

RULES FOR CLASSIFICATION(STEEL SHIPS)

(Sub-committee)

Part 14 Structural Rules for Container Ships



2025. 10. 23

Hull Rule Development Team

- Main Amendments -

(1) Enter into force on 1 July 2026 (the contract date for ship construction)

- To reflect Request for Establishment/Revision of Classification Technical Rules
- Revised the requirement for the cofferdam
- Improved the bow impact pressure for fore part
- Revised the standard loading conditions for ships with gas fuel tank
- Improved the slenderness requirement for flat bar
- Improved the simplified stress analysis with stress due to relative displacement
- Revised the requirement for Breakwater or whaleback(tuttle deck)



| Present | Amendment | Note |
|---|---|---|
| <p>Chapter 2 General Arrangement</p> <p>Section 1 ~ 2 <omitted></p> <p>Section 3 Compartment Arrangement</p> <p>1. Cofferdam</p> <p>1.1 <omitted></p> <p>1.2 Arrangement of cofferdams</p> <p>1.2.1 ~ 1.2.3 <omitted></p> <p>1.2.4</p> <p>The cofferdams specified in [1.2.1] may be waived when deemed impracticable or unreasonable by the Society in relation to the characteristics and dimensions of the spaces containing such tanks, provided that:</p> <ul style="list-style-type: none"> • the thickness of common boundary plates of adjacent tanks is increased, with respect to the thickness obtained according to Ch 6, Sec 4, by 2 mm in the case of tanks carrying fresh water or boiler feed water, and by 1 mm in all other cases; • the sum of the throats of the weld fillets at the edges of these plates is not less than the thickness of the plates themselves; • the structural test is carried out with a test pressure increased by 1 m with respect to Pt 1, Ch 1, Sec 3, 306. | <p>Chapter 2 General Arrangement</p> <p>Section 1 ~ 2 <same as the present></p> <p>Section 3 Compartment Arrangement</p> <p>1. Cofferdam</p> <p>1.1 <same as the present></p> <p>1.2 Arrangement of cofferdams</p> <p>1.2.1 ~ 1.2.3 <same as the present></p> <p>1.2.4</p> <p>The cofferdams specified in [1.2.1] may be waived when deemed impracticable or unreasonable by the Society in relation to the characteristics and dimensions of the spaces containing such tanks, provided <u>that the common boundaries of fuel oil and lubricating oil tank have full penetration welds.</u></p> | <p>- revised the cofferdam requirement applicable to ships not covered by the CSR.</p> <p>- revised the requirements regarding feedback on internal review.</p> |

| Present | Amendment | Note |
|---|---|---|
| <p style="text-align: center;">Chapter 4 Loads</p> <p style="text-align: center;">Section 1 ~ 4 <omitted></p> <p style="text-align: center;">Section 5 External Loads</p> <p>1. ~ 2. <omitted></p> <p>3. External impact pressures</p> <p>3.1 <omitted></p> <p>3.2 Equivalent design pressure</p> <p>3.2.1 <omitted></p> <p>3.2.2 Breaking wave impact pressure</p> <p>The breaking wave impact pressure, P_{BI} in kN/m^2, is to be taken as: $P_{BI} = CP_B$ where: C : Vertical distribution coefficient, as given in [3.2.1]. C_w : Wave coefficient, as defined in Sec 4. h_0 : Vertical distance, in m, as given in [3.2.1]. P_B : Impact pressure, in kN/m^2. $P_B = \frac{1}{2} \rho K_B V_B^2 C_\phi$ K_B : Coefficient, to be taken as: $K_B = 4$ <omitted></p> | <p style="text-align: center;">Chapter 4 Loads</p> <p style="text-align: center;">Section 1 ~ 4 <same as the present></p> <p style="text-align: center;">Section 5 External Loads</p> <p>1. ~ 2. <same as the present></p> <p>3. External impact pressures</p> <p>3.1 <same as the present></p> <p>3.2 Equivalent design pressure</p> <p>3.2.1 <same as the present></p> <p>3.2.2 Breaking wave impact pressure</p> <p>The breaking wave impact pressure, P_{BI} in kN/m^2, is to be taken as: $P_{BI} = CP_B$ where: C : Vertical distribution coefficient, as given in [3.2.1]. C_w : Wave coefficient, as defined in Sec 4. h_0 : Vertical distance, in m, as given in [3.2.1]. P_B : Impact pressure, in kN/m^2. $P_B = \frac{1}{2} \rho K_B V_B^2 C_\phi$ K_B : Coefficient, to be taken as: $K_B = 4$ $K_B = 0.023L$ but not less than 4 nor greater than 7.5 <same as the present></p> | <p style="text-align: center;">Note</p> <p style="text-align: right;">– adjustment of the coefficient for considering the ship length</p> |

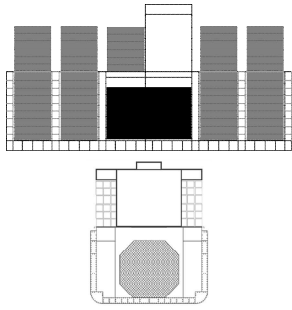
| Present | Amendment | Note |
|--|--|--|
| <p>3.3 <omitted></p> <p>3.4 Bow impact</p> <p>3.4.1 Design pressures</p> <p>The bow impact pressure, P_{FB} in kN/m², to be considered for the bow impact design load scenario is to be taken as:</p> $P_{FB} = \max(P_{EI}, P_{BI}) \cdot f_{FB}$ <p>where:</p> <p>P_{EI} : Entry impact pressure, in kN/m², as defined in [3.2.1].</p> <p>P_{BI} : Breaking wave impact pressure, in kN/m², as defined in [3.2.2].</p> <p>f_{FB} : Longitudinal distribution factor along the ship length, to be taken as follow but not to be taken greater than 1.0:</p> $f_{FB} = 2.8 \left(f_{xL} + 1.5 \frac{L}{2500} - 0.12 \right)^2 - 1.4 \quad \text{for } L \leq 200\text{m}$ $f_{FB} = 2.8 f_{xL}^2 - 1.4 \quad \text{for } L > 200\text{m}$ | <p>3.3 <same as present></p> <p>3.4 Bow impact</p> <p>3.4.1 Design pressures</p> <p>The bow impact pressure, P_{FB} in kN/m², to be considered for the bow impact design load scenario is to be taken as:</p> $P_{FB} = \max(f_{FB-EI} P_{EI}, f_{FB-BI} C_{FB} P_{BI})$ <p>where:</p> <p>P_{EI} : Entry impact pressure, in kN/m², as defined in [3.2.1].</p> <p>P_{BI} : Breaking wave impact pressure, in kN/m², as defined in [3.2.2].</p> <p>f_{FB-EI} : Longitudinal distribution factor <u>for entry impact</u> along the ship length, to be taken as follow but not to be taken greater than 1.0:</p> $f_{FB-EI} = 3.0 \left(f_{xL} + 2.5 \frac{L}{2500} - 0.2 \right) - 1.7 \quad \text{for } L \leq 200\text{m}$ $f_{FB-EI} = 3.0 f_{xL} - 1.7 \quad \text{for } L > 200\text{m}$ <p>f_{FB-BI} : Longitudinal distribution factor for breaking wave impact along the ship length, to be taken as:</p> $f_{FB-BI} = 15.7 - 15 f_{xL} \quad \text{but not less than } 0.7 \text{ nor greater than } 1.0$ <p>C_{FB} : Vertical distribution factor, to be taken as:</p> $C_{FB} = \frac{z}{T_{SC}} - 0.15 \quad \text{but not less than } 0.7 \text{ nor greater than } 1.0$ | <ul style="list-style-type: none"> - adjusted the longitudinal distribution factor for the entry impact pressure - newly added the longitudinal distribution factor for the breaking wave impact pressure - newly added the vertical distribution factor for the break wave impact pressure |

| Present | Amendment | Note |
|---|--|---|
| <p style="text-align: center;">Section 6 ~ 7 <omitted> Section 8 Loading Conditions</p> <p>1. <omitted></p> <p>2. Design loading conditions</p> <p>2.1 ~ 2.3 <omitted></p> <p>2.4 Loading conditions</p> <p>2.4.1 ~ 2.4.3 <omitted></p> <p>2.4.4 Standard loading conditions for liquefied natural gas fuel tank strength check</p> <p>The loading conditions to be considered for liquefied natural gas fuel tank strength check are given in Table 3.</p> <p>2.4.5 Standard loading conditions for independent fuel tanks strength check</p> <p>The loading conditions to be considered for independent fuel tank strength check are performed considering the Guideline of Structural Assessment for Liquefied Gas Carriers with Type A Prismatic Tank.</p> <p>2.4.6 Standard loading conditions for cargo holds fatigue check</p> <p>The loading conditions to be considered for cargo hold fatigue check are given in Table 4. <omitted></p> | <p style="text-align: center;">Section 6 ~ 7 <same as the present> Section 8 Loading Conditions</p> <p>1. <same as the present></p> <p>2. Design loading conditions</p> <p>2.1 ~ 2.3 <same as the present></p> <p>2.4 Loading conditions</p> <p>2.4.1 ~ 2.4.3 <same as the present></p> <p>2.4.4 Standard loading conditions for <u>membrane or independent</u> gas fuel tanks strength check</p> <p>The loading conditions to be considered for <u>membrane or independent</u> gas fuel tanks strength check are given in Table 3. <u>The 「Guideline of Structural Assessment for Liquefied Gas Carriers with Type A and B Prismatic Tanks」 provides analysis procedures for designs with independent prismatic gas fuel tanks of Type A and B. For designs with independent gas fuel tanks of Type C, the 「Guidelines for Direct Strength Analysis of Liquefied Gas Carriers with Independent Type C Tanks」 provides the relevant analysis procedures.</u></p> <p>2.4.5 Standard loading conditions for cargo holds fatigue check</p> <p>The loading conditions to be considered for cargo hold fatigue check are given in Table 4. <same as the present></p> | <p>- revised the standard loading conditions for membrane or independent gas fuel tanks</p> |

Present

Note

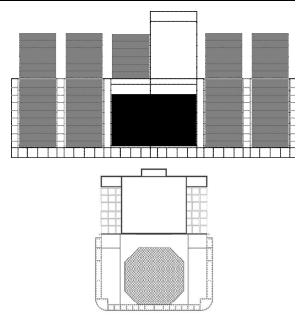
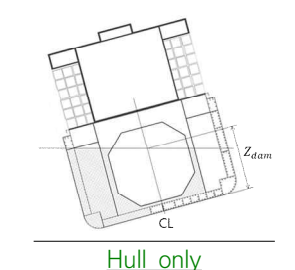
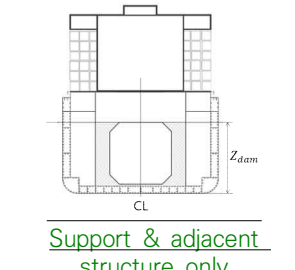
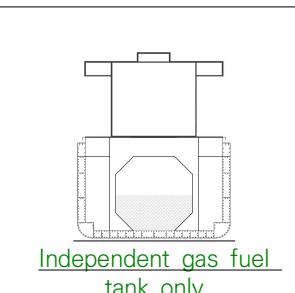
Table 3 : Standard loading conditions for ~~liquefied natural~~ gas fuel tanks strength check in cargo hold region

| 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 | | | |
| <omitted> | | | | | | | |
| Accidental condition | | | | | | | |
| A1 |  | T_{sc} | Max. 40 ft stack weight All ballast tanks empty Fuel oil tanks empty Liquefied natural gas fuel tank full | Max. 40 ft stack weight | $\leq 100\%$ | $\leq 100\%$ | Static Forward $a_x=0.5g$ Aftward $a_x=0.25g$ |
| <newly added> | | | | | | | |
| <newly added> | | | | | | | |
| <newly added> | | | | | | | |
| Testing condition | | | | | | | |
| <omitted> | | | | | | | |
| <newly added> | | | | | | | |
| <omitted> | | | | | | | |
| ³⁾ <newly added> ⁴⁾ <newly added> | | | | | | | |

Amendment

Note

Table 3 : Standard loading conditions for gas fuel 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 | | | |
| (same as the present) | | | | | | | |
| Accidental condition | | | | | | | |
| <u>GA1</u> |  | T_{SC} | Max. 40 ft stack weight All ballast tanks empty Fuel oil tanks empty Gas fuel tank full | Max. 40 ft stack weight | $\leq 100\%$ | $\leq 100\%$ | Static Forward $a_x=0.5g$ Aftward $a_x=0.25g$ |
| <u>Flooded condition</u> – for independent gas fuel tanks | | | | | | | |
| <u>GD1</u> <small>3)</small> |  | T_{FD} | <u>The space in flooded side is filled up to flooded draught except empty gas fuel tank</u> | <u>Max. 40 ft stack weight</u> | $\leq 100\%$ | $\leq 100\%$ | <u>Static</u> |
| <u>GD2</u> |  | $T_{DC}^{2)}$ | <u>Max. 40 ft stack weight</u> <u>All ballast and fuel oil tanks empty</u> <u>Gas fuel tank empty</u> | <u>Max. 40 ft stack weight</u> | $\leq 100\%$ | $\leq 100\%$ | <u>Static</u> |
| Testing condition | | | | | | | |
| (same as the present) | | | | | | | |
| <u>GT2</u> |  | $T_{BAL}^{1)}$ | <u>All container bays empty</u> <u>All ballast tanks empty</u> <u>Fuel oil tanks empty</u> <u>Gas fuel tank full³⁾</u> | <u>All container bays are empty</u> | <u>SWBM in ballast condition²⁾</u> | $\leq 100\%$ | <u>Static</u> |
| (same as the present) | | | | | | | |
| ²⁾ <u>Flooding draught corresponding to fully submerged tank in upright condition</u> ³⁾ <u>Where the transverse bulkhead is determined based on the loading condition defined at A1 in Table 1, an exception may be considered.</u> ⁴⁾ <u>The tank filling ratio is based on the tank test plan considering the harbour condition.</u> | | | | | | | |

- the term "Liquefied natural gas fuel tank" is replaced with "Gas fuel tank".
- the flooded condition is newly added
- additional GT2 for testing condition is newly added

| Present | Amendment | Note |
|--|--|------|
| <p style="text-align: center;">Chapter 8 Buckling</p> <p style="text-align: center;">Section 1 <omitted></p> <p style="text-align: center;">Section 2 Slenderness Requirements</p> <p>1. ~ 2. <omitted></p> <p>3. Stiffener</p> <p>3.1 Proportions of stiffeners</p> <p>3.1.1 Net thickness of all stiffener types</p> <p>The net thickness of stiffeners is to satisfy the following criteria:</p> <p>a) Stiffener web plate:</p> $t_w \geq \frac{h_w}{C_w} \sqrt{\frac{R_{eH}}{235}}$ <p>b) Flange:</p> $t_f \geq \frac{b_{f-out}}{C_f} \sqrt{\frac{R_{eH}}{235}}$ <p>where: C_w, C_f : Slenderness coefficients given in Table 1.</p> <p>If requirement b) is not fulfilled, the effective free flange outstand, in mm, used in strength assessment including the calculation of actual net section modulus, is not to be taken greater than:</p> $b_{f-out-max} = C_f t_f \sqrt{\frac{235}{R_{eH}}}$ | <p style="text-align: center;">Chapter 8 Buckling</p> <p style="text-align: center;">Section 1 <same as the present></p> <p style="text-align: center;">Section 2 Slenderness Requirements</p> <p>1. ~ 2. <same as the present></p> <p>3. Stiffener</p> <p>3.1 Proportions of stiffeners</p> <p>3.1.1 Net thickness of all stiffener types</p> <p>The net thickness of stiffeners is to satisfy the following criteria:</p> <p>a) Stiffener web plate:</p> $t_w \geq \frac{h_w}{C_w} \sqrt{\frac{R_{eH}}{235}}$ <p>b) Flange:</p> $t_f \geq \frac{b_{f-out}}{C_f} \sqrt{\frac{R_{eH}}{235}}$ <p>where: C_w, C_f : Slenderness coefficients given in Table 1.</p> <p>If requirement b) is not fulfilled, the effective free flange outstand, in mm, used in strength assessment including the calculation of actual net section modulus, is not to be taken greater than:</p> $b_{f-out-max} = C_f t_f \sqrt{\frac{235}{R_{eH}}}$ | |

| Present | Amendment | Note | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|--|-------------------|---------------|-------|-----------------------|---------------|--------|-----------|----|----|-----------|----|---|-----------|----|---|---------------|--|--|---|-------------------|-------|-------|-----------------------|----|----|--------|----|----|-----------|----|---|-----------|------------------|---|--|--|--|--|------|---------------|---|-----------|---------------|--------|---|-------|------|----|------|------|----|------|-----|-------|------|----|------|------|----|------|-----|--------|------|-----|------|------|-----|------|----|------|------|-----|------|------|-----|------|----|----------|------|-----|------|------|-----|------|-----------|------------------------|-------------|-----|------|-------------|-----|------|-----------|------------|------|-----|------|------|-----|------|----|--|
| Table 1 : Slenderness coefficients <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Type of Stiffener</th> <th style="text-align: center;">C_w</th> <th style="text-align: center;">C_f</th> </tr> </thead> <tbody> <tr> <td>Angle, L2 and L3 bars</td> <td style="text-align: center;">75</td> <td style="text-align: center;">12</td> </tr> <tr> <td>T-bars</td> <td style="text-align: center;">75</td> <td style="text-align: center;">12</td> </tr> <tr> <td>Bulb bars</td> <td style="text-align: center;">45</td> <td style="text-align: center;">-</td> </tr> <tr> <td>Flat bars</td> <td style="text-align: center;">22</td> <td style="text-align: center;">-</td> </tr> <tr> <td colspan="3" style="text-align: left;">(newly added)</td> </tr> </tbody> </table> | Type of Stiffener | C_w | C_f | Angle, L2 and L3 bars | 75 | 12 | T-bars | 75 | 12 | Bulb bars | 45 | - | Flat bars | 22 | - | (newly added) | | | Table 1 : Slenderness coefficients <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="text-align: center;">Type of Stiffener</th> <th style="text-align: center;">C_w</th> <th style="text-align: center;">C_f</th> </tr> </thead> <tbody> <tr> <td>Angle, L2 and L3 bars</td> <td style="text-align: center;">75</td> <td style="text-align: center;">12</td> </tr> <tr> <td>T-bars</td> <td style="text-align: center;">75</td> <td style="text-align: center;">12</td> </tr> <tr> <td>Bulb bars</td> <td style="text-align: center;">45</td> <td style="text-align: center;">-</td> </tr> <tr> <td>Flat bars</td> <td style="text-align: center;">22 ¹⁾</td> <td style="text-align: center;">-</td> </tr> <tr> <td colspan="3" style="text-align: left;"> ¹⁾ $C_w=28$, for flat bars under lateral loads which does not affect the hull girder bending strength. </td> </tr> </tbody> </table> <p>for reference) - CSR TB Part1, Ch 8, Sec 2, [2.1.1] & [3.1.3]</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th></th> <th style="text-align: center;">F(k)</th> <th style="text-align: center;">σ_{EL}</th> <th style="text-align: center;">K</th> <th style="text-align: center;">λ</th> <th style="text-align: center;">σ_{cr}</th> <th style="text-align: center;">η</th> <th style="text-align: center;">C</th> </tr> </thead> <tbody> <tr> <td>Plate</td> <td style="text-align: center;">4.00</td> <td style="text-align: center;">74</td> <td style="text-align: center;">0.31</td> <td style="text-align: center;">1.78</td> <td style="text-align: center;">74</td> <td style="text-align: center;">0.31</td> <td style="text-align: center;">100</td> </tr> <tr> <td>Plate</td> <td style="text-align: center;">4.00</td> <td style="text-align: center;">47</td> <td style="text-align: center;">0.20</td> <td style="text-align: center;">2.24</td> <td style="text-align: center;">47</td> <td style="text-align: center;">0.20</td> <td style="text-align: center;">126</td> </tr> <tr> <td>L or T</td> <td style="text-align: center;">4.00</td> <td style="text-align: center;">132</td> <td style="text-align: center;">0.56</td> <td style="text-align: center;">1.33</td> <td style="text-align: center;">130</td> <td style="text-align: center;">0.55</td> <td style="text-align: center;">75</td> </tr> <tr> <td>Bulb</td> <td style="text-align: center;">1.25</td> <td style="text-align: center;">115</td> <td style="text-align: center;">0.49</td> <td style="text-align: center;">1.43</td> <td style="text-align: center;">115</td> <td style="text-align: center;">0.49</td> <td style="text-align: center;">45</td> </tr> <tr> <td>Flat bar</td> <td style="text-align: center;">0.43</td> <td style="text-align: center;">165</td> <td style="text-align: center;">0.70</td> <td style="text-align: center;">1.19</td> <td style="text-align: center;">151</td> <td style="text-align: center;">0.64</td> <td style="text-align: center;">22</td> </tr> <tr> <td>Flat bar ¹⁾</td> <td style="text-align: center;">0.61</td> <td style="text-align: center;">143</td> <td style="text-align: center;">0.61</td> <td style="text-align: center;">1.28</td> <td style="text-align: center;">139</td> <td style="text-align: center;">0.59</td> <td style="text-align: center;">28</td> </tr> <tr> <td>Face plate</td> <td style="text-align: center;">0.43</td> <td style="text-align: center;">554</td> <td style="text-align: center;">2.36</td> <td style="text-align: center;">0.65</td> <td style="text-align: center;">210</td> <td style="text-align: center;">0.89</td> <td style="text-align: center;">12</td> </tr> </tbody> </table> <p>Note) ¹⁾ $K=0.61$ for stiffeners not subject to hull girder stresses, which represents a slenderness ratio of $\lambda=1.28$.</p> <p>The inertia stiffness requirement has been based calibrated based on current practice with adjustments for the net thickness approach to give a slenderness coefficient C of:</p> <ul style="list-style-type: none"> 1.43. Based on $K=1.24$ for stiffeners subjected to hull girder stresses, which represents a slenderness ratio of $\lambda=0.90$. This factor should be used for all longitudinal stiffeners, both continuous and sniped stiffeners. The reason for using the same factor for sniped stiffeners is because stresses will be distributed from the plating to the stiffener due to shortening of the plate. 0.72. Based on $K=0.61$ for stiffeners not subject to hull girder stresses, which represents a slenderness ratio of $\lambda=1.28$. $C = \sqrt{\frac{F \pi^2 E}{12(1 - \nu^2)K \cdot 235}}$ | Type of Stiffener | C_w | C_f | Angle, L2 and L3 bars | 75 | 12 | T-bars | 75 | 12 | Bulb bars | 45 | - | Flat bars | 22 ¹⁾ | - | ¹⁾ $C_w=28$, for flat bars under lateral loads which does not affect the hull girder bending strength. | | | | F(k) | σ_{EL} | K | λ | σ_{cr} | η | C | Plate | 4.00 | 74 | 0.31 | 1.78 | 74 | 0.31 | 100 | Plate | 4.00 | 47 | 0.20 | 2.24 | 47 | 0.20 | 126 | L or T | 4.00 | 132 | 0.56 | 1.33 | 130 | 0.55 | 75 | Bulb | 1.25 | 115 | 0.49 | 1.43 | 115 | 0.49 | 45 | Flat bar | 0.43 | 165 | 0.70 | 1.19 | 151 | 0.64 | 22 | Flat bar ¹⁾ | 0.61 | 143 | 0.61 | 1.28 | 139 | 0.59 | 28 | Face plate | 0.43 | 554 | 2.36 | 0.65 | 210 | 0.89 | 12 | - improved the slenderness coefficient, C_w , of flat bars |
| Type of Stiffener | C_w | C_f | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Angle, L2 and L3 bars | 75 | 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| T-bars | 75 | 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bulb bars | 45 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Flat bars | 22 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| (newly added) | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Type of Stiffener | C_w | C_f | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Angle, L2 and L3 bars | 75 | 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| T-bars | 75 | 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bulb bars | 45 | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Flat bars | 22 ¹⁾ | - | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ¹⁾ $C_w=28$, for flat bars under lateral loads which does not affect the hull girder bending strength. | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | F(k) | σ_{EL} | K | λ | σ_{cr} | η | C | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Plate | 4.00 | 74 | 0.31 | 1.78 | 74 | 0.31 | 100 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Plate | 4.00 | 47 | 0.20 | 2.24 | 47 | 0.20 | 126 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| L or T | 4.00 | 132 | 0.56 | 1.33 | 130 | 0.55 | 75 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Bulb | 1.25 | 115 | 0.49 | 1.43 | 115 | 0.49 | 45 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Flat bar | 0.43 | 165 | 0.70 | 1.19 | 151 | 0.64 | 22 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Flat bar ¹⁾ | 0.61 | 143 | 0.61 | 1.28 | 139 | 0.59 | 28 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Face plate | 0.43 | 554 | 2.36 | 0.65 | 210 | 0.89 | 12 | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

| Present | Amendment | Note |
|--|---|--|
| <p>4. PRIMARY SUPPORTING MEMBERS</p> <p>4.1 Proportions and stiffness</p> <p>4.1.1 Proportions of web plate and flange</p> <p>The net thicknesses of the web plates and flanges of primary supporting members are to satisfy the following criteria:</p> <p>a) Web plate:</p> $t_w \geq \frac{s_w}{C_w} \sqrt{\frac{R_{eH}}{235}}$ <p>b) Flange:</p> $t_f \geq \frac{b_{f-out}}{C_f} \sqrt{\frac{R_{eH}}{235}}$ <p>where:</p> <p>s_w : Plate breadth, in mm, taken as the spacing of the web stiffeners.</p> <p>C_w : Slenderness coefficient for the web plate taken as:</p> <p>$C_w = 125$ for double skin construction</p> <p>$C_w = 100$ elsewhere</p> <p>C_f : Slenderness coefficient for the flange taken as:</p> <p>$C_f = 12$</p> <p>If requirement b) is not fulfilled, the effective free flange outstand, in mm, used in strength assessment including the calculation of actual net section modulus, is not to be taken greater than:</p> $b_{f-out-max} = C_f t_f \sqrt{\frac{235}{R_{eH}}}$ | <p>4. PRIMARY SUPPORTING MEMBERS</p> <p>4.1 Proportions and stiffness</p> <p>4.1.1 Proportions of web plate and flange</p> <p>The net thicknesses of the web plates and flanges of primary supporting members are to satisfy the following criteria:</p> <p>a) Web plate:</p> $t_w \geq \frac{s_w}{C_w} \sqrt{\frac{R_{eH}}{235}}$ <p>b) Flange:</p> $t_f \geq \frac{b_{f-out}}{C_f} \sqrt{\frac{R_{eH}}{235}}$ <p>where:</p> <p>s_w : Plate breadth, in mm, taken as the spacing of the web stiffeners.</p> <p>C_w : Slenderness coefficient for the web plate taken as:</p> <p>$C_w = 125$ for double skin construction</p> <p>$C_w = 100$ elsewhere</p> <p>C_f : Slenderness coefficient for the flange taken as:</p> <p>$C_f = 12$</p> <p><u>R_{eH}</u> : Specified minimum yield stress of the plate material, in N/mm² For the web plates, a lower R_{eH} may be used in this slenderness criterion provided the requirements specified in Sec 3 and Sec 4, if applicable, are satisfied for the structure assumed in the same lower R_{eH}.</p> <p>If requirement b) is not fulfilled, the effective free flange outstand, in mm, used in strength assessment including the calculation of actual net section modulus, is not to be taken greater than:</p> $b_{f-out-max} = C_f t_f \sqrt{\frac{235}{R_{eH}}}$ | <p>- in line with Pt.13 CSR-BC&OT</p> |

| Present | Amendment | Note |
|---|---|---|
| <p style="text-align: center;">Chapter 9 Fatigue</p> <p style="text-align: center;">Section 1 ~ 2 <omitted></p> <p style="text-align: center;">Section 3 Fatigue Evaluation</p> <p>1. ~ 2. <omitted></p> <p>3. Reference Stresses for Fatigue Assessment</p> <p>3.1 ~ 3.2 <omitted></p> <p>3.3 Thickness effect</p> <p>3.3.1</p> <p>Plate thickness primarily influences the fatigue strength of welded joints through the effect of geometry, and through-thickness stress distribution. The correction factor, f_{thick}, for plate thickness effect is taken as: <omitted> where: <omitted></p> <p>l_{leg} : Fillet weld leg length, in mm.</p> <p>When post weld treatment methods are applied to improve the fatigue life of considered welded joint, the thickness exponent is provided in [6].</p> <p>4. S-N Curves</p> <p>4.1 Basic S-N curves</p> <p>4.1.1 ~ 4.1.3 <omitted></p> <p>4.1.4 In-air environment</p> <p>The basic design curves in-air environment shown in Figure 3 are represented by linear relationships between $\log(\Delta\sigma)$ and $\log(N)$ as follows: $\log(N) = \log(K_2) - m \cdot \log(\Delta\sigma)$ where: $\log(K_2) = \log(K_1) - 2 \cdot \log(\delta)$ <omitted></p> | <p style="text-align: center;">Chapter 9 Fatigue</p> <p style="text-align: center;">Section 1 ~ 2 <same as the present></p> <p style="text-align: center;">Section 3 Fatigue Evaluation</p> <p>1. ~ 2. <same as the present></p> <p>3. Reference Stresses for Fatigue Assessment</p> <p>3.1 ~ 3.2 <same as the present></p> <p>3.3 Thickness effect</p> <p>3.3.1</p> <p>Plate thickness primarily influences the fatigue strength of welded joints through the effect of geometry, and through-thickness stress distribution. The correction factor, f_{thick}, for plate thickness effect is taken as: <same as the present> where: <same as the present></p> <p>l_{leg} : Fillet weld leg length, in mm.</p> <p>4. S-N Curves</p> <p>4.1 Basic S-N curves</p> <p>4.1.1 ~ 4.1.3 <omitted></p> <p>4.1.4 In-air environment</p> <p>The basic design curves in-air environment shown in Figure 3 are represented by linear relationships between $\log(\Delta\sigma)$ and $\log(N)$ as follows: $\log(N) = \log(K_2) - m \cdot \log(\Delta\sigma)$ where: $\log(K_2) = \log(K_1) - 2 \delta$ <same as the present></p> | <p>- in line with CSR Corrigenda1(2024)</p> |

Table 2 : Basic S-N curve data, in-air environment

| Class | K_1 | | m | Standard deviation δ | K_2 | Design stress range at 10^7 cycles | Design stress range at 2×10^6 cycles |
|-------|----------|-----------------|-----|--------------------------------|---------|--------------------------------------|---|
| | K_1 | $\log_{10} K_1$ | | $\log_{10} \delta$ | K_2 | $\Delta \sigma_q$ N/mm ² | N/mm ² |
| B | 2.343E15 | 15.3697 | 4.0 | 0.1821 | 1.01E15 | 100.2 | 149.9 |
| C | 1.082E14 | 14.0342 | 3.5 | 0.2041 | 4.23E13 | 78.2 | 123.9 |
| D | 3.988E12 | 12.6007 | 3.0 | 0.2095 | 1.52E12 | 53.4 | 91.3 |

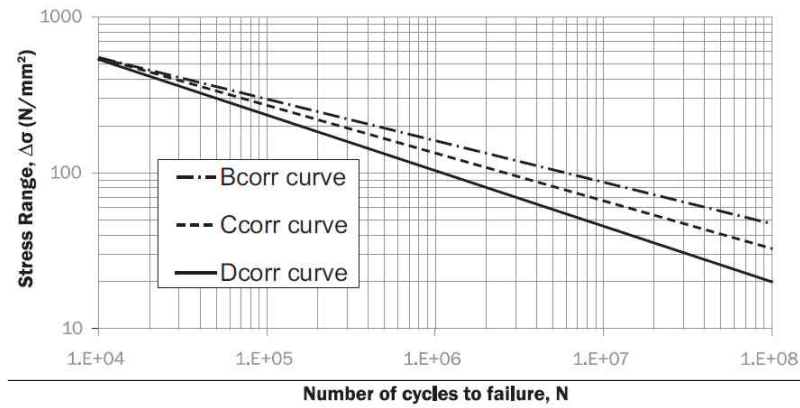


Figure 4 : Basic design S-N curves, corrosive environment

Amendment

Note

Table 2 : Basic S-N curve data, in-air environment

| Class | K_1 | $\log_{10} K_1$ | m | δ | K_2 | Design stress range at 10^7 cycles | Design stress range at 2×10^6 cycles |
|-------|----------|-----------------|-----|----------|---------|--------------------------------------|---|
| | | | | | | $\Delta \sigma_q$ N/mm ² | N/mm ² |
| B | 2.343E15 | 15.3697 | 4.0 | 0.1821 | 1.01E15 | 100.2 | 149.9 |
| C | 1.082E14 | 14.0342 | 3.5 | 0.2041 | 4.23E13 | 78.2 | 123.9 |
| D | 3.988E12 | 12.6007 | 3.0 | 0.2095 | 1.52E12 | 53.4 | 91.3 |

- in line with CSR Corrigenda1(2024)

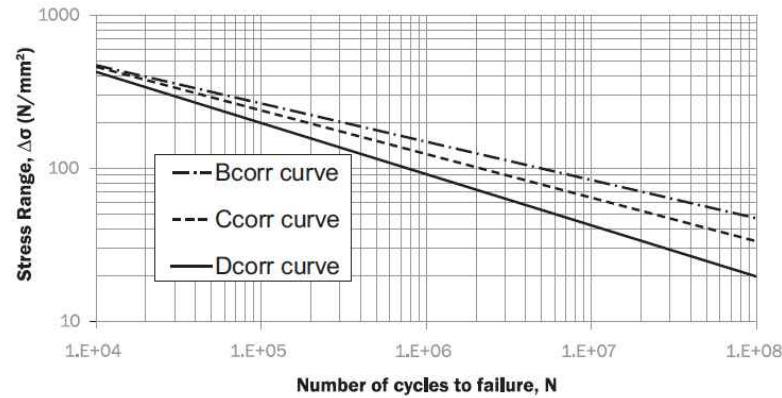
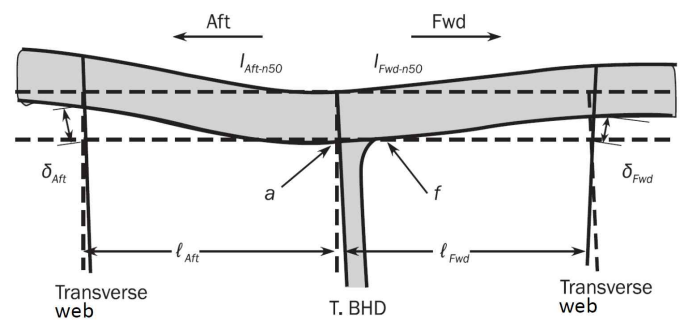
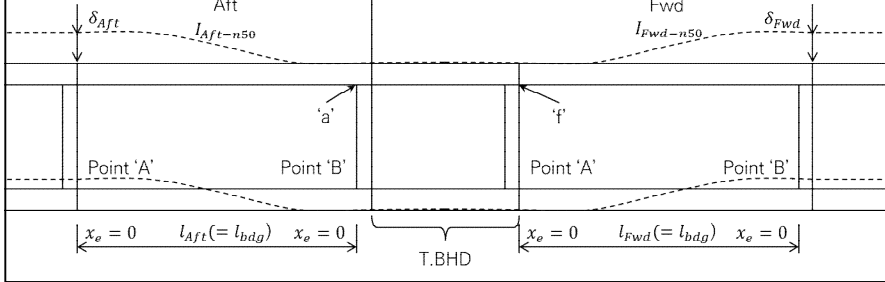


Figure 4 : Basic design S-N curves, corrosive environment

| Present | Amendment | Note |
|--|--|---|
| <p>5. Fatigue Damage Calculation</p> <p>5.1 <omitted></p> <p>5.2 Elementary fatigue damage</p> <p>5.2.1</p> <p>The elementary fatigue damage for each fatigue loading condition (j) is to be calculated independently for both protected in-air environment and unprotected corrosive environment, based on the fatigue stress range obtained for the predominant load case as follows:</p> $D_{E(j)} = \frac{\alpha_{(j)} \cdot N_D}{K_2} \frac{\Delta \sigma_{FS, (j)}^m}{(\ln N_R)^{m/\xi}} \cdot \mu_{(j)} \cdot \Gamma\left(1 + \frac{m}{\xi}\right)$ <p>where:</p> <p>N_D : Total number of wave cycles experienced by ship during the design fatigue life, taken as:</p> $N_D = 31.557 \times 10^6 (f_0 T_D) / (4 \log L)$ <p><omitted></p> | <p>5. Fatigue Damage Calculation</p> <p>5.1 <same as the present></p> <p>5.2 Elementary fatigue damage</p> <p>5.2.1</p> <p>The elementary fatigue damage for each fatigue loading condition (j) is to be calculated independently for both protected in-air environment and unprotected corrosive environment, based on the fatigue stress range obtained for the predominant load case as follows:</p> $D_{E(j)} = \frac{\alpha_{(j)} \cdot N_D}{K_2} \frac{\Delta \sigma_{FS, (j)}^m}{(\ln N_R)^{m/\xi}} \cdot \mu_{(j)} \cdot \Gamma\left(1 + \frac{m}{\xi}\right)$ <p>where:</p> <p>N_D : Total number of stress cycles due to wave loads assumed during the design fatigue life, taken as:</p> $N_D = 31.557 \times 10^6 (f_0 T_D) / (4 \log L)$ <p><same as the present></p> | <p>- in line with CSR Corrigenda1(2024)</p> |

| Present | Amendment | Note |
|--|--|---|
| <p style="text-align: center;">Section 4 Simplified Stress Analysis</p> <p>1. ~ 3. <omitted></p> <p>4. Local Stiffener Stress</p> <p>4.1 <omitted></p> <p>4.2 Stress due to relative displacement</p> <p>4.2.1 ~ 4.2.4 <omitted></p> <p>4.2.5 Stress due to relative displacement derived using FE method</p> <p>The following procedure is based on a cargo hold model complying with Ch 7, Sec 2, [2] to calculate the stress due to relative displacements. The stress due to relative displacements, in N/mm², for load case <i>i1</i> and <i>i2</i> of loading condition (<i>j</i>) for both locations “a” and “f” is to be calculated directly using the following expression:</p> $\sigma_{dD,ik(j)} = \begin{cases} K_b \sigma_{dFwd-a,ik(j)} + K_b \sigma_{dAft-a,ik(j)} & \text{for location a} \\ K_b \sigma_{dFwd-f,ik(j)} + K_b \sigma_{dAft-f,ik(j)} & \text{for location f} \end{cases} \quad (k = 1, 2)$ <p>where:</p> <p><i>a, f</i> : Suffix which denotes the location as indicated in Figure 2.</p> <p><i>Aft, Fwd</i> : Suffix which denotes the direction, afterward (<i>Aft</i>) or forward (<i>Fwd</i>), from the transverse bulkhead. as shown in Figure 2.</p> <p><i>K_b</i> : Stress concentration factor due to bending for the location ‘a’ or ‘f’ which may correspond to points ‘A’ or ‘B’ as defined in Table 3.</p> | <p style="text-align: center;">Section 4 Simplified Stress Analysis</p> <p>1. ~ 3. <same as the present></p> <p>4. Local Stiffener Stress</p> <p>4.1 <same as the present></p> <p>4.2 Stress due to relative displacement</p> <p>4.2.1 ~ 4.2.4 <same as the present></p> <p>4.2.5 Stress due to relative displacement derived using FE method</p> <p>The following procedure is based on a cargo hold model complying with Ch 7, Sec 2, [2] to calculate the stress due to relative displacements. The stress due to relative displacements, in N/mm², for load case <i>i1</i> and <i>i2</i> of loading condition (<i>j</i>) for both locations “a” and “f” is to be calculated directly using the following expression:</p> $\sigma_{dD,ik(j)} = \begin{cases} K_b \sigma_{dAft-a,ik(j)} & \text{for location a} \\ K_b \sigma_{dFwd-f,ik(j)} & \text{for location f} \end{cases} \quad (k = 1, 2)$ <p>where:</p> <p><i>a, f</i> : Suffix which denotes the location as indicated in Figure 2.</p> <p><i>Aft, Fwd</i> : Suffix which denotes the direction, afterward (<i>Aft</i>) or forward (<i>Fwd</i>), from the transverse bulkhead. as shown in Figure 2.</p> <p><i>K_b</i> : Stress concentration factor due to bending for the location ‘a’ or ‘f’ which may correspond to points ‘A’ or ‘B’ as defined in Table 3.</p> | <p>- revised the formula for the stress due to relative displacement with clamped end</p> |

| Present | Amendment | Note |
|--|--|---|
| <p>$\sigma_{dFwd-a, ik(j)}$, $\sigma_{dAft-a, ik(j)}$, $\sigma_{dFwd-f, ik(j)}$, $\sigma_{dAft-f, ik(j)}$: Additional stress at location 'a' and 'f', in N/mm², due to the relative displacement between the transverse bulkhead and the forward (<i>Fwd</i>) and afterward (<i>Aft</i>) transverse web or floor respectively for load case <i>i1</i> and <i>i2</i> of loading condition (<i>j</i>), taken as:</p> $\sigma_{dFwd-a, ik(j)} = \frac{3.9\delta_{Fwd, ik(j)} EI_{Aft-n50} I_{Fwd-n50}}{Z_{Aft-n50} \ell_{Fwd} (\ell_{Aft} I_{Fwd-n50} + \ell_{Fwd} I_{Aft-n50})} \left(1 - 1.15 \frac{ x_{eAft} }{\ell_{Aft}}\right) 10^{-5}$ $\sigma_{dAft-a, ik(j)} = \left[\frac{3.9\delta_{Aft, ik(j)} EI_{Aft-n50} I_{Fwd-n50}}{Z_{Aft-n50} \ell_{Aft} (\ell_{Aft} I_{Fwd-n50} + \ell_{Fwd} I_{Aft-n50})} \left(1 - 1.15 \frac{ x_{eAft} }{\ell_{Aft}}\right) - \frac{0.9\delta_{Aft, ik(j)} EI_{Aft-n50} x_{eAft} }{Z_{Aft-n50} \ell_{Aft}^3} \right] 10^{-5}$ $\sigma_{dFwd-f, ik(j)} = \left[\frac{3.9\delta_{Fwd, ik(j)} EI_{Aft-n50} I_{Fwd-n50}}{Z_{Fwd-n50} \ell_{Fwd} (\ell_{Aft} I_{Fwd-n50} + \ell_{Fwd} I_{Aft-n50})} \left(1 - 1.15 \frac{ x_{eFwd} }{\ell_{Fwd}}\right) - \frac{0.9\delta_{Aft, ik(j)} EI_{Aft-n50} x_{eAft} }{Z_{Aft-n50} \ell_{Aft}^3} \right] 10^{-5}$ $\sigma_{dAft-f, ik(j)} = \frac{3.9\delta_{Aft, ik(j)} EI_{Aft-n50} I_{Fwd-n50}}{Z_{Fwd-n50} \ell_{Aft} (\ell_{Aft} I_{Fwd-n50} + \ell_{Fwd} I_{Aft-n50})} \left(1 - 1.15 \frac{ x_{eFwd} }{\ell_{Fwd}}\right) 10^{-5}$ | <p>$\sigma_{dAft-a, ik(j)}$, $\sigma_{dFwd-f, ik(j)}$: Additional stress at location 'a' and 'f', in N/mm², due to the relative displacement between the transverse bulkhead and the forward (<i>Fwd</i>) and afterward (<i>Aft</i>) transverse web or floor respectively for load case <i>i1</i> and <i>i2</i> of loading condition (<i>j</i>), taken as:</p> $\sigma_{dAft-a, ik(j)} = \frac{4\delta_{Aft, ik(j)} EI_{Aft-n50}}{Z_{Aft-n50} \ell_{Aft}^2} \left(1 - \frac{ x_{eAft} }{\ell_{Aft}}\right)^2 10^{-5}$ $\sigma_{dFwd-f, ik(j)} = \frac{4\delta_{Fwd, ik(j)} EI_{Fwd-n50}}{Z_{Fwd-n50} \ell_{Fwd}^2} \left(1 - \frac{ x_{eFwd} }{\ell_{Fwd}}\right)^2 10^{-5}$ | |
| <p>$I_{Fwd-n50}$, $I_{Aft-n50}$: Net moment of inertia, in cm⁴, of forward (<i>Fwd</i>) and afterward (<i>Aft</i>) longitudinal.</p> | <p>$I_{Fwd-n50}$, $I_{Aft-n50}$: Net moment of inertia, in cm⁴, of forward (<i>Fwd</i>) and afterward (<i>Aft</i>) longitudinal, <u>with effective breadth of attached plating defined in [4.1.1]</u>.</p> | <p>- in line with CSR Corrigenda1(2024)</p> |
| <p>$Z_{Fwd-n50}$, $Z_{Aft-n50}$: Net section modulus of forward (<i>Fwd</i>) and afterward (<i>Aft</i>) stiffener, in cm³.</p> | <p>$Z_{Fwd-n50}$, $Z_{Aft-n50}$: Net section modulus of forward (<i>Fwd</i>) and afterward (<i>Aft</i>) stiffener, in cm³, <u>with effective breadth of attached plating defined in [4.1.1]</u>.</p> | |
| <p><omitted></p> | <p><same as the present></p> | |
|  |  | |

| Present | Amendment | Note |
|---|--|---|
| <p style="text-align: center;">Section 5 Finite Element Stress Analysis</p> <p>1. ~ 2. <omitted></p> <p>3. Hot Spot Stress for Details Different from Web–Stiffened Cruciform Joints</p> <p>3.1 Welded details</p> <p>3.1.1</p> <p>For hot spot type ‘a’, the structural hot spot stress, σ_{HS}, is calculated from a finite element analysis with $t_{gr} \times t_{gr}$ mesh density and is obtained by the following formula: $\sigma_{HS} = 1.12 \cdot \sigma$ <omitted></p> <p>For hot spot type ‘b’, the stress distribution is not dependent on the plate thickness; the structural hot spot stress, σ_{HS}, is derived from a finite element analysis with mesh density 10 × 10 mm and is obtained by the following formula: $\sigma_{HS} = 1.12 \cdot \sigma$ where: σ : Surface principal stress, in N/mm², read out at an absolute distance from the intersection line of 5 mm.</p> | <p style="text-align: center;">Section 5 Finite Element Stress Analysis</p> <p>1. ~ 2. <same as the present></p> <p>3. Hot Spot Stress for Details Different from Web–Stiffened Cruciform Joints</p> <p>3.1 Welded details</p> <p>3.1.1</p> <p>For hot spot type ‘a’, the structural hot spot stress, σ_{HS}, is calculated from a finite element analysis with $t_{gr} \times t_{gr}$ mesh density and is obtained by the following formula: $\sigma_{HS} = 1.12 \cdot \sigma$ <same as the present></p> <p>For hot spot type ‘b’, the stress distribution is not dependent on the plate thickness; the structural hot spot stress, σ_{HS}, is derived from a finite element analysis with mesh density 10 × 10 mm and is obtained by the following formula: $\sigma_{HS} = 1.12 \cdot \sigma$ where: σ : <u>Beam element stress</u>, in N/mm², read out at <u>a</u> distance <u>of 5 mm</u> from the intersection line.</p> | <p>- in line with CSR Corrigenda1(2024)</p> |

| Present | Amendment | Note |
|---|--|---|
| <p style="text-align: center;">Chapter 11 Superstructure, Deckhouses and Hull Outfitting</p> <p style="text-align: center;">Section 1 <omitted> Section 2 Bulwark, Guard Rails and Breakwater</p> <p>1. ~ 3. <omitted></p> <p>4. Breakwater</p> <p>4.1 General</p> <p>4.1.1 <omitted></p> <p>4.1.2 Dimensions of the breakwater</p> <p>a) The recommended height of the breakwater, in m, 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. $b = 1.0 + 2.75 \left(\frac{x}{C_B + 0.2} - 0.45 \right)^2$ with $0.6 \leq C_B \leq 0.8$ 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.</p> <p>b) The breakwater has to be at least as broad as the width of the area behind the breakwater, intended for carrying deck cargo.</p> | <p style="text-align: center;">Chapter 11 Superstructure, Deckhouses and Hull Outfitting</p> <p style="text-align: center;">Section 1 <same as the present> Section 2 Bulwark, Guard Rails and Breakwater</p> <p>1. ~ 3. <same as the present></p> <p>4. Breakwater</p> <p>4.1 General</p> <p>4.1.1 <same as the present></p> <p>4.1.2 <u>Width of breakwater</u></p> <p>The breakwater has to be at least as broad as the width of the area behind the breakwater, intended for carrying deck cargo.</p> | <p>- The recommended height of the breakwater is removed for clarification. This could be set based on the yard practice and/or Spec.</p> |

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| <p>4.1.3 Cutouts</p> <p>Cutouts in the webs of primary supporting members of the breakwater are to be reduced to their necessary minimum. Free edges of the cutouts are to be reinforced by stiffeners. If cutouts in the plating are provided to reduce the load on the breakwater, the area of single cutouts should not exceed 0.2 m² and the sum of the cutout areas not 3% of the overall area of the breakwater plating</p> <p>4.1.4 Loads</p> <p>a) The loads for dimensioning, in kN/m², are to be determined according to following formula:</p> $P_A = nc(bC_w - z)$ <p>P_A is not to be less than following values</p> $25 + \frac{L}{10} \text{ where } L \leq 250 \text{ m}$ $50 \text{ where } L > 250 \text{ m}$ $n = 10 + \frac{L_2}{20}$ $c = \sin \alpha_w$ <p>where;</p> <p>α_w : Inclining angle, in deg, of breakwater at centre line. The angle is between 20 and 90 deg including 20 and 90 deg.</p> | <p>4.1.3 Cutouts</p> <p>Cutouts in the webs of primary supporting members of the breakwater are to be reduced to their necessary minimum. Free edges of the cutouts are to be reinforced by stiffeners.</p> <p>If cutouts in the plating are provided to reduce the load on the breakwater, the area of single cutouts should not exceed 0.2 m² and the sum of the cutout areas not 3% of the overall area of the breakwater plating</p> <p>4.1.4 Loads on breakwater</p> <p><u>The design pressure on breakwater, P_A in kN/m², is to be taken as:</u></p> $\underline{P_A = nc [bC_w - (z - T_{SC})]} \text{ but not less than } P_{A-\min}$ <p>where;</p> $n = 10 + \frac{L_2}{20}$ $c = \sin \alpha_w$ $b = 1.0 + 2.75 \left(\frac{\frac{x}{L} - 0.45}{C_B + 0.2} \right)^2 \text{ with } 0.6 \leq C_B \leq 0.8$ <p>α_w : Inclining angle, in deg, of breakwater at centre line. The angle is between 20 and 90 deg including 20 and 90 deg.</p> <p><u>$P_{A-\min}$: Minimum design pressure, in kN/m²</u></p> $\underline{P_{A-\min} = 25 + \frac{L_1}{10}}$ <p><u>The design pressure on the whalebacks with an inclining angle α_w of less than 20° is to be taken as:</u></p> $\underline{P_A = P_D}$ <p>where;</p> <p><u>P_D : Lateral pressure for exposed decks, in kN/m², as defined in Ch 4, Sec 5, [2.2]</u></p> | <p>- for clarification</p> |

