sin\left(\frac{2\pi}{0.8}(f_{xL} - 0.1)\right) - 0.5\right)f_{yB} + \left(8\sin\left(\frac{2\pi}{2.5}(f_{xL} + 0.3)\right) - 6.6\right)(1 - f_{yB})$~~ ~~for $0.3 \le f_{xL} < 0.7$~~ ~~$f_{p-OSA}(P) = \left(1.5\sin\left(\frac{2\pi}{0.9}(f_{xL} - 0.6)\right) - 3\right)f_{yB} + \left(8\sin\left(\frac{2\pi}{2.5}(f_{xL} + 0.3)\right) + 6.6\right)(1 - f_{yB})$~~ ~~for $0.8 \le f_{xL}$~~ ~~$f_{p-OSA}(S) = \left(0.5\sin\left(\frac{2\pi}{0.8}(f_{xL} - 0.2)\right) + 0.5\right)f_{yB} + \left(0.5\sin\left(\frac{2\pi}{0.5}(f_{xL} - 0.3)\right) + 1.5\right)(1 - f_{yB})$~~ ~~for $f_{xL} < 0.2$~~ ~~$f_{p-OSA}(S) = \left(0.5\sin\left(\frac{2\pi}{0.8}(f_{xL} - 0.2)\right) + 0.5\right)f_{yB} + \left(8\sin\left(\frac{2\pi}{2.5}(f_{xL} + 0.3)\right) - 6.6\right)(1 - f_{yB})$~~ ~~for $0.2 \le f_{xL} < 0.4$~~ ~~$f_{p-OSA}(S) = \left(-\sin\left(\frac{2\pi}{0.8}(f_{xL} - 0.6)\right)\right)f_{yB} + \left(8\sin\left(\frac{2\pi}{2.5}(f_{xL} + 0.3)\right) - 6.6\right)(1 - f_{yB})$~~ ~~for $0.4 \le f_{xL} < 0.8$~~ ~~$f_{p-OSA}(S) = \left(\sin\left(\frac{2\pi}{0.8}(f_{xL} - 0.6)\right) - 2\right)f_{yB} + \left(8\sin\left(\frac{2\pi}{2.5}(f_{xL} + 0.3)\right) - 6.6\right)(1 - f_{yB})$~~ ~~for $0.8 \le f_{xL}$~~	f_{p-OSA} : Pressure distribution coefficient in the longitudinal direction of the ship, to be taken as: $\underline{f_{p-OSA} = k_a k_p}$	

Present	Amendment	Reason
~~b) For ballast load condition:~~ ~~$f_{p-OSA}(P) = (-2.5f_{xL}+0.5)f_{yB} + \left(2\sin\left(\frac{2\pi}{0.7}(f_{xL}-0.4)\right)+2\right)(1-f_{yB})$~~ ~~for $f_{xL} < 0.4$~~ ~~$f_{p-OSA}(P) = (-2.5f_{xL}+0.5)f_{yB} + \left(7\sin\left(\frac{2\pi}{2.4}(f_{xL}+0.15)\right)-6\right)(1-f_{yB})$~~ ~~for $0.4 \le f_{xL} < 0.6$~~ ~~$f_{p-OSA}(P) = -f_{yB} + \left(7\sin\left(\frac{2\pi}{2.4}(f_{xL}+0.15)\right)-6\right)(1-f_{yB})$ for $0.6 \le f_{xL} < 0.8$~~ ~~$f_{p-OSA}(P) = -3f_{yB}-6(1-f_{yB})$ for $f_{xL} = 1.0$~~ ~~$f_{p-OSA}(S) = \left(0.5\sin\left(\frac{2\pi}{0.6}(f_{xL}-0.25)\right)+0.5\right)f_{yB} + \left(2\sin\left(\frac{2\pi}{0.7}(f_{xL}-0.4)\right)+2\right)(1-f_{yB})$~~ ~~for $f_{xL} < 0.3$~~ ~~$f_{p-OSA}(S) = \left(0.5\sin\left(\frac{2\pi}{0.6}(f_{xL}-0.25)\right)+0.5\right)f_{yB} + \left(7\sin\left(\frac{2\pi}{2.4}(f_{xL}+0.15)\right)-6\right)(1-f_{yB}$~~ ~~for $0.3 \le f_{xL} < 0.4$~~ ~~$f_{p-OSA}(S) = (-\sin(2\pi(f_{xL}-0.65)))f_{yB} + \left(7\sin\left(\frac{2\pi}{2.4}(f_{xL}+0.15)\right)-6\right)(1-f_{yB})$~~ ~~for $0.4 \le f_{xL} < 0.8$~~ ~~$f_{p-OSA}(S) = -1.5f_{yB}-6(1-f_{yB})$ for $f_{xL} = 1.0$~~ ~~Intermediate values are obtained by linear interpolation.~~		
⟨newly added⟩	k_a : Amplitude coefficient in the longitudinal direction of the ship, to be taken as: $k_a = k_{a-WL}f_{zT} + k_{a-CL}(1-f_{zT})$ Intermediate values are obtained by linear interpolation.	

Present	Amendment	Reason
〈newly added〉	**Table 28 : k_{a-WL} values for OSA load case**	

Transverse position	OSA-1P, OSA-2P		OSA-1S, OSA-2S	
	f_{xL}	k_{a-WL}	f_{xL}	k_{a-WL}
$y \geq 0$	0.0	$-f_T+1$	0.0	$2f_T$
	0.1	$-0.4f_T+0.7$	0.1	$3f_T-1$
	0.2	$1.2f_T-0.6$	0.3	$3f_T-1$
	0.3	$-0.2f_T+1.1$	0.4	f_T
	0.4	1.0	0.5	1.0
	0.5	1.0	0.6	1.5
	0.6	f_T	0.7	2.0
	0.7	f_T	0.8	$0.6f_T+0.9$
	0.8	$0.8f_T+0.4$	0.9	2.0
	0.9	$0.4f_T+1$	1.0	3.0
	1.0	f_T+1		
$y < 0$	0.0	$2f_T$	0.0	$-f_T+1$
	0.1	$3f_T-1$	0.1	$-0.4f_T+0.7$
	0.3	$3f_T-1$	0.2	$1.2f_T-0.6$
	0.4	f_T	0.3	$-0.2f_T+1.1$
	0.5	1.0	0.4	1.0
	0.6	1.5	0.5	1.0
	0.7	2.0	0.6	f_T
	0.8	$0.6f_T+0.9$	0.7	f_T
	0.9	2.0	0.8	$0.8f_T+0.4$
	1.0	3.0	0.9	$0.4f_T+1$
			1.0	f_T+1

<table>
<tr><th>Present</th><th>Amendment</th><th>Reason</th></tr>
<tr>
<td>〈newly added〉</td>
<td>

Table 29 : k_{a-CL} values for OSA load case

<table>
<tr><td>f_{xL}</td><td>0.0</td><td>0.1</td><td>0.2</td><td>0.6</td><td>0.7</td><td>0.8</td><td>0.9</td><td>1.0</td></tr>
<tr><td>k_{a-CL}</td><td>4.0</td><td>2.0</td><td>1.0</td><td>1.0</td><td>$2f_T$</td><td>$3f_T+0.5$</td><td>$3f_T+2.5$</td><td>$3f_T+4.5$</td></tr>
</table>

</td>
<td></td>
</tr>
<tr>
<td>〈newly added〉</td>
<td>

k_p : Phase coefficient tin the longitudinal direction of the ship, to be taken as:

$k_p = k_{p-WL} f_{zT} + k_{p-CL}(1-f_{zT})$

Intermediate values are obtained by linear interpolation.

</td>
<td></td>
</tr>
</table>

<table>
<tr><th>Present</th><th>Amendment</th><th>Reason</th></tr>
<tr><td>〈newly added〉</td><td>

Table 30 : k_{p-WL} values for OSA load case

<table>
<tr><th rowspan="2">Transverse position</th><th colspan="2">OSA-1P, OSA-2P</th><th colspan="2">OSA-1S, OSA-2S</th></tr>
<tr><th>f_{xL}</th><th>k_{p-WL}</th><th>f_{xL}</th><th>k_{p-WL}</th></tr>
<tr><td rowspan="11">$y \geq 0$</td><td>0.0</td><td>f_T</td><td>0.0</td><td>0.5</td></tr>
<tr><td>0.1</td><td>$2f_T-1$</td><td>0.1</td><td>0.5</td></tr>
<tr><td>0.2</td><td>$4f_T-3$</td><td>0.2</td><td>$f_T-0.5$</td></tr>
<tr><td>0.3</td><td>$0.4f_T+0.6$</td><td>0.3</td><td>$2.2f_T-1.7$</td></tr>
<tr><td>0.4</td><td>$1.1-0.2f_T$</td><td>0.4</td><td>$3f_T-2.5$</td></tr>
<tr><td>0.5</td><td>$1.1-0.4f_T$</td><td>0.5</td><td>$0.4f_T-0.9$</td></tr>
<tr><td>0.6</td><td>$1.2-1.2f_T$</td><td>0.6</td><td>$-0.6f_T-0.4$</td></tr>
<tr><td>0.7</td><td>$-0.6f_T-0.2$</td><td>0.7</td><td>$-0.6f_T-0.4$</td></tr>
<tr><td>0.8</td><td>$0.2f_T-1.1$</td><td>0.8</td><td>-1.0</td></tr>
<tr><td>0.9</td><td>-1.0</td><td>0.9</td><td>$0.4f_T-1.2$</td></tr>
<tr><td>1.0</td><td>-1.0</td><td>1.0</td><td>$0.4f_T-1.2$</td></tr>
<tr><td rowspan="11">$y < 0$</td><td>0.0</td><td>0.5</td><td>0.0</td><td>f_T</td></tr>
<tr><td>0.1</td><td>0.5</td><td>0.1</td><td>$2f_T-1$</td></tr>
<tr><td>0.2</td><td>$f_T-0.5$</td><td>0.2</td><td>$4f_T-3$</td></tr>
<tr><td>0.3</td><td>$2.2f_T-1.7$</td><td>0.3</td><td>$0.4f_T+0.6$</td></tr>
<tr><td>0.4</td><td>$3f_T-2.5$</td><td>0.4</td><td>$1.1-0.2f_T$</td></tr>
<tr><td>0.5</td><td>$0.4f_T-0.9$</td><td>0.5</td><td>$1.1-0.4f_T$</td></tr>
<tr><td>0.6</td><td>$-0.6f_T-0.4$</td><td>0.6</td><td>$1.2-1.2f_T$</td></tr>
<tr><td>0.7</td><td>$-0.6f_T-0.4$</td><td>0.7</td><td>$-0.6f_T-0.2$</td></tr>
<tr><td>0.8</td><td>-1.0</td><td>0.8</td><td>$0.2f_T-1.1$</td></tr>
<tr><td>0.9</td><td>$0.4f_T-1.2$</td><td>0.9</td><td>-1.0</td></tr>
<tr><td>1.0</td><td>$0.4f_T-1.2$</td><td>1.0</td><td>-1.0</td></tr>
</table>

</td><td></td></tr>
</table>

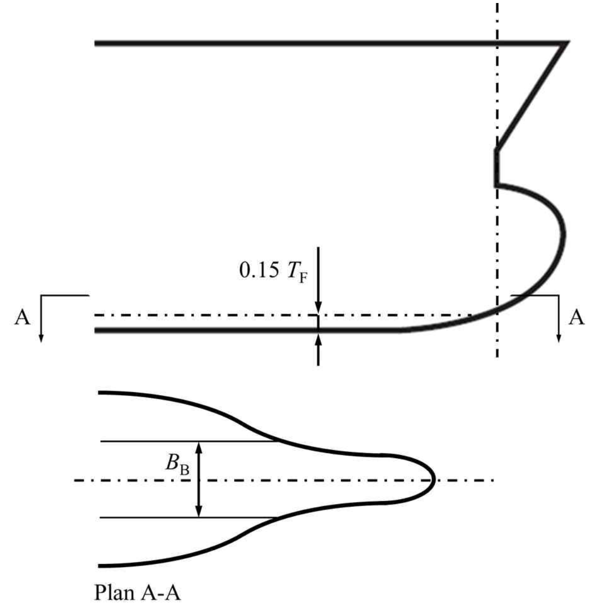
<table>
<tr><th>Present</th><th>Amendment</th><th>Reason</th></tr>
<tr><td>⟨newly added⟩</td><td>

Table 31 : k_{p-CL} values for OSA load case

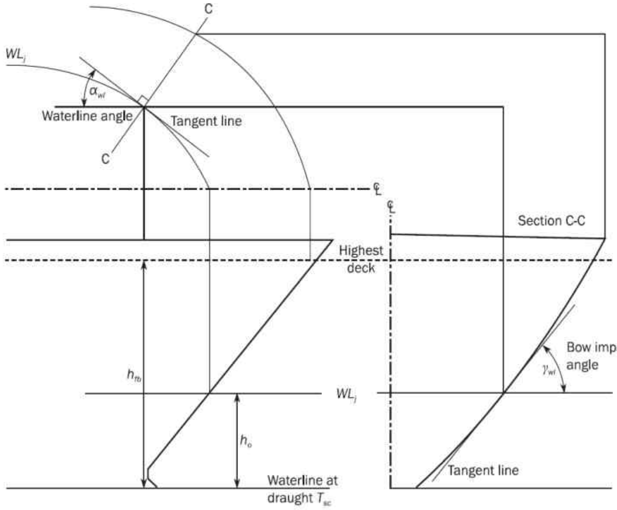
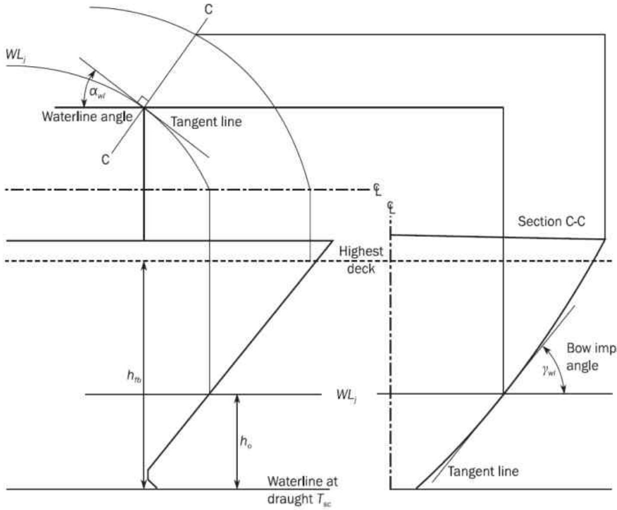
<table>
<tr><td>f_{xL}</td><td>0.0</td><td>0.1</td><td>0.2</td><td>0.3</td><td>0.4</td></tr>
<tr><td>k_{p-CL}</td><td>$0.9-0.4f_T$</td><td>$0.9-0.4f_T$</td><td>$2f_T-1$</td><td>$2f_T-1$</td><td>f_T</td></tr>
<tr><td>f_{xL}</td><td>0.5</td><td>0.6</td><td>0.7</td><td>0.8</td><td>1.0</td></tr>
<tr><td>k_{p-CL}</td><td>$1.2-0.4f_T$</td><td>$2.5-3f_T$</td><td>$-0.6f_T-0.2$</td><td>-1.0</td><td>-1.0</td></tr>
</table>

</td><td></td></tr>
</table>

Present	Amendment	Reason
2. 〈omitted〉 **3. External impact pressures ~~for the bow area~~** **3.1 Application** **3.1.1** The impact pressures for the bow area are only to be applied for strength assessment. **3.2 Bottom slamming pressure** **3.2.1** ~~The bottom slamming pressure P_{SL}, in $\mathrm{kN/m^2}$, for the bottom slamming design load scenario is to be evaluated for the following two cases:~~ ~~Case 1 : An empty ballast tank or a void space in way of the bottom shell.~~ ~~$P_{SL}=10g\sqrt{L}f_{SL}c_{SL-et}$ for $L<170\mathrm{m}$~~ ~~$P_{SL}=130gf_{SL}c_{SL-et}e^{c_1}$ for $L\geq 170\mathrm{m}$~~ ~~Case 2 : A full ballast tank in way of the bottom shell.~~ ~~$P_{SL}=10g\sqrt{L}f_{SL}c_{SL-ft}-1.25\rho g(z_{top}-z)$ for $L<170\mathrm{m}$~~ ~~$P_{SL}=130gf_{SL}c_{SL-ft}e^{c_1}-1.25\rho g(z_{top}-z)$ for $L\geq 170\mathrm{m}$~~ ~~where:~~ ~~c_1 : Coefficient to be taken as:~~ ~~$c_1=0$ for $L\leq 180\mathrm{m}$~~ ~~$c_1=-0.0125(L-180)^{0.705}$ for $L>180\mathrm{m}$~~ ~~c_{SL-et} : Slamming coefficient for case with an empty ballast tank or void space:~~ ~~$c_{SL-et}=5.95-10.5\left(\frac{T_{F-e}}{L}\right)^{0.2}$~~	**2. 〈same as the present〉** **3. External impact pressures** **3.1 Application** **3.1.1** The impact pressures for the bow / stern area are only to be applied for strength assessment. **3.2 Bottom slamming pressure** **3.2.1** The bottom slamming pressure P_{SL}, in $\mathrm{kN/m^2}$, for the bottom slamming design load scenario is to be taken as: $P_{SL}=\frac{c_1c_2}{T_F}B_B\left(0.56-\frac{L}{1250}-\frac{x}{L}\right)$ where: c_1 : Coefficient to be taken as: $c_1=L^{1/3}$ for $L\leq 150$ m $c_1=(225-0.5L)^{1/3}$ for $L>150$ m c_2 : Coefficient to be taken as: $c_2=1675\left(1-\frac{20T_F}{L}\right)$ x : Longitudinal distance in m from FE to cross section considered, but need not to be taken smaller than x_1: $x_1=\left(1.2-C_B^{1/3}-\frac{L}{2500}\right)L$ B_B : Breadth of bottom in m at the height 0.15 T_F above the baseline measured at the cross section considered. B_B shall not be taken greater than the smaller of 1.35 T_F and 0.55 $\sqrt{L}$	

Present	Amendment	Reason
~~c_{SL-ft} : Slamming coefficient for case with a full ballast tank:~~ ~~$c_{SL-ft}=5.95-10.5\left(\frac{T_{F-f}}{L}\right)^{0.2}$~~ ~~$f_{SL}$: Longitudinal slamming distribution factor, to be taken as:~~ ~~$f_{SL}=0$ for $x/L \le 0.5$~~ ~~$f_{SL}=1.0$ for $x/L=0.5+c_2$~~ ~~$f_{SL}=1.0$ for $x/L=0.65+c_2$~~ ~~$f_{SL}=0.5$ for $x/L \ge 1$~~ ~~Intermediate values of f_{SL} are to be obtained by linear interpolation.~~ ~~c_2 : Coefficient to be taken as:~~ ~~$c_2=0.33\,C_B+\frac{L}{2500}$ but not to be taken greater than 0.35.~~ ~~T_{F-e} : Design slamming draught at the FP to be provided by the Designer. T_{F-e} is not to be greater than the minimum draught at the FP indicated in the loading manual for all seagoing conditions where any of the ballast tanks within the bottom slamming region are empty. This includes all loading conditions with tanks inside the bottom slamming region that use the "sequential" ballast water exchange method, if relevent.~~ ~~T_{F-f} : Design slamming draught at the FP to be provided by the Designer. T_{F-f} is not to be greater than the minimum draught at the FP indicated in the loading manual for all seagoing conditions where all ballast tanks within the bottom slamming region are full. This includes all loading conditions with tanks inside the bottom slamming region that use the "flow-through" ballast water exchange method, if relevent.~~ ~~z_{top} : Z coordinate of the highest point of the tank, excluding small hatchways, in m.~~ ~~For strength assessment of double bottom floors and girders, z_{top} is not to be taken greater than the double bottom height.~~	T_F : Design bottom slamming draught, in m, at the FE to be provided by designer.  **Figure 2 : Breadth of bottom at the height 0.15 T_F**	

Present	Amendment	Reason
~~**3.2.2 Loading manual information**~~ ~~The loading guidance information is to clearly state the design slamming draughts and the ballast water exchange method used for each ballast tank, if any.~~ ~~**3.3 Bow impact pressure**~~ ~~**3.3.1 Design pressures**~~ ~~The bow impact pressure P_{FB}, in $\mathrm{kN/m^2}$, to be considered for the bow impact design load scenario is to be taken as:~~ ~~$P_{FB}=1.025 f_{FB} c_{FB} V_{im}^2 \sin\gamma_{wl}$~~ ~~where:~~ ~~$f_{FB}$: Longitudinal bow flare impact pressure distribution factor. To be taken as:~~ ~~$f_{FB}=0.55$ for $x/L \le 0.9$~~ ~~$f_{FB}=4(x/L-0.9)+0.55$ for $0.9 < x/L \le 0.9875$~~ ~~$f_{FB}=8(x/L-0.9875)+0.9$ for $0.9875 < x/L \le 1.0$~~ ~~$f_{FB}=1.0$ for $x/L > 1.0$~~ ~~V_{im} : Impact speed, in knots, to be taken as:~~ ~~$V_{im}=0.514 V_{ref} \sin\alpha_{wl} + \sqrt{L}$~~ ~~$V_{ref}$: Forward speed, in knots, to be taken as:~~ ~~$V_{ref}=0.75V$ but not less than 10.~~ ~~α_{wl} : Local waterline angle, in deg, at the considered position, but not less than 35 deg. See **Figure 2**.~~ ~~γ_{wl} : Local bow impact angle, in deg, measured in a vertical plane containing the normal to the shell, from the horizontal to the tangent line at the considered position but not less than 50 deg, as shown in **Figure 2**. Where this value is not available, it may be taken as:~~ ~~$\gamma_{wl}=\tan^{-1}\left(\frac{\tan\beta_{pl}}{\cos\alpha_{wl}}\right)$~~	**3.3 Bow impact pressure** **3.3.1 Design pressures** The bow impact pressure P_{FB}, in $\mathrm{kN/m^2}$, to be considered for the bow impact design load scenario is to be taken as: $P_{FB}=C\left[2.2+C_f\right]\left(0.4V\sin\beta+0.6\sqrt{L}\right)^2$ where: C : Coefficient, to be taken as: $C=0.18\left(C_w-0.5h_0\right)$ with $0.0 \le C \le 1.0$ C_w : Wave coefficient as defined in **Ch 4, Sec 4** h_0 : Vertical distance, in m, from the waterline at the draught T_{SC} to the calculation point, see **Figure 3**, to be taken as: $h_0=0.0$ for calculation point between T_{BAL} and T_{SC} $h_0=z-T_{SC}$ for calculation point above the draught T_{SC} C_f : Coefficient, to be taken as: $C_f=1.5\tan(\alpha+\gamma)$ but not greater than 10.0 z : Z coordinates, in m, of the calculation point with respect to the reference coordinate system α : Flare angle, in deg, at the calculation point defined as the angle between a vertical line and the tangent to the side plating, measured in a vertical plane normal to the horizontal tangent to the shell plating, see **Figure 3**. β : Angle, in deg, at the calculation point defined as the angle between a longitudinal line and a tangent to the side plating in a horizontal plan, see **Figure 3**.	

Present	Amendment	Reason
~~β_{pl} : Local body plan angle, in deg, at the considered position from the horizontal to the tangent line, but not less than 35 deg.~~ ~~c_{FB} : Coefficient to be taken as:~~ ~~$c_{FB}=1.0$ for positions between draughts T_{BAL} and T_{SC}.~~ ~~$c_{FB}=\sqrt{1.0+\cos^2[90\frac{(h_{fb}-2h_0)}{h_{fb}}]}$ for positions above draughts T_{SC}.~~ ~~h_{fb} : Vertical distance, in m, from the waterline at the draught T_{SC} to the highest deck at side. See **Figure 2.**~~ ~~h_0 : Vertical distance, in m, from the waterline at the draught T_{SC} to the considered position. See **Figure 2.**~~  **Figure 2 : Definition of bow geometry**	γ : Correction angle, in deg, to be taken as: $\gamma=0.4(\theta\cos\beta+\phi\sin\beta)$ θ : Roll angle, in deg, as given in **Ch 4, Sec 3 [2.1.1]** ϕ : pitch angle, in deg, as given in **Ch 4, Sec 3 [2.1.2]**  **Figure 3 : Definition of bow geometry**	

Present	Amendment	Reason
⟨newly added⟩	**3.4 Stern slamming** **3.4.1 Design pressures** The stern slamming pressure P_{SS}, in $\mathrm{kN/m^2}$, to be considered for the stern slamming design load scenario is to be taken as: $P_{SS} = 2.2CL\left(0.6 + \frac{1.65a_{ss}(0.55L - x)\sin^3\alpha}{C_B L}\right)^2$ where: C : Coefficient, to be taken as: $C = 0.18(C_w - 2h_0)$ with $0.0 \le C \le 1.0$ C_w : Wave coefficient as defined in **Ch 4, Sec 4** a_{ss} : Acceleration parameter to be taken as: $a_{ss} = \frac{3C_w}{L} + 0.16$ h_0 : Vertical distance, in m, from the waterline at the draught T_{AE} to the calculation point, to be taken as: $h_0 = z - T_{AE}$ for calculation point above the draught T_{AE} z : Z coordinates, in m, of the calculation point with respect to the reference coordinate system T_{AE} : Minimum draught, in m, at AE x : Longitudinal distance in m from AE to cross section considered, but need not to be taken smaller than 0.05 L α : Flare angle, in deg, at the calculation point defined as the angle between a vertical line and the tangent to the side plating, measured in a vertical plane normal to the horizontal tangent to the shell plating, see **Figure 3**.	

Present	Amendment	Reason
Section 6 Internal loads	**Section 6 Internal loads**	
Symbols	**Symbols**	
For symbols not defined in this section, refer to **Ch 1, Sec 4**	For symbols not defined in this section, refer to **Ch 1, Sec 4**	
a_X, a_Y, a_Z : Longitudinal, transverse and vertical accelerations, in $\mathrm{m/s^2}$, at x_G, y_G, z_G, as defined in **Ch 4, Sec 3, [3.2].**	a_X, a_Y, a_Z : Longitudinal, transverse and vertical accelerations, in $\mathrm{m/s^2}$, at x_G, y_G, z_G, as defined in **Ch 4, Sec 3, [3.2].**	
~~f_{cdl} : Factor for joint probability of occurrence of liquid cargo density and maximum sea state in 25 years design life, to be taken as:~~ ~~a) For strength assessment with FE analysis of cargo tanks filled with liquid cargo:~~ ~~$f_{cdl} = 1.0$ for $\rho_L > 1.025\,\mathrm{t/m^3}$.~~ ~~$f_{cdl} = 0.88$ for $\rho_L = 1.025\,\mathrm{t/m^3}$.~~ ~~b) For other cases:~~ ~~$f_{cdl} = 1.0$.~~		
f_β : Coefficient defined in **Ch 4, Sec 4.**	f_β : Coefficient defined in **Ch 4, Sec 4.**	
h_{air} : Height of air pipe or overflow pipe above the top of the tank, in m.	h_{air} : Height of air pipe or overflow pipe above the top of the tank, in m.	
$h_{\max}$: Maximum permissible filling level, in m, taken as: a) For ballast tanks: maximum tank height	$h_{\max}$: Maximum permissible filling level, in m, maximum tank height for ballast tanks	
P_{drop} : Overpressure, in $\mathrm{kN/m^2}$, due to sustained liquid flow through air pipe or overflow pipe in case of overfilling or filling during flow through ballast water exchange. It is to be defined by the designer, but not to be less than $25\,\mathrm{kN/m^2}$.	P_{drop} : Overpressure, in $\mathrm{kN/m^2}$, due to sustained liquid flow through air pipe or overflow pipe in case of overfilling or filling during flow through ballast water exchange. It is to be defined by the designer, but not to be less than $25\,\mathrm{kN/m^2}$.	
P_{PV} : Design vapour pressure, in $\mathrm{kN/m^2}$, but not less than $25\,\mathrm{kN/m^2}$.	P_{PV} : Design vapour pressure, in $\mathrm{kN/m^2}$, but not less than 25.0 $\mathrm{kN/m^2}$.	
x, y, z : X, Y and Z coordinates, in m, of the load point with respect to the reference coordinate system defined in **Ch 4, Sec 1, [1.2.1].**	x, y, z : X, Y and Z coordinates, in m, of the load point with respect to the reference coordinate system defined in **Ch 4, Sec 1, [1.2.1].**	

Present	Amendment	Reason
x_G, y_G, z_G : X, Y and Z coordinates, in m, of the volumetric centre of gravity of the tank or fully filled cargo hold, i.e. V_{Full}, considered with respect to the reference coordinate system defined in **Ch 4, Sec 1, [1.2].**	x_G, y_G, z_G : X, Y and Z coordinates, in m, of the volumetric centre of gravity of the tank or fully filled cargo hold, i.e. V_{Full}, considered with respect to the reference coordinate system defined in **Ch 4, Sec 1, [1.2].**	
z_{top} : Z coordinate of the highest point of tank, excluding small hatchways, in m.	z_{top} : Z coordinate of the highest point of tank, excluding small hatchways, in m.	
ρ_L : Density of liquid in the tank, in $\mathrm{t/m^3}$, but not less than: ~~a) For strength assessment~~ ~~$\rho_L = 1.025$ for all liquids including oil cargoes. If a tank filled at 98% is intended to carry heavier liquid cargoes than 1.025 (i.e. $\rho_{\max-LM} > 1.025$), then $\rho_L = \rho_{max-LM}$.~~ ~~b) For fatigue assessment~~ ~~$\rho_L = 0.9$ for liquid cargoes.~~ $\rho_L = 1.025$ for all other liquids.	ρ_L : Density of liquid in the tank, in $\mathrm{t/m^3}$, but not less than: $\rho_L = 1.025$	
~~ρ_{max-LM} : Maximum liquid cargo density in $\mathrm{t/m^3}$, associated with a full tank at 98%, from any loading condition in the ship's loading manual or value specified by the designer.~~		
ρ_{slh} : Liquid density, in $\mathrm{t/m^3}$, to be used for sloshing assessment, taken as: $\rho_{slh} = \rho_L$	ρ_{slh} : Liquid density, in $\mathrm{t/m^3}$, to be used for sloshing assessment, taken as: $\rho_{slh} = \rho_L$	
ρ_{ST} : Density of steel, in $\mathrm{t/m^3}$, to be taken as 7.85.	ρ_{ST} : Density of steel, in $\mathrm{t/m^3}$, to be taken as 7.85.	
θ : Roll angle, in $\deg$, defined in **Ch 4, Sec 3, [2.1.1].**	θ : Roll angle, in $\deg$, defined in **Ch 4, Sec 3, [2.1.1].**	

Present	Amendment	Reason
1. Pressure due to liquids **1.1 ~ 1.2 ⟨omitted⟩** **1.3 Dynamic liquid pressure** **1.3.1** The dynamic pressure, P_{ld} due to liquid in tanks, in $\mathrm{kN/m^2}$, is to be taken as: $P_{ld} = f_\beta f_{cd} \rho_L [a_Z(z_0 - z) + f_{ull-l} a_X(x_0 - x) + f_{ull-t} a_Y(y_0 - y)]$ ⟨omitted⟩ **1.4 Static pressure in flooded conditions** **1.4.1 Static pressure in flooded compartments** The static pressure, P_{fs} in $\mathrm{kN/m^2}$, for watertight boundaries of flooded compartments is to be taken as: $P_{fs} = \rho g h_{fs}$ but not less than 0. where: h_{fs} : Pressure height, in m, in flooded condition, to be taken as: $h_{fs} = \max(z_{FD} - z, \lvert y \rvert \sin\theta_{dam} + (z_{dam} - z)\cos\theta_{dam})$ for hull local scantling according to **Ch 6** $h_{fs} = y \sin\theta_{dam} + (z_{dam} - z)\cos\theta_{dam}$ for direct strength analysis according to **Ch 7** ⟨newly added⟩ z_{FD} : Z coordinate, in m, of the freeboard deck at side in way of the transverse section considered. ⟨omitted⟩	**1. Pressure due to liquids** **1.1 ~ 1.2 ⟨same as the present⟩** **1.3 Dynamic liquid pressure** **1.3.1** The dynamic pressure, P_{ld} due to liquid in tanks, in $\mathrm{kN/m^2}$, is to be taken as: $P_{ld} = f_\beta \rho_L [a_Z(z_0 - z) + f_{ull-l} a_X(x_0 - x) + f_{ull-t} a_Y(y_0 - y)]$ ⟨same as the present⟩ **1.4 Static pressure in flooded conditions** **1.4.1 Static pressure in flooded compartments** The static pressure, P_{fs} in $\mathrm{kN/m^2}$, for watertight boundaries of flooded compartments is to be taken as: $P_{fs} = \rho g h_{fs}$ but not less than 0. where: h_{fs} : Pressure height, in m, in flooded condition, to be taken as: $h_{fs} = \max(z_{FD} - z, \lvert y \rvert \sin\theta_{dam} + (z_{dam} - z)\cos\theta_{dam})$ for hull local scantling according to **Ch 6** $h_{fs} = y \sin\theta_{dam} + (z_{dam} - z)\cos\theta_{dam} + 1.0$ for direct strength analysis according to **Ch 7** Alternatively, the worst damage water line corresponding to the damage stability calculation for every individual cargo hold may be used for direct strength assessment. z_{FD} : Z coordinate, in m, of the freeboard deck at side in way of the transverse section considered. ⟨same as the present⟩	

Present	Amendment	Reason
2. Pressures and forces due to container **2.1 Container design load** **2.1.1 ~ 2.1.2 〈omitted〉** **2.1.3 Dynamic force of a container** The dynamic container force components of a container at the container center of gravity, in kN, is to be taken as: $F_{con-d-x-i} = M_{con-i}\, a_X$ $F_{con-d-y-i} = M_{con-i}\, a_Y$ $F_{con-d-z-i} = M_{con-i}\, a_Z$ 〈newly added〉 〈omitted〉	**2. Pressures and forces due to container** **2.1 Container design load** **2.1.1 ~ 2.1.2 〈same as the present〉** **2.1.3 Dynamic force of a container** The dynamic container force components of a container at the container center of gravity, in kN, is to be taken as: $F_{con-d-x-i} = M_{con-i}\, a_X$ $F_{con-d-y-i} = M_{con-i}\, a_Y$ $F_{con-d-z-i} = M_{con-i}\, a_Z$ The reference point of a_X, a_Y and a_Z is to be taken at the center of considered cargo hold. 〈same as the present〉	
3. Sloshing pressure in tanks **3.1 General** **3.1.1 Application** This article applies to all ~~liquid cargo~~, ballast tanks and other tanks with volume exceeding $100\,\mathrm{m}^3$. 〈omitted〉	**3. Sloshing pressure in tanks** **3.1 General** **3.1.1 Application** This article applies to all ballast tanks and other tanks with volume exceeding $100\,\mathrm{m}^3$. The ballast tanks within cargo hold region need not to be considered for the sloshing pressure. 〈same as the present〉	

Present	Amendment	Reason
Section 7 Design load scenarios	**Section 7 Design load scenarios**	
Symbols	Symbols	
For symbols not defined in this section, refer to **Ch 1, Sec 4.**	For symbols not defined in this section, refer to **Ch 1, Sec 4.**	
VBM : Design vertical bending moment, in kNm.	VBM : Design vertical bending moment, in kNm.	
〈omitted〉	〈same as the present〉	
M_{sw-f} : Permissible hull girder hogging or sagging still water bending moment M_{sw-f} for seagoing operation in the flooded condition, in kNm, as defined in **Ch 4, Sec 4, [2.2.4].**	M_{sw-f} : Permissible hull girder hogging or sagging still water bending moment M_{sw-f} for seagoing operation in the flooded condition, in kNm, as defined in **Ch 4, Sec 4, [2.2.4].**	
	M_{sw-t} : Permissible hull girder hogging and sagging still water bending moment for tank testing, in kNm, as defined in **Ch 4, Sec 4, [2.2.5].**	
M_{wv-LC} : Vertical wave bending moment for a considered dynamic load case, in kNm, as defined in **Ch 4, Sec 4, [3.2].**	M_{wv-LC} : Vertical wave bending moment for a considered dynamic load case, in kNm, as defined in **Ch 4, Sec 4, [3.2].**	
〈omitted〉	〈same as the present〉	
Q_{sw-f} : Permissible hull girder positive and negative still water shear force for seagoing operation in the flooded condition, in kN, as defined in **Ch 4, Sec 4, [2.3.3].**	Q_{sw-f} : Permissible hull girder positive and negative still water shear force for seagoing operation in the flooded condition, in kN, as defined in **Ch 4, Sec 4, [2.3.3].**	
	Q_{sw-p} : Permissible hull girder positive and negative still water shear force limits for tank testing, in kN.	
Q_{wv-LC} : Vertical wave shear force for a considered dynamic load case, in kN, as defined in **Ch 4, Sec 4, [3.3].**	Q_{wv-LC} : Vertical wave shear force for a considered dynamic load case, in kN, as defined in **Ch 4, Sec 4, [3.3].**	
〈omitted〉	〈same as the present〉	
P_{SL} : Bottom slamming pressure, in $\mathrm{kN/m^2}$, as defined in **Ch 4, Sec 5, [3.2].**	P_{SL} : Bottom slamming pressure, in $\mathrm{kN/m^2}$, as defined in **Ch 4, Sec 5, [3.2].**	
P_{FB} : Bow impact pressure, in $\mathrm{kN/m^2}$, as defined in **Ch 4, Sec 5, [3.3].**	P_{FB} : Bow impact pressure, in $\mathrm{kN/m^2}$, as defined in **Ch 4, Sec 5, [3.3].**	
	P_{SS} : Stern slamming pressure, in $\mathrm{kN/m^2}$, as defined in **Ch 4, Sec 5, [3.4].**	
P_{slh} : Sloshing pressure, in $\mathrm{kN/m^2}$, as defined in **Ch 4, Sec 6, [3].**	P_{slh} : Sloshing pressure, in $\mathrm{kN/m^2}$, as defined in **Ch 4, Sec 6, [3].**	

Present

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 : Principal design load scenarios for strength assessment

Design load scenario			Harbour and sheltered water	Seagoing conditions with extreme sea loads	Ballast water exchange(2)	Accidental flooded conditions[2]	Tank testing[2]
Load components			Static (S)	Static + Dynamic (S+D)	Static + Dynamic (S+D)	Accidental (A)	<u>Accidental (A)</u>
Hull Girder	VBM		M_{sw-p}	$M_{sw}+M_{wv-LC}$	$M_{sw}+M_{wv-LC}$	M_{sw-f} [1]	$\underline{M_{sw-p}}$
	HBM		–	M_{wh-LC}	M_{wh-LC}	–	–
	VSF		Q_{sw-p}	$Q_{sw}+Q_{wv-LC}$	$Q_{sw}+Q_{wv-LC}$	–	$\underline{Q_{sw-p}}$
	TM		–	$M_{st}+M_{wt-LC}$	$M_{st}+M_{wt-LC}$	–	–
Local Loads	P_{ex}	External deck for green sea	–	P_D	–	–	–
		Hull envelope	P_s	P_s+P_w	P_s+P_w	–	P_s
	P_{in}	Ballast tanks	P_{ls}	$P_{ls}+P_{ld}$	$P_{ls}+P_{ld}$	–	$\underline{\max(P_{ls}, P_{ST})}$
		Other tanks			–	–	
		Watertight boundaries	–	–	–	P_{fs}	–
	F_{con}	Container	F_{con-s}	$F_{con-s}+F_{con-d}$	–	–	–
	P_{dk}	Internal decks for dry spaces	P_{dl-s}	$P_{dl-s}+P_{dl-d}$	–	–	$\underline{P_{dl-s}}$
		External deck for distributed loads	P_{dl-s}	$P_{dl-s}+P_{dl-d}$	–	–	$\underline{P_{dl-s}}$
		External deck for heavy units	F_{U-s}	$F_{U-s}+F_{U-d}$	–	–	$\underline{F_{U-s}}$

(1) M_{sw-f} used for hull local scantling of watertight bulkhead.
(2) Applicable to prescriptive assessment only.

Amendment

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 : Principal design load scenarios for strength assessment

Design load scenario			Harbour and sheltered water	Seagoing conditions with extreme sea loads	Ballast water exchange(2)	Accidental flooded conditions[2]	Tank testing[2]
Load components			Static (S)	Static + Dynamic (S+D)	Static + Dynamic (S+D)	Accidental (A)	<u>Test (T)</u>
Hull Girder	VBM		M_{sw-p}	$M_{sw}+M_{wv-LC}$	$M_{sw}+M_{wv-LC}$	M_{sw-f} **(1)**	$\underline{M_{sw-t}}$
	HBM		–	M_{wh-LC}	M_{wh-LC}	–	–
	VSF		Q_{sw-p}	$Q_{sw}+Q_{wv-LC}$	$Q_{sw}+Q_{wv-LC}$	–	$\underline{Q_{sw-t}}$
	TM		–	$M_{st}+M_{wt-LC}$	$M_{st}+M_{wt-LC}$	–	–
Local Loads	P_{ex}	External deck for green sea	–	P_D	–	–	–
		Hull envelope	P_s	P_s+P_w	P_s+P_w	–	P_s
	P_{in}	Ballast tanks	P_{ls}	$P_{ls}+P_{ld}$	$P_{ls}+P_{ld}$	–	$\underline{P_{ST}}$
		Other tanks			–	–	
		Watertight boundaries	–	–	–	P_{fs}	–
	F_{con}	Container	F_{con-s}	$F_{con-s}+F_{con-d}$	–	–	–
	P_{dk}	Internal decks for dry spaces	P_{dl-s}	$P_{dl-s}+P_{dl-d}$	–	–	<u>–</u>
		External deck for distributed loads	P_{dl-s}	$P_{dl-s}+P_{dl-d}$	–	–	<u>–</u>
		External deck for heavy units	F_{U-s}	$F_{U-s}+F_{U-d}$	–	–	<u>–</u>

(1) M_{sw-f} used for hull local scantling of watertight bulkhead.
(2) Applicable to prescriptive assessment only.

Reason

Present

2.2 Additional design load scenarios

2.2.1

The design load scenarios to be considered for sloshing, bottom slamming and bow impact are given in **Table 2.**

Table 2 : Design load scenarios for impact and sloshing conditions

Design load scenario			Bow impact	Bottom slamming	Sloshing
Load components			Impact (I)	Impact (I)	Sloshing (SL)
Hull Girder	VBM		–	–	M_{sw}
	HBM		–	–	–
	VSF		–	–	–
	TM		–	–	–
Local Loads	P_{ex}	External deck for green sea	–	–	–
		Hull envelope	P_{FB}	P_{SL}	–
	P_{in}	Ballast tanks	–	–	P_{slh}
		Other tanks			
		Watertight boundaries		–	–
	F_{con}	Container	–	–	–
	P_{dk}	Internal decks for dry spaces	–	–	–
		External deck for distributed loads	–	–	–
		External deck for heavy units	–	–	–

Amendment

2.2 Additional design load scenarios

2.2.1

The design load scenarios to be considered for sloshing, bottom slamming and bow impact are given in **Table 2.**

Table 2 : Design load scenarios for impact and sloshing conditions

Design load scenario			Bow impact	Bottom slamming	Stern slamming	Sloshing
Load components			Impact (I)	Impact (I)	Impact (I)	Sloshing (SL)
Hull Girder	VBM		–	–	–	M_{sw}
	HBM		–	–	–	–
	VSF		–	–	–	–
	TM		–	–	–	–
Local Loads	P_{ex}	External deck for green sea	–	–	–	–
		Hull envelope	P_{FB}	P_{SL}	P_{SS}	–
	P_{in}	Ballast tanks	–	–	–	P_{slh}
		Other tanks				
		Watertight boundaries		–	–	–
	F_{con}	Container	–	–	–	–
	P_{dk}	Internal decks for dry spaces	–	–	–	–
		External deck for distributed loads	–	–	–	–
		External deck for heavy units	–	–	–	–

Reason

Present	Amendment	Reason
Section 8 Loading Conditions **1. ⟨omitted⟩** **2. Design loading conditions** **2.1 ~ 2.3 ⟨omitted⟩** **2.4 Loading conditions** **2.4.1 Alternative design** For structural arrangement not covered by this section, the loading conditions, including loading pattern, corresponding draught, still water bending moment and shear forces are to be agreed by the Society. **2.4.2 Standard loading conditions for cargo holds strength check** The loading conditions to be considered for cargo hold strength check are given in **Table 1.** **2.4.3 Standard loading conditions for fuel oil tanks strength check** The loading conditions to be considered for fuel oil tank strength check are given in **Table 2.** **2.4.4 Standard loading conditions for cargo holds fatigue check** The loading conditions to be considered for cargo hold fatigue check are given in **Table 3.**.	**Section 8 Loading Conditions** **1. ⟨same as the present⟩** **2. Design loading conditions** **2.1 ~ 2.3 ⟨same as the present⟩** **2.4 Loading conditions** **2.4.1 Alternative design** For structural arrangement not covered by this section, the loading conditions, including loading pattern, corresponding draught, still water bending moment and shear forces are to be agreed by the Society. **2.4.2 Standard loading conditions for cargo holds strength check** The loading conditions to be considered for cargo hold strength check are given in **Table 1.** **2.4.3 Standard loading conditions for fuel oil tanks strength check** The loading conditions to be considered for fuel oil tank strength check are given in **Table 2.** **2.4.4 Standard loading conditions for cargo holds fatigue check** The loading conditions to be considered for cargo hold fatigue check are given in **Table 3.**.	

Present

Table 1 : Standard loading conditions for cargo holds strength check to cargo hold region

No	Loading Pattern	Still water loads					Dynamic load cases
		Draught	Container load		% of perm. SWBM	% of perm. SWSF	Midship cargo region
			In hold	On deck			
Seagoing conditions							
B1[3]	〈omitted〉						
F1[3]	〈omitted〉	T_{SC}	~~30.5 t/FEU not exceeding~~ max 40 ft stack weight all tanks empty	max 40 ft stack weight	100% (hog.)	≤100%	〈omitted〉
F2[3]	〈omitted〉						
F3[3]	〈omitted〉	0.9 T_{SC}	~~24 t/TEU not exceeding~~ max 20 ft stack weight all tanks empty	max 20 ft stack weight, if mixed stowage is applicable, max 20 ft + 40 ft stack weight	100% (sag. or min. hog.)	≤100%	〈omitted〉
F4[3]	〈omitted〉						
F5	〈omitted〉	T_{SC}	~~30.5 t/FEU not exceeding~~ max 40 ft stack weight all tanks empty	max 40 ft stack weight	100% (hog.)	≤100%	〈omitted〉
F6	〈omitted〉	T_{SC}	~~30.5 t/FEU not exceeding~~ max 40 ft stack weight all tanks empty	max 40 ft stack weight	100% (hog.)	≤100%	〈omitted〉
F7[3]	〈omitted〉	T_{SC}	~~30.5 t/FEU not exceeding~~ max 40 ft stack weight all fuel oil tanks full all ballast tanks full	max 20 ft stack weight, if mixed stowage is applicable, max 20 ft + 40 ft stack weight	100% (sag. or min. hog.)	≤100%	〈omitted〉
Flooded conditions							
A1[4]	〈omitted〉						
〈omitted〉							

Amendment

Table 1 : Standard loading conditions for cargo holds strength check to cargo hold region

No	Loading Pattern	Still water loads					Dynamic load cases
		Draught	Container load		% of perm. SWBM	% of perm. SWSF	Midship cargo region
			In hold	On deck			
Seagoing conditions							
B1[3]	〈same as the present〉						
F1[3]	〈same as the present〉	T_{SC}	Max 40 ft stack weight all tanks empty	max 40 ft stack weight	100% (hog.)	≤100%	〈same as the present〉
F2[3]	〈omitted〉						
F3[3]	〈same as the present〉	0.9 T_{SC}	Max 20 ft stack weight all tanks empty	max 20 ft stack weight, if mixed stowage is applicable, max 20 ft + 40 ft stack weight	100% (sag. or min. hog.)	≤100%	〈same as the present〉
F4[3]	〈same as the present〉						
F5	〈same as the present〉	T_{SC}	Max 40 ft stack weight all tanks empty	max 40 ft stack weight	100% (hog.)	≤100%	〈same as the present〉
F6	〈same as the present〉	T_{SC}	Max 40 ft stack weight all tanks empty	max 40 ft stack weight	100% (hog.)	≤100%	〈same as the present〉
F7[3]	〈same as the present〉	T_{SC}	Max 40 ft stack weight all fuel oil tanks full all ballast tanks full	max 20 ft stack weight, if mixed stowage is applicable, max 20 ft + 40 ft stack weight	100% (sag. or min. hog.)	≤100%	〈same as the present〉
Flooded conditions							
A1[4]	〈same as the present〉						
〈same as the present〉							

Reason

Present

Table 2 : Standard loading conditions for fuel oil tanks strength check in cargo hold region

No	Loading Pattern	Still water loads					Dynamic load cases
		Draught	Container load		% of perm. SWBM	% of perm. SWSF	Midship cargo region
			In hold	On deck			
Seagoing conditions							
OF1	〈omitted〉	T_{sc}	~~30.5 t/FEU not exceeding~~ max 40 ft stack weight all ballast tanks empty all fuel oil tanks full	max 40 ft stack weight	100% (sag. or min. hog.)	≤100%	〈omitted〉
OF2	〈omitted〉	T_{sc}	~~30.5 t/FEU not exceeding~~ max 40 ft stack weight all ballast tanks empty relevant fuel oil tanks are full and empty	max 40 ft stack weight	100% (sag. or min. hog.)	≤100%	〈omitted〉
OF3	〈omitted〉	T_{sc}	~~30.5 t/FEU not exceeding~~ max 40 ft stack weight all ballast tanks empty relevant fuel oil tanks are full and empty	max 40 ft stack weight	100% (sag. or min. hog.)	≤100%	〈omitted〉
OF4	〈omitted〉						
OF5	〈omitted〉	0.9 T_{sc}	max 20 ft stack weight,~~ if unavailable 24t/TEU~~ all ballast tanks empty all fuel oil tanks empty	max 20 ft stack weight, if mixed stowage is applicable, max 20 ft + 40 ft stack weight	100% (sag. or min. hog.)	≤100%	〈omitted〉
Ballast conditions							
〈omitted〉							

Amendment

Table 2 : Standard loading conditions for fuel oil tanks strength check in cargo hold region

No	Loading Pattern	Still water loads					Dynamic load cases
		Draught	Container load		% of perm. SWBM	% of perm. SWSF	Midship cargo region
			In hold	On deck			
Seagoing conditions							
OF1	〈same as the present〉	T_{sc}	Max 40 ft stack weight all ballast tanks empty all fuel oil tanks full	max 40 ft stack weight	100% (sag. or min. hog.)	≤100%	〈same as the present〉
OF2	〈same as the present〉	T_{sc}	Max 40 ft stack weight all ballast tanks empty relevant fuel oil tanks are full and empty	max 40 ft stack weight	100% (sag. or min. hog.)	≤100%	〈same as the present〉
OF3	〈same as the present〉	T_{sc}	Max 40 ft stack weight all ballast tanks empty relevant fuel oil tanks are full and empty	max 40 ft stack weight	100% (sag. or min. hog.)	≤100%	〈same as the present〉
OF4	〈same as the present〉						
OF5	〈same as the present〉	0.9 T_{sc}	max 20 ft stack weight, all ballast tanks empty all fuel oil tanks empty	max 20 ft stack weight, if mixed stowage is applicable, max 20 ft + 40 ft stack weight	100% (sag. or min. hog.)	≤100%	〈same as the present〉
Ballast conditions							
〈same as the present〉							

Reason

Present	Amendment	Reason
Chapter 6 Hull Local Scantling	**Chapter 6 Hull Local Scantling**	
Section 1 General	**Section 1 General**	
1. Application	**1. Application**	
1.1 Application	**1.1 Application**	
1.1.1 ~ 1.1.3 ⟨omitted⟩	**1.1.1 ~ 1.1.3 ⟨same as the present⟩**	
1.1.4	**1.1.4**	
Additional local strength requirements are provided in **Ch 10** considering bow impact loads, bottom slamming loads and sloshing loads, and for fore end, machinery space and aft end.	Additional local strength requirements are provided in **Ch 10** considering bow impact loads, bottom slamming loads, stern slamming loads and sloshing loads, and for fore end, machinery space and aft end.	
1.2 Acceptance criteria	**1.2 Acceptance criteria**	
1.2.1	**1.2.1**	
Acceptance criteria set to be selected based on design load as follows:	Acceptance criteria set to be selected based on design load as follows:	
a) AC-S for design load S; static loads	a) AC-S for design load S; static loads	
b) AC-SD for design load S+D; combination of static and dynamic loads	b) AC-SD for design load S+D; combination of static and dynamic loads	
c) AC-A for design load A; accidental loads	c) AC-A for design load A; accidental loads	
⟨newly added⟩	d) AC-T for design load T : tank testing loads	

Present

Section 2 Load Application

1. 〈omitted〉

2. Design load sets

2.1 Application of load components

〈omitted〉

Table 1 : Design load sets

Structural member	Design load set	Load component	Draught	Design load	Loading condition
External shell and Exposed deck	〈omitted〉				
	〈omitted〉				
Water ballast tank	WB-1	$P_{in} - P_{ex}$(1)	T_{BAL}	S+D	Normal ballast condition
	WB-2	$P_{in} - P_{ex}$(1)	T_{BAL}	S+D	Normal ballast condition Water ballast exchange
	WB-3	$P_{in} - P_{ex}$(1)	$0.25\,T_{SC}$	S	Harbour condition
	WB-4	$P_{in} - P_{ex}$(1)	$0.25\,T_{SC}$	A	Test condition
Tanks other than water ballast tank	TK-1	$P_{in} - P_{ex}$(1)	T_{BAL}	S+D	Normal ballast condition
	TK-2	$P_{in} - P_{ex}$(1)	$0.25\,T_{SC}$	S	Harbour condition
	TK-3	$P_{in} - P_{ex}$(1)	$0.25\,T_{SC}$	A	Test condition
Watertight boundaries	〈omitted〉				
Dry space and hatch coaming	〈omitted〉				

Notes:

(1) P_{ex} is to be considered for external shell only.

(2) FD-1 is not applicable to external shell.

〈omitted〉

Amendment

Section 2 Load Application

1. 〈same as the present〉

2. Design load sets

2.1 Application of load components

〈same as the present〉

Table 1 : Design load sets

Structural member	Design load set	Load component	Draught	Design load	Loading condition
External shell and Exposed deck	〈same as the present〉				
	〈same as the present〉				
Water ballast tank	WB-1	$P_{in} - P_{ex}$(1)	T_{BAL}	S+D	Normal ballast condition
	WB-2	$P_{in} - P_{ex}$(1)	T_{BAL}	S+D	Normal ballast condition Water ballast exchange
	WB-3	$P_{in} - P_{ex}$(1)	$0.25\,T_{SC}$	S	Harbour condition
	WB-4	$P_{in} - P_{ex}$(1)	$0.25\,T_{SC}$	T	Test condition
Tanks other than water ballast tank	TK-1	$P_{in} - P_{ex}$(1)	T_{BAL}	S+D	Normal ballast condition
	TK-2	$P_{in} - P_{ex}$(1)	$0.25\,T_{SC}$	S	Harbour condition
	TK-3	$P_{in} - P_{ex}$(1)	$0.25\,T_{SC}$	T	Test condition
Watertight boundaries	〈same as the present〉				
Dry space and hatch coaming	〈same as the present〉				

Notes:

(1) P_{ex} is to be considered for external shell only.

(2) FD-1 is not applicable to external shell.

〈same as the present〉

Reason

Present	Amendment	Reason

Present

Section 3 Minimum Thickness

1. Plating

1.1 Minimum thickness requirements

1.1.1

The net thickness of plating in mm, is to comply with the appropriate minimum thickness requirements given in **Table 1.**

Table 1 : Minimum net thickness for plating

Element	Location	Area	Net thickness
Shell	Keel	–	$7.5+0.03L_2\sqrt{k}$
	Bottom Side shell Bilge	Fore Part	$5.5+0.03L_2\sqrt{k}$
		Machinery space, Aft part	$7.0+0.02L_2\sqrt{k}$
		Elsewhere	$4.5+0.03L_2\sqrt{k}$
Breast hook	–	Fore part	6.5
Deck	〈omitted〉		
Inner bottom(1)	〈omitted〉		
Bulkheads	〈omitted〉		
Other members	〈omitted〉		
(1) Applicable for both tight and non tight members			

〈omitted〉

Amendment

Section 3 Minimum Thickness

1. Plating

1.1 Minimum thickness requirements

1.1.1

The net thickness of plating in mm, is to comply with the appropriate minimum thickness requirements given in **Table 1.**

Table 1 : Minimum net thickness for plating

Element	Location	Area	Net thickness
Shell	Keel	–	$7.5+0.03L_2\sqrt{k}$
	Bottom Side shell Bilge	Fore Part	$5.5+0.03L_2\sqrt{k}$
		Machinery space, Aft part	$7.0+0.02L_2\sqrt{k}$
		Elsewhere	$4.0+0.035L_2\sqrt{k}$
Breast hook	–	Fore part	6.5
Deck	〈same as the present〉		
Inner bottom(1)	〈same as the present〉		
Bulkheads	〈same as the present〉		
Other members	〈same as the present〉		
(1) Applicable for both tight and non tight members			

〈same as the present〉

Reason

Present

Section 4 Plating

1. Plating subjected to lateral pressure

1.1 Yielding check

1.1.1 Plating

〈omitted〉

Table 1 : Definition β, α and C_{a-max}

Acceptance criteria set	Structural member		β	α	C_{a-max}
AC-S	Longitudinal strength members	Longitudinally stiffened plating	0.9	0.5	0.8
		Transversely stiffened plating	0.9	1.0	0.8
	Other members		0.8	0	0.8
AC-SD	Longitudinal strength members	Longitudinally stiffened plating	1.05	0.5	0.95
		Transversely stiffened plating	1.05	1.0	0.95
	Other members		1.0	0	1.0
AC-A	Longitudinal strength members	Longitudinally stiffened plating	1.10	0.5	1.0
		Transversely stiffened plating	1.10	1.0	1.0
	Other members		1.0	0	1.0

〈omitted〉

Amendment

Section 4 Plating

1. Plating subjected to lateral pressure

1.1 Yielding check

1.1.1 Plating

〈same as the present〉

Table 1 : Definition β, α and C_{a-max}

Acceptance criteria set	Structural member		β	α	C_{a-max}
AC-S	Longitudinal strength members	Longitudinally stiffened plating	0.9	0.5	0.8
		Transversely stiffened plating	0.9	1.0	0.8
	Other members		0.8	0	0.8
AC-SD	Longitudinal strength members	Longitudinally stiffened plating	1.05	0.5	0.95
		Transversely stiffened plating	1.05	1.0	0.95
	Other members		1.0	0	1.0
AC-A	Longitudinal strength members	Longitudinally stiffened plating	1.10	0.5	1.0
		Transversely stiffened plating	1.10	1.0	1.0
	Other members		1.0	0	1.0
AC-T	Longitudinal strength members	Longitudinally stiffened plating	1.25	0.5	1.15
		Transversely stiffened plating	1.15	1.0	1.15
	Other members		1.15	0.0	1.15

〈same as the present〉

Reason

Present	Amendment	Reason
Section 5 Stiffeners **1. Stiffeners subject to lateral pressure** **1.1 Yielding check** **1.1.1 Web plating** The minimum net web thickness, t_w in mm, is not to be taken less than the greatest value calculated for all applicable design load sets as defined in **Ch 6, Sec 2, [2]**, given by: $t_w = \frac{f_{shr}\lvert P\rvert s \ell_{shr}}{d_{shr}\chi C_t \tau_{eH}}$ with χC_t not to be taken greater than 1.0. where: f_{shr} : Shear force distribution factor taken as: a) For continuous stiffeners with fixed ends, f_{shr} is not to be taken less than: • $f_{shr} = 0.5$ for horizontal stiffeners and upper end of vertical stiffeners. • $f_{shr} = 0.7$ for lower end of vertical stiffeners b) For stiffeners with reduced end fixity, variable load or being part of grillage, the requirement in **[1.2]** applies. C_t : Permissible shear stress coefficient for the design load set being considered, taken as: a) $C_t = 0.75$ for acceptance criteria set AC-S. b) $C_t = 0.90$ for acceptance criteria set AC-SD. c) $C_t = 1.00$ for acceptance criteria set AC-A. d) ⟨newly added⟩	**Section 5 Stiffeners** **1. Stiffeners subject to lateral pressure** **1.1 Yielding check** **1.1.1 Web plating** The minimum net web thickness, t_w in mm, is not to be taken less than the greatest value calculated for all applicable design load sets as defined in **Ch 6, Sec 2, [2]**, given by: $t_w = \frac{f_{shr}\lvert P\rvert s \ell_{shr}}{d_{shr}\chi C_t \tau_{eH}}$ with χC_t not to be taken greater than 1.0. where: f_{shr} : Shear force distribution factor taken as: a) For continuous stiffeners with fixed ends, f_{shr} is not to be taken less than: • $f_{shr} = 0.5$ for horizontal stiffeners and upper end of vertical stiffeners. • $f_{shr} = 0.7$ for lower end of vertical stiffeners b) For stiffeners with reduced end fixity, variable load or being part of grillage, the requirement in **[1.2]** applies. C_t : Permissible shear stress coefficient for the design load set being considered, taken as: a) $C_t = 0.75$ for acceptance criteria set AC-S. b) $C_t = 0.90$ for acceptance criteria set AC-SD. c) $C_t = 1.00$ for acceptance criteria set AC-A. d) $C_t = 0.95$ for acceptance criteria set AC-T.	

Present

1.1.2 Section modulus

The minimum net section modulus, Z in cm^3, is not to be taken less than the greatest value calculated for all applicable design load sets as defined in **Ch 6, Sec 2, [2.1.3],** given by:

$$Z = \frac{|P|\, s\, \ell_{bdg}^2}{f_{bdg}\, \chi\, C_s\, R_{eH}}$$ with $\chi\, C_s$ not to be taken greater than 1.0

〈omitted〉

β_s : Coefficient as defined in **Table 2.**

α_s : Coefficient as defined in **Table 2.**

$C_{s-\max}$: Coefficient as defined in **Table 2.**

〈omitted〉

Table 2 : Definition of β_s, α_s and $C_{s-\max}$

Acceptance criteria set	Structural member	β_s	α_s	$C_{s-\max}$
AC-S	Longitudinal strength member	0.85	1.0	0.75
	Transverse or vertical member	0.75	0	0.75
AC-SD	Longitudinal strength member	1.0	1.0	0.9
	Transverse or vertical member	0.9	0	0.9
AC-A	Longitudinal strength member	1.1	1.0	1.0
	Transverse or vertical member	1.0	0	1.0

〈omitted〉

Amendment

1.1.2 Section modulus

The minimum net section modulus, Z in cm^3, is not to be taken less than the greatest value calculated for all applicable design load sets as defined in **Ch 6, Sec 2, [2.1.3],** given by:

$$Z = \frac{|P|\, s\, \ell_{bdg}^2}{f_{bdg}\, \chi\, C_s\, R_{eH}}$$ with $\chi\, C_s$ not to be taken greater than 1.0

〈same as the present〉

β_s : Coefficient as defined in **Table 2.**

α_s : Coefficient as defined in **Table 2.**

$C_{s-\max}$: Coefficient as defined in **Table 2.**

〈same as the present〉

Table 2 : Definition of β_s, α_s and $C_{s-\max}$

Acceptance criteria set	Structural member	β_s	α_s	$C_{s-\max}$
AC-S	Longitudinal strength member	0.85	1.0	0.75
	Transverse or vertical member	0.75	0.0	0.75
AC-SD	Longitudinal strength member	1.00	1.0	0.90
	Transverse or vertical member	0.90	0.0	0.90
AC-A	Longitudinal strength member	1.10	1.0	1.00
	Transverse or vertical member	1.00	0.0	1.00
AC-T	Longitudinal strength member	1.20	1.0	1.00
	Transverse or vertical member	1.00	0.0	1.00

〈same as the present〉

Reason

Present	Amendment	Reason
Chapter 7 Direct Strength Analysis	**Chapter 7 Direct Strength Analysis**	
Section 1 Strength Assessment	**Section 1 Strength Assessment**	
1. General	**1. General**	
1.1 Application	**1.1 Application**	
1.1.1 ~ 1.1.4 〈omitted〉	**1.1.1 ~ 1.1.4 〈same as the present〉**	
1.1.5	**1.1.5**	
〈mewly added〉	Global Analysis is to be carried out for ships of length 290 m or above in accordance with the requirements in Pt 3, Annex 3-2. Cargo Hold Analysis is to be carried out for ships of length 150 m or above in accordance with the requirements in this chapter.	
A flow diagram showing the minimum requirement of finite element analysis is shown in **Figure 1.**	A flow diagram showing the minimum requirement of finite element analysis is shown in **Figure 1.**	
1.1.6 〈omitted〉	**1.1.6 〈same as the present〉**	
2. Net scantling	**2. Corrosion addition**	
2.1 Net scantling application	**2.1 General**	
2.1.1	**2.1.1**	
FE models for cargo hold FE analyses, local fine mesh FE analysis and very fine mesh FE analyses, are to be based on the net scantling approach, applying a corrosion addition as defined in **Ch 3, Sec 2, Table 1.**	FE models for cargo hold FE analyses, local fine mesh FE analysis and very fine mesh FE analyses, are to be based on the net scantling approach, applying a corrosion addition as defined in **Ch 3, Sec 2, Table 1.**	
All buckling capacity assessment are to be based on corrosion addition, as defined in **Ch 3, Sec 2, Table 1.**	All buckling capacity assessment are to be based on corrosion addition, as defined in **Ch 3, Sec 2, Table 1.**	
〈omitted〉	〈same as the present〉	

Present	Amendment	Reason
Section 2 Cargo Hold Structural Strength Analysis **1. ~ 4. 〈omitted〉** **5. Analysis criteria** **5.1 〈omitted〉** **5.2 Yield strength assessment** **5.2.1 ~ 5.2.4 〈omitted〉** **5.2.5 Shear stress correction for cut-out** Except as indicated in **[5.2.6]**, the element shear stress in way of cut-outs in webs is to be corrected for loss in shear area in accordance with the following formula. The corrected element shear stress is to be used to calculate the von Mises stress of the element for verification against the yield criteria. $\tau_{cor} = \frac{h\,t_{\mathrm{mod}-n50}}{A_{shr-n50}}\tau_{elem}$ where: τ_{cor} : Corrected element shear stress, in N/mm^2. h : Height of web of girder, in mm, in way of opening, see **Table 1**. Where the geometry of the opening is modelled, h is to be taken as the height of web of the girder deducting the height of the modelled opening. $t_{\mathrm{mod}-n50}$: Modelled web thickness, in mm, in way of opening. $A_{shr-n50}$: Effective net shear area of web, in mm^2, taken as the web area deducting the area lost of all openings, including slots for stiffeners, calculated in accordance with **Ch 3, Sec 7, [1.4.8]**. τ_{elem} : Element shear stress, in N/mm^2, before correction.	**Section 2 Cargo Hold Structural Strength Analysis** **1. ~ 4. 〈same as the present〉** **5. Analysis criteria** **5.1 〈same as the present〉** **5.2 Yield strength assessment** **5.2.1 ~ 5.2.4 〈same as the present〉** **5.2.5 Shear stress correction for cut-out** Except as indicated in **[5.2.6]**, the element shear stress in way of cut-outs in webs is to be corrected for loss in shear area in accordance with the following formula. The corrected element shear stress is to be used to calculate the von Mises stress of the element for verification against the yield criteria. $\tau_{cor} = \frac{h\,t_{\mathrm{mod}}}{A_{shr}}\tau_{elem}$ where: τ_{cor} : Corrected element shear stress, in N/mm^2. h : Height of web of girder, in mm, in way of opening, see **Table 1**. Where the geometry of the opening is modelled, h is to be taken as the height of web of the girder deducting the height of the modelled opening. t_{mod} : Modelled web thickness, in mm, in way of opening. A_{shr} : Effective shear area of web, in mm^2, taken as the web area deducting the area lost of all openings, including slots for stiffeners, calculated in accordance with **Ch 3, Sec 7, [1.4.8]**. τ_{elem} : Element shear stress, in N/mm^2, before correction.	

Present

5.2.6 Exceptions for shear stress correction for openings

Correction of element shear stress due to presence of cut-outs is not required for cases given in **Table 9** provided λ_y / C_r complies with the criteria given in **[5.2.4]**.

Table 9 : Exceptions for shear stress correction

Identification	Figure	Difference between modelled shear area and the net effective shear area in % of the modelled shear area $\frac{A_{FEM-n50} - A_{shr-n50}}{A_{FEM-n50}} \cdot 100\%$	Reduction factor for yield criteria, C_r
Upper and lower slots for local support stiffeners fitted with lugs or collar plates	〈omitted〉	〈 15%	0.85
Upper or lower slots for local support stiffeners fitted with lugs or collar plates	〈omitted〉	〈 20%	0.80
In way of opening; upper and lower slots for local support stiffeners fitted with collar plates	〈omitted〉	〈 40%	0.60

$A_{shr-n50}$: Effective net shear area of web, in mm^2, taken as the web area deducting the area lost of all openings, including slots for stiffeners, calculated in accordance with Ch 3, Sec 7, [1.4.8].

〈omitted〉

Amendment

5.2.6 Exceptions for shear stress correction for openings

Correction of element shear stress due to presence of cut-outs is not required for cases given in **Table 9** provided λ_y / C_r complies with the criteria given in **[5.2.4]**.

Table 9 : Exceptions for shear stress correction

Identification	Figure	Difference between modelled shear area and the effective shear area in % of the modelled shear area $\frac{A_{FEM} - A_{shr}}{A_{FEM}} \cdot 100\%$	Reduction factor for yield criteria, C_r
Upper and lower slots for local support stiffeners fitted with lugs or collar plates	〈same as the present〉	〈 15%	0.85
Upper or lower slots for local support stiffeners fitted with lugs or collar plates	〈same as the present〉	〈 20%	0.80
In way of opening; upper and lower slots for local support stiffeners fitted with collar plates	〈same as the present〉	〈 40%	0.60

A_{shr} : Effective shear area of web, in mm^2, taken as the web area deducting the area lost of all openings, including slots for stiffeners, calculated in accordance with Ch 3, Sec 7, [1.4.8].

〈same as the present〉

Reason

Present	Amendment	Reason
Section 3 Local Structural Strength Analysis	**Section 3 Local Structural Strength Analysis**	
4. Analysis criteria	**4. Analysis criteria**	
4.2 Stress assessment	**4.2 Stress assessment**	
4.2.1	**4.2.1**	
Verification of stress results against the acceptance criteria is to be carried out in accordance with **[4.1].** The structural assessment is to demonstrate that the stress complies with the following criteria:	Verification of stress results against the acceptance criteria is to be carried out in accordance with **[4.1].** The structural assessment is to demonstrate that the stress complies with the following criteria:	
$\lambda_f \le \lambda_{fperm}$	$\lambda_f \le \lambda_{fperm}$	
where:	where:	
λ_f : 〈omitted〉	λ_f : 〈same as the present〉	
σ_{vm} : 〈omitted〉	σ_{vm} : 〈same as the present〉	
σ_{axial} : 〈omitted〉	σ_{axial} : 〈same as the present〉	
λ_{fperm} : 〈omitted〉	λ_{fperm} : 〈same as the present〉	
f_f : Fatigue factor, taken as:	f_f : Fatigue factor, taken as:	
• $f_f = 1.0$ in general,	• $f_f = 1.0$ in general, including the free edge of base material.	
• $f_f = 1.2$ for details assessed by very fine mesh analysis complying with the fatigue assessment criteria given in **Ch 9, Sec 2.**	• $f_f = 1.2$ for details assessed by very fine mesh analysis complying with the fatigue assessment criteria given in **Ch 9, Sec 2.**	
Note 1: 〈omitted〉	Note 1: 〈same as the present〉	
Note 2: 〈omitted〉	Note 2: 〈same as the present〉	
Note 3: 〈omitted〉	Note 3: 〈same as the present〉	

Present	Amendment	Reason
Chapter 8 Buckling **Section 1 〈omitted〉** **Section 2 〈newly added〉**	**Chapter 8 Buckling** **Section 1 〈same as the present〉** **Section 2 Slenderness requirements** **Symbols** For symbols not defined in this section, refer to Ch 1, Sec 4. b_{f-out} : Maximum distance, in mm, from mid thickness of the web to the flange edge, as shown in Figure 1. h_w : Depth of stiffener web, in mm, as shown in Figure 1. ℓ : Length of stiffener between effective supports, in m s_{eff} : Effective width of attached plate of stiffener, in mm, taken equal to: $s_{eff} = 0.8\,s$ t_f : Net flange thickness, in mm. t_p : Net thickness of plate, in mm. t_w : Net web thickness, in mm. **1. Structural elements** **1.1 General** **1.1.1** All structural elements are to comply with the applicable slenderness and proportion requirements given in [2] and [3].	

Present	Amendment	Reason
〈newly added〉	**2. Plates** **2.1 Net thickness of plate panels** 2.1.1 The net thickness of plate panels is to satisfy the following criteria: $t_p \geq \frac{b}{C}$ where: C : Slenderness coefficient taken as: $C = 100$ for hull envelope $C = 125$ for other structures. 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** **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: $t_f \geq \frac{b_{t-out}}{C_f}\sqrt{\frac{R_{eH}}{235}}$ where: C_w, C_f : Slenderness coefficients given in Table 1.	

Present

〈newly added〉

Amendment

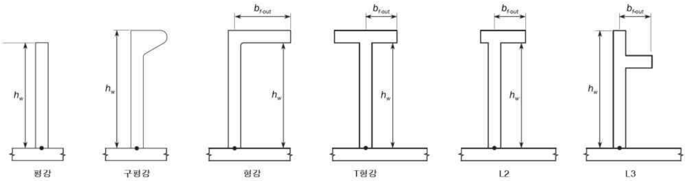


Figure 1 : Stiffener scantling parameters

Table 1 : Slenderness coefficients

Type of Stiffener	C_w	C_f
Angle, L2 and L3 bars	75	12
T-bars	75	12
Bulb bars	45	-
Flat bars	22	-

3.1.2 Net dimensions of angle and T-bars

The total flange breadth b_f in mm, for angle and T-bars is to satisfy the following criterion:

$$b_f \geq 0.25\,h_w$$

3.1.3 Bending stiffness of stiffeners

The net moment of inertia, in cm^4, of the stiffener with the effective width of attached plate, about the neutral axis parallel to the attached plating, is not to be less than the minimum value given by:

$$I_{st} \geq C\ell^2 A_{eff} \frac{R_{eH}}{235}$$

where:

A_{eff} : Net sectional area of stiffener including effective attached plate, s_{eff}, in cm^2.

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

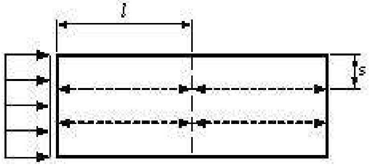
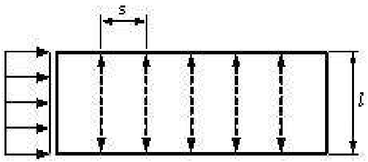
Reason

Present	Amendment	Reason
⟨newly added⟩	C : Slenderness coefficient taken as: C = 0.93 for longitudinal stiffeners including sniped stiffeners. C = 0.72 for other stiffeners. **4. PRIMARY SUPPORTING MEMBERS** **4.1 Proportions and stiffness** **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: $C_w = 125$ for double skin construction $C_w = 100$ elsewhere C_f : Slenderness coefficient for the flange taken as: $C_f = 12$	

Present	Amendment	Reason
〈newly added〉	**4.1.2 Deck transverse primary supporting members** The net moment of inertia for deck transverse primary supporting members, $I_{psm-n50}$, in cm^4, supporting deck longitudinals subject to axial compressive hull girder stress, is to comply, within its central half of the bending span, with the following criterion: $I_{psm-n50} \geq 300 \frac{\ell_{bdg}^4}{S^3 s} I_{st}$ where: $I_{psm-n50}$: Net moment of inertia, in cm^4, of deck transverse primary supporting member, with effective width of attached plate equal to $0.8S$. ℓ_{bdg} : Effective bending span of deck transverse primary supporting member, in m, as defined in Ch 3, Sec 7. S : Spacing of deck transverse primary supporting members, in m, as defined in Ch 3, Sec 7. I_{st} : Moment of inertia of deck stiffeners within the central half of the bending span, in cm^4, as given in [3.1.3]. **4.2 Web stiffeners of primary supporting members** **4.2.1 Proportions of web stiffeners** The net thickness of web and flange of web stiffeners fitted on primary supporting members is to satisfy the requirements specified in [3.1.1] and [3.1.2]. **4.2.2 Bending stiffness of web stiffeners** The net moment of inertia, in cm^4, of web stiffener, I_{st}, fitted on primary supporting members, with effective attached plate, s_{eff}, is not to be less than the minimum moment of inertia defined in Table 2.	

<table>
<tr><th>Present</th><th>Amendment</th><th>Reason</th></tr>
<tr><td>〈newly added〉</td><td>

Table 2 : Stiffness criteria for web stiffeners

<table>
<tr><th colspan="2">Stiffener arrangement</th><th>Minimum moment of inertia of web stiffeners, in cm^4</th></tr>
<tr><td>A</td><td>Web stiffeners fitted along the PSM span
 </td><td>$I_{st} \geq C \ell^2 A_{eff} \dfrac{R_{eH}}{235}$</td></tr>
<tr><td>B</td><td>Web stiffeners fitted normal to the PSM span
 </td><td>$I_{st} \geq 1.14\, \ell\, s^2 t_w \left(2.5 \dfrac{1000\,\ell}{s} - 2 \dfrac{s}{1000\,\ell} \right) \dfrac{R_{eH}}{235} 10^{-5}$</td></tr>
<tr><td colspan="3">

C : Slenderness coefficient to be taken as:
C = 0.93 for longitudinal stiffeners including sniped stiffeners.
C = 0.72 for other stiffeners.
ℓ : Length of web stiffener, in m.
For web stiffeners welded to local supporting members, the length is to be measured between the flanges of the local support members.
For sniped web stiffeners, the length is to be measured between the lateral supports, e.g. the total distance between the flanges of the primary supporting member as shown for stiffener arrangement B.
A_{eff} : Net section area of web stiffener including effective attached plate, s_{eff}, in cm^2.
t_w : Net web thickness of the primary supporting member, in mm.
R_{eH} : Specified minimum yield stress of the material of the web plate of the primary supporting member, in $\mathrm{N/mm}^2$.

</td></tr>
</table>

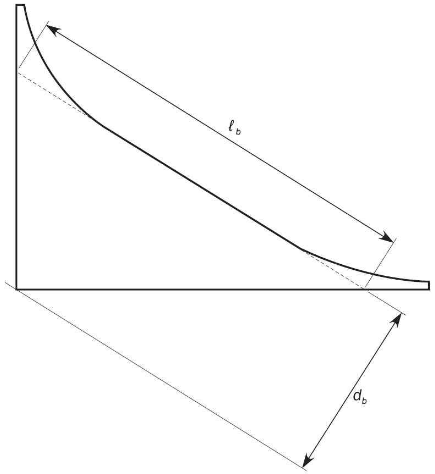
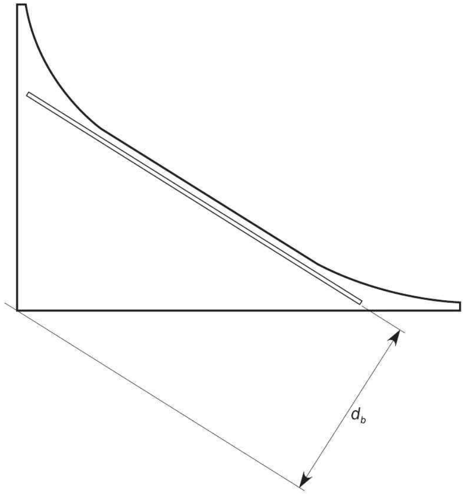
</td><td></td></tr>
</table>

Present	Amendment	Reason
〈newly added〉	**5. BRACKETS** **5.1 Tripping brackets** **5.1.1 Unsupported flange length** The unsupported length of the flange of the primary supporting member, in m, i.e. the distance between tripping brackets, is not to be greater than: $S_b = b_f C \sqrt{\frac{A_{f-n50}}{\left(A_{f-n50}+\frac{A_{w-n50}}{3}\right)}\left(\frac{235}{R_{eH}}\right)}$, but need not be less than $S_{b-\min}$ where: b_f : Flange breadth of primary supporting members, in mm. C : Slenderness coefficient taken as: $C = 0.022$ for symmetrical flanges. $C = 0.033$ for asymmetrical flanges. A_{f-n50} : Net cross sectional area of flange, in cm^2. A_{w-n50} : Net cross sectional area of the web plate, in cm^2. R_{eH} : Specified minimum yield stress of the PSM material, in $\mathrm{N/mm}^2$. $S_{b-\min}$: Minimum unsupported flange length taken as: $S_{b-\min} = 3.0\,\mathrm{m}$ for the cargo hold region, on hold boundaries or the hull envelope including external decks. $S_{b-\min} = 4.0\,\mathrm{m}$ for other areas. **5.1.2 Edge stiffening** Tripping brackets on primary supporting members are to be stiffened by a flange or edge stiffener if the effective length of the edge, ℓ_b as defined in Table 3, in mm, is greater than: $\ell_b = 75\,t_b$ where: t_b : Bracket net web thickness, in mm.	

Present	Amendment	Reason
⟨newly added⟩	**5.2 End brackets** **5.2.1 Proportions** The net web thickness of end brackets, in mm, subject to compressive stresses is not to be less than: $t_b = \frac{d_b}{C}\sqrt{\frac{R_{eH}}{235}}$ where: d_b : Depth of brackets, in mm, as defined in Table 3. C : Slenderness coefficient as defined in Table 3. R_{eH} : Specified minimum yield stress of the end bracket material, in $\mathrm{N/mm^2}$. **5.3 Edge reinforcement** **5.3.1 Edge reinforcements of bracket edges** The depth of stiffener web, h_w in mm, of edge stiffeners in way of bracket edges is not to be less than: $h_w = \frac{C\,\ell_b}{1000}\sqrt{\frac{R_{eH}}{235}}$ or 50 mm, whichever is greater. where: C : Slenderness coefficient taken as: $C = 75$ for end brackets. $C = 50$ for tripping brackets. R_{eH} : Specified minimum yield stress of the stiffener material, in $\mathrm{N/mm^2}$. **5.3.2 Proportions of edge stiffeners** The net thickness of the web plate and flange of the edge stiffener is to satisfy the requirements specified in [3.1.1] and [3.1.2].	

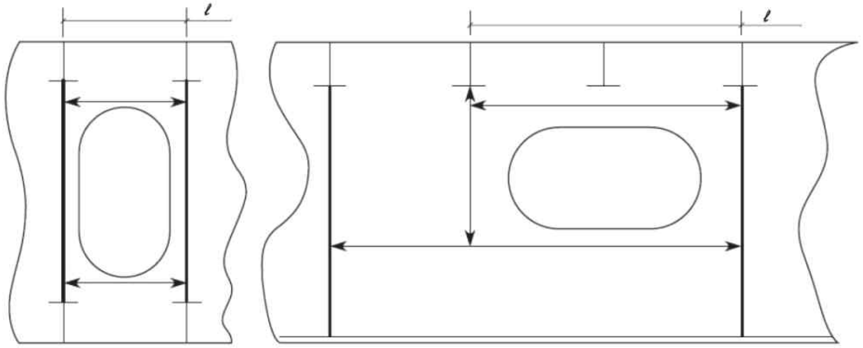
<table>
<tr><th>Present</th><th>Amendment</th><th>Reason</th></tr>
<tr><td>〈newly added〉</td><td>

Table 3 : Buckling coefficient, C, for proportions of brackets

<table>
<tr><th>Mode</th><th>C</th></tr>
<tr><td>Brackets without edge stiffener
 </td><td>$C = 20\left(\frac{d_b}{\ell_b}\right) + 16$
where:
$0.25 \le \frac{d_b}{\ell_b} \le 1.0$</td></tr>
<tr><td>Brackets with edge stiffener
 </td><td>$C = 70$</td></tr>
</table>

</td><td></td></tr>
</table>

Present	Amendment	Reason
⟨newly added⟩	**6. OTHER STRUCTURES** **6.1 Pillars** **6.1.1 Proportions of I-section pillars** For I-sections, the thickness of the web plate and the flange thickness are to comply with requirements specified in [3.1.1] and [3.1.2]. **6.1.2 Proportions of box section pillars** The thickness of thin walled box sections is to comply with the requirements specified in item (a) of [3.1.1]. **6.1.3 Proportions of circular section pillars** The net thickness, t, of circular section pillars, in mm, is to comply with the following criterion: $t \geq \frac{r}{50}$ where: r : Mid thickness radius of the circular section, in mm. **6.2 Edge reinforcement in way of openings** **6.2.1 Depth of edge stiffener** When fitted as shown in **Figure 2**, the depth of web, h_w in mm, of edge stiffeners in way of openings is not to be less than: $h_w = C\,\ell\sqrt{\frac{R_{eH}}{235}}$ or 50 mm, whichever is greater. where: C : Slenderness coefficient taken as: C = 50 R_{eH} : Specified minimum yield stress of the edge stiffener material, in $\mathrm{N/mm^2}$. **6.2.2 Proportions of edge stiffeners** The net thickness of the web plate and flange of the edge stiffener is to satisfy the requirements specified in [3.1.1] and [3.1.2].	

Present	Amendment	Reason
〈newly added〉	 Figure 2 : Typical edge reinforcements	
Section 2 Prescriptive buckling requirements **Section 3 Buckling requirements for DSA** **Section 4 Buckling capacity**	**Section 3 Prescriptive buckling requirements** **Section 4 Buckling requirements for DSA** **Section 5 Buckling capacity**	
1. General	**1. General**	
1.1 Scope	**1.1 Scope**	
1.1.1 This section contains the methods for determination of the buckling capacity of plate panels, stiffeners, primary supporting members and pillars.	**1.1.1** This section contains the methods for determination of the buckling capacity of plate panels, stiffeners, primary supporting members and pillars.	
〈newly added〉	As accepted by the Society, assessment of local plate panel can only be performed in accordance with Ch 8, Sec 4.	
〈omitted〉	〈same as the present〉	
Section 5 Stress based reference stresses	**Section 6 Stress based reference stresses**	
〈omitted〉	〈same as the present〉	

Present	Amendment	Reason
Chapter 9 Fatigue **Section 1 General Considerations** **1. Rule Application for Fatigue Requirements** **1.1 Scope** **1.1.1 General** This chapter provides requirements applicable to ships having rule length L 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}. 〈omitted〉	**Chapter 9 Fatigue** **Section 1 General Considerations** **1. Rule Application for Fatigue Requirements** **1.1 Scope** **1.1.1 General** This chapter provides requirements applicable to ships having rule length L between 150 m and 500 m to evaluate fatigue strength of the ship's structural details considering an operation time in North Atlantic or worldwide environment equal to the design fatigue life, T_{DF}. 〈same as the present〉	

Present	Amendment	Reason
Section 2 ⟨omitted⟩ **Section 3 Fatigue Evaluation**	**Section 2 ⟨same as the present⟩** **Section 3 Fatigue Evaluation**	
Symbols	Symbols	
For symbols not defined in this section, refer to **Ch 1, Sec 4.**	For symbols not defined in this section, refer to **Ch 1, Sec 4.**	
(i) : ⟨omitted⟩	(i) : ⟨same as the present⟩	
(j) : ⟨omitted⟩	(j) : ⟨same as the present⟩	
T_C : Time in corrosive environment, in years, according to **Table 5.**	T_C : Time in corrosive environment, in years, according to **Table 5.**	
T_D : Design life, in years, to be taken as 25 years.	T_D : Design life, in years, to be taken as 25 years.	
T_{DF} : Design fatigue life, in year, as defined in **Ch 9, Sec 1.**	T_{DF} : Design fatigue life, in year, as defined in **Ch 9, Sec 1.**	
T_F : Fatigue life, in year, calculated according to **[5].**	T_F : Fatigue life, in year, calculated according to **[5].**	
m : Inverse slope of the design S-N curve, as given in **Table 2** for in-air environment and in **Table 3** for corrosive environment. The inverse slope for S-N curves in-air environment changes from m to m+2 at N = 10^7 cycles.	m : Inverse slope of the design S-N curve, as given in **Table 2** for in-air environment and in **Table 3** for corrosive environment. The inverse slope for S-N curves in-air environment changes from m to m+2 at N = 10^7 cycles.	
n_{LC} : Number of applicable loading conditions, as defined in **Ch 9, Sec 1, [6.2].**	n_{LC} : Number of applicable loading conditions, as defined in **Ch 9, Sec 1, [6.2].**	
f_c : Correction factor as defined in **Ch 9, Sec 1, [5.1.2].**	f_c : Correction factor as defined in **Ch 9, Sec 1, [5.1.2].**	
f_{thick} : Correction factor for plate thickness effect given in **[3.3].**	f_{thick} : Correction factor for plate thickness effect given in **[3.3].**	
$f_{mean,i(j)}$: Correction factor for mean stress effect given in **[3.2].**	$f_{mean,i(j)}$: Correction factor for mean stress effect given in **[3.2].**	
⟨newly added⟩	f_e : Environmental factor, to be taken as: $f_e = 1.0$ for North Atlantic wave environment $f_e = 0.8$ for worldwide wave environment	

Present	Amendment	Reason
3. Reference Stresses for Fatigue Assessment **3.1 Fatigue stress range** **3.1.1 〈omitted〉** **3.1.2 Welded joints** For welded joints, the fatigue stress range $\Delta\sigma_{FS,i(j)}$, in N/mm^2, corrected for mean stress effect, thickness effect and warping effect, is taken as: • For simplified stress analysis: $\underline{\Delta\sigma_{FS,i(j)} = f_{mean,i(j)} \cdot f_{thick} \cdot f_{warp} \cdot \Delta\sigma_{HS,i(j)}}$ • For FE analysis: For web-stiffened cruciform joints: $\Delta\sigma_{FS,i(j)} = f_w \cdot f_s \cdot \max(\Delta\sigma_{FS1,i(j)}, \Delta\sigma_{FS2,i(j)})$ For other joints: $\Delta\sigma_{FS,i(j)} = \max_{(SideL,\,SideR)}[\max(\Delta\sigma_{FS1,i(j)}, \Delta\sigma_{FS2,i(j)})]$ where: f_W : 〈omitted〉 f_S : 〈omitted〉 $\Delta\sigma_{HS,i(j)}$: Hot spot stress range, in N/mm^2, due to dynamic loads in load case (i) of loading condition (j) given in **Ch9, Sec 4, [2.1.1].** $\Delta\sigma_{FS1,i(j)}$: Fatigue stress range, in N/mm^2, due to the principal hot spot stress range $\Delta\sigma_{HS1,i(j)}$ $\underline{\Delta\sigma_{FS1,i(j)} = f_{mean,i(j)} \cdot f_{thick} \cdot f_c \cdot \Delta\sigma_{HS1,i(j)}}$ $\Delta\sigma_{FS2,i(j)}$: Fatigue stress range, in N/mm^2, due to the principal hot spot stress range $\Delta\sigma_{HS2,i(j)}$ $\underline{\Delta\sigma_{FS2,i(j)} = 0.9 \cdot f_{mean2,i(j)} \cdot f_{thick} \cdot f_c \cdot \Delta\sigma_{HS2,i(j)}}$ $SideL, SideR$: 〈omitted〉 〈omitted〉	**3. Reference Stresses for Fatigue Assessment** **3.1 Fatigue stress range** **3.1.1 〈same as the present〉** **3.1.2 Welded joints** For welded joints, the fatigue stress range $\Delta\sigma_{FS,i(j)}$, in N/mm^2, corrected for mean stress effect, thickness effect and warping effect, is taken as: • For simplified stress analysis: $\underline{\Delta\sigma_{FS,i(j)} = f_{mean,i(j)} \cdot f_{thick} \cdot f_{warp} \cdot f_e \cdot \Delta\sigma_{HS,i(j)}}$ • For FE analysis: For web-stiffened cruciform joints: $\Delta\sigma_{FS,i(j)} = f_w \cdot f_s \cdot \max(\Delta\sigma_{FS1,i(j)}, \Delta\sigma_{FS2,i(j)})$ For other joints: $\Delta\sigma_{FS,i(j)} = \max_{(SideL,\,SideR)}[\max(\Delta\sigma_{FS1,i(j)}, \Delta\sigma_{FS2,i(j)})]$ where: f_W : 〈same as the present〉 f_S : 〈same as the present〉 $\Delta\sigma_{HS,i(j)}$: Hot spot stress range, in N/mm^2, due to dynamic loads in load case (i) of loading condition (j) given in **Ch9, Sec 4, [2.1.1].** $\Delta\sigma_{FS1,i(j)}$: Fatigue stress range, in N/mm^2, due to the principal hot spot stress range $\Delta\sigma_{HS1,i(j)}$ $\underline{\Delta\sigma_{FS1,i(j)} = f_{mean,i(j)} \cdot f_{thick} \cdot f_c \cdot f_e \cdot \Delta\sigma_{HS1,i(j)}}$ $\Delta\sigma_{FS2,i(j)}$: Fatigue stress range, in N/mm^2, due to the principal hot spot stress range $\Delta\sigma_{HS2,i(j)}$ $\underline{\Delta\sigma_{FS2,i(j)} = 0.9 \cdot f_{mean2,i(j)} \cdot f_{thick} \cdot f_c \cdot f_e \cdot \Delta\sigma_{HS2,i(j)}}$ $SideL, SideR$: 〈same as the present〉 〈same as the present〉	

Present	Amendment	Reason
3.2 Mean stress effect **3.2.1 Correction factor for mean stress effect** The mean stress correction factor to be considered for each principal hot spot stress range of welded joint, $\triangle\sigma_{HS,i(j)}$, or for local stress range at free edge, $\triangle\sigma_{BS,i(j)}$, is taken as: a) For welded joint: 〈omitted〉 b) For base material: 〈omitted〉 where: $\sigma_{mCor,i(j)} = \begin{cases} \sigma_{mean,i(j)} & \text{for } \sigma_{\max} \le R_{eEq} \\ R_{eEq} - \sigma_{\max} + \sigma_{mean,i(j)} & \text{for } \sigma_{\max} > R_{eEq} \end{cases}$ $\sigma_{\max} = \begin{cases} \max_{i,(j)}(\triangle\sigma_{HS,i(j)} + \sigma_{mean,i(j)}) & \text{for } weled joint \\ \max_{i,(j)}(\triangle\sigma_{BS,i(j)} + \sigma_{mean,i(j)}) & \text{for } base material \end{cases}$ $\underline{R_{eEq} = \max(315; ReE)}$ $\sigma_{mean,i(j)}$: Fatigue mean stress, in N/mm², for base material according to **[3.2.2]** or welded joint calculated according to **[3.2.3]** or **[3.2.4]** as applicable. 〈omitted〉	**3.2 Mean stress effect** **3.2.1 Correction factor for mean stress effect** The mean stress correction factor to be considered for each principal hot spot stress range of welded joint, $\triangle\sigma_{HS,i(j)}$, or for local stress range at free edge, $\triangle\sigma_{BS,i(j)}$, is taken as: a) For welded joint: 〈same as the present〉 b) For base material: 〈same as the present〉 where: $\sigma_{mCor,i(j)} = \begin{cases} \sigma_{mean,i(j)} & \text{for } \sigma_{\max} \le R_{eEq} \\ R_{eEq} - \sigma_{\max} + \sigma_{mean,i(j)} & \text{for } \sigma_{\max} > R_{eEq} \end{cases}$ $\sigma_{\max} = \begin{cases} \max_{i,(j)}(\triangle\sigma_{HS,i(j)} + \sigma_{mean,i(j)}) & \text{for } weled joint \\ \max_{i,(j)}(\triangle\sigma_{BS,i(j)} + \sigma_{mean,i(j)}) & \text{for } base material \end{cases}$ $\underline{R_{eEq} = \max(315; R_{eH})}$ $\sigma_{mean,i(j)}$: Fatigue mean stress, in N/mm², for base material according to **[3.2.2]** or welded joint calculated according to **[3.2.3]** or **[3.2.4]** as applicable. 〈same as the present〉	

Present

4. 〈omitted〉

5. Fatigue Damage Calculation

5.1 ~ 5.2 〈omitted〉

5.3 Combined fatigue damage

5.3.1

The combined fatigue damage in protected in-air environment and unprotected corrosive environment for each loading condition (j) is to be calculated as follows:

$$D_{(j)} = D_{E,air\,(j)} \bullet \frac{T_D - T_C}{T_D} + D_{E,corr(j)} \bullet \frac{T_C}{T_D}$$

where:

$D_{E,air\,(j)}$: The elementary fatigue damage for in-air environment for loading condition (j) given in **[5.2.1].**

$D_{E,corr(j)}$: The elementary fatigue damage for corrosive environment for loading condition (j) as calculated in **[5.2.1].**

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	10
Cargo hold	
Void space	5
Other areas	

〈omitted〉

Amendment

4. 〈same as the present〉

5. Fatigue Damage Calculation

5.1 ~ 5.2 〈same as the present〉

5.3 Combined fatigue damage

5.3.1

The combined fatigue damage in protected in-air environment and unprotected corrosive environment for each loading condition (j) is to be calculated as follows:

$$D_{(j)} = D_{E,air\,(j)} \bullet \frac{T_D - T_C}{T_D} + D_{E,corr(j)} \bullet \frac{T_C}{T_D}$$

where:

$D_{E,air\,(j)}$: The elementary fatigue damage for in-air environment for loading condition (j) given in **[5.2.1].**

$D_{E,corr(j)}$: The elementary fatigue damage for corrosive environment for loading condition (j) as calculated in **[5.2.1].**

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
Cargo hold	0
Void space	
Other areas	

〈same as the present〉

Reason

Present	Amendment	Reason
Section 5 Finite Element Stress Analysis **1. ~ 3. 〈omitted〉** **4. Hot Spot Stress for Web-Stiffened Cruciform Joint** **4.1 〈omitted〉** **4.2 Calculation of hot spot stress at the flange** **4.2.1** For hot spot at the flange of web-stiffened cruciform joints, the surface principal stress is to be read out from a point shifted away from the intersection line between the considered member and abutting member to the position of the actual weld toe and multiplied by 1.12. The intersection line is taken at the mid-thickness of the cruciform joint assuming a median alignment. The hot spot stress, in N/mm^2, is to be obtained as: $\sigma_{HS} = 1.12\sigma_{shift}$ where: σ_{shift} : Surface principal stress, in N/mm^2, at shifted stress read out position. The stress read out point shifted away from the intersection line is obtained as: $\underline{x_{shift} = \frac{t_{1-n50}}{2} \times x_{Wt}}$ where: t_{1-n50} : Net plate thickness of the plate number 1, in mm, as shown in **Figure 10.** x_{wt} : Extended fillet weld leg length, in mm, as defined in **Figure 10,** not taken larger than t_{1-n50}. 〈omitted〉	**Section 5 Finite Element Stress Analysis** **1. ~ 3. 〈same as the present〉** **4. Hot Spot Stress for Web-Stiffened Cruciform Joint** **4.1 〈same as the present〉** **4.2 Calculation of hot spot stress at the flange** **4.2.1** For hot spot at the flange of web-stiffened cruciform joints, the surface principal stress is to be read out from a point shifted away from the intersection line between the considered member and abutting member to the position of the actual weld toe and multiplied by 1.12. The intersection line is taken at the mid-thickness of the cruciform joint assuming a median alignment. The hot spot stress, in N/mm^2, is to be obtained as: $\sigma_{HS} = 1.12\sigma_{shift}$ where: σ_{shift} : Surface principal stress, in N/mm^2, at shifted stress read out position. The stress read out point shifted away from the intersection line is obtained as: $\underline{x_{shift} = \frac{t_{1-n50}}{2} + x_{wt}}$ where: t_{1-n50} : Net plate thickness of the plate number 1, in mm, as shown in **Figure 10.** x_{wt} : Extended fillet weld leg length, in mm, as defined in **Figure 10,** not taken larger than t_{1-n50}. 〈same as the present〉	

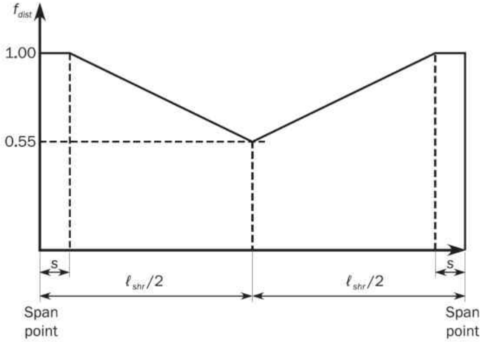
Present	Amendment	Reason
Section 6 Detail Design Standard	**Section 6 Detail Design Standard**	
1. General **1.1 ⟨omitted⟩** **1.2 Application** **1.2.1** The structural details described in this section are to be designed according to the given design standard but alternative detail design configurations may be accepted subject to demonstration of satisfactory fatigue performance. ~~For the details given in **Ch 9, Sec 2, Table 3**, the fatigue assessment by very fine mesh finite element analysis may be omitted if the detail is designed in accordance with the design standard given in this section.~~	**1. General** **1.1 ⟨same as the present⟩** **1.2 Application** **1.2.1** The structural details described in this section are to be designed according to the given design standard but alternative detail design configurations may be accepted subject to demonstration of satisfactory fatigue performance.	
2. Stiffener-Frame Connections **2.1 Design standard A** **2.1.1** Designs for cut outs in cases where web stiffeners are omitted or not connected to the longitudinals are required to adopt tight collar or the improved design standard “A” as shown in **Table 1** or equivalent, for the following members: • Side shell below $1.1T_{SC}$. • Bottom. • Inner hull longitudinal bulkhead below $1.1T_{SC}$. • Inner bottom. For designs that are different from those shown in **Table 1**, satisfactory fatigue performance may be demonstrated by, e.g., using comparative FE analysis according to **[2.2]**. ⟨omitted⟩	**2. Stiffener-Frame Connections** **2.1 Design standard A** **2.1.1** Designs for cut outs in cases where web stiffeners are omitted or not connected to the longitudinals are recommended to adopt tight collar or the improved design standard “A” as shown in **Table 1** or equivalent, for the following members: • Side shell below $1.1T_{SC}$. • Bottom. • Inner hull longitudinal bulkhead below $1.1T_{SC}$. • Inner bottom. For designs that are different from those shown in **Table 1**, satisfactory fatigue performance may be demonstrated by, e.g., using comparative FE analysis according to **[2.2]**. ⟨same as the present⟩	

Present	Amendment	Reason
Chapter 10 Other Structures	**Chapter 10 Other Structures**	
Section 1 Fore Part	**Section 1 Fore Part**	
Symbols	Symbols	
For symbols not defined in this section, refer to **Ch 1, Sec 4.**	For symbols not defined in this section, refer to **Ch 1, Sec 4.**	
⟨omitted⟩	⟨same as the present⟩	
n_s : ⟨omitted⟩	n_s : ⟨same as the present⟩	
	d_{shr} : Effective web depth of stiffener, in mm, as defined in **Ch 3, Sec 7 [1.4.3]**	
3. Structure subjected to impact loads	**3. Structure subjected to impact loads**	
3.1 ⟨omitted⟩	**3.1 ⟨same as the present⟩**	
3.2 Bottom slamming	**3.2 Bottom slamming**	
3.2.1 Application	**3.2.1 Application**	
Where the minimum draughts forward, T_{F-e}or T_{F-f}, as specified in **Ch 4, Sec 5, [3.2.1]**, are less than 0.045L, the bottom forward is to be additionally strengthened to resist bottom slamming pressures.	Where the minimum draughts forward, T_F, as specified in **Ch 4, Sec 5, [3.2.1]**, are less than 0.045 L, the bottom forward is to be additionally strengthened to resist bottom slamming pressures.	
The draughts for which the bottom has been strengthened are to be indicated on the shell expansion plan and loading guidance information, as required in **Ch 1, Sec 5.**	The draughts for which the bottom has been strengthened are to be indicated on the shell expansion plan and loading guidance information, as required in **Ch 1, Sec 5.**	
The load calculation point of the primary supporting members is specified in **Ch 3, Sec 7, [4].**	The load calculation point of the primary supporting members is specified in **Ch 3, Sec 7, [4].**	
3.2.2 ⟨omitted⟩	**3.2.2 ⟨same as the present⟩**	
3.2.3 Design to resist bottom slamming loads	**3.2.3 Design to resist bottom slamming loads**	
The design of end connections of stiffeners in the bottom slamming region is to provide end fixity, either by making the stiffeners continuous through supports or by providing end brackets complying with **Ch 3, Sec 6, [3.2].**	The design of end connections of stiffeners in the bottom slamming region is to provide end fixity, either by making the stiffeners continuous through supports or by providing end brackets complying with **Ch 3, Sec 6, [3.2].**	

Present	Amendment	Reason
~~Where it is not practical to comply with this requirement, the net plastic section modulus, Z_{pl-alt}, in cm^3, for alternative end fixity arrangements is not to be less than:~~ ~~$Z_{pl-alt} = \frac{16Z_{pl}}{f_{bdg}}$~~ ~~where:~~ ~~$Z_{pl}$: Net plastic section modulus, in cm^3, as required by **[3.2.5].**~~		
Scantlings and arrangements of primary supporting members, including bulkheads in way of stiffeners, are to comply with **[3.2.7].**	Scantlings and arrangements of primary supporting members, including bulkheads in way of stiffeners, are to comply with **[3.2.6].**	
3.2.4 Shell plating	**3.2.4 Shell plating**	
The net thickness of the hull envelope plating, t, in mm, except for the transversely stiffened bilge plating within the cylindrical part of the ship, is not to be less than:	The net thickness of the hull envelope plating, t in mm, except for the transversely stiffened bilge plating within the cylindrical part of the ship, is not to be less than:	
$t = \frac{0.0158\alpha_p b}{C_d}\sqrt{\frac{P_{SL}}{C_a R_{eH}}}$	$t = \frac{0.0158\alpha_p b}{C_d}\sqrt{\frac{P_{SL}}{R_{eH}}}$	
where:		
C_d : plate capacity correction coefficient taken as: $C_d = 1.3.$	C_d : Plate capacity correction coefficient taken as: $C_d = 1.22$	
~~C_a : Permissible bending stress coefficient taken as:~~ ~~$C_a = 1.0$ for acceptance criteria set AC-I~~		
~~The transversely stiffened bilge plating within the cylindrical part of the ship is to comply with the requirement given in **Ch 6, Sec 4, [2.2].**~~		

Present	Amendment	Reason
3.2.5 Shell stiffeners The shell stiffeners within the strengthening area defined in **[3.2.2]** are to comply with the following criteria: a) The net plastic section modulus, Z_{pl}, in cm^3, is not to be less than: $Z_{pl} = \frac{P_{SL} s \ell_{bdg}^2}{f_{bdg} C_s R_{eH}}$ where : C_s : Permissible bending stress coefficient taken as: $C_s = 0.9$ for acceptance criteria set AC-I. b) The net web thickness, t_w, in mm, is not to be less than: $t_w = \frac{P_{SL} s \ell_{shr}}{2 d_{shr} C_t \tau_{eH}}$ where: C_t : Permissible shear stress coefficient taken as: $C_t = 1.0$ for acceptance ariteria set AC-I.	**3.2.5 Shell stiffeners** The shell stiffeners within the strengthening area defined in **[3.2.2]** are to comply with the following criteria: a) The net web thickness, t_w in mm, is not to be less than: $t_w = \frac{0.35 P_{SL} s \ell_{shr}}{d_{shr} \tau_{eH}}$ a) The net plastic section modulus, Z_{pl} in cm^3, is not to be less than: $Z_{pl} = \frac{0.6 P_{SL} s \ell_{bdg}^2}{f_{bdg} R_{eH}}$	
~~**3.2.6 Bottom slamming load area for primary supporting members**~~ ~~The scantlings of primary supporting members according to **[3.2.7]** are based on the application of the slamming pressure defined in **Ch 4, Sec 5, [3.2]** to an idealised slamming load area of hull envelope plating, A_{SL}, in m^2, given by:~~ $\cancel{A_{SL} = \frac{1.1 L B C_b}{1000}}$	**3.2.6 〈del〉**	

Present	Amendment	Reason
3.2.7 Primary supporing members The size and number of openings in web plating of the floors and girders is to be minimised considering the required shear area as given in a): ~~a) Net shear area~~ ~~The net shear area, $A_{shr-n50}$, in cm^2, of each primary supporting member web at any position along its span is not to be less than:~~ ~~$A_{shr-n50} = 10\frac{Q_{SL}}{C_t \tau_{eH}}$~~ ~~where :~~ ~~$Q_{SL}$: The greatest shear force due to slamming for the position being cosidered, in kN, based on the application of a patch load, F_{SL} to the most onerous location, as determined in accordance with b) or c).~~ ~~C_t : Permissible shear stress coefficient taken as:~~ ~~$C_t = 0.9$ for acceptance criteria set AC-I.~~ ~~b) Simplified calculation of slamming shear force~~ ~~For simple arrangements of primary supporting members, where the grillage affect may be ignored, the shear force, Q_{SL}, in kN, is given by:~~ ~~$Q_{SL} = f_{pt} f_{dist} F_{SL}$~~ ~~where:~~ ~~$f_{pt}$: Correction factor for the proportion of patch load acting on a single primary supporting member, taken as:~~ ~~$f_{pt} = 0.5\,(f_{SL}^3 - 2f_{SL}^2 + 2)$~~ ~~$f_{SL}$: Patch load modification factor taken as:~~ ~~$f_{SL} = 0.5\frac{b_{SL}}{S}$~~ ~~$f_{dist}$: Factor for the greatest shear force distribution along the span, according to **Figure 3**~~	**3.2.6 Primary supporting members** The size and number of openings in web plating of the floors and girders is to be minimised considering the required shear area. The shear area, A_{shr} in cm^2, of each primary supporting member web at any position along its span is not to be less than: $A_{shr} = \frac{2P_{SL} S \ell_{shr}}{\tau_{eH}}$	

Present	Amendment	Reason
~~F_{SL} : Patch load, in kN, taken as:~~ ~~$F_{SL} = P_{SL} \ell_{SL} b_{SL}$~~ ~~$\ell_{SL}$: Extent of slamming load area along the span, in m, taken as:~~ ~~$\ell_{SL} = \sqrt{A_{SL}}$ but not to be greater than $0.5 \ell_{shr}$~~ ~~b_{SL} : Breadth of impact area supported by primary supporting member, in m, taken as:~~ ~~$b_{SL} = \sqrt{A_{SL}}$ but not to be greater than S.~~ ~~A_{SL} : Surface defined in **[3.2.6]**.~~  ~~**Figure 3 : Distribution of f_{dist} along the span of simple primary supporting members**~~		

Present	Amendment	Reason

~~c) Direct calculation method for slamming shear force~~

~~For complex arrangements of primary supporting members, the greatest shear force, Q_{SL}, at any location along the span of each primary supporting member is to be derived by direct calculation in accordance with~~ ~~**Table 1.**~~

~~d) Web thickness of primary supporting member~~

~~The net web thickness, t_w, in mm, of primary supporting members adjacent to the shell is not to be less than:~~

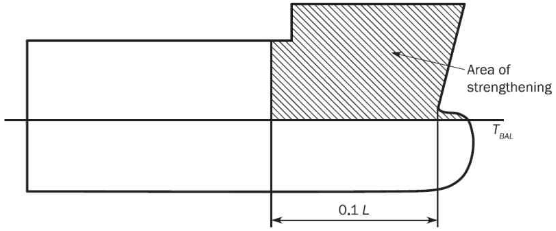
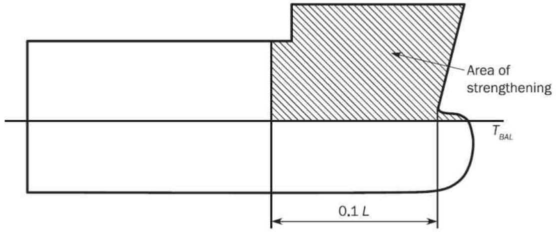
~~$t_w = \frac{s_W}{70}\sqrt{\frac{R_{eH}}{235}}$~~

~~where:~~

~~s_W : plate breath, in mm, taken as the spacing between the web stiffening.~~

~~**Table 1 : Direct calculation methods for derivation of Q_{SL}**~~

~~Type of analysis~~	~~Model extent~~	~~Assumed end fixity of floors~~
~~Beam theory~~	~~Overall span of member between effective bending supports.~~	~~Fixed at ends~~
~~Double bottom grillage~~	~~Longitudinal extent to be one cargo tank length.~~ ~~Transverse extent to be between inner hopper knuckle and centreline.~~	~~Floors and girders to be fixed at boundaries of the model.~~
~~Note 1: The envelope of greatest shear force along each primary supporting member is to be derived by applying the load patch on a square area as defined in [3.2.6], to a number of locations along the span.~~ ~~Note 2: A more extensive model in length and breadth can be considered.~~		

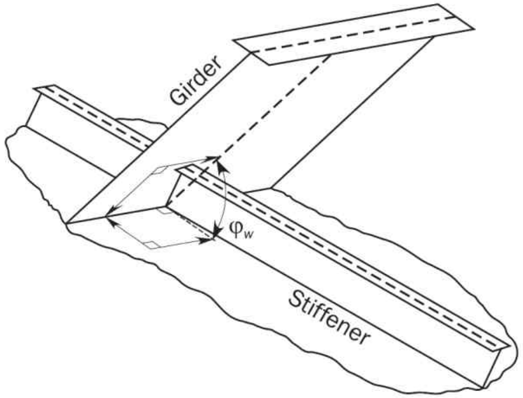
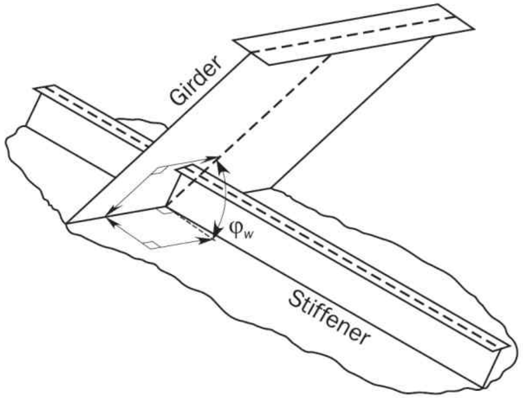
Present	Amendment	Reason
3.3 Bow impact **3.3.1 Application** The side structure in the ship forward area is to be strengthened against bow impact pressures. The strengthening isto extend forward of 0.1L from the FP and vertically above the minimum design ballast draught, T_{BAL}, defined in **Ch 1, Sec 4, [3.1.5]** and forecastle deck if any. See **Figure 4.** Outside the strengthening area the scantlings are to be tapered to maintain continuity of longitudinal and/or transverse strength.  **Figure 4 : Extent of strengthening against bow impact**	**3.3 Bow impact** **3.3.1 Application** The side structure in the ship forward area is to be strengthened against bow impact pressures. **3.2.2 Extent of strengthening** The strengthening is to extend forward of 0.1 L from the FP and vertically above the minimum design ballast draught, T_{BAL}, defined in **Ch 1, Sec 4, [3.1.5]** and forecastle deck if any. See **Figure 3.** If the flare angle, α as defined in **Ch 4, Sec 5, [3.3.1]**, is greater than 40° at 0.1 L from F.E., the bow impact area shall be extended to 0.15 L from F.E. Outside the strengthening area the scantlings are to be tapered to maintain continuity of longitudinal and / or transverse strength.  **Figure 3 : Extent of strengthening against bow impact**	
3.3.2 Design to resist bow impact loads a) In the bow impact strengthening area, longitudinal framing is to be carried as far forward as practicable. The design of end connections of stiffeners in the bow impact region are to ensure end fixity, either by making the stiffeners continuous through supports or by providing end brackets complying with **Ch 3, Sec 6, [3.2].** ~~Where it is not practical to comply with this requirement, the net plastic section modulus, Z_{pl-alt}, in cm^3, for alternative end fixity arrangements is not to be less than:~~	**3.3.3 Design to resist bow impact loads** a) In the bow impact strengthening area, longitudinal framing is to be carried as far forward as practicable. The design of end connections of stiffeners in the bow impact region are to ensure end fixity, either by making the stiffeners continuous through supports or by providing end brackets complying with **Ch 3, Sec 6, [3.2].**	

Present	Amendment	Reason
~~$Z_{pl-alt} = \frac{16 Z_{pl}}{f_{bdg}}$~~ ~~where:~~ ~~$Z_{pl}$: Effective net plastic section modulus, in cm^3, required by **[3.3.4]**.~~		
b) Scantlings and arrangements of primary supporting members, including decks and bulkheads, in way of the stiffeners, are to comply with **[3.3.6]**. In areas of the greatest bow impact load, the web stiffeners arranged perpendicular to the hull envelope plating and the double sided lug connections are to be provided. The main stiffening direction of decks and bulkheads supporting shell framing is to be arranged parallel to the span direction of the supported shell frames, to protect against buckling.	b) Scantlings and arrangements of primary supporting members, including decks and bulkheads, in way of the stiffeners, are to comply with **[3.3.6]**. In areas of the greatest bow impact load, the web stiffeners arranged perpendicular to the hull envelope plating and the double sided lug connections are to be provided. The main stiffening direction of decks and bulkheads supporting shell framing is to be arranged parallel to the span direction of the supported shell frames, to protect against buckling.	
3.3.3 Side shell plating	**3.3.4 Side shell plating**	
The net thickness of the side shell plating, t, in mm is not to be less than:	The net thickness of the side shell plating, t in mm is not to be less than:	
$t = 0.0158 \alpha_p b \sqrt{\frac{P_{FB}}{C_a R_{eH}}}$	$t = \frac{0.0158 \alpha_p b}{C_d} \sqrt{\frac{P_{FB}}{R_{eH}}}$	
where: C_a : Permissible bending stress coefficient taken as: $C_a = 1.0$ ~~for acceptance criteria set AC-I.~~	C_d : Plate capacity correction coefficient taken as: $C_d = 1.22$	
3.3.4 Side shell stiffeners	**3.3.5 Side shell stiffeners**	
The side shell stiffeners within the strengthening area defined in **[3.3.1]** are to comply with the following criteria:	The side shell stiffeners within the strengthening area defined in **[3.3.2]** are to comply with the following criteria:	
a) The effective net plastic section modulus, Z_{pl}, in cm^3 in association with the effective plating to which it is attached, is not to be less than: $Z_{pl} = \frac{P_{FB}\, s\, \ell_{bdg}^2}{f_{bdg}\, C_s\, R_{eH}}$ ~~where:~~ ~~C_s : Permissible bending stress coefficient taken as:~~ ~~$C_s = 0.9$ for acceptance criteria set AC-I.~~	a) The net web thickness, t_w in mm, is not to be less than: $t_w = \frac{0.35 P_{FB}\, s\, \ell_{shr}}{d_{shr}\, \tau_{eH}}$	

Present	Amendment	Reason
b) The net web thickness, t_w, in mm, is not to be less than: $t_w = \frac{P_{FB} s \ell_{shr}}{2 d_{shr} C_t \tau_{eH}}$ ~~where:~~ ~~d_{shr} : Effective web depth of stiffener, in mm, as defined in **Ch 3, Sec 7, [1.4.3].**~~ ~~C_t : Permissible shear stress coefficient taken as:~~ ~~$C_t = 1.0$ for acceptance criteria set AC-I.~~	b) The net plastic section modulus, Z_{pl} in cm^3, is not to be less than: $Z_{pl} = \frac{0.6 P_{FB} s \ell_{bdg}^2}{f_{bdg} R_{eH}}$	
~~**3.3.5 Bow impact load area for primary supporting members**~~ ~~The scantlings of primary supporting members according to **[3.3.6]** are based on the application of the bow impact pressure, as defined in **Ch 4, Sec 5, [3.3.1],** to an idealised bow impact load area of hull envelope plating, A_{BI}, in m^2, is given by:~~ ~~$A_{BI} = \frac{1.1 L B C_b}{1000}$~~	**3.3.5 〈del〉**	
3.3.6 Primary supporting members ~~a) The section modulus of the primary supporting member is to apply along the bending span clear of end brackets and cross sectional areas of the primary supporting member are to be applied at the ends/supports and may be gradually reduced along the span and clear of the ends/supports following the distribution of f_{dist}, indicated in **Figure 3**.~~	**3.3.6 Primary supporting members**	
b) Primary supporting members in the bow impact strengthening area are to be configured to provide effective continuity of strength and the avoidance of hard spots.	a) Primary supporting members in the bow impact strengthening area are to be configured to provide effective continuity of strength and the avoidance of hard spots.	
c) End brackets of primary supporting members are to be suitably stiffened along their edge. Consideration is to be given to the design of bracket toes to minimise abrupt changes of cross section.	b) End brackets of primary supporting members are to be suitably stiffened along their edge. Consideration is to be given to the design of bracket toes to minimise abrupt changes of cross section.	
d) Tripping arrangements are to comply with **Ch 8, Sec 2, [5.1.1]**. In addition, tripping brackets are to be fitted at the toes of end brackets and at locations where the primary supporting member flange is knuckled or curved.	c) Tripping brackets are to be fitted at the toes of end brackets and at locations where the primary supporting member flange is knuckled or curved.	

Present	Amendment	Reason
~~e) The net section modulus of each primary supporting member, Z_{n50}, in cm^3, is not to be less than:~~ ~~$Z_{n50} = 1000 \frac{f_{bdg-pt} P_{FB} b_{BI} f_{BI} \ell_{bdg}^2}{f_{bdg} C_s R_{eH}}$~~ ~~where:~~ ~~$f_{bdg-pt}$: Correction factor for the bending moment at the ends and considering the patch load taken as:~~ ~~$f_{bdg-pt} = 3f_{BI}^3 - 8f_{BI}^2 + 6f_{BI}$~~ ~~$f_{BI}$: Patch load modification factor taken as:~~ ~~$f_{BI} = \frac{\ell_{BI}}{\ell_{bdg}}$~~ ~~$\ell_{BI}$: Extent of bow impact load area, in m, along the span:~~ ~~$\ell_{BI} = \sqrt{A_{BI}}$ but not to be taken as greater than ℓ_{bdg}.~~ ~~b_{BI} : Breadth of impact load area, in m, supported by the primary supporting member, to be taken as the spacing between primary supporting members, S, as defined in **Ch 1, Sec 4, Table 5,** but not to be taken as greater than ℓ_{BI}.~~ ~~A_{BI} : Bow impact load area, in m^2, as defined in **[3.3.5]**.~~ ~~f_{bdg} : Bending moment factor taken as:~~ ~~$f_{bdg} = 12$ for primary supporting members with end fixed continuous flange or where brackets at both ends are fitted in accordance with **Ch 3, Sec 6, [4.4]**.~~ ~~C_s : Permissible bending stress coefficient taken as:~~ ~~$C_s = 0.8$ for acceptance criteria set AC-I.~~	d) The net thickness of Primary supporting members in way of bow impact strengthening area defined in **[3.3.1]**, t_w, in mm, is not to be less than: $t_w = \frac{b}{75} \sqrt{\frac{R_{eH}}{235}}$ where: s_W : plate breath, in mm, taken as the spacing between the web stiffening. e) The effective section modulus of each primary supporting member, Z in cm^3, is not to be less than: $Z = \frac{400 P_{FB} S \ell_{bdg}^2}{f_{bdg} R_{eH}}$ with f_{bdg} is not to be taken less than 10 f) The effective shear area of the web, A_{shr} in cm^2, of each primary supporting member at the support / toe of end brackets is not to be less than: $A_{shr} = \frac{2.8 P_{FB} S \ell_{shr}}{\tau_{eH}}$	

Present	Amendment	Reason
~~f) The net shear area of the web, $A_{shr-n50}$, in cm^2, of each primary supporting member at the support/toe of end brackets is not to be less than:~~ ~~$A_{shr-n50} = \frac{5 f_{PL} P_{FB} b_{BI} \ell_{shr}}{C_t \tau_{eH}}$~~ ~~where:~~ ~~$f_{PL}$: Patch load modification factor taken as:~~ ~~$f_{PL} = \frac{\ell_{BI}}{\ell_{shr}}$~~ ~~$\ell_{BI}$: Extent of bow impact load area, in m, along the span taken as:~~ ~~$\ell_{BI} = \sqrt{A_{BI}}$ but not greater than ℓ_{shr}.~~ ~~C_t : Permissible shear stress coefficient taken as:~~ ~~$C_t = 0.75$ for acceptance criteria set AC-I.~~ ~~g) The net web thickness of each primary supporting member, t_w, in mm, including decks/bulkheads in way of the side shell is not to be less than:~~ ~~$t_w = \frac{P_{FB} b_{BI}}{\sin\varphi_w \sigma_{cr}}$~~ ~~where :~~ ~~$\varphi_w$: Angle, in deg, between the primary supporting member web and the shell plate, see **Figure 5.**~~ ~~σ_{cr} : Critical buckling stress in compression of the web of the primary supporting member or deck/bulkhead panel in way of the applied load given by **Ch 8, Sec 5, [1.1.3]**, in N/mm^2. In the calculation, both σ_x and σ_y given in **Ch 8, Sec 5, [1.1.3]** are to be considered and UP-B is to be applied.~~		

Present	Amendment	Reason
 Figure 5 : Angle between shell primary member and shell plate	 Figure 4 : Angle between shell primary member and shell plate	

Present	Amendment	Reason
Section 3 Aft part	**Section 3 Aft part**	
4. ⟨omitted⟩	**4. ⟨same as the present⟩**	
5. ⟨newly added⟩	**5. Structure subjected to impact loads**	
	5.1 General	
	5.1.1 Application	
	The requirements of this sub-section cover the strengthening requirements for local impact loads that may occur in the stern bottom structure of the ships with length $L \geq 150$ m. The stern slamming loads, P_{SS}, to be applied in **[5.2]** are described in **Ch 4, Sec 5, [3].** The requirements of **[5.2]** are to be applied in addition to applicable scantling requirements in **Ch 6.**	
	5.2 Stern slamming	
	5.2.1 Application	
	The stern bottom structure is to be strengthened against stern slamming pressures.	
	5.2.2 Extent of strengthening	
	In general the strengthening is to extend aft of 0.1 L forward of AE and vertically above the minimum design ballast draught, T_{AE}, defined in **Ch 1, Sec 4, Table 2**. Outside the strengthening area the scantlings are to be tapered to maintain continuity of longitudinal and / or transverse strength.	
	5.2.3 Side shell plating	
	The net thickness of the side shell plating, t in mm, is not to be less than:	
	$t = \frac{0.0158\alpha_p b}{C_d}\sqrt{\frac{P_{SS}}{R_{eH}}}$	
	C_d : Plate capacity correction coefficient taken as:	
	$C_d = 1.22$	

Present	Amendment	Reason
	5.2.4 Side shell stiffeners The side shell stiffeners within the strengthening area defined in **[5.2.2]** are to comply with the following criteria: a) The net web thickness, t_w in mm, is not to be less than: $t_w = \dfrac{0.35 P_{SS} s \, \ell_{shr}}{d_{shr} \, \tau_{eH}}$ b) The net plastic section modulus, Z_{pl} in cm^3, is not to be less than: $Z_{pl} = \dfrac{0.6 P_{SS} s \, \ell_{bdg}^2}{f_{bdg} R_{eH}}$ **5.2.5 Primary supporting members** The size and number of openings in web plating of the floors and girders is to be minimised considering the required shear area as given: a) Section modulus The section modulus of each primary supporting member, Z in cm^3, is not to be less than: $Z = \dfrac{400 P_{SS} S \, \ell_{bdg}^2}{f_{bdg} \, R_{eH}}$ with f_{bdg} is not to be taken less than 10 b) Shear area The shear area, A_{shr}, in cm^2, of each primary supporting member web at any position along its span is not to be less than: $A_{shr} = \dfrac{2.8 \, P_{SS} S \, \ell_{shr}}{\tau_{eH}}$	

Present	Amendment	Reason
Section 4 Tanks subject to sloshing	**Section 4 Tanks subject to sloshing**	
Symbols	Symbols	
For symbols not defined in this section, refer to **Ch 1, Sec 4.**	For symbols not defined in this section, refer to **Ch 1, Sec 4.**	
α_p : Correction factor for the panel aspect ratio to be taken as: $\alpha_p = 1.2 - \frac{b}{2.1\,a}$ but not to be taken as greater than 1.0	α_p : Correction factor for the panel aspect ratio to be taken as: $\alpha_p = 1.2 - \frac{b}{2.1\,a}$ but not to be taken as greater than 1.0	
a : Length of plate panel, in mm, as defined in **Ch 3, Sec 7, [2.1.1].**	a : Length of plate panel, in mm, as defined in **Ch 3, Sec 7, [2.1.1].**	
b : Breadth of plate panel, in mm, as defined in **Ch 3, Sec 7, [2.1.1].**	b : Breadth of plate panel, in mm, as defined in **Ch 3, Sec 7, [2.1.1].**	
ℓ_{bdg} : Effective bending span, as defined in **Ch 3, Sec 7, [1.1.2],** in m.	ℓ_{bdg} : Effective bending span, as defined in **Ch 3, Sec 7, [1.1.2],** in m.	
ℓ_{slh} : Effective sloshing length, in m, as defined in **Ch 4, Sec 6, [6.3.2].**	ℓ_{tk-h} : Effective sloshing length, in m, as defined in **Ch 4, Sec 6, [3.3.2].**	
b_{slh} : Effective sloshing breadth, in m, as defined in **Ch 4, Sec 6, [6.4.2].**	b_{tk-h} : Effective sloshing breadth, in m, as defined in **Ch 4, Sec 6, [3.4.2].**	
〈omitted〉	〈same as the present〉	
1. General	**1. General**	
1.1 Application	**1.1 Application**	
1.1.1	**1.1.1**	
The requirements of this section cover the strengthening requirements for localised sloshing loads that may occur in tanks ~~carrying liquid~~.	The requirements of this section cover the strengthening requirements for localised sloshing loads that may occur in tanks.	
Sloshing loads due to the free movement of liquid in tanks are given in **Ch 4, Sec 6, [6].**	Sloshing loads due to the free movement of liquid in tanks are given in **Ch 4, Sec 6, [3].**	

Present	Amendment	Reason
1.2 General requirements	**1.2 General requirements**	
1.2.1 Filling heights of fuel oil and ballast tanks The scantlings of all ~~cargo and~~ ballast tanks are to comply with the sloshing requirements given in this section for the following cases: ~~a) Unrestricted filling height for ballast tanks,~~ ~~b) Unrestricted filling height for fuel oil tanks with cargo density equal to ρ_L, as defined in **Ch 4, Sec 6**,~~ ~~c) All filling levels up to h_{part} for cargo tanks with cargo density equal to ρ_{part} taken as:~~ ~~$h_{part} = \frac{h_{tk}\rho_L f_{CD}}{\rho_{part}}$~~ ~~where:~~ ~~$h_{part}$: Maximum permissible filling height, in m, associated with a partial filling of the considered cargo tank with a high liquid density equal to ρ_{part}.~~ ~~h_{tk} : Maximum tank height, in m.~~ ~~ρ_L : Fuel oil density as defined in **Ch 4, Sec 6.**~~ ~~f_{cd} : Factor defined in **Ch 4, Sec 6.**~~ ~~ρ_{part} : Maximum permissible high liquid density as defined in **Ch 4, Sec 6.**~~	**1.2.1 Filling heights of fuel oil and ballast tanks** The scantlings of all ballast tanks are to comply with the sloshing requirements given in this section for the unrestricted filling height for ballast tanks.	
1.2.2 Structural details Local scantling increases due to sloshing loads are to be made with due consideration given to details and avoidance of hard spots, notches and other harmful stress concentrations.	**1.2.2 Structural details** Local scantling increases due to sloshing loads are to be made with due consideration given to details and avoidance of hard spots, notches and other harmful stress concentrations.	

Present	Amendment	Reason
1.3 Application of sloshing pressure **1.3.1 General** The structural members of the following tanks are to be assessed for the design sloshing pressures $P_{slh-lng}$ and P_{slh-t} in accordance with **[1.3.4]** and **[1.3.5]**. a) Fore peak and aft peak ballast tanks. b) Other tanks which allow free movement of liquid, e.g. ballast tanks, fuel oil bunkering tanks and fresh water tanks, etc. Where the effective sloshing length, ℓ_{slh} is less than $0.03L$, calculations involving $P_{slh-lng}$ are not required and where the effective sloshing breadth b_{slh} is less than $0.32B$, calculations involving P_{slh-t} are not required. **1.3.2 Minimum sloshing pressure** The minimum sloshing pressure, $P_{slh-\min}$, as defined in **Ch 4, Sec 6, [6.2]** is to apply to tanks in which the effective sloshing length, ℓ_{slh} or breadth b_{slh}, is less than defined in **[1.3.1]**. **1.3.3 Structural members to be assessed** The following structural members are to be assessed: a) Plates and stiffeners forming boundaries of tanks. b) Plates and stiffeners on wash bulkheads. c) Web plates and web stiffeners of primary supporting members located in tanks. d) Tripping brackets supporting primary supporting members in tanks. **1.3.4 Application of design sloshing pressure due to longitudinal liquid motion** The design sloshing pressure due to longitudinal liquid motion, $P_{slh-lng}$, as defined in **Ch 4, Sec 6, [6.3.3]** is to be applied to the following members as shown in **Figure 1.** a) Transverse tight bulkheads. b) Transverse wash bulkheads. c) Stringers on transverse tight and wash bulkheads.	**1.3 Application of sloshing pressure** **1.3.1 General** The structural members of the following tanks are to be assessed for the design sloshing pressures $P_{slh-lng}$ and P_{slh-t} in accordance with **[1.3.4]** and **[1.3.5]**. a) Fore peak and aft peak ballast tanks. b) Other tanks which allow free movement of liquid, e.g. ballast tanks, fuel oil bunkering tanks and fresh water tanks, etc. Where the effective sloshing length, ℓ_{tk-h} is less than 0.03 L, calculations involving $P_{slh-lng}$ are not required and where the effective sloshing breadth b_{tk-h} is less than 0.32 B, calculations involving P_{slh-t} are not required. **1.3.2 Minimum sloshing pressure** The minimum sloshing pressure, $P_{slh-\min}$, as defined in **Ch 4, Sec 6, [3.2]** is to apply to tanks in which the effective sloshing length, ℓ_{tk-h} or breadth b_{tk-h}, is less than defined in **[1.3.1]**. **1.3.3 Structural members to be assessed** The following structural members are to be assessed: a) Plates and stiffeners forming boundaries of tanks. b) Plates and stiffeners on wash bulkheads. c) Web plates and web stiffeners of primary supporting members located in tanks. d) Tripping brackets supporting primary supporting members in tanks. **1.3.4 Application of design sloshing pressure due to longitudinal liquid motion** The design sloshing pressure due to longitudinal liquid motion, $P_{slh-lng}$, as defined in **Ch 4, Sec 6, [3.3.2]** is to be applied to the following members as shown in **Figure 1.** a) Transverse tight bulkheads. b) Transverse wash bulkheads. c) Stringers on transverse tight and wash bulkheads.	

Present	Amendment	Reason
d) Plating and stiffeners on the longitudinal bulkheads, deck and inner hull within a distance from the transverse bulkhead taken as: • $0.25\ell_{slh}$ • The distance between the transverse bulkhead and the first web frame if located inside the tank at the considered level, whichever is less. In addition, the first web frame next to a transverse tight or wash bulkhead if the web frame is located within $0.25\ell_{slh}$ from the bulkhead, as shown in **Figure 1,** is to be assessed for the web frame reflected sloshing pressure, P_{slh-wf}, as defined in **Ch 4, Sec 6, [6.3.4].** The minimum sloshing pressure, $P_{slh-\min}$, as defined in **Ch 4, Sec 6, [6.2]** is to be applied to all other members. 〈omitted〉 **1.3.5 Application of design sloshing pressure due to transverse liquid motion** The design sloshing pressure due to transverse liquid motion, P_{shl-t}, as defined in **Ch 4, Sec 6, [6.4.3],** is to be applied to the following members as shown in **Figure 2.** a) Longitudinal tight bulkhead. b) Longitudinal wash bulkhead. c) Horizontal stringers on longitudinal tight and wash bulkheads. d) Plating and stiffeners on the transverse tight bulkheads including stringers and deck within a distance from the longitudinal bulkhead taken as: • $0.25b_{slh}$ • The distance between the longitudinal bulkhead and the first girder if located inside the tank at the considered level, whichever is less.	d) Plating and stiffeners on the longitudinal bulkheads, deck and inner hull within a distance from the transverse bulkhead taken as: • $0.25\ \ell_{tk-h}$ • The distance between the transverse bulkhead and the first web frame if located inside the tank at the considered level, whichever is less. In addition, the first web frame next to a transverse tight or wash bulkhead if the web frame is located within $0.25\ \ell_{tk-h}$ from the bulkhead, as shown in **Figure 1,** is to be assessed for the web frame reflected sloshing pressure, P_{slh-wf}, as defined in **Ch 4, Sec 6, [3.3.3].** The minimum sloshing pressure, $P_{slh-\min}$, as defined in **Ch 4, Sec 6, [3.2]** is to be applied to all other members. 〈same as the present〉 **1.3.5 Application of design sloshing pressure due to transverse liquid motion** The design sloshing pressure due to transverse liquid motion, P_{shl-t}, as defined in **Ch 4, Sec 6, [3.4.2],** is to be applied to the following members as shown in **Figure 2.** a) Longitudinal tight bulkhead. b) Longitudinal wash bulkhead. c) Horizontal stringers on longitudinal tight and wash bulkheads. d) Plating and stiffeners on the transverse tight bulkheads including stringers and deck within a distance from the longitudinal bulkhead taken as: • $0.25b_{tk-h}$ • The distance between the longitudinal bulkhead and the first girder if located inside the tank at the considered level, whichever is less.	

Present	Amendment	Reason
In addition, the first girder next to the longitudinal tight or wash bulkhead if the girder is located within $0.25b_{slh}$ from longitudinal bulkhead, as shown in **Figure 2,** is to be assessed for the reflected sloshing pressure, $P_{slh-grd}$ as defined in **Ch 4, Sec 6, [6.4.4].** The minimum sloshing pressure, $P_{slh-\min}$, as defined in **Ch 4, Sec 6, [6.2]**, is to be applied to all other members. 〈omitted〉 **1.3.6 Combination of transverse and longitudinal fluid motion** The sloshing pressures due to transverse and longitudinal fluid motion are assumed to act independently. Structural members are therefore to be evaluated based on the greatest sloshing pressure due to longitudinal and transverse fluid motion. **1.3.7 Additional sloshing impact assessment** For tanks with effective sloshing breadth, b_{slh}, greater than $0.56B$ or effective sloshing length, ℓ_{slh}, greater than $0.13L$, an additional sloshing impact assessment is to be carried out in accordance with the individual Society' procedures.	In addition, the first girder next to the longitudinal tight or wash bulkhead if the girder is located within 0.25 b_{tk-h} from longitudinal bulkhead, as shown in **Figure 2,** is to be assessed for the reflected sloshing pressure, $P_{slh-grd}$ as defined in **Ch 4, Sec 6, [3.4.3].** The minimum sloshing pressure, $P_{slh-\min}$, as defined in **Ch 4, Sec 6, [3.2]**, is to be applied to all other members. 〈same as the present〉 **1.3.6 Combination of transverse and longitudinal fluid motion** The sloshing pressures due to transverse and longitudinal fluid motion are assumed to act independently. Structural members are therefore to be evaluated based on the greatest sloshing pressure due to longitudinal and transverse fluid motion. **1.3.7 Additional sloshing impact assessment** For tanks with effective sloshing breadth, b_{tk-h}, greater than 0.56 B or effective sloshing length, ℓ_{tk-h}, greater than 0.13 L, an additional sloshing impact assessment is to be carried out in accordance with the individual Society' procedures.	

Present	Amendment	Reason
Chapter 11 Superstructure, Deckhouses and Hull Outfitting	**Chapter 11 Superstructure, Deckhouses and Hull Outfitting**	
Section 1 Superstructures, Deckhouses and Companionways	**Section 1 Superstructures, Deckhouses and Companionways**	
Symbols	Symbols	
For symbols not defined in this Section, refer to **Ch 1, Sec 4.**	For symbols not defined in this Section, refer to **Ch 1, Sec 4.**	
⟨omitted⟩	⟨same as the present⟩	
P_A : External pressure for end bulkheads of superstructure and deckhouse walls, in $\mathrm{kN/m^2}$ according to **Ch 4, Sec 5, [4.4.1]**.	P_A : External pressure for end bulkheads of superstructure and deckhouse walls, in $\mathrm{kN/m^2}$ according to **Ch 4, Sec 5, [4.4.1]**.	
	C_w : Wave coefficient, as defined in **Ch 4, Sec 4**.	
ℓ_{bdg} : Effective bending span, in m, as defined in **Ch 3, Sec 7**.	ℓ_{bdg} : Effective bending span, in m, as defined in **Ch 3, Sec 7**.	
ℓ_{shr} : Effective shear span, in m, as defined in **Ch 3, Sec 7**.	ℓ_{shr} : Effective shear span, in m, as defined in **Ch 3, Sec 7**.	
c : Coefficient taken as: c = 0.75 for beams, girders and transverses which are simply supported in one or both ends. c = 0.55 in other cases.	c : Coefficient taken as: c = 0.75 for beams, girders and transverses which are simply supported in one or both ends. c = 0.55 in other cases.	
m_a : Coefficient taken as: $m_a = 0.204\frac{s}{1000\,l_{bdg}}\left[4-\left(\frac{s}{1000\,l_{bdg}}\right)^2\right]$ with $\frac{s}{1000\,l_{bdg}} \le 1$	m_a : Coefficient taken as: $m_a = 0.204\frac{s}{1000\,l_{bdg}}\left[4-\left(\frac{s}{1000\,l_{bdg}}\right)^2\right]$ with $\frac{s}{1000\,\ell_{bdg}} \le 1$	

Present	Amendment	Reason
Section 2 Bulwark, Guard Rails and Breakwater **1. ~ 3. 〈omitted〉** **4. Breakwater** **4.1 General** **4.1.1 〈omitted〉** **4.1.2 Dimensions of the breakwater** a) The recommended height of the breakwater is as following. $h_w = 0.8\,(b\,c_1 - z)$ (m) ($h_{w\_\min} = 0.6(b\,c_1 - z)$) where z : the vertical distance (m) between the summer load line and the bottom line of the breakwater. $b = 1.0 + 2.75\left(\dfrac{\dfrac{x}{L} - 0.45}{C_B + 0.2}\right)^2$ $(0.6 \le C_B \le 0.8)$ x : distance (m) from aft end of L to breakwater ~~c_1 : Wave coefficient~~ ~~$10.75 - \left(\dfrac{300 - L}{100}\right)^{1.5}$ where $L \le 300$ m~~ ~~10.75 where $300 < L \le 350$ m~~ ~~$10.75 - \left(\dfrac{L - 300}{150}\right)^{1.5}$ where $350 < L \le 500$ m~~ The average height of whalebacks or turtle decks has to be determined analogously according to **Figure 1**. 〈omitted〉	**Section 2 Bulwark, Guard Rails and Breakwater** **1. ~ 3. 〈same as the present〉** **4. Breakwater** **4.1 General** **4.1.1 〈same as the present〉** **4.1.2 Dimensions of the breakwater** a) The recommended height of the breakwater is as following. $h_w = 0.8\,(b\,C_w - z)$ but not less than $h_{w\_\min}$ where; $h_{w\_\min} = 0.6(b\,C_w - z)$ z : the vertical distance (m) between the summer load line and the bottom line of the breakwater. $b = 1.0 + 2.75\left(\dfrac{\dfrac{x}{L} - 0.45}{C_B + 0.2}\right)^2$ with $0.6 \le C_B \le 0.8$ x : distance (m) from aft end of *L* to breakwater The average height of whalebacks or turtle decks has to be determined analogously according to **Figure 1**. 〈same as the present〉	

Present	Amendment	Reason
4.1.4 Loads a) The loads for dimensioning are to be determined according to following formula. $p_A = nc(bc_1 - z) \qquad (\mathrm{kN/m^2})$ p_A is not to be less than following values $25 + \frac{L}{10}$ where $L \le 250$ m 50 where $L > 250$ m $n = 10 + L/20$ ~~where $L \le 300$ m, if L is greater than 300 m, L is to be taken as 300 m~~ $c = \sin\alpha_w$ (α_w is to be determined on centre line)	**4.1.4 Loads** a) The loads for dimensioning, in $\mathrm{kN/m^2}$, are to be determined according to following formula. $P_A = nc(bC_w - z)$ P_A is not to be less than following values $25 + \frac{L}{10}$ where $L \le 250$ m 50 where $L > 250$ m $n = 10 + \frac{L_2}{20}$ $c = \sin\alpha_w$ where; α_w : Inclining angle, in deg, of breakwater at centre line	
4.1.5 Plate thickness and stiffeners a) The plate thickness has to be determined according to following formula. ~~$t = t' + t_k$ (mm)~~ $t' = 0.9s\sqrt{p_A K}$ ~~$t_k = 1.5$ where $t' \le 10$ mm~~ ~~$t_k = 0.1t'/\sqrt{K} + 0.5$ where $t' > 10$ mm~~ $t_{\min} = (5.0 + \frac{L}{100})\sqrt{K}$ (mm) (where $L \le 300$ m, if L is greater than 300 m, L is to be taken as 300 m) b) The section modulus of stiffeners are to be calculated according to following formula. Stiffeners are to be connected on both ends to the structural members supporting them. $Z = 0.35 s l^2 p_A K \qquad (\mathrm{cm^3})$ l : span (m) of stiffeners s : spacing (m) of stiffeners	**4.1.5 Plate thickness and stiffeners** a) The net thickness of plate, in mm, has to be determined according to following formula. $t = 0.9s\sqrt{P_A k} \cdot 10^{-3}$ but not less than $t_{\min}$ where; $t_{\min} = (3.5 + \frac{L_2}{100})\sqrt{k}$ b) The net section modulus of stiffeners, in $\mathrm{cm^3}$, are to be calculated according to following formula. Stiffeners are to be connected on both ends to the structural members supporting them. $Z = 0.07\frac{s\,\ell_{bdg}^2 P_A}{R_{eH}}$	

Present	Amendment	Reason
c) For whalebacks with an inclining angle α_w of less than 20° the scantlings of plates and stiffeners are to be in accordance with the discretion of the Society.	c) For whalebacks with an inclining angle α_w of less than 20° the scantlings of plates and stiffeners are to be in accordance with the discretion of the Society.	
〈omitted〉	〈same as the present〉	
4.1.6 Primary supporting members	**4.1.6 Primary supporting members**	
For primary supporting members of the structure, a stress analysis has to be carried out. The permissible equivalent stress, σ_v is $230/K$ $(\mathrm{kN/m^2})$.	For primary supporting members of the structure, a stress analysis has to be carried out. The permissible equivalent stress, σ_{vm} in $\mathrm{N/mm^2}$, shall not exceed R_Y.	
4.1.7 Proof of buckling strength	**4.1.7 Proof of buckling strength**	
Structural members' buckling strength has to be proved according to **Ch 8, Sec 5**.	Structural members' buckling strength has to be proved according to **Ch 8, Sec 5**.	

Present	Amendment	Reason
Chapter 12 Construction **Section 1 ~ 2 〈omitted〉** **Section 3 Design of Weld Joints** **1. 〈omitted〉** **2. Tee or Cross Joint** **2.1 ~ 2.3 〈omitted〉** **2.4 Partial or full penetration welds** **2.4.1 〈omitted〉** **2.4.2 Partial or full penetration welding** In areas with high tensile stresses or areas considered critical, full or partial penetration welds are to be used. In case of full penetration welding, the root face is to be removed, e.g. by gouging before welding of the back side. For partial penetration welds the root face, f, is, to be taken between 3 mm and $t_{as-built}/3$. The groove angle α made to ensure welding bead penetrating up to the root of the groove is usually from 40° to 60°. The welding bead of the full/partial penetration welds is to cover root of the groove. Examples of partial penetration welds are given on **Figure 2.** The weld size of partial penetration is to satisfy the following equation. 〈omitted〉	**Chapter 12 Construction** **Section 1 ~ 2 〈same as the present〉** **Section 3 Design of Weld Joints** **1. 〈same as the present〉** **2. Tee or Cross Joint** **2.1 ~ 2.3 〈same as the present〉** **2.4 Partial or full penetration welds** **2.4.1 〈same as the present〉** **2.4.2 Partial or full penetration welding** In areas with high tensile stresses or areas considered critical, full or partial penetration welds are to be used. In case of full penetration welding, the root face is to be removed, e.g. by gouging before welding of the back side. For partial penetration welds the root face, f, is, to be taken between 3.0 mm and $t_{as-built}/3$. The groove angle α made to ensure welding bead penetrating up to the root of the groove is usually from 40° to 60°. The welding bead of the full / partial penetration welds is to cover root of the groove. Examples of partial penetration welds are given on **Figure 2.** The weld size of partial penetration for extremely thick steel is to satisfy the following equation. 〈same as the present〉	

Present	Amendment	Reason
$t_{p1}+t_{p2} \geq 2(f_{yd} \cdot f_c \cdot f_{ten} \cdot t_{as-built}+t_{gap})$	$t_{p1}+t_{p2} \geq 2(f_{yd} \cdot f_c \cdot f_{ten} \cdot t_{as-built}+t_{gap})$	
t_{p1},t_{p2} : The weld size in Figure 2	t_{p1}, t_{p2} : The weld size in Figure 2	
f_c : Position coefficient, which is 1.1 for ballast tank and bilge well and 1.0 for elsewhere	f_c : Position coefficient, which is 1.1 for ballast tank and bilge well and 1.0 for elsewhere	
f_{ten} : 0.44 as the welding factor	f_{ten} : welding factor $f_{ten}=0.22+0.66\,f/t_{as-built}$	
2.4.3 ~ 2.4.4 〈omitted〉	**2.4.3 ~ 2.4.4 〈same as the present〉**	
2.4.5 Locations required for full penetration welding	**2.4.5 Locations required for full penetration welding**	
Full penetration welds are to be used in the following locations and elsewhere as required by the rules :	Full penetration welds are to be used in the following locations and elsewhere as required by the rules :	
a) Radiused hatch coaming plate at corners to deck.	a) Radiused hatch coaming plate at corners to deck.	
b) Edge reinforcement or pipe penetration both to strength deck, sheer strake and bottom plating within 0.6L amidships, when the dimensions of the opening exceeds 300 mm.	b) Edge reinforcement or pipe penetration both to strength deck, sheer strake and bottom plating within 0.6 L amidships, when the dimensions of the opening exceeds 300 mm.	
c) Abutting plate panels with as-built thickness less than or equal to 12 mm, forming outer shell boundaries below the scantling draught, including but not limited to: sea chests, rudder trunks, and portions of transom. ~~For as-built thickness greater than 12 mm, partial penetration in accordance with **[2.4.2]**.~~	c) Abutting plate panels with as-built thickness less than or equal to 12.0 mm, forming outer shell boundaries below the scantling draught, including but not limited to: sea chests, rudder trunks, and portions of transom.	
d) Crane pedestals and associated bracketing and support structure.	d) Crane pedestals and associated bracketing and support structure.	
e) For toe connections of longitudinal hatch coaming end bracket to the deck plating, full penetration weld for a distance of 0.15 H_c from toe of side coaming termination bracket is required, where H_c is the hatch coaming height.	e) For toe connections of longitudinal hatch coaming end bracket to the deck plating, full penetration weld for a distance of 0.15 H_c from toe of side coaming termination bracket is required, where H_c is the hatch coaming height.	
f) Rudder horns and shaft brackets to shell structure.	f) Rudder horns and shaft brackets to shell structure.	
~~g) Thick flanges of long transverse web frames to side web frames. Thick flanges of long longitudinal girder to bulkhead web frames.~~		
~~h) Brackets connecting face plates of cross decks and deck girders~~		
~~I) Cross deck structures to transverse web frames(recommendation)~~		

Present	Amendment	Reason
2.4.6 Locations required for partial penetration welding Partial penetration welding as defined in **[2.4.2]**, is to be used in the following locations. a) Longitudinal/transverse bulkhead primary supporting member end connections to the double bottom. b) Structural elements in double bottom below bulkhead primary supporting members. c) Horizontal stringers on bulkheads in way of their bracket toe and the heel.	**2.4.6 Locations required for partial penetration welding** Partial penetration welding as defined in **[2.4.2]**, is to be used in the following locations. a) Abutting plate panels with as-built thickness greater than 12mm, forming outer shell boundaries below the scantling draught, including but not limited to : sea chests, rudder trunks, and portions of transom.	

<table>
<tr><th>Present</th><th>Amendment</th><th>Reason</th></tr>
<tr>
<td>

2.5 Weld size criteria

2.5.1 ⟨omitted⟩

2.5.2

⟨omitted⟩

Table 2 : Weld factors for different structural members

<table>
<tr><td rowspan="2">Hull area</td><td colspan="4">Connection</td><td rowspan="2">f_{weld}</td></tr>
<tr><td colspan="2">of</td><td colspan="2">to</td></tr>
<tr><td colspan="6">⟨omitted⟩</td></tr>
<tr><td rowspan="9">Deck</td><td rowspan="3">Strength deck</td><td rowspan="2">$t_{as-built} \geq 13$</td><td colspan="2">Side shell plating within 0.6L midship</td><td>PPW(3)</td></tr>
<tr><td colspan="2">Elsewhere</td><td>0.48</td></tr>
<tr><td>$t_{as-built} < 13$</td><td colspan="2">Side shell plating</td><td>0.48</td></tr>
<tr><td colspan="2" rowspan="2">Other deck</td><td colspan="2">Side shell plating/bulkhead</td><td>0.38</td></tr>
<tr><td colspan="2">Stiffeners</td><td>0.20</td></tr>
<tr><td colspan="2" rowspan="3">Hatch coamings</td><td rowspan="3">Deck plating</td><td>Longitudinal hatch coaming corners of hatchways in a length of 15% of the hatch coaming heigth</td><td>FPW(1)(4) or PPW(3)</td></tr>
<tr><td>Longitudinal hatch coaming on a length starting from 15% of the hatch coaming height from the corners of hatchways up to 15% of the hatch length</td><td>0.48 or PPW(3)</td></tr>
<tr><td>Elsewhere</td><td>0.38 or PPW(3)</td></tr>
<tr><td colspan="2">Web stiffeners</td><td colspan="2">Coaming webs</td><td>0.20(2)</td></tr>
<tr><td colspan="6">⟨omitted⟩</td></tr>
<tr><td colspan="6">(1) f_{weld} =0.43 for hatch coaming other than in cargo holds.
(2) Continuous welding.
(3) PPW: Partial penetration welding in accordance with [2.4.2].
(4) FPW: Full penetration welding in accordance with [2.4.2].
(5) Bulkheads of superstructure and deckhouse are to be considered in the row corresponding to “Superstructure and deck house”.</td></tr>
</table>

</td>
<td>

2.5 Weld size criteria

2.5.1 ⟨same as the present⟩

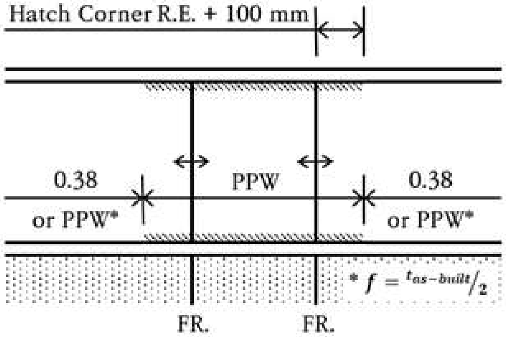
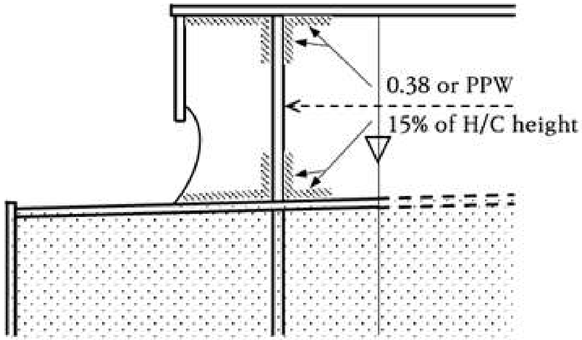
2.5.2

⟨same as the present⟩

Table 2 : Weld factors for different structural members

<table>
<tr><td rowspan="2">Hull area</td><td colspan="4">Connection</td><td rowspan="2">f_{weld}</td></tr>
<tr><td colspan="2">of</td><td colspan="2">to</td></tr>
<tr><td colspan="6">⟨same as the present⟩</td></tr>
<tr><td rowspan="9">Deck</td><td rowspan="3">Strength deck</td><td rowspan="2">$t_{as-built} \geq 13$</td><td colspan="2">Side shell plating within 0.6 L midship</td><td>PPW(3)</td></tr>
<tr><td colspan="2">Elsewhere</td><td>0.48</td></tr>
<tr><td>$t_{as-built} < 13$</td><td colspan="2">Side shell plating</td><td>0.48</td></tr>
<tr><td colspan="2" rowspan="2">Other deck</td><td colspan="2">Side shell plating/bulkhead</td><td>0.38</td></tr>
<tr><td colspan="2">Stiffeners</td><td>0.20</td></tr>
<tr><td colspan="2" rowspan="3">Hatch coamings(1)</td><td rowspan="3">Deck plating</td><td>End of hatch corner curvature radius (R.E) + 100 mm
See Figure 4</td><td>PPW(3)</td></tr>
<tr><td>Transverse hatch coaming 15% of hatch coaming height(5)
See Figure 5</td><td>0.38 orPW(3)</td></tr>
<tr><td>Elsewhere</td><td>0.38 or PPW(4)</td></tr>
<tr><td colspan="2">Web stiffeners</td><td colspan="2">Coaming webs</td><td>0.20(2)</td></tr>
<tr><td colspan="6">⟨same as the present⟩</td></tr>
<tr><td colspan="6">(1) f_{weld} = 0.43 for hatch coaming other than in cargo holds.
(2) Continuous welding.
(3) PPW : Partial penetration welding in accordance with [2.4.2].
(4) PPW : Partial penetration welding in accordance with [2.4.2], with $f = t_{as-built}/2$
(5) Need not to be taken greater than 250 mm
(5) Bulkheads of superstructure and deckhouse are to be considered in the row corresponding to “Superstructure and deck house”.</td></tr>
</table>

</td>
<td></td>
</tr>
</table>

Present	Amendment	Reason
〈newly added〉	 Figure 4 : Welding of hatch coaming (Longitudinal)  Figure 5 : Welding of hatch coaming (Transverse)	

Present	Amendment	Reason

Present

Table 3 : Weld factors for miscellaneous fittings and equipment

Item	Connection to	f_{weld}
Hatch cover	Watertight/oil-tight joints	0.48
	At ends of stiffeners	0.38
	Elsewhere	0.24
Mast, derrick post, crane pedestal, etc.	Deck / Underdeck reinforced structure	0.43
Deck machinery seat	Deck	0.24
Mooring equipment seat	Deck	0.43
Ring for access hole type cover	Anywhere	0.43
Stiffening of side shell doors and weathertight doors	Anywhere	0.24
Frames of shell and weathertight doors	Anywhere	0.43
Coaming of ventilator and air pipe	Deck	0.43
Ventilators, etc., fittings	Anywhere	0.24
Ventilators, air pipes, etc., coaming to deck	Deck	0.43
Scupper and discharge	Deck	0.55
Bulwark stay	Deck	0.24
Bulwark plating	Deck	0.43
Guard rail, stanchion	Deck	0.43
〈newly added〉		
〈newly added〉		
〈newly added〉		
Cleats and fittings	Hatch coaming and hatch cover	0.60$^{(1)}$

(1) Minimum weld factor. Where $t_{as-built}$ 〉 11.5mm, $\ell_{\leq g}$ need not exceed 0.62 $t_{as-built}$. Penetration welding may be required depending on design.

Amendment

Table 3 : Weld factors for miscellaneous fittings and equipment

Item	Connection to	f_{weld}
Hatch cover	Watertight/oil-tight joints	0.48
	At ends of stiffeners	0.38
	Elsewhere	0.24
Mast, derrick post, crane pedestal, etc.	Deck / Underdeck reinforced structure	0.43
Deck machinery seat	Deck	0.24
Mooring equipment seat	Deck	0.43
Ring for access hole type cover	Anywhere	0.43
Stiffening of side shell doors and weathertight doors	Anywhere	0.24
Frames of shell and weathertight doors	Anywhere	0.43
Coaming of ventilator and air pipe	Deck	0.43
Ventilators, etc., fittings	Anywhere	0.24
Ventilators, air pipes, etc., coaming to deck	Deck	0.43
Scupper and discharge	Deck	0.55
Bulwark stay	Deck	0.24
Bulwark plating	Deck	0.43
Guard rail, stanchion	Deck	0.43
Cell guide backing bracket	Bulkhead	0.24
Cone bracket	Deck and Girder	0.43
Lashing bridge, Container stanchion	Deck	PPW$^{(1)}$
Cleats and fittings	Hatch coaming and hatch cover	0.24$^{(2)}$

(1) PPW : Partial penetration welding in accordance with [2.4.2].

(2) Minimum weld factor. Where $t_{as-built} > 11.5\text{mm}$, ℓ_{leg} need not exceed 0.62 $t_{as-built}$. Penetration welding may be required depending on design.

Present	Amendment	Reason
Chapter 13 Ship in Operation – Renewal Criteria	**Chapter 13 Ship in Operation – Renewal Criteria**	
Section 1 Principles and Survey Requirements	**Section 1 Principles and Survey Requirements**	
1. Principles	**1. Principles**	
1.1 ~ 1.2 〈omitted〉	1.1 ~ 1.2 〈same as the present〉	
~~**1.3 Requirements for documentation**~~	1.3 〈del〉	
~~**1.3.1 Plans**~~ ~~The plans to be supplied onboard the ship, as required in **Ch 1, Sec 3**, are to include, for each structural element, both the as-built and renewal thickness as defined in **Sec 2**. Any thickness for voluntary addition is also to be clearly indicated on the plans.~~	1.3.1 〈del〉	
~~**1.3.2 Hull girder sectional properties**~~ ~~The Midship section plan to be supplied onboard the ship is to include the minimum required hull girder sectional properties, as defined in **Ch 5, Sec 1**, for the representative transverse sections of all cargo holds.~~	1.3.2 〈del〉	
2. Hull Survey Requirements	**2. Hull Survey Requirements**	
2.1 General	**2.1 General**	
2.1.1 Minimum hull survey requirements The minimum hull survey requirements including thickness measurements for the maintenance of class are given in **Pt 1.** Refer to **[1.1.4].**	**2.1.1 Minimum hull survey requirements** The minimum hull survey requirements including thickness measurements for the maintenance of class are given in **Pt 1.** Refer to **[1.1.4].**	

Present	Amendment	Reason
Section 2 Acceptance Criteria Symbols $t_{as-built}$: As built thickness, in mm. t_c : Corrosion addition in mm, as defined in **Ch 3, Sec 2**. t_{res} : Reserve thickness, taken equal to 0.5 mm. $t_{vol-add}$: Thickness for voluntary addition, in mm. **1. 〈omitted〉** **2. Renewal Criteria** **2.1 Local corrosion** **2.1.1 Renewal thickness of local structural elements** Local structural elements include local supporting members and primary supporting members. Steel renewal is required if the measured thickness, t_m in mm, is less than the renewal thickness, t_{ren} defined as: $t_{ren} = t_{as-built} - t_c - t_{vol-add}$	**Section 2 Acceptance Criteria** Symbols $t_{as-built}$: As built thickness, in mm. t_{c-m} : Diminution thickness, in mm t_{res} : Reserve thickness, taken equal to 0.5 mm. $t_{vol-add}$: Thickness for voluntary addition, in mm. **1. 〈same as the present〉** **2. Renewal Criteria** **2.1 Local corrosion** **2.1.1 Renewal thickness of local structural elements** Local structural elements include local supporting members and primary supporting members. Steel renewal is required if the measured thickness, t_m in mm, is less than the renewal thickness, t_{ren} defined as: $t_{ren} = t_{as-built} - t_{c-m} - t_{vol-add}$ where: $t_{c-m} = (t_{as-built} - t_{vol-add})\ C_{Wear-limit}$ $C_{Wear-limit}$: Local wear limit defined in **Table 1**.	

<table>
<tr><th>Present</th><th>Amendment</th><th>Reason</th></tr>
<tr>
<td>〈newly added〉</td>
<td>

Table 1 : Local wear limit, $C_{Wear-limit}$

<table>
<tr><td rowspan="6">Local
Wear
Limit</td><td rowspan="2">Name of member</td><td>Wear limit</td></tr>
<tr><td>Class I</td></tr>
<tr><td>Strength deck plating and Sheer strake including welded longitudinals,
Side and bottom shell plating
Stringer deck plating
Inner bottom plating
Longitudinal and Side longitudinal bulkhead plating
Bulkhead plating of deep tank
Floor and Girder of double bottom
Transverse web frame and Side stringer of double side
Longitudinal deck girder
Web and face of primary supporting member
Web, face and brackets of frames in cargo hold</td><td>0.2</td></tr>
<tr><td>Effective deck plating (3)
Superstructure deck plating
Deck plating inside the line of cargo hatch openings
Watertight bulkhead plating other than bulkhead plating of deep tank,
Hatch cover(including stiffeners) and Hatch coaming(including stiffeners),
Web, face and brackets of secondary stiffener (2)</td><td>0.25</td></tr>
<tr><td>Partial corrosion (e.g pitting)</td><td>0.3</td></tr>
<tr><td colspan="2">(1) For ships classed through the Classification Survey after Construction, the separate requirements specified by the Society are to be applied.
(2) Secondary stiffener refers to the member which is supported by the primary supporting member and does not support another reinforcement member.
(3) Definition of effective deck is specified in Pt 3, Ch 5, 103. of the Rules.</td></tr>
</table>

</td>
<td></td>
</tr>
<tr><td>〈omitted〉</td><td>〈same as the present〉</td><td></td></tr>
</table>

RULES FOR CLASSIFICATION(STEEL SHIPS)

(Part 14 Structural Rules for Container Ships)

Hull Rule Development Team

- Main Amendments -

(1) Enter into force on 1 January 2021 (the contract date for ship construction)

◉ To reflect Request for Establishment/Revision of Classification Technical Rules

- To reflect UR S33 Rev.2

Present	Amendment
Chapter 12 Construction	**Chapter 12 Construction**
Section 1 ~ Section 3 <Omitted>	**Section 1 ~ Section 3 <Omitted>**
Section 4 Use of Extremely Thick Steel	**Section 4 Use of Extremely Thick Steel**
1. Application	1. Application
1.1 General	1.1 General
1.1.1 〈Omitted〉	1.1.1 〈same as the present rule〉
1.1.2 〈Omitted〉	1.1.2 〈same as the present rule〉
1.1.3 This requirements gives the basic concepts for application of extremely thick steel plates to longitudinal structural members in the uppder deck ~~and hatch coaming structural~~ region~~(i.e. uppder deck plating, hatch side coaming and hatch coaming top).~~	1.1.3 This requirements gives the basic concepts for application of extremely thick steel plates to longitudinal structural members in the upper deck.
1.1.4 The application of the measures specified in [2], [3] and [4] of this requirements is to be in accordance with [5].	1.1.4 This requirements defines the following methods to apply to the extremely thick plates of container ships for preventing the crack initiation and propagation: a) Non-Destructive Testing(NDT) during construction detailed in [2] b) Welding to increase toughness in [3] c) Brittle crack arrest design detailed in [4] The application of the measures specified in [2], [3] and [4] of this requirements is to be in accordance with [5].
1.1.5 〈New〉	1.1.5 For the application of this requirements, the upper deck region means the upper deck plating, hatch side coaming plating, hatch coaming top plating and their attached longitudinals.
1.2 Steel Grade	1.2 Steel Grade
1.2.1 This requirements is to be applied to when any of YP36, YP40 and YP47 steel plates are sued for the longitudinal structure members.	1.2.1 This requirements is to be applied to when any of YP36, YP40 and YP47 steel plates are sued for the longitudinal structure members in the upper deck region.
1.2.2 〈Omitted〉	1.2.2 〈same as the present rule〉
1.2.3 In ~~the~~ case ~~that~~ YP47 steel plates are used for longitudinal structural members in the upper deck region ~~such as upper deck plating, hatch side coaming and hatch coaming top and their attached longitudinals,~~ the ~~grade of YP47~~ steel plates ~~is~~ to be EH47 specified in Pt 2, Ch 1, Sec 3.	1.2.3 In case YP47 steel plates are used for longitudinal structural members in the upper deck region, the steel plates are to be EH47 specified in Pt 2, Ch 1, Sec 3.

Present	Amendment
1.3 〈Omitted〉	1.3 〈same as the present rule〉
2. ~ 3. 〈Omitted〉	2. ~ 3. 〈same as the present rule〉
4. Brittle crack arrest design(Measure No. 3, 4 and 5 of [5])	4. Brittle crack arrest design(Measure No. 3, 4 and 5 of [5])
4.1 General 4.1.1 Measures for prevention of brittle crack propagation~~, which is the same meaning as Brittle crack arrest design,~~ are to be taken within the cargo hold region. 4.1.2 The ~~approach~~ given in this section generally ~~applies~~ to the block-to-block joints but it should be noted that cracks can initiate and propagate away from such joints. Therefore, appropriate measures should be considered ~~in accordance with~~ [4.2.2.b]. 4.1.3 Brittle crack arrest steel ~~is~~ defined in Pt 2, Ch 1, Sec 3. ~~Only for the scope of this Guidance, the definition in Pt 2, Ch 1, Sec 3 also applies to YP36 and YP40 steels.~~	4.1 General 4.1.1 The brittle crack arrest steel method detailed in [4] may be used when the measures No. 3, 4, and 5 of [5] are applied and the steel grade material of the upper deck is not higher than YP40. Otherwise other means for preventing the crack initiation and propagation shall be aagreed with the Society. 4.1.2 Measures for prevention of brittle crack propagation are to be taken within the cargo hold region. A brittle crack arrest design means a design using these measures. 4.1.3 The measures given in this section generally apply to the block-to-block joints but it should be noted that cracks can initiate and propagate away from such joints. Therefore, appropriate measures should also be considered for the cases specified in [4.2.2.b]. 4.1.4 Brittle crack arrest steels are defined in Pt 2, Ch 1, Sec 3.
4.2 Functional requirements of brittle crack arrest design The purpose of the brittle crack design is aimed at arresting propagation of a rack at a proper position and to prevent large scale fracture of the hull girder. 4.2.1 ~~The point of a brittle crack initiation is to be considered in the block-to-block butt joints both of hatch side coaming and upper deck.~~	4.2 Functional requirements of brittle crack arrest design The purpose of the brittle crack design is aimed at arresting propagation of a rack at a proper position and to prevent large scale fracture of the hull girder. 4.2.1 The locations of most concern fro brittle crack initiation and propagation are the block-to-block butt weld joints either on hatch side coaming or on upper deck plating. Other locations in block fabrication where joints are aligned may also present higher opportunity for crack initiation and propagation along butt weld joints.

Present	Amendment
4.2.2 Both of the following cases are to be considered: a)～b) 〈Omitted〉 c) "Other weld ~~areas~~" in (b) includes the following(refer to Figure 4): $\boxed{1}$ Fillet weld~~s where~~ hatch side coaming plating, including top plating, ~~meet~~ longitudinals; $\boxed{2}$ Fillet weld~~s where~~ hatch side coaming plating, including top plating and longitudinals, ~~meet~~ attachments. (e.g., Fillet welds ~~where~~ hatch side top plating ~~meet~~ hatch cover pad plating.); $\boxed{3}$ Fillet weld~~s where~~ hatch side coaming top plating ~~meet~~ hatch side coaming plating; $\boxed{4}$ Fillet weld~~s where~~ hatch side coaming plating ~~meet~~ upper deck plating; $\boxed{5}$ Fillet weld~~s where~~ upper deck plating ~~meet~~ inner hull/bulkheads; $\boxed{6}$ Fillet weld~~s where~~ upper deck plating ~~meet~~ longitudinals; and $\boxed{7}$ Fillet weld~~s where~~ sheer strakes ~~meet~~ upper deck plating. **4.3 Concept examples of brittle crack arrest design** The following are considered to be acceptable examples ~~of brittle crack arrest design~~. The detail design arrangements are to be submitted for approval~~ by the Society~~. Other ~~concept designs~~ may be considered and accepted for review by ~~each Classification~~ Society. 4.3.1 ～ 4.3.5 〈Omitted〉	4.2.2 Both of the following cases are to be considered: a)～b) 〈same as the present rule〉 c) "Other weld" in (b) includes the following(refer to Figure 4): $\boxed{1}$ Fillet weld~~s~~ between hatch side coaming plating, including top plating, and longitudinals; $\boxed{2}$ Fillet weld~~s~~ between hatch side coaming plating, including top plating and longitudinals, and attachments. (e.g., Fillet welds between hatch side top plating and hatch cover pad plating.); $\boxed{3}$ Fillet weld~~s~~ between hatch side coaming top plating and hatch side coaming plating; $\boxed{4}$ Fillet weld~~s~~ between hatch side coaming plating and upper deck plating; $\boxed{5}$ Fillet weld~~s~~ between upper deck plating and inner hull/bulkheads; $\boxed{6}$ Fillet weld~~s~~ between upper deck plating and longitudinals; and $\boxed{7}$ Fillet weld~~s~~ between sheer strakes and upper deck plating. **4.3 Concept examples of brittle crack arrest design** The followings are considered to be acceptable examples of measures that can be used on a brittle crack arrest-design to prevent brittle crack propagations. The detail design arrangements are to be submitted to the Society for their approval. Other measures may be considered and accepted for review by the Society. 4.3.1 ～ 4.3.5 〈same as the present rule〉

<table>
<tr><th>Present</th><th>Amendment</th></tr>
<tr><td>4.4 〈New〉</td><td>

4.4 Selection of brittle crack arrest steels

4.4.1 The brittle crack arrest steels fitted in the upper deck region of container ships are to comply with **Table 1** where suffixes BCA1 and BCA2 are defined in **Rule Part 2.**

4.4.2 The brittle crack arrest steel property is to be selected for each individual structural member with thickness above 50mm according to Table 1.

Table 1 Brittle crack arrest steel requirement in function of structural members and thickness

<table>
<tr><th>Structural Members plating$^{(1)}$</th><th>Thickness(mm)</th><th>Brittle crack arrest steel requirement</th></tr>
<tr><td>Upper deck</td><td>$50 < t \leq 100$</td><td>Steel grade YP36 or 40 with suffix BCA1</td></tr>
<tr><td rowspan="2">Hatch coaming side</td><td>$50 < t \leq 80$</td><td>Steel grade YP40 or 47 with suffix BCA1</td></tr>
<tr><td>$80 < t \leq 100$</td><td>Steel grade YP40 or 47 with suffix BCA2</td></tr>
<tr><td colspan="3">Note
(1)Excluding their attached longitudinals</td></tr>
</table>

4.4.3 When brittle crack arrest steels as specified in Table 1 are used, the weld joints between the hatch coaming side and the upper deck are to be partial penetration weld details approved by the Society.
In the vicinity of ship block joints, alternative weld details may be used for the deck and hatch coaming side connection provided additional means for preventing the crack propagation are implemented and agreed by the Society in this connection area.

</td></tr>
</table>

Present

5. Measures for Extremely Thick Steel Plates

The thickness and the yield strength shown in the **Table ~~1~~** apply to the hatch coaming top plating and side plating, and are the controlling parameters for the application of countermeasures. If the as built thickness of the hatch coaming top plating and side plating is below the values contained in the table, countermeasures are not necessary regardless of the thickness and yield strength of the upper deck.

Table ~~1:~~ Measures for extremely thick steel plates

Yield strength	Thickness (mm)	Option	Measures
36			
40			
47(FCAW)			
47(EGW)			

NO.	Measures
1	
2	
3	
4	
5	Brittle crack arrest design against propagation of cracks from other weld ~~areas~~ such as fillets and attachment welds. (during construction) See [4.3.1]

〈Omitted〉

Amendment

5. Measures for Extremely Thick Steel Plates

The thickness and the yield strength shown in the **Table 2** apply to the hatch coaming top plating and side plating, and are the controlling parameters for the application of countermeasures. These controlling parameters are not applicable for the upper deck.

If the as built thickness of the hatch coaming top plating and side plating is below the values contained in the table, countermeasures are not necessary regardless of the thickness and yield strength of the upper deck.

Table 2 Measures for extremely thick steel plates

Yield strength	Thickness (mm)	Option	Measures
36			
40			
47(FCAW)			
47(EGW)			

NO.	Measures
1	
2	
3	
4	
5	Brittle crack arrest design against propagation of cracks from other weld such as fillets and attachment welds. (during construction) See [4.3.1]

〈same as the present rule〉

Amendments of Guidance

Pt. 14 Structural Rules for Container Ships

2021. 2.
Hull Rule Development Team

Present	Amendment	Reason
〈Newly added〉	**Annex 14-1 Strength assessment of flooded condition for fire-fighting** **1. General** **1.1 Application** **1.1.1 Scope** In addition to the Rules, this Annex applies to the strength assessment of container ships with flooding requirements for fire-fighting in cargo holds in accordance with **Pt 8**, **Annex 8-9**, **405. 5** of **Guidance relating to Rules for the Classification of Steel Ships**. **1.1.2 Limitations** The cargo hold flooding condition is regarded as an accident condition and the design load and acceptance criteria are applied. The ship is assumed to be intact and upright. **1.2 Loading Manual and Loading Instrument** **1.2.1 Loading Manual** The maximum flooding level of each hold is to be specified in the loading manual according to the strength assessment results based on this annex. It is to be specified in the loading manual to ensure that the permissible vertical bending moment and shear force in **[2.2]** are not exceeded under actual loading conditions and flooding level when filling the cargo hold with water. **1.2.2 Loading instrument** The loading instrument shall be equipped with a function to check the vertical still water bending moment, the vertical still water shear force, and the intact stability at specified read-out points when any cargo hold is completely or partially flooded.	

Present	Amendment	Reason
〈Newly added〉	## 2. Loads ### 2.1 Application **2.1.1** For requirements not described in this Article, refer to **Ch 4** of the Rules. **2.1.2 Coefficient for strength assessment** For the flooded condition for fire-fighting, the coefficient for strength assessment is to be taken as 0.8. ### 2.2 Hull girder loads **2.2.1 Permissible vertical still water bending moment in flooded condition for fire-fighting** Permissible vertical still water bending moment, M_{sw-FSC}, in flooded condition for fire-fighting is calculated as: $M_{sw-FSC} = M_{sw} + M_{wv}(1 - f_{ps})$ where: M_{sw} : Permissible hogging and sagging vertical still water bending moment in seagoing operation, in kNm, at the hull transverse section considered, defined in **Ch 4**, **Sec 4**, **[2.2.2]** of the Rules. M_{wv} : Vertical wave bending moment in seagoing condition, in kNm, in seagoing operation at the hull transverse section considered, defined in **Ch 4**, **Sec 4**, **[3.2.1]** of the Rules. f_{ps} : The coefficient for strength assessment in flooded condition for fire-fighting, refer to **[2.1.2]**.	

Present	Amendment	Reason
⟨Newly added⟩	**2.2.2 Permissible vertical still water shear force in flooded condition for fire-fighting** Permissible vertical still water shear force, Q_{sw-FSC}, in flooded condition for fire-fighting is calculated as: $Q_{sw-FSC} = Q_{sw} + Q_{wv}(1 - f_{ps})$ where: 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**, **[2.3.1]** of the Rules. Q_{wv} : Vertical wave shear force in seagoing condition, in kN, at the hull transverse section considered, defined in **Ch 4**, **Sec 4**, **[3.3.1]** of the Rules. f_{ps} : The coefficient for strength assessment in flooded condition for fire-fighting, refer to **[2.1.2]**. **2.3 Internal loads** **2.3.1 Pressures for the strength assessment of flooded conditions for fire-fighting** The internal pressure in flooded condition for fire-fighting, in $\mathrm{kN/m^2}$, acting on any load point of the watertight boundary of a hold for the flooded static (S) design load scenarios, given in **[2.4]** is to be taken as: $P_{in} = P_{FSC}$ $P_{FSC} = \rho g h$ ρ : Density of seawater, taken equal to 1.025 t/m^3 g : Gravity acceleration, taken equal to 9.81 m/s^2 h : Pressure height, in m, in flooded condition, to be taken as: $h = z_{FSC} - z$ where: z_{FSC} : Vertical distance from the top of inner bottom plating to the maximum flooding level, in m z : Vertical distance from the top of inner bottom plating to the load point, in m	

<table>
<tr><th>Present</th><th>Amendment</th><th>Reason</th></tr>
<tr>
<td>〈Newly added〉</td>
<td>

2.4 Design load scenarios

2.4.1 Design load scenarios for strength assessment in flooded condition for fire-fighting

The design load scenarios for strength assessment in flooded condition for fire-fighting are given in **Table 1**.

Table 1 : Design load scenarios for strength assessment in flooded condition

<table>
<tr><td colspan="3">Design load scenario</td><td>Flooded condition
(for fire-fighting)</td></tr>
<tr><td colspan="3">Load components</td><td>Accidental
(A)</td></tr>
<tr><td rowspan="4">Hull Girder</td><td colspan="2">VBM</td><td>M_{sw-FSC}</td></tr>
<tr><td colspan="2">HBM</td><td>-</td></tr>
<tr><td colspan="2">VSF</td><td>-</td></tr>
<tr><td colspan="2">TM</td><td>-</td></tr>
<tr><td rowspan="9">Local Loads</td><td rowspan="2">P_{ex}</td><td>External deck for green sea</td><td>-</td></tr>
<tr><td>Hull envelope</td><td>-</td></tr>
<tr><td rowspan="3">P_{in}</td><td>Ballast tanks</td><td>-</td></tr>
<tr><td>Other tanks</td><td>-</td></tr>
<tr><td>Watertight boundaries</td><td>P_{FSC}</td></tr>
<tr><td>F_{con}</td><td>Container</td><td>-</td></tr>
<tr><td rowspan="3">P_{dk}</td><td>Internal decks for dry spaces</td><td>-</td></tr>
<tr><td>External deck for distributed loads</td><td>-</td></tr>
<tr><td>External deck for heavy units</td><td>-</td></tr>
</table>

</td>
<td></td>
</tr>
</table>

Present	Amendment	Reason

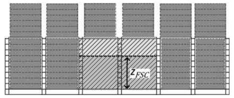
〈Newly added〉

2.5 Loading conditions

2.5.1 Loading condition for cargo hold strength assessment in flooded condition for fire-fighting

The loading condition for strength assessment in flooded condition for fire-fighting is given in **Table 2**.

Table 3 : Loading conditions for cargo holds strength check to cargo hold region

No	Loading Pattern	Still water loads					Dynamic load cases
		Draught	Container load		% of perm. SWBM	% of perm. SWSF	Midship cargo region
			In hold	On deck			
Flooded condition(for fire-fighting)							
A2		T_{SC}	centre: flooded adjacent: 40t/FEU all ballast tanks empty	max 40 ft stack weight	100% (sag. or min. hog.)	-	Static
▦ heavy cargo ░ light cargo ▒ ballast tank ■ fuel oil tank							

3. Hull local scantling

3.1 Application

3.1.1

Hull local scantlings for cargo hold region in flooded condition for fire-fighting are to be evaluated in accordance with **Ch 6** of the Rules.

Present	Amendment	Reason

〈Newly added〉

3.2 Load combination

3.2.1 Design load sets for plating, stiffeners and PSM in flooded condition for fire-fighting

Design load sets for plating, stiffeners and primary supporting members in flooded condition for fire-fighting are given in **Table 3**.

Table 3 : Design load sets in flooded condition for fire-fighting

Structural member	Design load set	Load component	Draught	Design load	Loading condition
Watertight boundaries	FD-2	P_{in}	-	A	Flooded condition (for fire-fighting)

4. Cargo Hold Structural Strength Analysis

4.1 Application

4.1.1

Cargo hold structural strength analysis is to be carried out in accordance with **Ch 7**, **Sec 1** and **2** of the Rules.

4.2 Design load combinations

4.2.1

The loading condition for cargo hold structural strength analysis in flooding condition for fire-fighting is in accordance with **Table 2**.

Present	Amendment	Reason
〈Newly added〉	**4.3 Internal loads** **4.3.1 Internal pressure in flooded condition** The internal pressure is calculated according to **[2.3.1]** for the design load scenarios in flooded condition for fire-fighting in **Table 1**. **4.4 Hull girder loads** **4.4.1** The hull girder loads is to be taken as the still water vertical bending moment according to **Table 2**. **4.4.2 Target hull girder vertical bending moment in flooded condition for fire-fighting** The target hull girder vertical bending moment, M_{v-targ}, in kNm, at a longitudinal position for a given FE load combination is taken as: $M_{v-targ} = M_{sw-FSC}$ where: M_{sw-FSC} : Permissible still water bending moments in kNm, at the considered longitudinal position in flooded condition for fire-fighting as defined in **[2.2.1]**. The values of M_{v-targ} are taken as the maximum hull girder bending moment within the mid-hold(s) for each individual cargo hold for each given FE load combination as defined in **Table 2**. **4.5 Alternative methods** **4.5.1 Strength assessment for PSM in flooded condition for fire-fighting** In evaluating the strength of the primary supporting members in flooded condition for fire-fighting, a method that considers the plasticity of the material using nonlinear finite element analysis can be used as an alternative evaluation method. In this case, evaluation procedures and methods are to be submitted to the Society for consultation in advance.	