Amendment on 27 June 2024
Resolved by Technical Committee on 30 January 2024

Survey and Construction of Steel Ships Part C

Object of Amendment

Rules for the Survey and Construction of Steel Ships Part C
Guidance for the Survey and Construction of Steel Ships Part C

Reason for Amendment

The Society received various feedback, including requests for clarification and suggestions for improvement from relevant industry members. After reviewing this feedback, the Society decided to incorporate some of the suggestions it received and amend relevant requirements accordingly.

Outline of Amendment

(1) Specifies guidelines for external pressure considerations in hydrostatic tests when predetermined values are unavailable.
(2) Clarifies the cases of flooding to be considered.
(3) Specifies that for tankers in the harbour condition, strength evaluations may be based on the planned draught as documented in the Loading Manual for the loading condition.
(4) Specifies buckling strength assessment criteria for the cargo hold analysis of ships carrying liquefied gases in bulk (membrane tanks) in the 30-degree static heel condition and the collision condition.
(5) Clarifies the application of steel material categories for hatch coamings.
(6) Revises the allowable stress values used in bending strength evaluations of double hull structures.
(7) Clarifies an acceptable alternative evaluation method to the prescriptive formula used to calculate the moment of inertia of girders
(8) Revises the application scope of minimum thickness requirements.
(9) Revises the corrosion addition values for the cargo holds of PCC.
(10) Clarifies some definitions and corrects typographical errors.

Effective Date and Application

1. Effective date of this amendment is 27 June 2024.
2. Notwithstanding 1 above, the version of Part C of the Rules in effect prior to its comprehensive revision (hereinafter referred to as “old Part C”) may still be applied to the sister ships of those ships constructed under old Part C in cases where the date of the contract for construction of the sister ships is before 1 January 2025.

ID: DH23-08

An asterisk (*) after the title of a requirement indicates that there is also relevant information in the corresponding Guidance.

Amended-Original Requirements Comparison Table
(Survey and Construction of Steel Ships Part C)

Amended	Original	Remarks
RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS **Part C HULL CONSTRUCTION AND EQUIPMENT** **Part 1 GENERAL HULL REQUIREMENTS** **Chapter 1 GENERAL** **1.3 Principles for Strength Assessment** **1.3.2 Factors to Be Considered for Strength Assessment** **1.3.2.8 Design Load Scenarios** The design load scenarios to be considered for the strength assessment are in accordance with the following **(1)** through **(5)**. However, when it is evident that structural responses under the scenarios concerned are not dominant over the structural strength, depending on the location of the member and the type of strength to be assessed, the assessment of the scenarios may be omitted. (1) Maximum load condition: The maximum values of the structural responses that may occur in the hull during the in-service period of the ship are to be assessed. The anticipated sea states are to be taken as those in the North Atlantic (all seasons), and the in-service period is to be	**RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS** **Part C HULL CONSTRUCTION AND EQUIPMENT** **Part 1 GENERAL HULL REQUIREMENTS** **Chapter 1 GENERAL** **1.3 Principles for Strength Assessment** **1.3.2 Factors to Be Considered for Strength Assessment** **1.3.2.8 Design Load Scenarios** The design load scenarios to be considered for the strength assessment are in accordance with the following **(1)** through **(5)**. However, when it is evident that structural responses under the scenarios concerned are not dominant over the structural strength, depending on the location of the member and the type of strength to be assessed, the assessment of the scenarios may be omitted. (1) Maximum load condition: The maximum values of the structural responses that may occur in the hull during the in-service period of the ship are to be assessed. The anticipated sea states are to be taken as those in the North Atlantic (all seasons), and the in-service period is to be	Clarifies the cases of flooding to be considered when determining the head to be considered.

Amended-Original Requirements Comparison Table
(Survey and Construction of Steel Ships Part C)

Amended	Original	Remarks
taken as 25 years. (2) Harbour condition: Structural responses during cargo loading/unloading in harbour and during anchorage in sheltered waters are to be assessed. The purpose of assessment of the former is to assess the significant temporary structural responses that may occur in the cargo loading/unloading sequence, while the purpose of the latter is to assess the effect of waves in sheltered waters. (3) Testing condition: The structural responses during the tank test are to be assessed. (4) Flooded condition: Structural responses in the flooded condition are to be assessed. That is, for ships applying probabilistic damage stability requirements, the object of the assessment is the structural responses in the final equilibrium state (in which the probability of survival exceeds 0) in a damage stability calculation. For ships applying deterministic damage stability requirements, however, the object of the assessment is the structural responses in the flooding cases considered under those requirements. In addition, the structural responses during the voyage to the port of repair after flooding are also to be assessed. (5) Cyclic load condition: For stress concentration areas where crack damage may occur, structural responses under cyclic load condition are to be assessed.	taken as 25 years. (2) Harbour condition: Structural responses during cargo loading/unloading in harbour and during anchorage in sheltered waters are to be assessed. The purpose of assessment of the former is to assess the significant temporary structural responses that may occur in the cargo loading/unloading sequence, while the purpose of the latter is to assess the effect of waves in sheltered waters. (3) Testing condition: The structural responses during the tank test are to be assessed. (4) Flooded condition: Structural responses in the flooded condition are to be assessed. That is, the object of the assessment is the structural responses in the final equilibrium state (in which the probability of survival exceeds 0) in a damage stability calculation. In addition, the structural responses during the voyage to the port of repair after flooding are also to be assessed. (5) Cyclic load condition: For stress concentration areas where crack damage may occur, structural responses under cyclic load condition are to be assessed.	

Amended	Original	Remarks

1.4 Symbols and Definitions

1.4.4 Glossary

1.4.4.1 Definition of Terms

Table 1.4.4-1 Definition of Terms

Terms	Definition
(Omitted)	
Deep tank	A tank used for the carriage of water, fuel oil, or other liquids, forming a part of the hull ~~in holds or tween decks~~.
(Omitted)	

Clarifies the definition of deep tanks.

Chapter 3 STRUCTURAL DESIGN PRINCIPLES

3.2 Materials

3.2.2 Application of Steels

3.2.2.1 General

Table 3.2.2-1 Application of Mild Steels for Structural Members

Structural member	Application	Thickness of plate: t (mm)					
		$t \leq 15$	$15 < t \leq 20$	$20 < t \leq 25$	$25 < t \leq 30$	$30 < t \leq 40$	$40 < t \leq 50$
(Omitted)							

Clarifies the requirements based on UR S6.

Amended-Original Requirements Comparison Table
(Survey and Construction of Steel Ships Part C)

Amended	Original	Remarks

Cargo hatch	Hatch coaming	~~Longitudinal coamings over 0.15 L_C (including top plate and its flange, but excluding other stiffeners; *See* **Fig. 3.2.2-1**) and end brackets and deckhouse transition~~ Longitudinal coamings over 0.15 L_C (including top plates and their flanges but excluding other stiffeners) (*See* **Fig. 3.2.2-1**) End brackets and deckhouse transitions	Within 0.4 L_C amidships	*D*	*E*	
			Within 0.6 L_C amidships excluding the above	*D*		*E*
			Other than those mentioned above	*D*		
	Hatch cover	Top plates, bottom plates and primary supporting members		*A*	*B*	*D*
(Omitted)						
(Remarks) (Omitted)						
(Notes) (Omitted)						

Table 3.2.2-2 Application of Tensile Steels for Structural Members

Structural member		Application		Thickness of plate: *t* (*mm*)					
				$t \leq 15$	$15 < t \leq 20$	$20 < t \leq 25$	$25 < t \leq 30$	$30 < t \leq 40$	$40 < t \leq 50$
(Omitted)									
Cargo hatch	Hatch coaming	~~Longitudinal coamings over 0.15 L_C (including top plate and its flange, but excluding other stiffeners) and end brackets and deckhouse transition~~	Within 0.4 L_C amidships	*DH*				*EH*	
			Within 0.6 L_C amidships excluding the above	*DH*					*EH*

		Longitudinal coamings over 0.15 L_C (including top plates and their flanges but excluding other stiffeners) (*See* **Fig. 3.2.2-1**) End brackets and deckhouse transitions	Other than those mentioned above	*DH*	
	Hatch cover	Top plates, bottom plates and primary supporting members		*AH*	*DH*
(Omitted)					
(Notes) (Omitted)					

Table 3.2.2-3 Application of Tensile Steels with Thickness of More than 50 *mm* and Not More than 70 *mm*

Structural member		Application		Thickness of plate: t (*mm*)	
				$50 < t \leq 60$	$60 < t \leq 70$
(Omitted)					
Cargo hatch	~~Face plate and web of cargo h~~Hatch coaming ~~longitudinally extended on the strength deck~~	~~Longitudinal coamings over 0.15 L_C and end brackets and deckhouse transition~~ Longitudinal coamings over 0.15 L_C (including top plates and their flanges but excluding other stiffeners) (*See* **Fig. 3.2.2-1**) End brackets and deckhouse transitions	Within 0.6 L_C amidships	*EH*	
			Other than those mentioned above	*DH*	
(Omitted)					
(Notes) (Omitted)					

Amended	Original	Remarks
3.3 Net Scantling Approach **3.3.3 Corrosion Model for Strength Assessment** **3.3.3.1** The scantlings to be considered in this **Part C** are as follows: (1) Net offered thickness of plating is to be equal to or greater than the net required thickness of plating. (2) The required net section modulus, moment of inertia and shear area properties of local supporting members are to be calculated using the net thickness of the attached plate, web and flange. The net sectional dimensions of local supporting members are as specified in **Fig. 3.3.3-1**. The net cross-sectional area, the moment of inertia about the axis parallel to the attached plate and the associated neutral axis position are to be obtained by deducting 50 % of the applicable corrosion magnitude from the surface of the profile cross section. The required section modulus and required web thickness are to apply to areas clear of the end brackets. Local supporting members other than shown in **Fig. 3.3.3-1** are to be at the Society's discretion. ((3) to (5) are omitted.)	**3.3 Net Scantling Approach** **3.3.3 Corrosion Model for Strength Assessment** **3.3.3.1** The scantlings to be considered in this **Part C** are as follows: (1) Net offered thickness of plating is to be equal to or greater than the net required thickness of plating. (2) The required net section modulus, moment of inertia and shear area properties of local supporting members are to be calculated using the net thickness of the attached plate, web and flange. The net sectional dimensions of local supporting members are as specified in **Fig. 3.3.3-1**. The net cross-sectional area, the moment of inertia about the axis parallel to the attached plate and the associated neutral axis position are to be determined through applying a corrosion magnitude of 0.5 t_c deducted from the surface of the profile cross section. The required section modulus and required web thickness are to apply to areas clear of the end brackets. Local supporting members other than shown in **Fig. 3.3.3-1** are to be at the Society's discretion. ((3) to (5) are omitted.)	Clarifies the requirement on corrosion deduction of stiffeners.

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td colspan="2">

3.3.4.3 Corrosion Addition Determination
1 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.
2 The corrosion addition of a stiffener is to be determined according to the location of its connection to the attached plating.

Table 3.3.4-1 Corrosion Addition for One Side of a Structural Member

<table>
<tr><td>Compartment type</td><td>Details</td><td>t_{c1} or t_{c2} (mm)</td></tr>
<tr><td colspan="3">(Omitted)</td></tr>
<tr><td rowspan="3">Cargo hold or cargo tank</td><td colspan="2">(Omitted)</td></tr>
<tr><td>Void cargo hold spaces (car carriers (Part 2-6))</td><td>~~0.5~~0.25</td></tr>
<tr><td colspan="2">(Omitted)</td></tr>
<tr><td colspan="3">(Omitted)</td></tr>
<tr><td colspan="3">(Omitted)</td></tr>
</table>

</td><td>Revises the corrosion addition values for the cargo holds of PCC.</td></tr>
<tr><td>

3.5 Minimum Requirements

3.5.1 Minimum Thicknesses

3.5.1.2 Double Bottom, Deep Tanks and Cargo Oil Tanks
1 The minimum thicknesses of girders, struts and their end brackets, bulkhead plates in double bottoms, ballast tanks and tanks carrying liquids within the cargo region are to be in accordance with **Table 3.5.1-1**.
2 Except for the members specified in **-1** above, no structural

</td><td>

3.5 Minimum Requirements

3.5.1 Minimum Thicknesses

3.5.1.2 Double Bottom, Deep Tanks and Cargo Oil Tanks
1 The minimum thicknesses of girders, struts and their end brackets, bulkhead plates in double bottoms, ballast tanks and tanks carrying liquids within the cargo hold region are to be in accordance with **Table 3.5.1-1**.
2 Except for the members specified in **-1** above, no structural

</td><td>Revices the term from “cargo hold region” to “cargo region”.</td></tr>
</table>

Amended-Original Requirements Comparison Table
(Survey and Construction of Steel Ships Part C)

Amended	Original	Remarks
members in double bottoms, ballast tanks or tanks carrying liquids within the cargo region are to be less than 6 *mm* in thickness (gross scantling). **3.5.1.3 Structural Members within Cargo Region** **1** The minimum thicknesses of girders, struts and their end brackets and bulkhead plates in the cargo region are to be in accordance with **Table 3.5.1-1**. **2** Except for the members specified in **-1** above, no structural members in the bulkhead and side structures within the cargo region are to be less than 6 *mm* in thickness (gross scantling).	members in double bottoms, ballast tanks or tanks carrying liquids within the cargo hold region are to be less than 6 *mm* in thickness (gross scantling). **3.5.1.3 Structural Members within Cargo ~~Hold~~ Region** **1** The minimum thicknesses of girders, struts and their end brackets and bulkhead plates in the cargo hold region are to be in accordance with **Table 3.5.1-1**. **2** Except for the members specified in **-1** above, no structural members in the bulkhead and side structures within the cargo region are to be less than 6 *mm* in thickness (gross scantling).	

Table 3.5.1-1 Minimum Thicknesses

Ship length (*m*)		≥	90	105	120	135	150	165	180	195	~~225~~	~~275~~
		<	105	120	135	150	165	180	195	~~225~~	~~275~~	
Thickness (*mm*)	Double bottoms, ballast tanks, and tanks carrying liquids within the cargo ~~hold~~ region	Girders, struts and their end brackets and bulkhead plates	5.5	6	6.5	7	7.5	8	8.5	9	~~9.5~~	~~10~~
		Structural members other than the above	6.0 (gross)									
	Within the cargo ~~hold~~ region	Girders, struts and their end brackets and bulkhead plates	4.5	5	5.5	6	6.5	7	7.5	8	~~8.5~~	~~9~~
		Structural members other than the above	6.0 (gross)									

Revises the application scope of minimum thickness requirements.

Amended	Original	Remarks

Chapter 4 LOADS

4.4 Loads to be Considered in Local Strength

4.4.2 Maximum Load Condition

4.4.2.8 Green Sea Pressure Acting on Weather Deck

Table 4.4.2-13 Values of a and ~~Minimum Values of~~ $\underline{P_{GW\_min}}$

Line	Position of deck	a	P_{GW_min}	C
		Stiffener[(1)] and deck		Stiffener[(1)] and deck
I	$x/L_C \geq 0.85$	14.7	$C\sqrt{L_{C230}+50}$	4.20
II	$0.7 \leq x/L_C < 0.85$	11.8		
III	$0.2 \leq x/L_C < 0.7$	6.90		2.05
IV	$x/L_C < 0.2$	9.80	$C\sqrt{L_{C230}}$	2.95
Second tier superstructure deck above freeboard deck[(2)]				1.95

Notes:

(1) For ships with L_C not exceeding 150 *m*, the values of a and C for stiffeners may be multipled by the value obtained by the following formula:

$$0.55\left(\frac{L_C}{100}\right)+0.175$$

(2) The values in line I through line IV are to be used for a on the second tier superstructure deck above freeboard deck.

Remarks: Clarifies the title of the table .

Amended	Original	Remarks

4.4.3 Testing Condition

4.4.3.2 Internal Pressure

Table 4.4.3-2 Design Testing Water Head Height z_{ST}

Compartment	z_{ST}
(Omitted)	
Cargo oil tanks	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 2.4, z_{top} + z_{PV})$(3)
(Omitted)	
Ballast ducts	$z_{ST} = \max(z_{bp}, z_{PV})$
Fuel oil tanks	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 2.4, z_{top} + z_{PV}, z_{bd})$(3)
Cargo tanks of ships carrying dangerous chemicals in bulk(2)	$z_{ST} = \max(z_{top} + 2.4, z_{top} + z_{PV})$(3)
(Omitted)	

Notes:
z_{top}: Z coordinate of the top of tank (m) (the highest point of the tank excluding small hatchways)
z_{bd}: Z coordinate of the bulkhead deck (m)
z_{PV}: ~~Z coordinate~~ Height of the test water head (m) corresponding to set pressure of pressure relief valve
z_{hc}: Z coordinate of the top of hatch coaming (m)
z_c: Z coordinate of the top of chain pipe (m)
z_{bp}: Z coordinate of the test water head (m) corresponding to maximum pressure of ballast pump
h_{air}: Height of the air pipe or overflow pipe (m) above the top of the tank

(Omitted)

Clarifies the definition of z_{PV}.

Amended-Original Requirements Comparison Table
(Survey and Construction of Steel Ships Part C)

Amended	Original	Remarks

4.4.4 Flooded Condition

4.4.4.1 Internal Pressure

Internal pressure P_{FD-in} (kN/m^2) acting on the watertight wall in flooded compartments is to be in accordance with **Table 4.4.4-1** but is not to be less than 0.

Table 4.4.4-1 Internal Pressure P_{FD-in} in Flooded Condition

Internal pressure P_{FD-in} (kN/m^2)
$P_{FD-in} = \rho g h_{FD}$
Notes: h_{FD}: Assumed draught height (m) at the time of flooding from the position under consideration, as given by the following formula~~(1)~~: $h_{FD} = \max(z_{FB} - z, \lvert y \rvert \sin\theta_{FD} + (z_{FD} - z)\cos\theta_{FD})$ z_{FB}: Z coordinate (m) of the freeboard deck at side in way of the transverse section of the hullunder consideration z_{FD}: Z coordinate (m) of the greatest value among the deepest equilibrium waterline at the centreline amidships~~, excluding flooded conditions where the probability of survival in damage stability calculations is 0~~(1)(2)(3) θ_{FD}: The greatest value among the deepest equilibrium heel angle (rad)~~, excluding flooded conditions where the probability of survival in damage stability calculations is 0~~(1)(2)(3).
(1) When the maximum draught was obtained based on the combination of ~~z_{FB} and~~ z_{FD} and θ_{FD} in each case to be considered in damage stability calculations, the said draught may be regarded as the assumed draught height. (2) For ships applying the damage stability requirements specified in **2.3**, the case where the probability of survival is 0 is excluded (i.e. is not to be considered). In addition, the case where the compartment adjacent to members being assessed does not flood and the case where two adjacent compartments simultaneously flood may be excluded. (3) For ships other than **(2)** above (i.e. ships not applying probabilistic damage stability requirements), the case where the compartment adjacent to members being assessed does not flood and the case where two adjacent compartments simultaneously flood may be excluded.

Clarifies the cases of flooding to be considered when determining the head to be considered.

Amended	Original	Remarks

4.6 Loads to be Considered in Strength Assessment by Cargo Hold Analysis

4.6.4 Testing Condition

4.6.4.3 Internal Pressure

Table 4.6.4-2 Design Testing Water Head Height z_{ST}

Compartment	z_{ST}
(Omitted)	
Cargo oil tanks	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 2.4, z_{top} + z_{PV})^{(3)}$
(Omitted)	
Ballast ducts	$z_{ST} = \max(z_{bp}, z_{PV})$
Fuel oil tanks	$z_{ST} = \max(z_{top} + h_{air}, z_{top} + 2.4, z_{top} + z_{PV}, z_{bd})^{(3)}$
Cargo tanks of ships carrying dangerous chemicals in bulk(2)	$z_{ST} = \max(z_{top} + 2.4, z_{top} + z_{PV})^{(3)}$
(Omitted)	
Notes: z_{top}: Z coordinate of the top of tank (m) (highest point of tank excluding small hatchways) z_{bd}: Z coordinate of the bulkhead deck (m) z_{PV}: ~~Z coordinate~~ Height of the test water head (m) corresponding to set pressure of pressure relief valve z_{hc}: Z coordinate (m) at the top of the hatch coaming z_c: Z coordinate (m) at the top of chain pipe z_{bp}: Z coordinate of the test water head (m) corresponding to maximum pressure of ballast pump h_{air}: Height of the air pipe or overflow pipe (m) above the top of the tank	
(Omitted)	

Clarifies the definition of z_{PV}.

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr>
<td>4.6.5 Flooded Condition
4.6.5.1 Loading Condition and Flooded Compartment
1 The compartment to be flooded is to be determined so as to maximise the stress in the member being evaluated. The water head of the compartment to be flooded is to be set so as to obtain Z coordinate where the deepest equilibrium waterline is the greatest or the height of the freeboard deck. For ships applying the damage stability requirements specified in 2.3, flooded conditions in which the survival probability is 0 may not be considered. For ships applying damage stability requirements different from 2.3, the condition is to be based on the flooding cases considered in those requirements.
2 In principle, the cargo load need not be considered.</td>
<td>4.6.5 Flooded Condition
4.6.5.1 Loading Condition and Flooded Compartment
The compartment to be flooded is to be determined so as to maximise the stress in the member being evaluated. The water head of the compartment to be flooded is to be set so as to obtain Z coordinate where the deepest equilibrium waterline is the greatest. However, flooded conditions in which the survival probability is 0 may not be considered.</td>
<td>Clarifies the cases of flooding to be considered when determining the head to be considered.</td>
</tr>
<tr>
<td colspan="2">4.6.5.2 External Pressure
External pressure P_{FD-ex} (kN/m^2) acting on the outer shell is to be in accordance with Table 4.6.5-1, but is not to be less than 0.
Table 4.6.5-1 External Pressure P_{FD-ex} in Flooded Condition
<table>
<tr><th colspan="2">External pressure P_{FD-ex} (kN/m^2)</th></tr>
<tr><td>$FD1^{(1)(2)}$</td><td>$P_{FD-ex} = \rho g h_{FD1}$</td></tr>
<tr><td>$FD2^{(1)(2)}$</td><td>$P_{FD-ex} = \rho g h_{FD2}$</td></tr>
<tr><td>$FD3^{(1)}$</td><td>$P_{FD-ex} = \rho g (z_{FB} - z)$</td></tr>
</table>
</td>
<td>Clarifies the cases of flooding to be considered when determining the head to be considered.</td>
</tr>
</table>

Amended	Original	Remarks

Notes:

h_{FD1}, h_{FD2}: Assumed draught height (m) in the flooded condition from the position under consideration, as given by the following formulae~~(3)~~:

$$h_{FD1} = y \sin \theta_{FD} + (z_{FD} - z) \cos \theta_{FD}$$

$$h_{FD2} = -y \sin \theta_{FD} + (z_{FD} - z) \cos \theta_{FD}$$

z_{FD} : Z coordinate (m) of the greatest value among deepest equilibrium waterline at the centreline amidships~~, excluding flooded conditions where the probability of survival in damage stability calculations is 0~~(1)(2)(3)

θ_{FD} : Greatest value among the deepest equilibrium heel angle (rad)~~, excluding flooded conditions where the probability of survival in damage stability calculations is 0~~(1)(2)(3).

z_{FB} : Z coordinate (m) of the freeboard deck at side in way of the transverse section under consideration(6)

(1) In case of $z_{FD} \geq z_{FB}$, $FD3$ may not be considered.

(2) For ships with structure symmetrical about centreline, either $FD1$ or $FD2$ may be considered.

(3) When the maximum draught was obtained based on the combination of z_{FD} and θ_{FD} in each case to be considered in damage stability calculations, the said draught may be regarded as the assumed draught height.

(4) For ships applying probabilistic damage stability requirements, the case where the probability of survival is 0 is excluded (i.e. is not to be considered). In addition, the case where the compartment adjacent to members being assessed does not flood, and the case where two adjacent compartments simultaneously flood may be excluded.

(5) For ships not applying probabilistic damage stability requirements, the case where the compartment adjacent to members being assessed does not flood and the case where two adjacent compartments simultaneously flood may be excluded.

(6) In situations where unintended structural responses are caused by loads acting on compartments other than the target hold, a water head to the satisfaction of the Society may be considered.

4.6.5.3 Internal Pressure

Internal pressure P_{FD-in} (kN/m^2) acting on watertight walls in a flooded compartment is to be in accordance with **Table 4.6.5-2**, but is not to be less than 0.

Clarifies the cases of flooding to be considered when determining the head to be considered.

Amended	Original	Remarks

Table 4.6.5-2 Internal Pressure P_{FD-in} in Flooded Condition

Internal pressure P_{FD-in} (kN/m^2)	
*FD*1(1)(2)	$P_{FD-in} = \rho g h_{FD1}$
*FD*2(1)(2)	$P_{FD-in} = \rho g h_{FD2}$
*FD*3(1)	$P_{FD-in} = \rho g (z_{FB} - z)$

Notes:
h_{FD1}, h_{FD2}: As specified in **Table 4.6.5-1**~~(3)~~
z_{FB} :As specified in **Table 4.6.5-1**

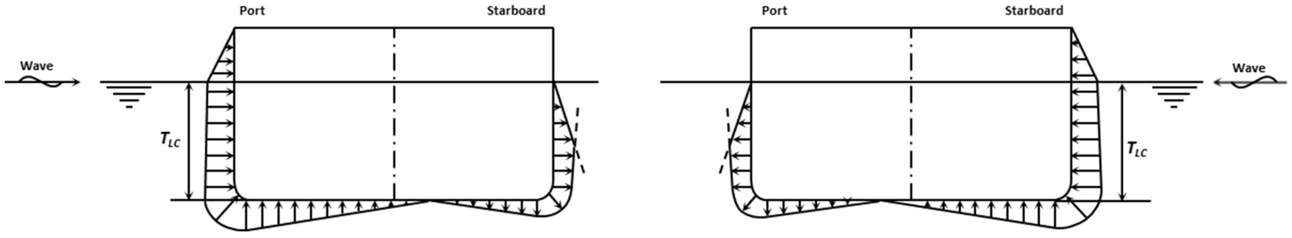
(1) In case of $z_{FD} \geq z_{FB}$, *FD*3 may not be considered.
(2) For ships with structure symmetrical about centreline, either *FD*1 or *FD*2 may be considered.
~~(3) When the maximum draught was obtained based on the combination of z_{FD} and θ_{FD} in each case to be considered in damage stability calculations, the said draught may be regarded as the assumed draught height.~~

Amended	Original	Remarks
4.7 Loads to be Considered in Fatigue **4.7.2 Cyclic Load Condition**		Corrects typographical errors.

4.7 Loads to be Considered in Fatigue

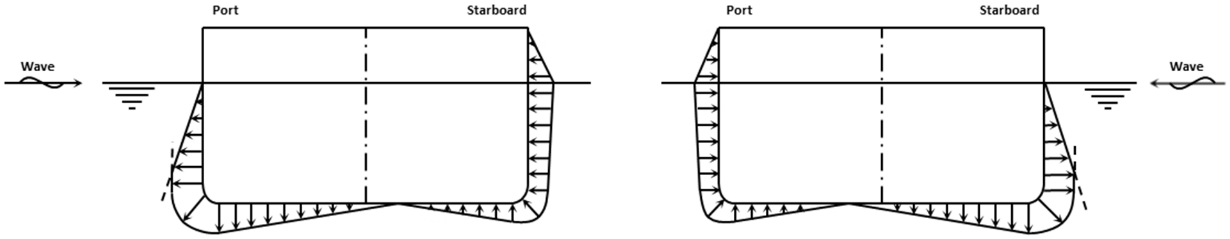
4.7.2 Cyclic Load Condition

Fig. 4.7.2-3 Hydrodynamic Pressure Distribution Amidships in Equivalent Design Wave *BR*



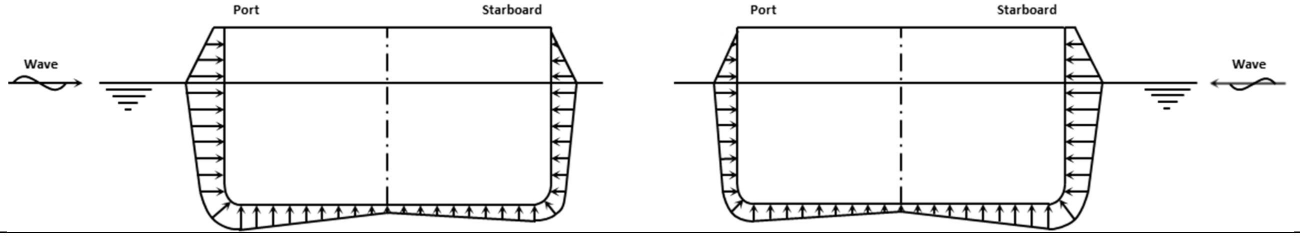
BR-1*P* *BR*-~~2*P*~~1*S*

Fig. 4.7.2-4 Hydrodynamic Pressure Distribution Amidships in Equivalent Design Wave *BR*



BR-~~1*S*~~2*P* *BR*-2*S*

Fig. 4.7.2-5 Hydrodynamic Pressure Distribution Amidships in Equivalent Design Wave *BP*

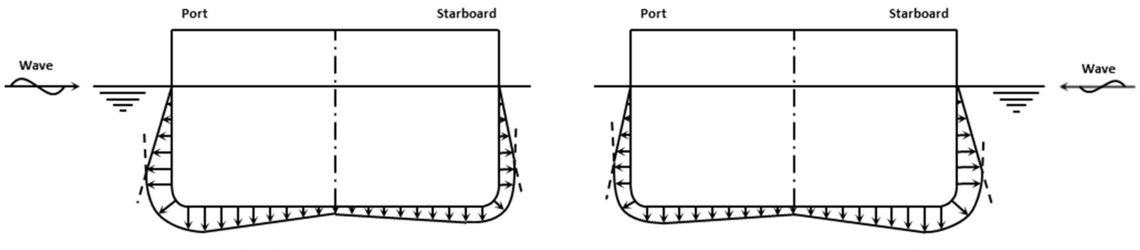


Amended	Original	Remarks

BP-1*P*

BP-~~2*P*~~1*S*

Fig. 4.7.2-6 Hydrodynamic Pressure Distribution Amidships in Equivalent Design Wave *BP*



BP-~~1*S*~~2*P*

BP-2*S*

4.8 Loads to be Considered in Additional Structural Requirements

4.8.2 Maximum Load Condition

4.8.2.4 Sloshing Loads

Table 4.8.2-12 Equivalent Tank Length and Equivalent Tank Breadth

	ℓ_e and b_e
Equivalent tank length	$\ell_e = \dfrac{(1+n_{WT}\,\alpha_{WT})(1+f_{wf}\,\alpha_{wf})}{(1+n_{WT})(1+f_{wf})}\ell_{tk-h}$
Equivalent tank breadth	$b_e = \dfrac{(1+n_{WL}\,\alpha_{WL})(1+f_{grd}\,\alpha_{grd})}{(1+n_{WL})(1+f_{grd})}b_{tk-h}$

Corrects typographical errors.

Amended-Original Requirements Comparison Table
(Survey and Construction of Steel Ships Part C)

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td colspan="2">Notes:
(Omitted)
((1) is omitted.)
(2) For tanks whose shape changes along their breadth and/or with longitudinal wash bulkheads of different shapes, α_{WL} is to be taken as the average of all longitudinal wash bulkheads in the tank, as given by the following formula:
~~$\alpha_{WL} = \frac{\sum_{i=1}^{n_{WL}} \frac{A_{OWL_i}}{A_{tk-L-h_i}}}{n_{WL}}$~~ $\underline{\alpha_{WL} = \frac{\sum_{i=1}^{n_{WL}} \frac{A_{OWL_i}}{A_{tk-l-h_i}}}{n_{WL}}}$
((3) is omitted.)
(4) For tanks whose shape changes shape along their breadth and/or with longitudinal girders of different shape, α_{grd} is to be taken as the average of all longitudinal girders in the tank, as given by the following formula:
~~$\alpha_{grd} = \frac{\sum_{i=1}^{n_{grd}} \frac{A_{O-wf-h_i}}{A_{tk-l-h_i}}}{n_{grd}}$~~ $\underline{\alpha_{grd} = \frac{\sum_{i=1}^{n_{grd}} \frac{A_{O-grd-h_i}}{A_{tk-l-h_i}}}{n_{grd}}}$</td><td></td></tr>
<tr><td>Chapter 6 LOCAL STRENGTH
6.3 Plates
6.3.3 Corrugated Bulkheads
6.3.3.1 Thickness of Corrugated Bulkheads
1 The thickness of the flange and web of corrugated bulkheads under all applicable design load scenarios specified in Table 6.2.2-1 is to be the largest of the values obtained by the following formula. Application of gross or net scantlings in the values obtained from following formula is specified in Table 6.3.3-1:</td><td>Chapter 6 LOCAL STRENGTH
6.3 Plates
6.3.3 Corrugated Bulkheads
6.3.3.1 Thickness of Corrugated Bulkheads
1 The thickness of the flange and web of corrugated bulkheads under all applicable design load scenarios specified in Table 6.2.2-1 is to be the largest of the values obtained by the following formula. Application of gross or net scantlings in the values obtained from following formula is specified in Table 6.3.3-1:</td><td>Corrects typographical errors.</td></tr>
</table>

Amended-Original Requirements Comparison Table
(Survey and Construction of Steel Ships Part C)

Amended	Original	Remarks
$t = C_{Safety}\sqrt{\frac{4}{1.15\sigma_Y}}\sqrt{\frac{\lvert P\rvert b^2\gamma}{f_P}} \times 10^{-3}(mm)$ C_{Safety}: Safety factor as specified in **Table 6.3.3-1**. σ_Y: Specified minimum yield stress (*N/mm*^{2}) P: Lateral pressure (*kN/m*^{2}) corresponding to each design load scenario specified in **Table 6.3.3-1**, to be calculated at the load calculation point specified in **3.7**. b: Width (*mm*) of the flange (face plate) or web, respectively, to be taken as in **Table 6.3.3-1**. γ: Coefficient as specified in **Table 6.3.3-1**. f_P: Strength coefficient given in **Table 6.3.3-1**. **2** Notwithstanding **-1** above, horizontal corrugated bulkheads are to be as deemed appropriate by the Society.	$t = C_{Safety}\sqrt{\frac{4}{1.15\sigma_Y}}\sqrt{\frac{\lvert P\rvert b^2\gamma}{f_P}} \times 10^{-3}(mm)$ C_{Safety}: Safety factor as specified in **Table 6.3.3-1**. σ_Y: Specified minimum yield stress (*N/mm*^{2}) P: Lateral pressure (*kN/m*^{2}) corresponding to each design load scenario specified in **Table 6.3.3-1**, to be calculated at the load calculation point specified in **3.7**. b: Width (*mm*) of the flange (face plate) and web, respectively, to be taken as b_f or b_w (*mm*) in **Fig. 6.3.3-1**. γ: Coefficient as specified in **Table 6.3.3-1**. f_P: Strength coefficient given in **Table 6.3.3-1**. **2** Notwithstanding **-1** above, horizontal corrugated bulkheads are to be as deemed appropriate by the Society.	

Table 6.3.3-1 Application of Gross or Net Scantlings and Each Parameter in the Evaluation for Each Design Load Scenario

Design load scenario	Application of gross or net scantlings	Lateral load P (*kN/m*^{2})	γ	Member	C_{Safety}	b	f_P
Maximum load condition	Net scantling	P_{ex}, P_{in}, P_{dk} and P_{GW} To be in accordance with **4.4.2.2-1** to **-4** corresponding to compartments/members to be assessed in **Table 6.2.2-1**	$\frac{\alpha+\beta^3}{\alpha+\beta}$	Flange and Web	1.0	b_f	12

Remarks: Clarifies the definition of “b” used in each design load scenario.and corrects typographical errors.

Amended	Original	Remarks

Testing condition	Case1	Gross scantling	P_{ST-in1} To be in accordance with **4.4.3.2**	$\dfrac{\alpha+\beta^3}{\alpha+\beta}$	Flange and Web	1.0	$\underline{b_f}$	12
	Case 2	Net scantling	P_{ST-in2} To be in accordance with **4.4.3.2**	1.0	Flange	1.15	$\underline{b_f}$	$8\left[1+\left(\dfrac{t_w}{t_f}\right)^2\right]$
					Web	1.07	$\underline{b_w}$	16
Flooded condition		Net scantling	P_{FD-in} To be in accordance with **4.4.4.1**	1.0	Flange	1.15	$\underline{b_f}$	$8\left[1+\left(\dfrac{t_w}{t_f}\right)^2\right]$
					Web	1.07	$\underline{b_w}$	16

Notes:

$\alpha = \dfrac{{t_w}^3}{{t_f}^3}, \beta = \dfrac{b_w}{b_f}$

t_f and t_w: Thickness (*mm*) of the flange and web, respectively

b_f and b_w: Width (*mm*) of the flange and web, respectively (*See* **Fig. 6.3.3-1**)

Amended	Original	Remarks
Chapter 7 STRENGTH OF PRIMARY SUPPORTING STRUCTURES **Symbols** For symbols not defined in this Chapter, refer to **1.4**. (Omitted) ℓ_{DB}: Length (*m*) of double bottom as specified in **7.3.1.6-1** ℓ_{DS}: Length (*m*) of double side as specified in **7.3.1.6-3**	**Chapter 7 STRENGTH OF PRIMARY SUPPORTING STRUCTURES** **Symbols** For symbols not defined in this Chapter, refer to **1.4**. (Omitted) ℓ_{DB}: Length (*m*) of double bottom as specified in **7.3.1.6-1** ℓ_{DS}: Length (*m*) of double side as specified in **7.3.1.6-3**	Revises the definition of D_{DB} and D_{DS}.

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr>
<td>ℓ_{DH}: Length (m) of double hull, given as ℓ_{DB} or ℓ_{DS}, depending on whether assessing a double bottom or a double side
B_{DB}: Breadth (m) of double bottom as specified in 7.3.1.6-2
B_{DS}: Height (m) of double side as specified in 7.3.1.6-4
B_{DH}: Breadth or height (m) of double hull, given as B_{DB} or B_{DS}, depending on whether assessing a double bottom or a double side
D_{DB}: When considering bending stiffness, depth (m) of double bottom is to be taken as the value at $x_{DH} = 0$ and $y_{DH} = 0$
D_{DS}: When considering bending stiffness, breadth (m) of double side
(Omitted)</td>
<td>ℓ_{DH}: Length (m) of double hull, given as ℓ_{DB} or ℓ_{DS}, depending on whether assessing a double bottom or a double side
B_{DB}: Breadth (m) of double bottom as specified in 7.3.1.6-2
B_{DS}: Height (m) of double side as specified in 7.3.1.6-4
B_{DH}: Breadth or height (m) of double hull, given as B_{DB} or B_{DS}, depending on whether assessing a double bottom or a double side
D_{DB}: Depth (m) of double bottom
D_{DS}: Breadth (m) of double side
(Omitted)</td>
<td></td>
</tr>
<tr>
<td colspan="2">7.3 Double Hull Structures

7.3.2 Requirements for Scantlings

7.3.2.1 Bending Strength
In each assessment condition, the thickness of plating of double hull is to be in accordance with the following requirements (1) and (2). The thickness of plating according to these requirements is to be uniform at any point in the double hull under assessment.
((1) is omitted.)
(2) Notwithstanding (1) above, where any of the requirements specified in 2.4.1.2-6(1) and 2.4.1.3-1(1) for the spacing of girders and floors in double bottom is not satisfied, the thickness of the bottom shell plating and inner bottom plating constituting a double bottom is to be not less than that obtained from the following formula. Similarly, if any of the requirements specified in 2.4.2.1(1)</td>
<td>Revises the allowable stress used in bending strength evaluations of double hull structures.</td>
</tr>
</table>

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td colspan="2">and 2.4.2.2(1) for the spacing of side transverses and side stringers is not satisfied, the thickness of the side shell plating and longitudinal bulkheads constituting a double side is to be not less than that obtained from the following formula. However, $C_{EX} = 1.0$ where no longitudinal girders are provided, while $C_{EY} = 1.0$ where no transverse girders are provided.
~~$t_{n50} = \frac{C_{Safety}}{C_{cnd}}\frac{(1-\nu^2)}{D_{DH}} \times \max\left(\frac{|M_X|}{\gamma_{stf-x}C_{bi-x}C_{EX}(\sigma_{all}-\sigma_{BM})}, \frac{|M_Y|}{\gamma_{stf-y}C_{bi-y}C_{EY}\sigma_{all}}\right) (mm)$~~
$\underline{t_{n50} = \frac{C_{Safety}}{C_{cnd}}\frac{(1-\nu^2)}{D_{DH}} \times \max\left(\frac{1}{\min(C_{bi-x},C_{EX})}\cdot\frac{|M_X|}{\gamma_{stf-x}(\sigma_{all}-\sigma_{BM})}, \frac{1}{\min\left(C_{bi-y},C_{EY}\right)}\cdot\frac{|M_Y|}{\gamma_{stf-y}\sigma_{all}}\right)}\ (mm)$
C_{Safety}: Safety factor to be taken as 1.2
γ_{stf-x}, γ_{stf-y}, C_{bi-x}, C_{bi-y}, M_X, M_Y and σ_{BM}: As specified in (1) above.</td><td></td></tr>
<tr><td colspan="2">Annex 8.6 BUCKLING STRENGTH ASSESSMENT BASED ON CARGO HOLD ANALYSIS
An2 Buckling Strength Assessment Methods for Different Types of Structures
An2.1 Buckling Strength Assessments for Stiffened Panels
An2.1.2 Buckling Strength Assessment under Compressive Loads in Shorter Side Direction
(Omitted)
2 The minimum multiplier $\gamma_c (> 0)$ that satisfies the buckling criteria obtained according to the procedure from the following (1) to (4) is to be obtained by iterative calculation. For the value of α_c, however, judgement of buckling is to be made for the two cases α and 1.
((1) to (3) are omitted.)
(4) Judgement of buckling
Judgement of buckling is to be made according to the following formula:
$\max(\lambda_a, \lambda_b) = 1$
$\lambda_a = \frac{\sqrt{(\sigma_x'+\sigma_{xb})^2-(\sigma_x'+\sigma_{xb})(\sigma_y'+\sigma_{yb})+\left(\sigma_y'+\sigma_{yb}\right)^2+3\tau'^2}}{\sigma_{YP}}$</td><td>Corrects typographical errors.</td></tr>
</table>

Amended	Original	Remarks

$$\lambda_b = \sqrt{\frac{2Q_n + 2.75Q_m + 3|Q_{nm}| + \sqrt{0.25{Q_m}^2 + {Q_{nm}}^2}}{2}}$$

Where:

$Q_n = {n_x}^2 - n_x n_y + {n_y}^2 + 3{n_{xy}}^2$

Where:

$n_x = \frac{\sigma_x{}'}{\sigma_{Y\underline{P}}}$, $n_y = \frac{\sigma_y{}' + \sigma_{yb2}}{\sigma_{Y\underline{P}}}$ and $n_{xy} = \frac{\tau'}{\sigma_{YP}}$

$Q_m = {m_y}^2$

Where:

$$m_y = \frac{M_y}{M_p}$$

$$M_p = \frac{{t_p}^2}{4}\sigma_{YP}$$

$Q_{nm} = m_y(n_y - 0.5n_x)$

Chapter 10 ADDITIONAL STRUCTURAL REQUIREMENTS

Revises the symbol from "L'" to "L_{C230}".

10.6 Strengthened Bottom Forward

10.6.1 General

Table 10.6.1-2 Transverse Area of Bottom Forward to be Strengthened (Coordinate System in **1.4.3.6**)

	Specifications of ship	Ship with $L_C > 150\ m$ or $C_B > 0.7$, or where the bow	Ship with $L_C \leq 150\ m$ and $0.6 < C_B \leq 0.7$, and the bow	Ship with $L_C \leq 150\ m$ and $C_B \leq 0.6$, and the bow draught

Amended	Original	Remarks

	$V/\sqrt{L_C}$	draught in the ballast condition is larger than $0.025\cancel{L'}\underline{L_{C230}}$	draught in the ballast condition is not more than $0.025\cancel{L'}\underline{L_{C230}}$	in the ballast condition is not more than $0.025\cancel{L'}\underline{L_{C230}}$
X-direction	(Omitted)			
Y-direction		(Omitted)		
Z-direction		(Omitted)		

Amended	Original	Remarks
Chapter 14 EQUIPMENT **14.7 Small Hatchway** **14.7.2 Machinery Space Openings** **14.7.2.2 Exposed Machinery Space Casings** **1** Exposed machinery space casings are to have scantlings not less than that those required in **4.9.2.2**, taking the *c*-value as 1.0. **2** The thickness (gross scantlings) of the top plating of exposed machinery space casings is not to be less than that obtained from the following formulae: Position I: $6.3S + 2.5$ (*mm*) Position II: $6.0S + 2.5$ (*mm*) Where: S : Spacing of stiffeners (*m*) **14.7.2.3 Machinery Space Casings below Freeboard Deck or within Enclosed Spaces** The scantlings of machinery space casings below the freeboard deck or within enclosed superstructures or deckhouses are to comply with the following **(1)** and **(2)**: (1) The thickness (gross scantlings) of the plating is to be at	**Chapter 14 EQUIPMENT** **14.7 Small Hatchway** **14.7.2 Machinery Space Openings** **14.7.2.2 Exposed Machinery Space Casings** **1** Exposed machinery space casings are to have scantlings not less than that those required in **4.9.2.2**, taking the *c*-value as 1.0. **2** The thickness of the top plating of exposed machinery space casings is not to be less than that obtained from the following formulae: Position I: $6.3S + 2.5$ (*mm*) Position II: $6.0S + 2.5$ (*mm*) Where: S : Spacing of stiffeners (*m*) **14.7.2.3 Machinery Space Casings below Freeboard Deck or within Enclosed Spaces** The scantlings of machinery space casings below the freeboard deck or within enclosed superstructures or deckhouses are to comply with the following **(1)** and **(2)**: (1) The thickness of the plating is to be at least 6.5 *mm*; where	Clarifies the requirement basesd on gross scantling.

Amended	Original	Remarks
least 6.5 *mm*; where the spacing of stiffeners is greater than 760 *mm*, the thickness is to be increased at the rate of 0.5 *mm* per 100 *mm* excess in spacing. In accommodation spaces, the thickness of the plating may be reduced by 2 *mm*. (2) The section modulus of stiffeners is not to be less than that obtained from the following formula: $1.2S\ell^3$ (*cm*³) Where: ℓ : Tween deck height (*m*) S : Spacing of stiffeners (*m*)	the spacing of stiffeners is greater than 760 *mm*, the thickness is to be increased at the rate of 0.5 *mm* per 100 *mm* excess in spacing. In accommodation spaces, the thickness of the plating may be reduced by 2 *mm*. (2) The section modulus of stiffeners is not to be less than that obtained from the following formula: $1.2S\ell^3$ (*cm*³) Where: ℓ : Tween deck height (*m*) S : Spacing of stiffeners (*m*)	
14.10 Doors **14.10.1 Bow Doors and Inner Doors** **14.10.1.4 Design Loads** (Omitted) **2** The design load of the inner door is to be as follows: (1) The design external pressure P_e and P_h considered for the scantlings of primary members, securing and supporting devices and surrounding structure of inner doors is to be taken as the greater of the following: $P_e = 0.45\underline{L_{C200}}$ (*kN/m*²) hydrostatic pressure $P_h = 10h_2$ (*kN/m*²) h_2 : Distance, in *m*, from the load point to the top of the cargo space (2) The design internal pressure P_b considered for the scantling devices of inner doors is not to be less than 25	**14.10 Doors** **14.10.1 Bow Doors and Inner Doors** **14.10.1.4 Design Loads** (Omitted) **2** The design load of the inner door is to be as follows: (1) The design external pressure P_e and P_h considered for the scantlings of primary members, securing and supporting devices and surrounding structure of inner doors is to be taken as the greater of the following: $P_e = 0.45\underline{L'}$ (*kN/m*²) hydrostatic pressure $P_h = 10h_2$ (*kN/m*²) h_2 : Distance, in *m*, from the load point to the top of the cargo space L' : Length as specified in-**1(1)**. (2) The design internal pressure P_b considered for the	Revises the symbol from "L'" to "L_{C230}".

Amended	Original	Remarks
kN/m^2.	scantling devices of inner doors is not to be less than 25 *kN/m*^{2}.	

Part 2-1 CONTAINER CARRIERS

Chapter 4 LOADS

4.4 Loads to be Considered in Strength of Primary Supporting Structures

4.4.3 Harbour Condition

4.4.3.2 External Pressure

For the requirements of double hull, the hydrostatic pressure ~~at the draught~~ specified in **Table 4.4.3-~~1~~2** are to be considered.

Table 4.4.3-2 External and Internal Pressure to be Considered

Structures to be assessed		P_{DB}(*kN/m*^{2})$^{(1)}$	P_{DS}(*kN/m*^{2})$^{(1)}$
Double bottom	*P1*	P_{exs}	P_{exs}
Double side	*P2*	P_{exs}	P_{exs}

Notes:

P_{exs} : Hydrostatic pressure (*kN/m*^{2}) act on bottom shell in case of P_{DB}. That value act on side shell in case of P_{DS}. Each value is calculated in accordance with **4.6.2.4, Part 1**.

(1) Load calculation points is in accordance with **7.3.1.5, Part 1** for all loading conditions.

Revises the reference and wording.

Amended	Original	Remarks
4.6 Loads to be Considered in Fatigue **4.6.4 Loads to be Considered in Fatigue Strength Assessment by Simplified Stress Analysis and Finite Element Analysis Using Partial Structural Model** **4.6.4.4 Hull Girder Loads** **1** Vertical still water bending moment M_{SV} is to be in accordance with the requirements of **4.6.3.2-1** instead of the requirements of **4.7.2.10, Part 1**. **2** The vertical wave bending moment in hogging condition M_{WV-h} (*kN-m*) and vertical wave bending moment M_{WV-s} (*kN-m*) in sagging condition are to be determined in accordance with the requirements of **4.6.3.2-2** instead of the requirements of **4.7.2.10, Part 1**. **3** When calculating the horizontal bending moment M_{WH}, it is necessary to apply **4.7.2.10, Part1** and use the value obtained by multiplying the structural draught T_{LC} (*m*) by 0.82.	**4.6 Loads to be Considered in Fatigue** **4.6.4 Loads to be Considered in Fatigue Strength Assessment by Simplified Stress Analysis and Finite Element Analysis Using Partial Structural Model** **4.6.4.4 Hull Girder Loads** **1** Vertical still water bending moment M_{SV} is to be in accordance with the requirements of **4.6.3.2-1** instead of the requirements of **4.7.2.10, Part 1**. **2** The vertical wave bending moment in hogging condition M_{WV-h} (*kN-m*) and vertical wave bending moment M_{WV-s} (*kN-m*) in sagging condition are to be determined in accordance with the requirements of **4.6.3.2-2** instead of the requirements of **4.7.2.10, Part 1**. **3** The horizontal bending moment M_{WH} is to be calculated by multiplying the value according to the formula specified in **4.7.2.10, Part 1** by 0.82.	Clarifies the requirements on the draught used in the loading condition to be considered.

Part 2-2 BOX-SHAPED BULK CARRIERS

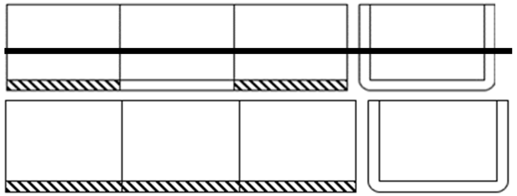
Chapter 4 LOADS

4.6 Loads to be Considered in Fatigue

4.6.2 Cyclic Load Condition

Table 4.6.2-1 Loading Conditions to be Considered in Cyclic Load Condition

Loading condition	Loading pattern		Draught	Vertical still water bending moment	Equivalent design wave
Full load condition (homogeneously loaded)	$FA1$		T_{SC}	Values in the loading conditions under consideration	HM FM BR BP
Full load condition (alternate loading)	$FA2^{(1)}$		T_{SC}		
	$FA3^{(2)}$		T_{SC}		

Ballast condition	*FA*4		T_{BAL}		
	*FA*5(3)		T_{BAL-H}		

▒, ■, ▧: As specified in **Table 4.5.2-1**.

Notes:

(1) Limited to ships designed to alternate loading conditions, and when conducting a strength assessment of an empty hold.

(2) Limited to ships designed to alternate loading conditions, and when conducting a strength assessment of a loaded hold.

(3) This only applies when conducting a strength assessment of a ballast hold.

Annex 4.5 OPERATIONAL LOADING CONDITIONS AND ANALYTICAL LOADING CONDITIONS

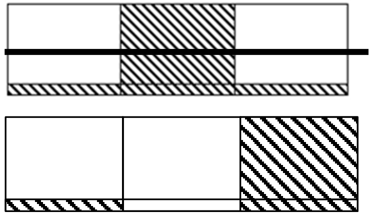
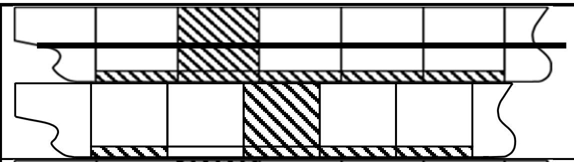
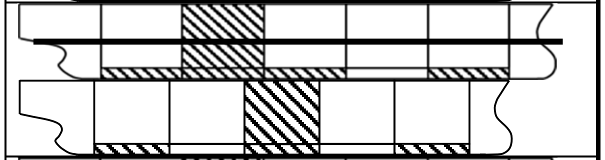
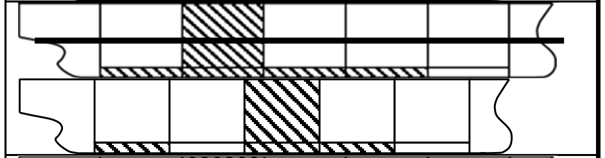
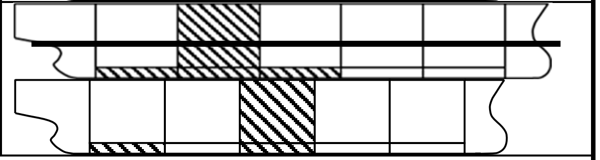
An2 Operational Loading Conditions and Analytical Loading Conditions

An2.3 Example Operational Loading Conditions and Analytical Loading Conditions

Fig. An3 Analytical Loading Conditions and Operational Loading Conditions for No. 4 Cargo Hold Evaluations

	Analytical loading condition	Operational loading condition that is the basis of the analytical loading condition
(Omitted)		

Amended	Original	Remarks

*S*8		   
(Omitted)		
▒: Bulk dry cargo ■: High density cargo ▨: Ballast water		

Amended-Original Requirements Comparison Table
(Survey and Construction of Steel Ships Part C)

Amended	Original	Remarks
Part 2-5 GENERAL CARGO SHIPS AND REFRIGERATED CARGO SHIPS **Chapter 1 GENERAL** **1.1 General** **1.1.1 Application** **1.1.1.2 Application of Chapter XII of the SOLAS Convention** Ships to which this part applies, those deemed to be bulk carriers as defined in **An1.2.1(1)** in **Annex 1.1 "Additional Requirements for Bulk Carriers in Chapter XII of the SOLAS Convention"** of **Chapter 1, Part 2-2**, are to also comply with the annex.	**Part 2-5 GENERAL CARGO SHIPS AND REFRIGERATED CARGO SHIPS** **Chapter 1 GENERAL** **1.1 General** **1.1.1 Application** **1.1.1.2 Application of Chapter XII of the SOLAS Convention** Ships to which this part applies, those deemed to be bulk carriers as defined in **An1.1.2(1)** in **Annex 1.1 "Additional Requirements for Bulk Carriers in Chapter XII of the SOLAS Convention"** of **Chapter 1, Part 2-2**, are to also comply with the annex.	Corrects typographical errors.

Amended	Original	Remarks
Part 2-6 VEHICLES CARRIERS AND ROLL-ON/ROLL-OFF SHIPS **Chapter 3 STRUCTURAL DESIGN PRINCIPLES** **3.1 Minimum Requirements** **3.1.2 Car Deck** **3.1.2.1 Application** Plates, stiffeners and girders of car decks solely loaded with wheeled vehicles need not comply with the minimum requirements of **3.5, Part1**. However, the plates and stiffeners of such decks are to comply with **3.1.2.2**. **3.1.2.2 Minimum Thickness of the Car Deck** **1** The gross thickness of the car deck is not to be less than 5 *mm*. **2** The gross thickness of web and flange of stiffeners attached to the car deck is not to be less than 5 *mm*.	**Part 2-6 VEHICLES CARRIERS AND ROLL-ON/ROLL-OFF SHIPS** **Chapter 3 STRUCTURAL DESIGN PRINCIPLES** **3.1 Minimum Requirements** **3.1.2 Car Deck** **3.1.2.1 Application** The car deck solely loaded with wheeled vehicles is to comply with the requirements of **3.1.2.2**. **3.1.2.2 Minimum Thickness of the Car Deck** **1** The gross thickness of the car deck is not to be less than 5 *mm*. **2** The gross thickness of web and flange of stiffeners attached to the car deck is not to be less than 5 *mm*.	Clarifies the reference.

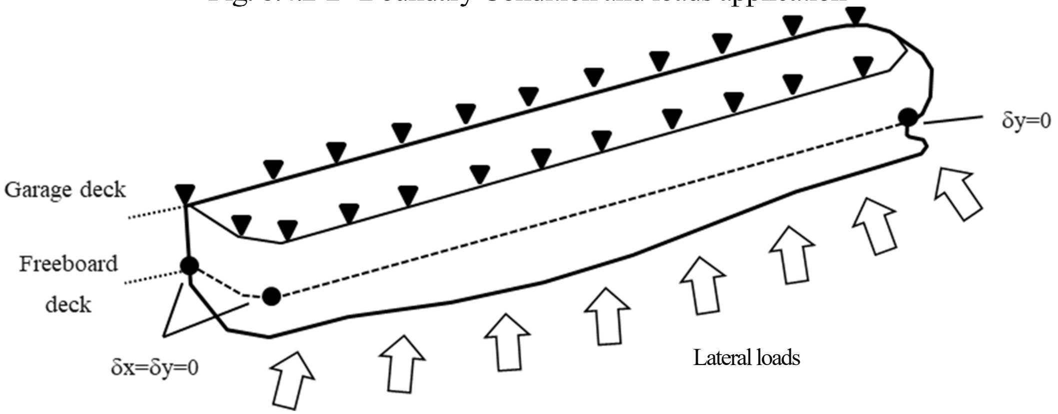
Amended	Original	Remarks

Chapter 8 STRENGTH ASSESSMENT BY CARGO HOLD ANALYSIS

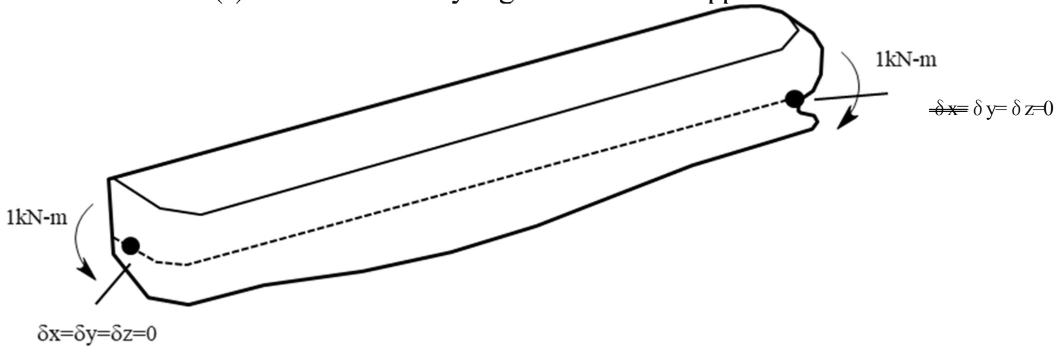
8.4 Strength Assessment of the Bottom Construction

8.4.2 Boundary Conditions and Loads Conditions

Fig. 8.4.2-2 Boundary Condition and loads application



(a) When analysing the lateral load applied



(b) When analysing only the vertical bending moment applied

Corrects typographical errors.

Amended	Original	Remarks

Chapter 10 ADDITIONAL STRUCTURAL REQUIREMENTS

10.1 Car Deck

10.1.1 Plates and Beams

10.1.1.2 Section Modulus of Beams

1 The section modulus of beams of decks loaded with wheeled vehicles (hereinafter referred to as “car decks”) is not to be less than that obtained from the following formula. However, Where the span length or moment of inertia changes along the continuous beam, the scantlings of the beam are to be determined by direct strength calculation as specified in **-2**.

(Omitted)

P_{Ii}, P_{IIj}, P_{IIIk}: The wheel load at each support point, ~~P_{CDK} (kN)~~ as specifiedin **4.7.2.1** and **4.7.3.1**. Subscript “ Ii” means the ith load point from left end of the Ith beam (*See* **Fig. 10.1.1-2**). Subscript “ IIj (or IIr)” means the jth (or rth) load point from left end of the IIth beam (*See* **Fig. 10.1.1-2**). Subscript “$IIIk$” means the kth load point from left end of the IIIth beam (*See* **Fig. 10.1.1-2**).

α_{Ii}, α_{IIj}, α_{IIIk}: Distance (m) from each support point to the point of action of wheel load (*See* **Fig. 10.1.1-2**), when wheels are so arranged that M may be at its maximum value.

N_I, N_{II}, N_{III}: Number of wheel loads between each span

R_{II}: The value obtained from following the formula

$$R_{II} = \frac{1}{\ell}\sum_{j=1}^{N_{II}} P_{IIj}\left(\ell - \alpha_{IIj}\right)$$

10.1.1.3 Thickness of Car Deck

The thickness of car deck is to be in accordance with **(1)** or **(2)** below.

(1) Where the distance between the centres of wheel prints in a panel is not less than $2S + a$:

Clarifies the reference.

Amended-Original Requirements Comparison Table
(Survey and Construction of Steel Ships Part C)

Amended	Original	Remarks
$C\sqrt{\frac{2S-b'}{2S+a}\cdot P\times 10^{3}}$ (mm) S: Beam spacing (*m*) P: ~~P_{CDK} (*kN*) in **4.6.2.1**~~The wheel load at each support point, as specified in **4.7.2.1** and **4.7.3.1**. However, when $b > S$, the value is to be multiplied by S/b. b': b or S, whichever is the smaller (*m*) b: Length (*m*) of wheel print measured at right angle to beams. (*See* **Fig. 10.1.1-1**) a: Length (*m*) of wheel print measured in parallel with beams. (*See* **Fig. 10.1.1-1**) However, for vehicles with ordinary pneumatic tires, values of a and b in **Table 10.1.1-1** may be used. C: Coefficient determined as follows. $C=\frac{1}{2}\sqrt{\frac{C_{coll}C_{load}}{C_a\sigma_Y}}$ C_{coll}: The safety factor in relation to the plastic collapse load of the plate, which is 1.7 C_{load}: The safety factor in relation to dynamical influence caused by ship motion, which is 1.0 under maximum load conditions, and 1.2 under harbour conditions (vehicles used for cargo handling only). C_a: Axial force influence coefficient, according to **Table 10.1.1-4**. ((2) is omitted.)		
10.2 Movable Car Deck **10.2.2 Support Structures of Movable Car Deck** **10.2.2.1** (Omitted) **5** Gross scantlings of supporting structural members are to be determined to withstand the design loads defined in **10.2.1.2-3 (1)**, using the allowable stresses (N/mm^2) shown in **Table 10.2.2-2**.		Corrects typographical errors.

Amended	Original	Remarks

Table 10.2.2-2 Allowable Stresses

	Maximum load condition	Harbour condition (vehicles used for cargo handling only)
Bending stress σ	$0.50\sigma_F$	$0.42\sigma_F$
Shear stress τ	$0.34\sigma_F$	$0.28\sigma_F$
Equivalent stress σ_e	$0.64\sigma_F$	0.~~63~~53σ_F

Notes:

Equivalent stress: $\sigma_e = \sqrt{\sigma^2 + 3\tau^2}$ (N/mm^2)

σ_F: Minimum upper yield stress or proof stress (N/mm^2) of the material

Part 2-7 TANKERS

Chapter 4 LOADS

4.3 Loads to be Considered in Strength of Primary Supporting Structures

4.3.3 Harbour Condition

4.3.3.1 General

Table 4.3.3-1 Loads to be Considered in Harbour Condition

Structures to be assessed		Loading patterns~~(1)~~			*Difference between external and internal pressure to be considered (kN/m²)*
		Draught(m)	Vertical bending moment in harbour(kN-m)	Loaded to be considered	
Double bottom	*P*1(1)	T_{SC}	M_{PT_max}	None	*Double bottom:* P_{DB} *Double side:* P_{DS}
	*P*2(2)	T_{BAL}	M_{PT_min}	Liquid cargo	

Specifies that for tankers in the harbour condition, strength evaluations may be based on the planned draught as documented in the Loading Manual for the loading condition.

Amended	Original	Remarks

Double side	*P*3(1)	T_{SC}	M_{PT_max}	None	
	*P*4(2)	T_{BAL}	M_{PT_min}	Liquid cargo	

Notes:

(1) For ships designed so that their draught is smaller than T_{SC} when the cargo tank to be assessed is empty, the smaller draught may be considered. In such cases, it is to be clearly stated in the Loading Manual that exceeding the smaller draught is not allowed when the cargo tank is empty.

(2) For ships designed so that their draught is greater than T_{BAL} when the cargo tank to be assessed is loaded, the greater draught may be considered. In such cases, it is to be clearly stated in the Loading Manual that being less than the greater draught is not allowed when the cargo tank is loaded.

Amended	Original	Remarks
Chapter 6 LOCAL STRENGTH **6.1 Independent Prismatic Tanks** **6.1.2 Supporting Structures in Independent Prismatic Tanks** **6.1.2.3 Strength Criteria** Compressive stresses σ_a (N/mm^2) acting on each plate which composes the supporting structures, excluding top plate, is to comply with the following criteria: $\sigma_a < \sigma_{cr}$ σ_a: The compressive stress acting on each plate which composes the supporting structures, excluding top plate, as given by the following: $\sigma_a = \frac{F_a}{A_{min}}$ (N/mm^2) Where: F_a: Load acting on the supporting structures as given by the following:	**Chapter 6 LOCAL STRENGTH** **6.1 Independent Prismatic Tanks** **6.1.2 Supporting Structures in Independent Prismatic Tanks** **6.1.2.3 Strength Criteria** Compressive stresses σ_a (N/mm^2) acting on each plate which composes the supporting structures, excluding top plate, is to comply with the following criteria: $\sigma_a < \sigma_{cr}$ σ_a: The compressive stress acting on each plate which composes the supporting structures, excluding top plate, as given by the following: $\sigma_a = \frac{F_a}{A_{min}}$ (N/mm^2) Where: F_a: Load acting on the supporting structures as given by the following:	Corrects typographical errors.

Amended-Original Requirements Comparison Table
(Survey and Construction of Steel Ships Part C)

Amended	Original	Remarks
$F_a = (\rho_L V_t \times 10^3 + m_T)(g + a_{ze})$ (*N*) ρ_L: Cargo density (*ton/m*^{3}) V_t: Tank volume (*m*^{3}) supported by the supporting structure under consideration m_t: Mass of tank, insulation and equipment (*kg*) a_{Ze}: Vertical envelope acceleration acting on the centre of gravity of the cargo tank under consideration, according to **4.2.2.1, Part 2-7** A_{min}: Minimum horizontal sectional area (*mm*^{2}) which is obtained by subtracting half of corrosion addition t_c from all side of the plates (*See* **Fig. 6.1.2-1**) σ_{cr}: Allowable stress obtained as follows, whichever is smaller. $\frac{\sigma_{yd}}{1.33}$ (*N/mm*^{2}) $C_x \sigma_{yd}$ (*N/mm*^{2}) Where: σ_{yd}: Yield stress (*N/mm*^{2}) of the material used for the supporting structure C_x: Reduction factor for each plate which composes the supporting structures, excluding top plates, as obtained by **Table 6.1.2-1**. Assessed plate which is not rectangular may be approximated using **Table 6.1.2-2**.	$F_a = (\rho_L V_t \times 10^3 + m_T)(g + a_{ze})$ (*N*) ρ_L: Cargo density (*ton/m*^{3}) V_t: Tank volume (*m*^{3}) supported by the supporting structure under consideration m_t: Mass of tank, insulation and equipment (*kg*) a_{Ze}: Vertical envelope acceleration acting on the centre of gravity of the cargo tank under consideration, according to **4.2.2.1, Part 2-7** A_{min}: Minimum horizontal sectional area (*mm*^{2}) which is obtained by subtracting half of corrosion addition t_c from all side of the plates (*See* **Fig. 6.1.2-1**) σ_{cr}: Allowable stress obtained as follows, whichever is smaller. $\frac{\sigma_{yd}}{1.33}$ (*N/mm*^{2}) $C_x \sigma_{yd}$ (*N/mm*^{2}) Where: σ_{yd}: Yield stress (*N/mm*^{2}) of the material used for the supporting structure C_x: Reduction factor for each plate which composes the supporting structures, excluding top plates, as obtained by **Table 6.1.2-1**. Assessed plate which is not rectangular may be approximated using **Table 6.1.2-2**.	

Amended-Original Requirements Comparison Table
(Survey and Construction of Steel Ships Part C)

Amended	Original	Remarks
Part 2-11 SHIPS CARRYING LIQUEFIED GASES IN BULK (MEMBRANE TANKS) **Chapter 8 STRENGTH ASSESSMENT BY CARGO HOLD ANALYSIS** **8.5 Strength Assessment** **8.5.1 Yield Strength Assessment** **8.5.1.1 Criteria** The permissible yield utilisation factor λ_{yperm} for the 30-degree static heel condition and collision condition is to be in accordance with **Table 8.5.1-1**. **8.5.2 Buckling Strength Assessment** **8.5.2.1 Criteria** The permissible buckling usage factor η_{all} for the 30-degree static lateral inclination condition and the collision condition is to be taken as 1.0.	**Part 2-11 SHIPS CARRYING LIQUEFIED GASES IN BULK (MEMBRANE TANKS)** **Chapter 8 STRENGTH ASSESSMENT BY CARGO HOLD ANALYSIS** **8.5 Strength Assessment** **8.5.1 Yield Strength Assessment** **8.5.1.1 Criteria** The permissible yield utilisation factor λ_{yperm} for the 30-degree static heel condition and collision condition is to be in accordance with **Table 8.5.1-1**.	Specifies buckling strength assessment criteria for the cargo hold analysis of ships carrying liquefied gases in bulk (membrane tanks) in the 30-degree static heel condition and the collision condition.

Amended-Original Requirements Comparison Table
(Survey and Construction of Steel Ships Part C)

Amended	Original	Remarks
EFFECTIVE DATE AND APPLICATION **1.** Effective date of this amendment is 27 June 2024. **2.** Notwithstanding **1.** above, the version of Part C of the Rules in effect prior to its comprehensive revision (hereinafter referred to as "old Part C") may still be applied to the sister ships of those ships constructed under old Part C in cases where the date of the contract for construction of the sister ships is before 1 January 2025.		

Amended-Original Requirements Comparison Table
(Survey and Construction of Steel Ships Part C)

Amended	Original	Remarks
GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS	**GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS**	Specifies guidelines for external pressure considerations in hydrostatic tests when predetermined values are unavailable.
Part C HULL CONSTRUCTION AND EQUIPMENT	**Part C HULL CONSTRUCTION AND EQUIPMENT**	
Part 1 GENERAL HULL REQUIREMENTS	**Part 1 GENERAL HULL REQUIREMENTS**	
C4 LOADS	(Newly added)	
C4.4 Loads to be Considered in Local Strength **C4.4.3 Testing Condition** **C4.4.3.1 External Pressure** In the application of **4.4.3.1, Part C of the Rules**, it may be assumed that the external pressure is 0 or a draught less than that of Case 1 (i.e. a value set with some margin to the minimum draught in the test plans of existing ships) in cases where the information for Case 1 cannot be obtained beforehand.		

Amended	Original	Remarks
C7 STRENGTH OF PRIMARY SUPPORTING STRUCTURES **C7.2 Simple Girders** **C7.2.6 Bending Stiffness** **C7.2.6.2 Moment of Inertia of Girders** For the stiffeners supported by girders, **7.2.6.2, Part C of the Rules** need not be applied in cases where the hot spot stress, including stress due to relative displacement, specified in **9.3.5, Part C of the Rules** (*See* **9.3.2, Part C of the Rules**) is considered and the fatigue strength assessment required by **9.5, Part C of the Rules** is satisfactory.	(Newly added)	Clarifies an acceptable alternative evaluation method to the prescriptive formula used to calculate the moment of inertia of girders
C9 FATIGUE **C9.1 General** **C9.1.2 Application of Fatigue Strength Assessment** **C9.1.2.2 Application** "Ships for which fatigue strength assessment is deemed necessary by the Society" specified in **9.1.2.2-1(3), Part C of the Rules** include those that opt to perform strength assessment by the cargo hold analysis specified in **Chapter 8, Part C of the Rules** in accordance with **1.2.2.4, Part C of the Rules**. In such cases, however, only the assessments specified in **9.3.1.2(2), Part C of the Rules** need be performed.	(Newly added)	Clarifies an acceptable alternative evaluation method to the prescriptive formula used to calculate the moment of inertia of girders

Amended-Original Requirements Comparison Table
(Survey and Construction of Steel Ships Part C)

Amended	Original	Remarks
EFFECTIVE DATE AND APPLICATION **1.** Effective date of this amendment is 27 June 2024. **2.** Notwithstanding **1.** above, the version of Part C of the Rules in effect prior to its comprehensive revision (hereinafter referred to as "old Part C") may still be applied to the sister ships of those ships constructed under old Part C in cases where the date of the contract for construction of the sister ships is before 1 January 2025.		