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

Hatch Covers, Hatch Coamings and Closing Arrangements

Object of Amendment

Rules for the Survey and Construction of Steel Ships Parts C and CS
Guidance for the Survey and Construction of Steel Ships Parts B and CS

Reason for Amendment

IACS Unified Requirements (UR) S21 and S21A specify requirements for hatch covers, hatch coamings and closing arrangements. UR S21 applies to hatch covers of certain types of bulk carriers, whereas UR S21A applies to all ships not subject to UR S21.

Since some of the requirements for buckling assessment methods specified in these URs were different, IACS decided to review not only just these requirements, but also the URs as a whole, including requirements not related to buckling. As a result of its review, IACS adopted UR S21(Rev.6) in February 2023 to harmonise UR S21 and UR S21A. This harmonised version eliminated any differences in general requirements, but it also retained those requirements specific to certain ship types.

Accordingly, relevant requirements are amended in accordance with UR S21(Rev.6).

Outline of Amendment

(1) Delete requirements related to hatch covers specified in Part 2, Part C of the Rules for the Survey and Construction of Steel Ships.
(2) Define ships subject to UR S21A as Type 1 ships and ships subject to UR S21 as Type 2 ships and specify common requirements and requirements for each ship type in Part 1, Part C of the Rules for the Survey and Construction of Steel Ships.
(3) Specify requirements for modelling in finite element analysis and buckling assessments of hatch covers with U-type stiffeners.
(4) Specify requirements for buckling assessments of the webs of hatch cover primary supporting members with openings.
(5) Delete requirements for grillage model analysis specified in Chapter 14, Part 1, Part C of the Rules for the Survey and Construction of Steel Ships.

Effective Date and application

This amendment applies to ships for which the date of contract for construction is on or after 1 July 2024. This includes those ships to which Part C of the Rules for the Survey and Construction of Steel Ships applied prior to its comprehensive revision.

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

ID: DH23-07

Amended	Original	Remarks
RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS **Part C HULL CONSTRUCTION AND EQUIPMENT** **Part 1 GENERAL HULL REQUIREMENTS** **Chapter 3 STRUCTURAL DESIGN PRINCIPLES** **3.3 Net Scantling Approach**	**RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS** **Part C HULL CONSTRUCTION AND EQUIPMENT** **Part 1 GENERAL HULL REQUIREMENTS** **Chapter 3 STRUCTURAL DESIGN PRINCIPLES** **3.3 Net Scantling Approach**	UR S21 7.1

~~Table 3.3.4-2 Corrosion Additions for Both Sides of Hatch Covers and Hatch Coamings~~

~~Ship type~~	~~Framing system~~		~~t_c (mm)~~
~~Container carrier Car carrier~~	~~Hatch covers (in general)~~		~~1.0~~
	~~Hatch coamings~~		~~1.5~~
~~Ships other than the above~~	~~Single skin hatch covers~~		~~2.0~~
	~~Double skin hatch covers~~	~~Top, side and bottom plating~~	~~1.5~~
		~~Internal structural members~~	~~1.0~~
	~~Hatch coamings, hatch coaming stays and stiffeners~~		~~1.5~~

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks

Table 3.3.4-2 Corrosion Additions for Both Sides of Hatch Covers and Hatch Coamings

Type	Ship type	Framing system		t_c (*mm*)
Type 1 Ship	Ships other than the below	Single skin hatch covers		2.0
		Double skin hatch covers	Top, side and bottom plating	1.5
			Internal structural members	1.0
		Hatch coamings, hatch coaming stays and stiffeners		1.5
	Container carrier Car carrier	Hatch covers (in general)		1.0
		Hatch coamings		1.5
Type 2 ship	Ore carrier Combination carriers which are designed to carry either oil or solid cargoes in bulk, like ore/oil carriers. Self-unloading ships (Ships specified in **1.3.1(13), Part B**(excluding those affixed with the notation "*CSR*") and **(19)**)	Single skin hatch covers		2.0
		Double skin hatch covers	Top, side and bottom plating	2.0
			Internal structural members	1.5
		Hatch coamings, hatch coaming stays and stiffeners		1.5

Notes

(1) Corrosion additions for both sides of hatch covers and hatch coamings on non-exposed decks are to be as deemed appropriate by the Society.

(2) The definitions of Type 1 ship and Type 2 ship are given **14.6.1.2.**

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
Chapter 4 LOADS **4.10 Loads to be Considered in Equipment** **4.10.1 General** **4.10.1.1 General** **1** Loads to be considered in the requirements for hatch covers, etc., in **14.6** are to be in accordance with this **4.10**. **2** In the application of the requirements in this **4.10**, the positions of exposed deck openings (Position I, Position II, etc.) are to be as specified in **1.4.3.2**. **3** Loads to be considered in strength assessments of steel hatch covers, steel pontoon covers, and hatch coamings are to be in accordance with **4.10.2**. (Omitted)	**Chapter 4 LOADS** **4.10 Loads to be Considered in Equipment** **4.10.1 General** **4.10.1.1 General** **1** Loads to be considered in the requirements for hatch covers, etc., in **14.6** are to be in accordance with this **4.10**. **2** In the application of the requirements in this **4.10**, the positions of exposed deck openings (Position I, Position II, etc.) are to be as specified in **1.4.3.2**. **3** Loads to be considered in strength assessments of steel hatch covers, steel pontoon covers, steel weathertight hatch covers, hatch beams and hatch coamings are to be in accordance with **4.10.2**. (Omitted)	
4.10.1.2 Definitions The definitions of the terms used in the requirements of **4.10** are defined in **14.6.1.2**.	(Newly added)	(Newly added)

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
4.10.2 Loads to be Considered in Strength Assessment of Steel Hatch Covers, Steel Pontoon Covers, and Hatch Coamings **4.10.2.1 Vertical Wave Load** **1** Vertical wave load P_{HC} (kN/m^2) is to be in accordance with **Table 4.10.2-1**. However, this load may not be considered simultaneously with the cargo loads specified in **4.10.2.3** and **4.10.2.4**. (Omitted)	**4.10.2 Loads to be Considered in Strength Assessment of Steel Hatch Covers, Steel Pontoon Covers, Steel Weathertight Hatch Covers, Hatch Beams and Hatch Coamings** **4.10.2.1 Vertical Wave Load** **1** Vertical wave load P_V (kN/m^2) is to be in accordance with **Table 4.10.2-1**. However, this load may not be considered simultaneously with the cargo loads specified in **4.10.2.3** and **4.10.2.4**. (Omitted)	UR S21 2.1

Table 4.10.2-1 Vertical Wave Load P_{HC} (kN/m^2)

		$L_f \leq 100$	$L_f > 100$
Position I	For $0.25L_f$ (1) forward	$\frac{9.81}{76}\left[(4.28L_f + 28)\frac{x_{Lf}}{L_f} - 1.71L_f + 95\right]$	For type B ships according to ICLL, $9.81\left\{(0.0296L_{f1} + 3.04)\frac{x_{Lf}}{L_f} - 0.0222L_{f1} + 1.22\right\}$ For types B-60 and B-100 ships according ICLL, $9.81\left\{(0.1452L_{f1} - 8.52)\frac{x_{Lf}}{L_f} - 0.1089L_{f1} + 9.89\right\}$
	Others	$\frac{9.81}{76}(1.5L_f + 116)$	9.81×3.5
Position II		$\frac{9.81}{76}(1.1L_f + 87.6)$	9.81×2.6 (2)

Notes:
x_{Lf}: Distance (m) of the mid length of the hatch cover from the aft end of L_f
L_{f1}: L_f (m), but to be taken as 340 when L_{f1} exceeds 340 m.

(1) For a hatchway located at least one superstructure standard height above the freeboard deck, the load for Others at Position I is to be used. For ships having an unusually large freeboard, "freeboard deck" may be read alternatively as "assumed freeboard deck."

(2) For the hatchway of an exposed superstructure deck located at least one superstructure standard height above deck Position II, P_V may be taken as 9.81×2.1 (kN/m^2).

(3) Loads on hatchways in exposed parts other than at Positions I and II are to be as deemed appropriate by the Society.

UR S21 2.1

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
4.10.2.2 Horizontal Wave Load **1** Horizontal wave load P_A (kN/m^2) is to be obtained from the following formula. However, P_A is not to be less than the minimum values given in **Table 4.10.2-2.** P_A may not be included in strength assessments by finite element analysis for hatch covers except where structures supporting stoppers are assessed. $P_A = f_n f_c \left[f_b C_1 - (z - T_{SC}) \right]$ f_n: As specified in **Table 4.10.2-3** x: X coordinate (m) of the hatch coaming or hatch cover edge member to be considered, or the respective mid-points of the side plating. However, where the length of the side plating exceeds $0.15L_C$, the side hatch coaming plates are to be equally subdivided into spans not exceeding $0.15\,L_C$ and the distance from the mid-point of the subdivisions is to be taken. f_c: As given by the following formula: $f_c = \max\left(0.475, 0.3 + 0.7\frac{b_1}{B_1}\right)$ b_1: Breadth (m) of hatch coamings at the position under consideration B_1: Breadth (m) of ship on the exposed deck at the position under consideration f_b: As given by the following formulae: For $x/L_C < 0.45, f_b = 1.0 + \left(\frac{0.45 - x/L_C}{C_{B4} + 0.2}\right)^2$ For $x/L_C \geq 0.45, f_b = 1.0 + 1.5\left(\frac{x/L_C - 0.45}{C_{B4} + 0.2}\right)^2$ z: Z coordinate (m) of the position under consideration, at the mid-point of the span of the stiffeners when	**4.10.2.2 Horizontal Wave Load** **1** Horizontal wave load P_H (kN/m^2) is to be obtained from the following formula. However, P_H is not to be less than the minimum values given in **Table 4.10.2-2.** P_H may not be included in strength assessments by grillage model analysis and finite element analysis for hatch covers except where structures supporting stoppers are assessed. $P_H = ac\left[bC_1 - (z - T_{SC})\right]$ a: As specified in **Table 4.10.2-3** x: X coordinate (m) of the hatch coaming or hatch cover edge member to be considered, or the respective mid-points of the side plating. However, where the length of the side plating exceeds $0.15L_C$, the side hatch coaming plates are to be equally subdivided into spans not exceeding $0.15\,L_C$ and the distance from the mid-point of the subdivisions is to be taken. c: As given by the following formula: $c = \max\left(0.475, 0.3 + 0.7\frac{b_1}{B_1}\right)$ b_1: Breadth (m) of hatch coamings at the position under consideration B_1: Breadth (m) of ship on the exposed deck at the position under consideration b: As given by the following formulae: For $x/L_C < 0.45, b = 1.0 + \left(\frac{0.45 - x/L_C}{C_{B4} + 0.2}\right)^2$ For $x/L_C \geq 0.45, b = 1.0 + 1.5\left(\frac{x/L_C - 0.45}{C_{B4} + 0.2}\right)^2$ z: Z coordinate (m) of the position under consideration, at	UR S21 2.2.1

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td>determining the scantlings of stiffeners, and at the mid-point of plating when determining the thickness of boundary wall plating</td><td>the mid-point of the span of the stiffeners when determining the scantlings of stiffeners, and at the mid-point of plating when determining the thickness of boundary wall plating</td><td></td></tr>
<tr><td>Table 4.10.2-2 Minimum Values of $P_{\underline{H}\underline{A}}$ (kN/m^2)
<table>
<tr><td></td><td>Unprotected front hatch coamings and front hatch cover skirt plates</td><td>Others</td></tr>
<tr><td>$L\underline{c} \leq \leq 250$</td><td>$25 + \frac{L_C}{10}$</td><td>$12.5 + \frac{L_C}{20}$</td></tr>
<tr><td>$L\underline{c} \geq \geq 250$</td><td>50</td><td>25</td></tr>
</table>
Table 4.10.2-3 Values of $\underline{f_n}$
<table>
<tr><th>Member</th><th>$\underline{f_n}$</th></tr>
<tr><td>Unprotected front coamings and hatch cover skirt plates</td><td>$20 + \frac{L_{C300}}{12}$</td></tr>
<tr><td>Unprotected front coamings and hatch cover skirt plates, where the distance from the actual freeboard deck to the summer load line exceeds the minimum non-corrected tabular freeboard by at least one superstructure standard height</td><td>$10 + \frac{L_{C300}}{12}$</td></tr>
<tr><td>Side and protected front coamings and hatch cover skirt plates</td><td>$5 + \frac{L_{C300}}{15}$</td></tr>
<tr><td>Aft ends of coamings and aft hatch cover skirt plates abaft amidships</td><td>$7 + \frac{L_{C300}}{100} - 8\frac{x}{L_C}$</td></tr>
<tr><td>Aft ends of coamings and aft hatch cover skirt plates forward of amidships</td><td>$5 + \frac{L_{C300}}{100} - 4\frac{x}{L_C}$</td></tr>
</table></td><td></td><td>UR S21 2.2.1</td></tr>
<tr><td><u>**2** The wave load P_{coam} to be considered in strength assessments of the hatch coaming of Type 2 ships is to be in accordance with the following **(1)** or **(2)**.</u>
<u>(1) Front-end hatch coaming of the foremost cargo hold:</u></td><td>(Newly added)</td><td>(Newly added)
UR S21 2.2.2</td></tr>
</table>

Amended	Original	Remarks
290 (kN/m^2) However, where a forecastle is installed in accordance with the requirements of **11.1, Part 2-3**, this value may be 220 kN/m^2. (2) Hatch coaming other than (1) above: 220 (kN/m^2)		
4.10.2.3 Cargo Loads Loads due to cargoes loaded on hatch covers are to be in accordance with the following **(1)** and **(2)**. The partial loading condition is also to be considered. However, container cargo loads are to comply with **4.10.2.4**. (1) Distributed load P_L (kN/m^2) acting on the hatch cover due to heave and pitch, without roll, is to obtained from the following formula: $P_L = P_{Cargo}(1 + a_V)$ P_{Cargo}: Static uniform cargo load (kN/m^2) a_V: Vertical acceleration addition, as given by the following formula: $a_V = \frac{0.11mV'}{\sqrt{L_C}}$ m: As given by the following formulae: For $0 \le x/L_C \le 0.2, m = m_0 - 5(m_0 - 1)\frac{x}{L_C}$ For $0.2 < x/L_C \le 0.7, m = 1.0$ For $0.7 < x/L_C \le 1.0, m = 1 + \frac{m_0 + 1}{0.3}\left(\frac{x}{L_C} - 0.7\right)$ m_0: As given by the following formula:	**4.10.2.3 Cargo Loads** Loads due to cargoes loaded on hatch covers are to be in accordance with the following **(1)** and **(2)**. The partial loading condition is also to be considered. However, container cargo loads are to comply with **4.10.2.4**. (1) Distributed load P_{cargo} (kN/m^2) acting on the hatch cover due to heave and pitch, without roll, is to obtained from the following formula: $P_{cargo} = P_C(1 + a_V)$ P_C: Static uniform cargo load (kN/m^2) a_V: Vertical acceleration addition, as given by the following formula: $a_V = \frac{0.11mV'}{\sqrt{L_C}}$ m: As given by the following formulae: For $0 \le x/L_C \le 0.2, m = m_0 - 5(m_0 - 1)\frac{x}{L_C}$ For $0.2 < x/L_C \le 0.7, m = 1.0$ For $0.7 < x/L_C \le 1.0, m = 1 + \frac{m_0 + 1}{0.3}\left(\frac{x}{L_C} - 0.7\right)$ m_0: As given by the following formula:	UR S21 2.3

Amended	Original	Remarks
$m_0 = 1.5 + \frac{0.11V'}{\sqrt{L_C}}$ V' : Speed of ship (*knot*) specified in **2.1.8, Part A**. However, where V' is less than $\sqrt{L_C}$, V' is to be taken as $\sqrt{L_C}$. x: As specified in **4.10.2.2** (2) Point load $\underline{P}$ (*kN*) acting on the hatch cover due to heave and pitch, without roll, is to be obtained from the following formula: $\underline{P} = \underline{P_S}(1 + a_V)$ $\underline{P_S}$: Static point load (*kN*) due to cargo a_V: As specified in **(1)** above	$m_0 = 1.5 + \frac{0.11V'}{\sqrt{L_C}}$ V' : Speed of ship (*knot*) specified in **2.1.8, Part A**. However, where V' is less than $\sqrt{L_C}$, V' is to be taken as $\sqrt{L_C}$. x: As specified in **4.10.2.2** (2) Point load $\underline{F_{cargo}}$ (*kN*) acting on the hatch cover due to heave and pitch, without roll, is to be obtained from the following formula: $\underline{F_{cargo}} = \underline{F_S}(1 + a_V)$ $\underline{F_S}$: Static point load (*kN*) due to cargo a_V: As specified in **(1)** above	
4.10.2.4 Container Cargo Loads **1** When containers are stowed on hatch covers, the following **(1)** to **(3)** are to be considered: (1) Vertical supporting force A_Z and B_Z (*kN*) and transverse supporting force B_Y (*kN*) acting on each corner of a container stack due to the heave, pitch and roll motion of the ship are to be obtained from the following formulae (*See* **Fig. 4.10.2-3**). When the load case of a partially loaded container is considered, **4.10.2.4-2** is to be followed. $A_Z = 9.81\frac{M}{2}(1 + a_V)\left(0.45 - 0.42\frac{h_m}{b}\right)$ $B_Z = 9.81\frac{M}{2}(1 + a_V)\left(0.45 + 0.42\frac{h_m}{b}\right)$ $B_Y = 2.4M$	**4.10.2.4 Container Cargo Loads** **1** When containers are stowed on hatch covers, the following **(1)** to **(3)** are to be considered: (1) Vertical supporting force A_Z and B_Z (*kN*) and transverse supporting force B_Y (*kN*) acting on each corner of a container stack due to the heave, pitch and roll motion of the ship are to be obtained from the following formulae (*See* **Fig. 4.10.2-3**). When the load case of a partially loaded container is considered, **4.10.2.4-2** is to be followed. $A_Z = 9.81\frac{M}{2}(1 + a_V)\left(0.45 - 0.42\frac{h_m}{b}\right)$ $B_Z = 9.81\frac{M}{2}(1 + a_V)\left(0.45 + 0.42\frac{h_m}{b}\right)$ $B_Y = 2.4M$	UR S21 2.4.2 UR S21 2.4.3

Amended	Original	Remarks
M: Maximum designed mass (*t*) of container stack, as given by the following formula: $M = \sum W_i$ W_i: Weight of *i*-th container a_V: As specified in **4.10.2.3** h_m: Design height of the centre of gravity (*m*) above the hatch cover top plates to be calculated by the following formula where the centre of gravity of each container is assumed to be the centre of the container: $h_m = \sum \frac{(z_i W_i)}{M}$ z_i: Distance (*m*) from hatch cover top plate to centre of *i*-th container b: Distance (*m*) between midpoints of foot points	M: Maximum designed mass (*t*) of container stack, as given by the following formula: $M = \sum W_i$ W_i: Weight of *i*-th container a_V: As specified in **4.10.2.3** h_m: Design height of the centre of gravity (*m*) above the hatch cover top plates to be calculated by the following formula where the centre of gravity of each container is assumed to be the centre of the container: $h_m = \sum \frac{(z_i W_i)}{M}$ z_i: Distance (*m*) from hatch cover top plate to centre of *i*-th container b: Distance (*m*) between midpoints of foot points	
(2) Application of **(1)** above is to be in accordance with the following **(a)** to **(c)**.	(2) Application of **(1)** above is to be in accordance with the following **(a)** to **(c)**. (a) When the strength of a hatch cover is assessed by a grillage model analysis according to **14.6.6.1**, h_m and z_i are to be measured from the hatch cover supports, not from the hatch cover top plates. Force B_Y does not need to be considered in this analysis.	
(a) The values of A_Z and B_Z applied for the assessment of hatch cover strength are to be shown in the drawings of the hatch covers.	(b) The values of A_Z and B_Z applied for the assessment of hatch cover strength are to be shown in the drawings of the hatch covers.	
(b) The value of the supporting force acting on the corner of the lowermost part of the container stack used in the calculation of cargo lashing is, in principle, not to be more than the value given by **(1)** above.	(c) The value of the supporting force acting on the corner of the lowermost part of the container stack used in the calculation of cargo lashing is, in principle, not to be more than the value given by **(1)** above.	
(3) Stack point load P_{stack} (*kN*) acting on each corner of the lowermost part of the container stack due to the heave, pitch,	(3) Stack point load P_{stack} (*kN*) acting on each corner of the lowermost part of the container stack due to the heave, pitch,	

Amended	Original	Remarks
without roll, is to be obtained from the following formula: $P_{stack} = 9.81\frac{M}{4}(1 + a_V)$ a_V: As specified in **4.10.2.3** M: As specified in **(1)** above	without roll, is to be obtained from the following formula: $P_{stack} = 9.81\frac{M}{4}(1 + a_V)$ a_V: As specified in **4.10.2.3** M: As specified in **(1)** above	
4.10.5 Loads to be Considered in Strength Assessment of Hatch Cover Supports and Stoppers **4.10.5.1 Horizontal Loads for Strength Assessment of Stopper Securing Devices** The larger of the following **(1)** and **(2)** is to be considered as the horizontal load for strength assessment of stoppers: (1) For the design of securing devices for prevention of shifting, the horizontal forces F (*kN*) obtained from the following formula are to be considered. Acceleration in the longitudinal direction a_X (m/s^2) and in the transverse direction a_Y (m/s^2) does not need be considered as acting simultaneously. $F = ma$ m: Sum of mass (*t*) of cargo lashed on the hatch cover and the mass of the hatch cover a: Acceleration (m/s^2) obtained from the following formulae: Longitudinal direction: $a_X = 0.2g$ Transverse direction $a_Y = 0.5g$ (2) P_A as specified in **4.10.2.2**	**4.10.5 Loads to be Considered in Strength Assessment of Hatch Cover Supports and Stoppers** **4.10.5.1 Horizontal Loads for Strength Assessment of Stopper Securing Devices** The larger of the following **(1)** and **(2)** is to be considered as the horizontal load for strength assessment of stoppers: (1) For the design of securing devices for prevention of shifting, the horizontal forces F (*kN*) obtained from the following formula are to be considered. Acceleration in the longitudinal direction a_X (m/s^2) and in the transverse direction a_Y (m/s^2) does not need be considered as acting simultaneously. $F = ma$ m: Sum of mass (*t*) of cargo lashed on the hatch cover and the mass of the hatch cover a: Acceleration (m/s^2) obtained from the following formulae: Longitudinal direction: $a_X = 0.2g$ Transverse direction $a_Y = 0.5g$ (2) P_H as specified in **4.10.2.2**	UR S21 6.2.1

Amended	Original	Remarks
4.10.5.2 Loads Acting on Hatch Cover Supports Loads acting on hatch cover supports are to be in accordance with the following **(1)** to **(3)**. (1) The nominal surface pressure $\underline{P_{n\,max}}$ (N/mm^2) acting on hatch cover supports is not to be greater than that obtained from the following formulae: $\underline{P_{n\,max}} = d\underline{P_n}$, in general $\underline{P_{n\,max}} = 3\underline{P_n}$, for metallic supporting surface not subjected to relative displacements d: As given by the following formula. Where d exceeds 3, d is to be taken as 3. However, d is not to be less than the following values depending on the loading condition: $d = \max(3.75 - 0.015L_C, d_{\min})$ $d_{\min} = 1.0$, in General $d_{\min} = 2.0$, for partial loading condition $\underline{P_n}$: As specified in **Table 4.10.5-1**	**4.10.5.2 Loads Acting on Hatch Cover Supports** Loads acting on hatch cover supports are to be in accordance with the following **(1)** to **(3)**. (1) The nominal surface pressure $\underline{p_{n\,max}}$ (N/mm^2) acting on hatch cover supports is not to be greater than that obtained from the following formulae: $\underline{p_{n\,max}} = d\underline{p_n}$, in general $\underline{p_{n\,max}} = 3\underline{p_n}$, for metallic supporting surface not subjected to relative displacements d: As given by the following formula. Where d exceeds 3, d is to be taken as 3. However, d is not to be less than the following values depending on the loading condition: $d = \max(3.75 - 0.015L_C, d_{\min})$ $d_{\min} = 1.0$, in General $d_{\min} = 2.0$, for partial loading condition $\underline{p_n}$: As specified in **Table 4.10.5-1**	UR S21 6.2.2
(2) When the manufacturer of the hatch cover support member material can provide proof that the material has sufficient strength for the maximum stress, not only under static loads but also under dynamic loads, the $\underline{P_{n\,max}}$ specified in **(1)** above may be relaxed. However, the long-term distributions of the stresses generated by the vertical loads and relative horizontal motion between hatch covers and hatch supports are to be as deemed appropriate by the Society.	(2) When the manufacturer of the hatch cover support member material can provide proof that the material has sufficient strength for the maximum stress, not only under static loads but also under dynamic loads, the $\underline{p_{n\,\max}}$ specified in **(1)** above may be relaxed. However, the long-term distributions of the stresses generated by the vertical loads and relative horizontal motion between hatch covers and hatch supports are to be as deemed appropriate by the Society.	UR S21 6.2.2
(3) Irrespective of the arrangement of stoppers, the supports are to be able to transmit the force $\underline{P_h}$ according to the	(3) Irrespective of the arrangement of stoppers, the supports are to be able to transmit the force $\underline{p_h}$ according to the	UR S21 6.2.2

Amended	Original	Remarks
following formula in the longitudinal and transverse directions: $\underline{P_h} = \mu \frac{P_V}{\sqrt{\sqrt{d}}}$ $\underline{P_V}$: Vertical supporting force acting on the members μ : Friction coefficient generally to be taken as 0.5. For non-metallic or low-friction materials, the friction coefficient may be reduced as appropriate by the Society. However, in no case is μ to be less than 0.35. d : As specified in **(1)** above.	following formula in the longitudinal and transverse directions: $\underline{p_h} = \mu \frac{p_v}{\sqrt{\sqrt{d}}}$ $\underline{p_v}$: Vertical supporting force acting on the members μ : Friction coefficient generally to be taken as 0.5. For non-metallic or low-friction materials, the friction coefficient may be reduced as appropriate by the Society. However, in no case is μ to be less than 0.35. d : As specified in **(1)** above.	

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td>Table 4.10.5-1 Permissible Nominal Surface Pressure ~~P_n~~ P_n
<table>
<tr><th rowspan="2">Material</th><th colspan="2">~~P_n~~ P_n</th></tr>
<tr><th>Vertical</th><th>Horizontal</th></tr>
<tr><td>Hull structure steel</td><td>25</td><td>40</td></tr>
<tr><td>Hardened steel</td><td>35</td><td>50</td></tr>
<tr><td>Lower friction materials</td><td>50</td><td>-</td></tr>
</table></td><td></td><td>UR S21 Tab.7</td></tr>
<tr><td><u>4.10.6 Wave Load to be Considered in Strength Assessments of Stoppers</u>
<u>The designed wave load $P_{stopper}$ to be considered in strength assessments of stoppers of Type 2 ships is to be in accordance with the following (1) or (2).</u>
<u>(1) Stoppers for the hatch cover to the foremost cargo hold</u>
<u>(a) Pressure acting in the direction of the stern on the front-end of the hatch cover: 230 (kN/m^2)
However, where a forecastle is installed in accordance with the requirements of **11.1, Part 2-3**, this value may be 175 kN/m^2.</u>
<u>(b) Pressure in the transverse direction of the ship: 175 kN/m^2</u>
<u>(2) Stoppers for hatch covers other than that specified in (1) above
Pressure acting in the direction of the stern on the front-end of the hatch cover and pressure in the transverse direction the ship: 175 kN/m^2</u></td><td>(Newly added)</td><td>(Newly added)
UR S21 6.2.3</td></tr>
</table>

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
Chapter 14 EQUIPMENT **14.6 Hatch Cover** **14.6.1 Application** **14.6.1.1 General** **1** The construction and the means for closing of cargo and other hatchways on exposed decks are to comply with the requirements in **14.6**. **2** Where the loading condition or the type of construction differs from that specified in **14.6**, the calculation method used is to be as deemed appropriate by the Society. **3** Hatch covers and hatch coamings on non-exposed decks of ships and those of fishing vessels are to be as deemed appropriate by the Society.	**Chapter 14 EQUIPMENT** **14.6 Hatch Cover** **14.6.1 Application** **14.6.1.1 General** **1** The construction and the means for closing of cargo and other hatchways are to comply with the requirements in **14.6**. **2** Where the loading condition or the type of construction differs from that specified in **14.6**, the calculation method used is to be as deemed appropriate by the Society. (Newly added)	UR S21 1.1 (Newly added)
14.6.1.2 Definitions The terms used in **14.6** are defined as follows. (1) "Type 1 ship" means any ship other than "Type 2 ship". (2) "Type 2 ship" means ore carriers and combination carriers designed to carry either oil or solid cargoes in bulk(e.g. ore/oil carriers) defined in **1.3.1(13), Part B** (excluding those affixed with the notation "*CSR*"), and self-unloading ships defined in **1.3.1(19), Part B**.	(Newly added)	(Newly added) UR S21 1.1

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
14.6.2 General Requirement **14.6.2.1 General** **1** Primary supporting members and stiffeners of hatch covers are to be continuous over the breadth and length of hatch covers. When this is impractical, appropriate arrangements are to be adopted to ensure sufficient load carrying capacity and sniped end connections are not to be allowed. **2** The spacing of primary supporting members parallel to the direction of stiffeners is not to exceed 1/3 of the span of the primary supporting members. When strength calculation is carried out by finite element method, this requirement is not applied. **3** Stiffeners of hatch coamings are to be continuous as far as practical over the breadth and length of said hatch coamings. **4** Where hatch covers serve as helicopter decks, it is to comply with the requirements in **10.4.6**.	**14.6.2 General Requirement** **14.6.2.1 General** **1** Primary supporting members and secondary stiffeners of hatch covers are to be continuous over the breadth and length of hatch covers. When this is impractical, appropriate arrangements are to be adopted to ensure sufficient load carrying capacity and sniped end connections are not to be allowed. **2** The spacing of primary supporting members parallel to the direction of secondary stiffeners is not to exceed 1/3 of the span of the primary supporting members. When strength calculation is carried out by finite element method, this requirement is not applied. **3** Secondary stiffeners of hatch coamings are to be continuous over the breadth and length of said hatch coamings. **4** Where hatch covers serve as helicopter decks, it is to comply with the requirements in **10.4.6**.	UR S21 1.4
14.6.3 Net Scantling Approach **14.6.3.1 Application** (Omitted) **4** Strength calculations using finite element method are to be performed with net scantlings.	**14.6.3 Net Scantling Approach** **14.6.3.1 Application** (Omitted) **4** Strength calculations using grillage model analysis or finite element method are to be performed with net scantlings.	UR S21 1.5

Amended	Original	Remarks
14.6.5 Strength Criteria of Hatch Covers **14.6.5.1 Permissible stresses and deflections** **1** All hatch cover structural members are to comply with the following formulae: $\sigma_{vm} \leq \sigma_a$ for shell elements in general. $\sigma_{axial} \leq \sigma_a$ for rod or beam elements in general. Where: σ_a: Allowable stress as defined in **Table 14.6.5-1** σ_{vm} : Von Mises stress (N/mm^2) to be taken as follows: $\sigma_{vm} = \sqrt{\sigma_x{}^2 - \sigma_x\sigma_y + \sigma_y{}^2 + 3\tau_{xy}^2}$ σ_{axial}: Axial stress (N/mm^2) in rod or beam elements σ_x : Normal stress (N/mm^2) in the x -direction (N/mm^2) σ_y : Normal stress (N/mm^2) in the y -direction (N/mm^2) τ_{xy} : Shear stress (N/mm^2) in the x-y plane x, y : Coordinates of a two-dimensional Cartesian system in the plane of the considered structural element σ_Y : Specified minimum yield stress ($N/mm2$) of the material. However, when material with σ_Y of more	**14.6.5 Strength Criteria of Hatch Covers** **14.6.5.1 Permissible stresses and deflections** **1** The equivalent stress σ_E (N/mm^2) in steel hatchway covers and steel weathertight covers is to comply with the criteria in the following **(1)** and **(2)**. (1) For grillage model analysis: $\sigma_E = \sqrt{\sigma^2 + 3\tau^2} \leq 0.8\sigma_F$ σ : Nominal stress (N/mm^2) τ : Shear stress (N/mm^2) σ_F : Minimum upper yield stress (N/mm^2) or proof stress (N/mm^2). However, when material with a σ_F of more than 355 N/mm^2 is used, the value for σ_F is to be as deemed appropriate by the Society. (2) For finite element method calculations Where the calculations use shell or plane strain elements, the stresses are to be taken from centre of the individual element. $\sigma_E = \sqrt{\sigma_x{}^2 - \sigma_x\sigma_y + \sigma_y{}^2 + 3\tau^2} \leq 0.8\sigma_F$ when assessed using the design load specified in **4.10.2.1** $\sigma_E = \sqrt{\sigma_x{}^2 - \sigma_x\sigma_y + \sigma_y{}^2 + 3\tau^2} \leq 0.9\sigma_F$ when assessed using any other design loads σ_x : Normal stress (N/mm^2) in the x -direction (N/mm^2) σ_y : Normal stress (N/mm^2) in the y -direction (N/mm^2) τ : Shear stress (N/mm^2) in the x-y plane x, y : Coordinates of a two-dimensional Cartesian system in the plane of the considered structural element σ_F: As specified in **(1)** above	UR S21 3.1.1

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td>than 355 N/mm2 is used, the value for σ_Y is to be as deemed appropriate by the Society.</td><td></td><td></td></tr>
<tr><td>Table 14.6.5-1 Allowable Stresses
<table>
<tr><th>Members of</th><th>Subject to</th><th>σ_a (N/mm^2)</th></tr>
<tr><td rowspan="2">Hatch cover structure</td><td>External pressure, as defined in 4.10.2.1</td><td>$0.80\sigma_Y$</td></tr>
<tr><td>Other loads, as defined in 4.10.2.2 to 4.10.2.5</td><td>$0.90\sigma_Y$ for static+dynamic load case
$0.72\sigma_Y$ for static load case</td></tr>
</table></td><td></td><td>UR S21 3.1.1</td></tr>
<tr><td>2 The equivalent stress σ_{vm} (N/mm^2) in steel pontoon covers and hatch beams is not to be greater than 0.68 σ_Y, where σ_Y is as specified in -1 above.</td><td>2 The equivalent stress σ_E (N/mm^2) in steel pontoon covers and hatch beams is not to be greater than 0.68 σ_F, where σ_F is as specified in -1 above.</td><td>International Convention on Load Lines, AnnexI ChapterII Reg.15(4)(6)</td></tr>
<tr><td>3 For finite element method calculations, equivalent stress σ_{vm} (N/mm^2) in girders with unsymmetrical flanges of steel hatchway covers and steel weathertight covers is to be determined according to the following (1) or (2):
(1) Finite element method calculations using the stress obtained for fine mesh elements; or
(2) Finite element method calculations using the stress at the edge of the element or the stress at the centre of the element, whichever is greater.
(Omitted)</td><td>3 For finite element method calculations, equivalent stress σ_E (N/mm^2) in girders with unsymmetrical flanges of steel hatchway covers and steel weathertight covers is to be determined according to the following (1) or (2):
(1) Finite element method calculations using the stress obtained for fine mesh elements; or
(2) Finite element method calculations using the stress at the edge of the element or the stress at the centre of the element, whichever is greater.
(Omitted)</td><td>UR S21 3.1.1</td></tr>
</table>

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
14.6.5.2 Local net plate thickness of steel hatch covers **1** The local net thickness t_{net} (*mm*) of steel hatch cover top plating is not to be less than that obtained from the following formula, and it is not to be less than 1% of the spacing of the stiffeners or 6 *mm*, whichever is greater: $t_{net} = 0.0158F_p s\sqrt{\frac{P}{0.95\sigma_Y}}$ (*mm*) F_p : Coefficient given by the following formula: 1.9 σ/σ_a ($\sigma/\sigma_a \geq 0.8$ for the attached plate flange of primary supporting members) 1.5 ($\sigma/\sigma_a < 0.8$ for the attached plate flange of primary supporting members) σ : Maximum normal stress (*N/mm*^{2}) of the attached plate flange of primary supporting members (*See* **Fig. 14.6.5-1**) σ_a : Permissible stress (*N/mm*^{2}) specified in **Table 14.6.5-1** s : Stiffener spacing (*mm*) P : Design load (*kN/m*^{2}) specified in **4.10.2.1** and **4.10.2.3-1(1)** σ_Y : Minimum yield stress (*N/mm*^{2}) of the material (Omitted)	**14.6.5.2 Local net plate thickness of steel hatch covers** **1** The local net thickness t_{net} (*mm*) of steel hatch cover top plating is not to be less than that obtained from the following formula, and it is not to be less than 1% of the spacing of the stiffeners or 6 *mm*, whichever is greater: $t_{net} = 15.8F_p S\sqrt{\frac{P_{HC}}{0.95\sigma_F}}$ (*mm*) F_p : Coefficient given by the following formula: 1.9 σ/σ_a ($\sigma/\sigma_a \geq 0.8$ for the attached plate flange of primary supporting members) 1.5 ($\sigma/\sigma_a < 0.8$ for the attached plate flange of primary supporting members) σ : Maximum normal stress (*N/mm*^{2}) of the attached plate flange of primary supporting members (*See* **Fig. 14.6.5-1**) σ_a : Permissible stress (*N/mm*^{2}) is to be as given by following formula: $\sigma_a = 0.8\sigma_F$ S : Stiffener spacing (*m*) P_{HC} : Design load (*kN/m*^{2}) specified in **4.10.2.1** and **4.10.2.3-1(1)** σ_F : Minimum upper yield stress (*N/mm*^{2}) or proof stress (*N/mm*^{2}) of the material (Omitted)	UR S21 3.2
5 When cargo likely to cause shear buckling is intended to be carried on a hatch cover, the net thickness t_{net} (*mm*) is not to be less than that obtained from the following formulae. In such cases, "cargo	**5** When cargo likely to cause shear buckling is intended to be carried on a hatch cover, the net thickness t_{net} (*mm*) is not to be less than that obtained from the following formulae. In such cases, "cargo	UR S21 3.2.2

Amended	Original	Remarks
likely to cause shear buckling" refers particularly to large or bulky cargo lashed to the hatch cover, such as parts of cranes or wind power stations, turbines, etc. Cargo that is considered to be uniformly distributed over the hatch cover (e.g. timber, pipes or steel coils) does not need to be considered. $t_{net} = 6.5s \times 10^{-3}$ s : As specified in **-1** above	likely to cause shear buckling" refers particularly to large or bulky cargo lashed to the hatch cover, such as parts of cranes or wind power stations, turbines, etc. Cargo that is considered to be uniformly distributed over the hatch cover (e.g. timber, pipes or steel coils) does not need to be considered. $t_{net} = 6.5S$ S : As specified in **-1** above	
14.6.5.3 Net scantling of Hatch Covers **1** The net section modulus Z_{net} of the stiffeners of hatch cover top plates, based on stiffener net member thickness, is not to be less than that obtained from the following formula. The net section modulus of the stiffeners is to be determined based on an attached plate width that is assumed to be equal to the stiffener spacing. $Z_{net} = \frac{Ps\ell^2}{f_{bc}\sigma_a}$ (cm^3) ℓ : Stiffener span (m) is to be taken as the spacing of primary supporting members or the distance between a primary supporting member and the edge support, as applicable. When brackets are fitted at both ends of all stiffener spans, the stiffener span may be reduced by an amount equal to 2/3 of the minimum brackets arm length, but not greater than 10% of the gross span, for each bracket. s : Stiffener spacing (mm) P : Design load (kN/m^2) as specified in **14.6.5.2-1** above σ_a : Permissible stress (N/mm^2) specified in **Table 14.6.5-**	**14.6.5.3 Net scantling of Hatch Covers** **1** The net section modulus Z_{net} of the secondary stiffeners of hatch cover top plates, based on stiffener net member thickness, is not to be less than that obtained from the following formula. The net section modulus of the secondary stiffeners is to be determined based on an attached plate width that is assumed to be equal to the stiffener spacing. for the design loads specified in **4.10.2.1** above $Z_{net} = \frac{104SP_{HC}\ell^2}{\sigma_F}$ (cm^3) for the design loads specified in **4.10.2.3-1(1)** above $Z_{net} = \frac{93SP_{HC}\ell^2}{\sigma_F}$ (cm^3) ℓ : Secondary stiffener span (m) is to be taken as the spacing of primary supporting members or the distance between a primary supporting member and the edge support, as applicable. S : Stiffener spacing (m) P_{HC} : Design load (kN/m^2) as specified in **14.6.5.2-1** above σ_F : Minimum upper yield stress (N/mm^2) or proof	UR S21 3.3

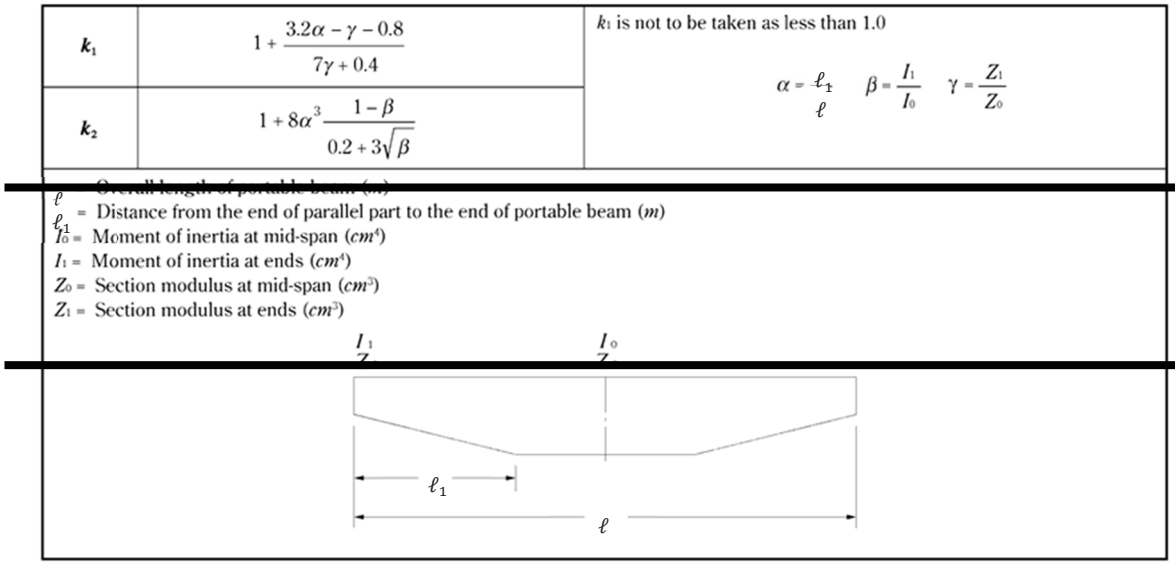
Amended	Original	Remarks
1 f_{bc}: Boundary coefficient of stiffener, taken equal to: f_{bc} = 12, in the case of stiffener clamped at both ends. f_{bc} = 8, in the case of stiffener simply supported at both ends or simply supported at one end and clamped at the other end	stress (N/mm^2) of the material	
2 The net shear sectional area A_{net} (cm^2) of the stiffener webs of hatch cover top plates is not to be less than that obtained from the following formula: $A_{net} = \frac{8.7Ps\ell}{\sigma_a}10^{-3}$ (cm^2) ℓ, s and P : As specified in **-1** above	**2** The net shear sectional area A_{net} (cm^2) of the secondary stiffener webs of hatch cover top plates is not to be less than that obtained from the following formula: for the design loads specified in **4.10.2.1** above $A_{net} = \frac{10.8SP_{HC}\ell}{\sigma_F}$ (cm^2) for the design loads specified in **4.10.2.3-1(1)** f above $A_{net} = \frac{9.6SP_{HC}\ell}{\sigma_F}$ (cm^2) ℓ, S and P_{HC} : As specified in **-1** above	UR S21 3.3
(Deleted)	**3** For flat bar secondary stiffeners and buckling stiffeners, the following formula is to be applied: $\frac{h}{t_{W,net}} \leq 15\sqrt{k}$ h : Height (mm) of the stiffener $t_{W,net}$: Net thickness (mm) of the stiffener $k = 235/\sigma_F$ σ_F : As specified in **-1** above	(Deleted) UR S21 3.3

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

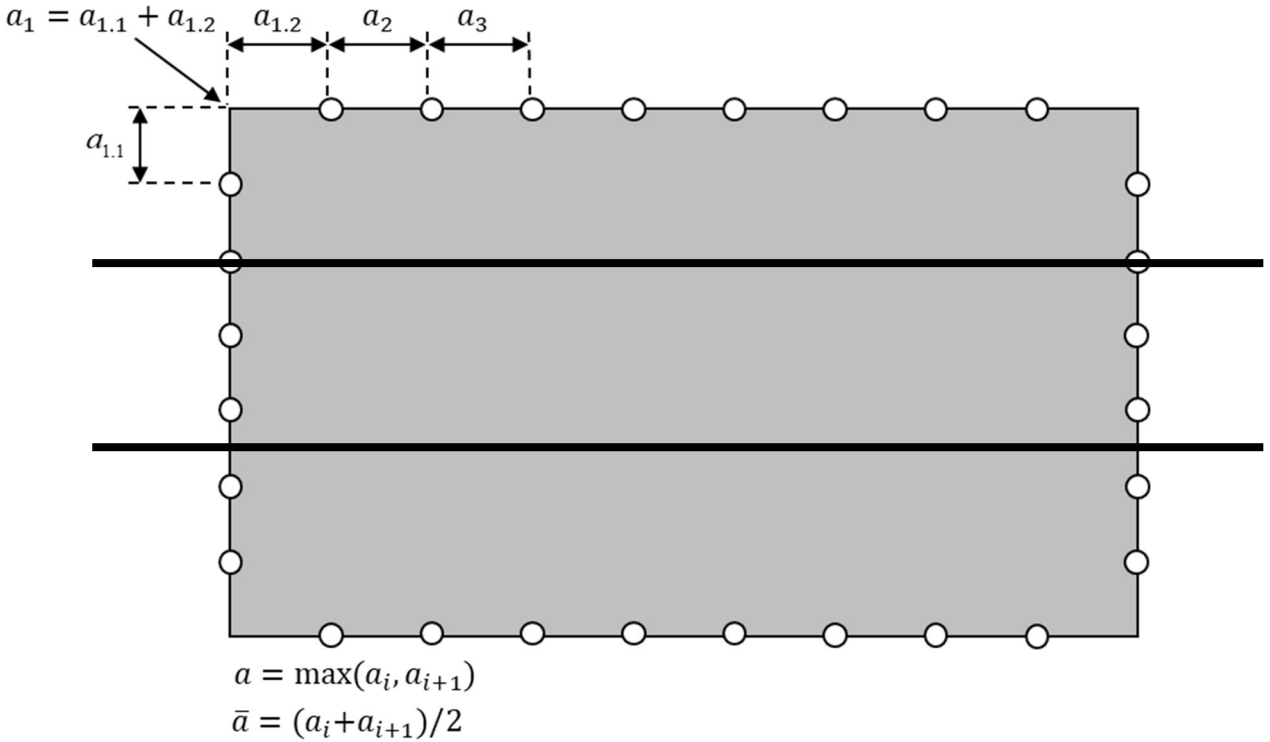
Amended	Original	Remarks
3 Stiffeners parallel to primary supporting members are to be continuous at crossing primary supporting member and may be regarded for calculating the cross sectional properties of primary supporting members.	**4** Stiffeners parallel to primary supporting members and arranged within the effective breadth according to **14.6.5.5-2** are to be continuous at crossing primary supporting member and may be regarded for calculating the cross sectional properties of primary supporting members.	UR S21 3.3
4 The combined stress of those stiffeners induced by the bending of primary supporting members and lateral pressures is not to exceed the permissible stresses according to **14.6.5.1-1**.	**5** The combined stress of those stiffeners induced by the bending of primary supporting members and lateral pressures is not to exceed the permissible stresses according to **14.6.5.1-1**.	UR S21 3.3
5 For hatch cover stiffeners under compression, sufficient safety against lateral and torsional buckling according to **14.6.5.6** is to be verified.	**6** For hatch cover stiffeners under compression, sufficient safety against lateral and torsional buckling according to **14.6.5.6-3** is to be verified.	UR S21 3.3
6 For stiffeners of the lower plating of double skin hatch covers, the requirements in **-1** and **-2** above do not need to be applied due to the absence of lateral loads and the requirements in **14.6.5** do not need to be applied to stiffeners in cases where the lower plating is not considered to be a strength member.	**7** For secondary stiffeners of the lower plating of double skin hatch covers, the requirements in **-1** and **-2** above do not need to be applied due to the absence of lateral loads.	UR S21 3.3
7 The net thickness (*mm*) of a stiffener (except for U-type stiffeners) web is not to be taken as less than 4 *mm*.	**8** The net thickness (*mm*) of a stiffener (except for U-type stiffeners) web is not to be taken as less than 4 *mm*.	UR S21 3.3
(Deleted)	**9** Single-side welding is not permitted for secondary stiffeners, except for U-type stiffeners.	(Deleted)
(Deleted)	**10** The requirements in **14.6.5** do not need to be applied to stiffeners of the lower plating of double skin hatch covers in cases where the lower plating is not considered to be a strength member.	(Deleted) UR S21 3.3

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
14.6.5.4 Primary supporting members of steel hatch covers **1** Scantlings of the primary supporting members of steel hatch covers are to be determined according to **14.6.5.1-1** below taking into consideration the permissible stresses specified in **14.6.5.5**.	**14.6.5.4 Primary supporting members of steel hatch covers and hatch beams** **1** Scantlings of the primary supporting members of steel hatch covers and hatch beams are to be determined according to **14.6.5.1-1** below taking into consideration the permissible stresses specified in **14.6.5.5**.	UR S21 3.4.1
(Deleted)	**2** Scantlings of the primary supporting members of steel hatch covers and hatch beam with variable cross-sections are to be not less than that obtained from the following formulae. For steel hatchway covers, S and ℓ are to be read as b and S, respectively. The net section modulus (cm^3) of hatch beams or primary supporting members at the mid-point $Z_{net} = Z_{net_{cs}}$ $Z_{net} = k_1 Z_{net_{cs}}$ The net moment of inertia (cm^4) of hatch beams or primary supporting members at the mid-point $I_{net} = I_{net_{cs}}$ $I_{net} = k_2 I_{net_{cs}}$ $Z_{net_{cs}}$: Net section modulus (cm^3) complying with requirement **-1** above $I_{net_{cs}}$: Net moment of inertia (cm^4) complying with requirement **-1** above S : Spacing (m) of portable beams or primary supporting members ℓ : Unsupported span (m)of portable beams or primary supporting members b : Width (m) of steel hatch covers k_1 and k_2 : Coefficients obtained from the formulae	(Deleted)

Amended	Original	Remarks
	given in Table 14.6.5-1	
~~Table 14.6.5-1 Coefficient k_1 and k_2~~  k_1: $1+\frac{3.2\alpha-\gamma-0.8}{7\gamma+0.4}$ k_2: $1+8\alpha^3\frac{1-\beta}{0.2+3\sqrt{\beta}}$ k_1 is not to be taken as less than 1.0 $\alpha=\frac{\ell_1}{\ell}$ $\beta=\frac{I_1}{I_0}$ $\gamma=\frac{Z_1}{Z_0}$ ~~ℓ = Overall length of portable beam (m)~~ ℓ_1 = Distance from the end of parallel part to the end of portable beam (m) I_0 = Moment of inertia at mid-span (cm^4) I_1 = Moment of inertia at ends (cm^4) Z_0 = Section modulus at mid-span (cm^3) Z_1 = Section modulus at ends (cm^3) 		
2 In addition to **-1**, the scantlings of the primary supporting members of steel hatch covers are to comply with the requirements specified in **14.6.5.6**.	**3** In addition to **-1** and **-2** above, the scantlings of the primary supporting members of steel hatch covers are to comply with the requirements specified in **14.6.5.6**.	UR S21 3.4.1
(Deleted)	**4** When biaxial compressed flange plates are considered, the effective width of flange plates is to comply with **14.6.5.6-3.**	(Deleted) UR S21 3.4.1
3 In addition to **-1** and **-2** above, net thickness t_{net} (mm) of the webs of primary supporting members is not to be less than that obtained from the following formulae, whichever is greater:	**5** In addition to **-1** to **-4** above, net thickness t_{net} (mm) of the webs of primary supporting members is not to be less than that obtained from the following formulae, whichever is greater:	UR S21 3.4.1

Amended	Original	Remarks
$t_{net} = 6.5s \times 10^{-3}$ $t_{net} = 5$ s : Stiffener spacing (*mm*)	$t_{net} = 6.5S$ $t_{net} = 5$ S : Stiffener spacing (*m*)	
4 In addition to **-1** to **-3** above, the net thickness t_{net} (*mm*) of edge girders exposed to sea wash is not to be less than that obtained from the following formulae, whichever is greater: $t_{net} = 0.0158s\sqrt{\frac{P_A}{0.95\sigma_Y}}$ $t_{net} = 8.5s \times 10^{-3}$ P_A : Design horizontal wave load (kN/m^2) as specified in **4.10.2.2-1** s : Stiffener spacing (*mm*) σ_Y : Minimum yield stress (N/mm^2) of the material	**6** In addition to **-1** to **-5** above, the net thickness t_{net} (*mm*) of edge girders exposed to sea wash is not to be less than that obtained from the following formulae, whichever is greater: $t_{net} = 15.8S\sqrt{\frac{P_H}{0.95\sigma_F}}$ $t_{net} = 8.5S$ P_H : Design horizontal wave load (kN/m^2) as specified in **4.10.2.2** S : Stiffener spacing (*m*) σ_F : Minimum upper yield stress (N/mm^2) or proof stress (N/mm^2) of the material	UR S21 3.4.1
(Deleted)	**7** The moment of inertia (cm^4) of the edge elements of hatch covers is not to be less than that obtained from the following formula: $I = 6pa^4$ (cm^4) a : Maximum of the distance (*m*), a_i, between two consecutive securing devices, measured along the hatch cover periphery, not to be taken as less than $2.5a_C$ (*m*), (*See* **Fig. 14.6.5-2**). a_C : $\max(a_{1,1}, a_{1,2})$ (*m*) (*See* **Fig. 14.6.5-2**). p : Packing line pressure (*N/mm*), minimum 5 *N/mm* When calculating the actual gross moment of inertia of edge elements, the effective breadth of the attached plating of hatch covers is to be taken as equal to the lesser of the following values: (1) $0.165a$	(Deleted) UR S21 3.4.2

Amended	Original	Remarks
	(2) Half the distance between the edge element and the adjacent primary member	
~~Fig. 14.6.5-2 Distance between Securing Devices, Measured Along Hatch Cover Periphery~~  		(Deleted)
14.6.5.5 Strength calculation (Deleted)	**14.6.5.5 Strength calculation** 1 Strength calculation for steel hatch covers may be carried out by using grillage model analysis or finite element method. Net scantlings are to be used for modeling. Strength calculations for	UR S21 3.5 (Deleted)

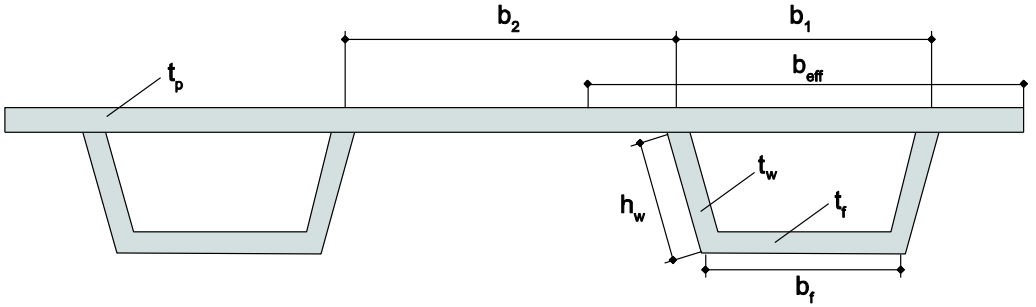
Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
(Deleted)	double skin hatch covers or hatch covers with box girders are to be assessed using finite element method, as specified in **14.6.5.5-3**. **2** Effective cross-sectional properties for calculation by grillage model analysis are to be determined by the following **(1)** to **(5)**: (1) The effective breadth of the attached plating e_m of the primary supporting members specified in **Table 14.6.5-2** according to the ratio of ℓ and e is to be considered for the calculation of effective cross-sectional properties. For intermediate values of ℓ/e, e_m is to be obtained by linear interpolation. (2) Separate calculations may be required for determining the effective breadth of one-sided or non-symmetrical flanges (3) The effective cross sectional areas of plates is not to be less than the cross sectional area of the face plate. (4) The cross sectional area of secondary stiffeners parallel to the primary supporting member under consideration within the effective breadth may be included in the calculations (*See* **Fig. 14.6.5-3**). (5) For flange plates under compression with secondary stiffeners perpendicular to the web of the primary supporting member, the effective width is to be determined according to **14.6.5.6-3**.	(Deleted)

Amended	Original	Remarks
~~Table 14.6.5-2 Effective Breadth e_m of Plating of Primary Supporting Members~~ ~~ℓ/e | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 and over~~ ~~e_{m1}/e | 0 | 0.36 | 0.64 | 0.82 | 0.91 | 0.96 | 0.98 | 1.00 | 1.00~~ ~~e_{m2}/e | 0 | 0.20 | 0.37 | 0.52 | 0.65 | 0.75 | 0.84 | 0.89 | 0.90~~ ~~(Notes)~~ ~~e_{m1} : Effective breadth (*m*) to be applied where primary supporting members are loaded by uniformly distributed loads or by not less than 6 equally spaced single loads~~ ~~e_{m2} : Effective breadth (*m*) to be applied where primary supporting members are loaded by 3 or less single loads~~ ~~ℓ : Length between zero-points of bending moment curve (*m*) taken equal to:~~ ~~For simply supported primary supporting members : ℓ_a~~ ~~For primary supporting members with both ends constant : $0.6\ell_a$~~ ~~ℓ_a : Unsupported length of the primary supporting members (*m*)~~ ~~e : Width of plating supported, measured from centre to centre of the adjacent unsupported fields~~		(Deleted)
1 Strength calculation for hatch covers is to be carried out by using the following finite element method. Those not specified in **14.6.5.5** are to comply with the requirements in **Chapter 8**. (1) Loads (a) The loads acting on steel hatch covers are to be according to **4.10** based on the type of load and loading condition. Except as deemed necessary by the Society, no loads are to be assumed to act jointly. (b) No dynamic loads due to ship motion are to be assumed as the wheel loads from wheeled vehicles only used for loading/unloading while in port. (2) Modelling of Structures (a) The structural model is to be able to reproduce the behavior of the structure with the highest possible fidelity. Stiffeners and primary supporting members subject to pressure loads are to be included in the modelling. However, buckling stiffeners may be disregarded for stress calculation.	**3** General requirements for finite element method are as follows: (Newly added) (1) The structural model is to be able to reproduce the behavior of the structure with the highest possible fidelity. Stiffeners and primary supporting members subject to pressure loads are to be included in the modelling. However, buckling stiffeners may be disregarded for stress calculation.	UR S21 3.5.1 (Newly added)

Amended	Original	Remarks
(b) Net scantlings which exclude corrosion additions are to be used for modelling.	(2) Net scantlings which exclude corrosion additions are to be used for modelling.	
(Deleted)	(3) Element size is to be suitable to take effective breadth into account.	(Deleted)
(c) In no case is element width to be larger than stiffener spacing. The ratio of element length to width is not to exceed 3.	(4) In no case is element width to be larger than stiffener spacing. The ratio of element length to width is not to exceed 4.	
(d) The element height of the webs of primary supporting members is not to exceed one-third of the web height.	(5) The element height of the webs of primary supporting members is not to exceed one-third of the web height.	
(e) Stiffeners may be modelled using shell elements, plane stress elements or beam elements.	(6) Stiffeners may be modelled using shell elements, plane stress elements or beam elements.	
(f) Hatch covers fitted with U-type stiffeners as shown in **Fig. 14.6.5-2** are to be assessed by means of FE analysis.	(Newly added)	(Newly added)
(g) The geometry of the U-type stiffeners is to be accurately modelled using shell/plate elements.		
(h) Nodal points are to be properly placed on the intersections between the webs of a U-type stiffener and the hatch cover plate, and between the webs and flange of the U-type stiffener.		
(3) Boundary Conditions Wherever applicable the following boundary conditions are to be applied to the FE model:		
(a) Boundary nodes in way of a bearing pad on the hatch coamings are to be fixed against displacement in the direction perpendicular to the pad.		
(b) Lifting stoppers are to be fixed against displacements in the direction determined by the stoppers.		
(c) For a folding type hatch cover, the FE nodes connected through a hinge are to have the same translational		

Amended	Original	Remarks
displacement in the direction perpendicular to the hatch cover top plating. **2** In addition to **-1**, the details for steel hatch covers carrying cargoes are to comply with the following **(1)** to **(6)**: (1) To prevent damage to hatch covers and the ship structure, the location of stoppers is to be compatible with the relative movements between hatch covers and the ship structure. (2) Hatch covers and supporting structures are to be adequately stiffened to accommodate the load from hatch covers. (3) At the cross-joints of multi-panel covers, vertical guides (male/female) are to be fitted to prevent excessive relative vertical deflections between loaded/unloaded panels. (4) The construction and scantlings of hatchways on exposed parts or on the lower deck are to comply with the following requirements in addition to those of **14.6.** (a) The loading arrangement is to be clearly shown in drawings submitted for approval. In the case of freight containers, the type and location are to be additionally described. (b) Girders or stiffeners are to be provided for reinforcement beneath the corner fittings of freight containers. (5) The scantlings of sub structures subject to concentrated loads acting on steel hatch covers are to be determined taking into consideration the design cargo loads and permissible stresses specified in **14.6.** (6) The scantlings of top plates and stiffeners of steel hatch covers subject to wheel loads may be determined by finite element method or in accordance with **10.1, Part 2-6**		

Amended	Original	Remarks
Fig. 14.6.5-2. Example of Hatch Cover Fitted with U-type Stiffeners  		(Newly added) UR S21 Fig.5
14.6.5.6 Buckling strength of steel hatch covers (Deleted)	**14.6.5.6 Buckling strength of steel hatch covers** The buckling strength of the structural members of steel hatch covers is to be in accordance with the following **(1)** to **(3)**: (1) The buckling strength of a single plate panel of the top and lower steel hatch cover plating is to comply with the following formulae: $\left(\frac{\lvert\sigma_x\rvert C_{sf}}{\kappa_x\sigma_F}\right)^{e_1}+\left(\frac{\lvert\sigma_y\rvert C_{sf}}{\kappa_y\sigma_F}\right)^{e_2}-B\left(\frac{\sigma_x\sigma_y {C_{sf}}^2}{{\sigma_F}^2}\right)+\left(\frac{\lvert\tau\rvert C_{sf}\sqrt{3}}{\kappa_\tau\sigma_F}\right)^{e_3}\leq 1.0$ $\left(\frac{\sigma_x C_{sf}}{\kappa_x\sigma_F}\right)^{e_1}\leq 1.0$ $\left(\frac{\sigma_y C_{sf}}{\kappa_y\sigma_F}\right)^{e_2}\leq 1.0$ $\left(\frac{\lvert\tau\rvert C_{sf}\sqrt{3}}{\kappa_\tau\sigma_F}\right)^{e_3}\leq 1.0$ σ_x, σ_y : Membrane stress in the *x*-direction and the *y*-direction (*N/mm²*). In cases where the	(Deleted)

Amended	Original	Remarks
	stresses are obtained from finite element method and already contain the Poisson-effect, the following modified stress values may be used. Both stresses σ_x^* and σ_y^* are to be compressive stress in order to apply stress reduction according to the following formulae: $\sigma_x = (\sigma_x{}^* - 0.3\sigma_y{}^*)/0.91$ $\sigma_y = (\sigma_y{}^* - 0.3\sigma_x{}^*)/0.91$ $\sigma_x{}^*$, $\sigma_y{}^*$: Stresses containing the Poisson-effect. These values are to comply with the following formulae: $\sigma_y = 0$ and $\sigma_x = \sigma_x{}^*$ for $\sigma_y{}^* < 0.3\sigma_x{}^*$ $\sigma_x = 0$ and $\sigma_y = \sigma_y{}^*$ for $\sigma_x{}^* < 0.3\sigma_y{}^*$ τ : Shear stress (N/mm^2) in x-y plane σ_F : Minimum yield stress (N/mm^2) of the material. Compressive and shear stresses are to be taken as positive values and tension stresses are to be taken as negative values. C_{sf} : Safety factor taken as equal to: $C_{sf} = 1.25$: for hatch covers when subjected to design vertical wave loads according to **4.10.2.1** $C_{sf} = 1.10$: for hatch covers when subjected to loads according to **4.10.2.3-3** to **-5**. F_1 : Correction factor for the boundary condition of stiffeners on the longer side of elementary plate panels according to **Table 14.6.5-3**. e_1,e_2,e_3 and B : Coefficient obtained from **Table 14.6.5-4**. κ_x,κ_y and κ_τ : Reduction factor obtained from **Table 14.6.5-5**. However, these values are to	

Amended	Original	Remarks
	comply with the following formulae: $\kappa_x = 1.0$ for $\sigma_x \leq 0$ (tension stress) $\kappa_y = 1.0$ for $\sigma_y \leq 0$ (tension stress) a : Length (*mm*) of the longer side of the partial plate field (*x*-direction) b : Length (*mm*) of the shorter side of the partial plate field (*y*-direction) n : Number of the elementary plate panel breadths within the partial or total plate panel (*See* **Fig. 14.6.5-3**) α : Aspect ratio of a single plate field obtained from the following formula: $\alpha = \frac{a}{b}$ λ : Reference degree of slenderness, taken as equal to: $\lambda = \sqrt{\frac{\sigma_F}{K\sigma_e}}$ K : Buckling factor according to **Table 14.6.5-5** σ_e : Reference stress (N/mm^2) , taken as equal to: $\sigma_e = 0.9E\left(\frac{t}{b}\right)^2$ E : Modulus of elasticity (N/mm^2) of the material, taken as equal to: $E = 2.06 \times 105$ t : Net thickness (mm) of plate under consideration (*mm*) ψ : Edge stress ratio taken as equal to: $\psi = \frac{\sigma_2}{\sigma_1}$ σ_1 : Maximum compressive	

Amended	Original	Remarks
	stress (N/mm^2) σ_2 : Minimum compressive stress or tension stress (N/mm^2) (2) The buckling strength of non-stiffened webs and the flanges of primary supporting members are to be according to requirement of **-1** above. (3) The buckling strength of partial and total fields included in the structural members of steel hatch covers is to comply with the following **(a)** to **(e)**: (a) The buckling strength of longitudinal and transverse secondary stiffeners is to comply with following **(d)** and **(e)**. For U-type stiffeners, however, the requirements in **(e)** below may be omitted. (b) When buckling calculation is carried out according to **(d)** and **(e)**, the effective breadth of steel hatch cover plating may be in accordance with following **i)** and **ii)**: i) The effective breadth a_m or b_m of attached plating may be determined by the following formulae (*See* **Fig. 14.6.5-3**). However, the effective breadth of plating is not to be taken greater than the value obtained from **14.6.5.5**. $b_m = \kappa_x b$ for longitudinal stiffeners $a_m = \kappa_y a$ for transverse stiffeners κ_x and κ_y : As obtained from **Table 14.6.5-5** a and b : As specified **-1** above ii) The effective breadth e_m' of the stiffened flange plates of primary supporting members may be determined according to the following **i)** and **ii)**. However, a_m and b_m for flange plates are in	

Amended	Original	Remarks
	general to determined for $\psi = 1$. 1) Stiffening parallel to the webs of primary supporting members (*See* **Fig. 14.6.5-4**). $b \geq e_m$, b and a have to be exchanged. $b < e_m$ $e_m{}' = nb_m$ n : Integer number of stiffener spacing b inside the effective breadth e_m according to **14.6.5.5**, taken as equal to: $n = \mathrm{int}\left(\frac{e_m}{b}\right)$ 2) Stiffening perpendicular to the webs of primary supporting members (*See* **Fig. 14.6.5-5**). For $a < e_m$, a and b have to be exchanged. $a \geq e_m$ $e_m{}' = na_m < e_m$ $n = 2.7\frac{e_m}{a} \leq 1$ (c) Stresses obtained from the calculation of the scantlings of plating and the stiffeners of steel hatch covers are to comply with the following: i) The scantlings of plates and stiffeners are in general to be determined according to the maximum stresses $\sigma_x(y)$ at the webs of primary supporting members and stiffeners respectively. ii) For stiffeners with spacing b under compression arranged parallel to primary supporting members, no value less than $0.25\sigma_F$ is to be inserted for $\sigma_x(y = b)$. iii) The stress distribution between two primary	

Amended	Original	Remarks
	supporting members may be obtained by the following formula: $\sigma_x(y) = \sigma_{x1}\left\{1 - \frac{y}{e}\left[3 + c_1 - 4c_2 - 2\frac{y}{e}(1 + c_1 - 2c_2)\right]\right\}$ c_1 : As given by the following formula: $c_1 = \frac{\sigma_{x1}}{\sigma_{x2}}$, however $0 \leq c_1 \leq 1$ c_2 : As given by the following formula: $c_2 = \frac{1.5}{e}(e_{m1}'' + e_{m2}'') - 0.5$ σ_{x1} and σ_{x2} : Normal stresses in the flange plates of adjacent primary supporting members 1 and 2 with spacing e, based on cross-sectional properties considering the effective breadth or effective width, as appropriate e_{m1}'' : Proportionate effective breadth e_{m1} or proportionate effective width e_{m1}' of primary supporting member 1 within the distance e, as appropriate e_{m2}'' : Proportionate effective breadth e_{m2} or proportionate effective width e_{m2}' of primary supporting member 2 within the distance e, as appropriate y : Distance from girder member 1 to the position to be considered iv) The shear stress distribution in flange plates may be assumed to be linear. (d) For lateral buckling, longitudinal and transverse	

Amended	Original	Remarks
	stiffeners are to comply with following **i)** to **iii)**: i) Secondary stiffeners subject to lateral loads are to comply with the following criteria: $\frac{\sigma_a + \sigma_b}{\sigma_F} C_{sf} \leq 1$ σ_a : Uniformly distributed compressive stress (N/mm^2) in the direction of the stiffener axis, given by the following formula: $\sigma_a = \sigma_x$ for longitudinal stiffeners $\sigma_a = \sigma_y$ for transverse stiffeners σ_b : Bending stress (N/mm^2) in the stiffeners, given by the following formula: $\sigma_b = \frac{M_0 + M_1}{Z_{st} 10^3}$ M_0 : Bending moment (N-mm) due to deformation w of stiffener, given by the following formula: $M_0 = F_{Ki} \frac{p_z w}{c_f - p_Z}$ with $(c_f - p_Z) > 0$ M_1 : Bending moment (N-mm) due to lateral load P given by the following formula: $M_1 = \frac{Pba^2}{24 \cdot 10^3}$ for longitudinal stiffeners $M_1 = \frac{P(nb)^2}{8 c_S 10^3}$ for transverse stiffeners. Where n is to be taken as equal to 1 for ordinary transverse stiffeners Z_{st} : Section modulus of stiffener (cm^3), including the effective breadth of plating according to **14.6.5.6-3** c_S : Factor accounting for the boundary conditions of	

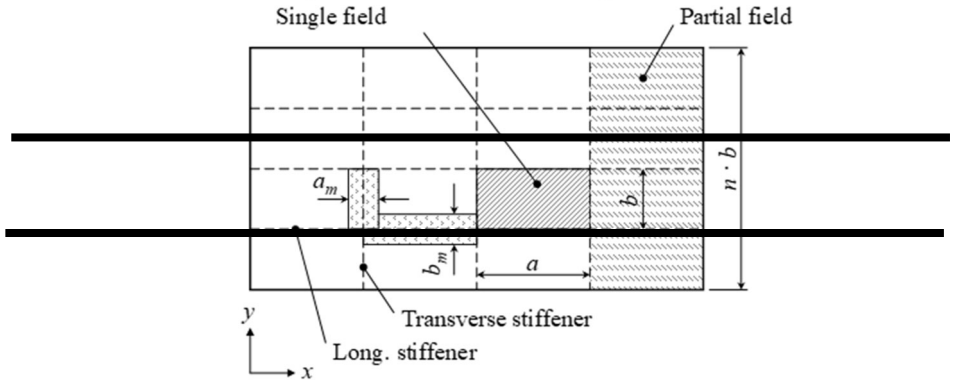
Amended	Original	Remarks
	the transverse stiffener taken as equal to: $c_S = 1.0$ for a stiffener that is simply supported stiffener $c_S = 2.0$ for a stiffener that is partially constrained P : Lateral load (kN/m^2) as specified in **4.10.2** according to the condition under consideration F_{Ki} : Ideal buckling force (N) of the stiffener given by the following formula: $F_{Kix} = \frac{\pi^2}{a2} EI_x 10^4$ for longitudinal stiffeners $F_{Kiy} = \frac{\pi^2}{(nb)^2} EI_y 10^4$ for transverse stiffeners I_x , I_y : Net moments of inertia (cm^4) of the longitudinal or transverse stiffener, including the effective breadth of attached plating according to **14.6.5.6-3**. I_x and I_y, are to comply with the following criteria: $I_x \geq \frac{bt^3}{12 \cdot 10^4}$ $I_y \geq \frac{at^3}{12 \cdot 10^4}$ p_z : Nominal lateral load (N/mm^2) of the stiffener due to σ_x σ_y and τ $p_{zx} = \frac{t_a}{b}\left[\sigma_{xl}\left(\frac{\pi b}{a}\right)^2 + 2c_y\sigma_y + \tau_1\sqrt{2}\right]$ for longitudinal stiffeners $p_{zy} = \frac{t_a}{b}\left[2c_x\sigma_{xl} + \sigma_y\left(\frac{\pi a}{nb}\right)^2\left(1 + \frac{A_y}{at_a}\right) + \tau_1\sqrt{2}\right]$	

Amended	Original	Remarks
	for transverse stiffeners t_a : Net thickness (*mm*) of attached plating c_x, c_y : Factor taking into account the stresses vertical to the stiffener's axis and distributed variable along the stiffener's length taken as equal to: $0.5(1+\psi)$ for $0 \le \psi \le 1$ $\frac{0.5}{1-\psi}$ for $\psi < 0$ A_x, A_y : Net sectional area (mm^2) of the longitudinal or transverse stiffener respectively without attached plating $\sigma_{xl} = \sigma_x \left(1 + \frac{A_x}{bt_a}\right)$ $\tau_1 = \left[\tau - t\sqrt{\sigma_F E \left(\frac{m_1}{a^2} + \frac{m_2}{b^2}\right)}\right] \ge 0$ m_1 and m_2 : Coefficient given by the following formulae: ・For longitudinal stiffeners: $m_1 = 1.47,\ m_2 = 0.49$ for $\frac{a}{b} \ge 2.0$ $m_1 = 1.96,\ m_2 = 0.37$ for $\frac{a}{b} < 2.0$ ・For transverse stiffeners: $m_1 = 0.37,\ m_2 = \frac{1.96}{n^2}$ for $\frac{a}{nb} \ge 0.5$ $m_1 = 0.49,\ m_2 = \frac{1.47}{n^2}$ for $\frac{a}{nb} < 0.5$ $w = w_0 + w_1$	

Amended	Original	Remarks
	w_0 : Assumed imperfection (*mm*) taken as equal to: $w_0 = \min\left(\frac{a}{250}, \frac{b}{250}, 10\right)$ for longitudinal stiffeners $w_0 = \min\left(\frac{a}{250}, \frac{nb}{250}, 10\right)$ for transverse stiffeners For stiffeners sniped at both ends w_0 is not to be taken as less than the distance from the mid-point of attached plating to the neutral axis of the stiffener calculated with the effective width of its attached plating. w_1 : Deformation of stiffener (*mm*) at the mid-point of stiffener span due to lateral load p. In the case of uniformly distributed loads, the following values for w_1 may be used: $w_1 = \frac{Pba^4}{384 \cdot 10^7 EI_x}$ for longitudinal stiffeners $w_1 = \frac{5Pa(nb)^4}{384 \cdot 10^7 EI_y {c_S}^2}$ for transverse stiffeners c_f : Elastic support (*N/mm²*) provided by the stiffener taken as equal to: ・For longitudinal stiffeners: $c_f = F_{Kix} \frac{\pi^2}{a^2}(1 + c_{px})$ $c_{px} = \frac{1}{1 + \frac{0.91\left(\frac{12 \cdot 10^4 I_x}{t^3 b} - 1\right)}{c_{xa}}}$	

Amended	Original	Remarks
	c_{xa} : Coefficient taken as equal to: $c_{xa} = \left(\frac{a}{2b} + \frac{2b}{a}\right)^2 \quad for \quad a \geq 2b$ $c_{xa} = \left[1 + \left(\frac{a}{2b}\right)^2\right] \quad for \quad a < 2b^2$ ・For transverse stiffeners: $c_f = c_S F_{Kiy} \frac{\pi^2}{(n \cdot b)^2}(1 + c_{py})$ $c_{py} = \frac{1}{1 + \frac{0.91\left(\frac{12 \cdot 10^4 I_y}{t^3 b} - 1\right)}{c_{ya}}}$ c_{ya} : Coefficient taken as equal to: $c_{ya} = \left(\frac{nb}{2a} + \frac{2a}{nb}\right)^2 \quad for \quad nb \geq 2a$ $c_{ya} = \left[1 + \left(\frac{nb}{2a}\right)^2\right]^2 \quad for \quad nb < 2a$ ii) For stiffeners not subject to lateral loads, the bending moment σb is to be calculated at the mid-point of the stiffener. iii) When lateral loads are acting, stress calculations are to be carried out for both fibres of the stiffener's cross sectional area (if necessary for the biaxial stress field at the plating side). (e) For torsional buckling, longitudinal and transverse stiffeners are to comply with the following **i)** and **ii)**: i) Longitudinal stiffeners are to comply with the following criteria:	

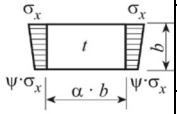
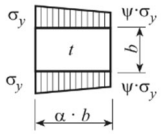
Amended	Original	Remarks
	$\frac{\sigma_x}{\kappa_T \sigma_F} C_{sf} \leq 1.0$ κ_T : Coefficient taken as equal to: $\kappa_T = 1.0$ for $\lambda_T \leq 0.2$ $\kappa_T = \frac{1}{\phi + \sqrt{\phi^2 - {\lambda_T}^2}}$ for $\lambda_T > 0.2$ $\phi = 0.5\left(1 + 0.21(\lambda_T - 0.2) + {\lambda_T}^2\right)$ λ_T : Reference degree of slenderness taken as equal to: $\lambda_T = \sqrt{\frac{\sigma_F}{\sigma_{KiT}}}$ $\sigma_{KiT} = \frac{E}{I_P}\left(\frac{\pi^2 I_\omega 10^2}{a^2}\varepsilon + 0.385 I_T\right)$ (N/mm^2) I_P : Net polar moment of inertia of the stiffener (cm^4) defined in **Table 14.6.5-6**, and related to point *C* as shown in **Fig. 14.6.5-6** I_T : Net St. Venant's moment of inertia of the stiffener (cm^4) defined in **Table 14.6.5-6** I_ω : Net sectorial moment of inertia of the stiffener (cm^6) defined in **Table 14.6.5-6** related to point *C* as shown in **Fig. 14.6.5-6** ε : Degree of fixation taken as equal to: $\varepsilon = 1 + 10^{-3}\sqrt{\frac{a^4}{\frac{3}{4}\pi^4 I_w\left(\frac{b}{t^3} + \frac{4h_w}{3{t_w}^3}\right)}}$ A_w : Net web area (mm^2) equal to:	

Amended	Original	Remarks
	$A_w = h_w t_w$ A_f : Net flange area (mm^2) equal to: $A_f = b_f t_f$ $e_f = h_w + \frac{t_f}{2}\ (mm)$ h_w, t_w, b_f, t_f : Dimensions of stiffener (mm) as specified in **Fig. 14.6.5-6** ii) For transverse secondary stiffeners loaded by compressive stress which are not supported by longitudinal stiffeners, sufficient torsional buckling strength is to be performed analogously in accordance with **i)** above.	
~~Fig. 14.6.5-3 General Arrangement of Panels~~  Longitudinal : stiffener in the direction of the length a Transverse : stiffener in the direction of the breath b		(Deleted)

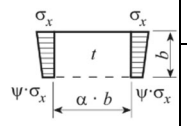
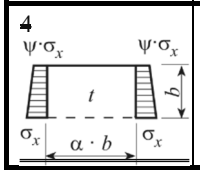
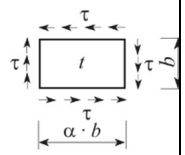
Amended	Original	Remarks
Table 14.6.5-3 Correction Factor $F_{\ddagger}$ Boundary condition / $F_{\ddagger}$(2) / Edge stiffener Stiffeners sniped at both ends / 1.00 / Guidance value(1) where both ends are effectively connected to adjacent structures / 1.05 / Flat bars 1.10 / Bulb sections 1.20 / Angles and *T* sections 1.30 / U-type sections(3) and girders of high rigidity (1) Exact values may be determined by direct calculations (2) An average value of $F_{\ddagger}$ is to be used for plate panels having different edge stiffeners (3) A higher value may be taken if it is verified by a buckling strength check of the partial plate field using non-linear FEA and deemed appropriate by the Society. However, such values are not to be greater than 2.0		(Deleted)
Table 14.6.5-4 Coefficient $e_{\ddagger}$,$e_{\ddagger}$,$e_{\ddagger}$ and B Exponents $e_{\ddagger}$,$e_{\ddagger}$,$e_{\ddagger}$ and B / Plate panel $e_{\ddagger}$ / $1+\kappa_{\ddagger}^{4}$ $e_{\ddagger}$ / $1+\kappa_{\ddagger}^{4}$ $e_{\ddagger}$ / $1+\kappa_{\ddagger}\kappa_{\ddagger}\kappa_{\ddagger}^{2}$ B For $\sigma_{\ddagger}$ and $\sigma_{\ddagger}$ positive (compressive stress) / $(\kappa_{\ddagger}\kappa_{\ddagger})^{5}$ B For $\sigma_{\ddagger}$ or $\sigma_{\ddagger}$ negative (tension stress) / 1		(Deleted)

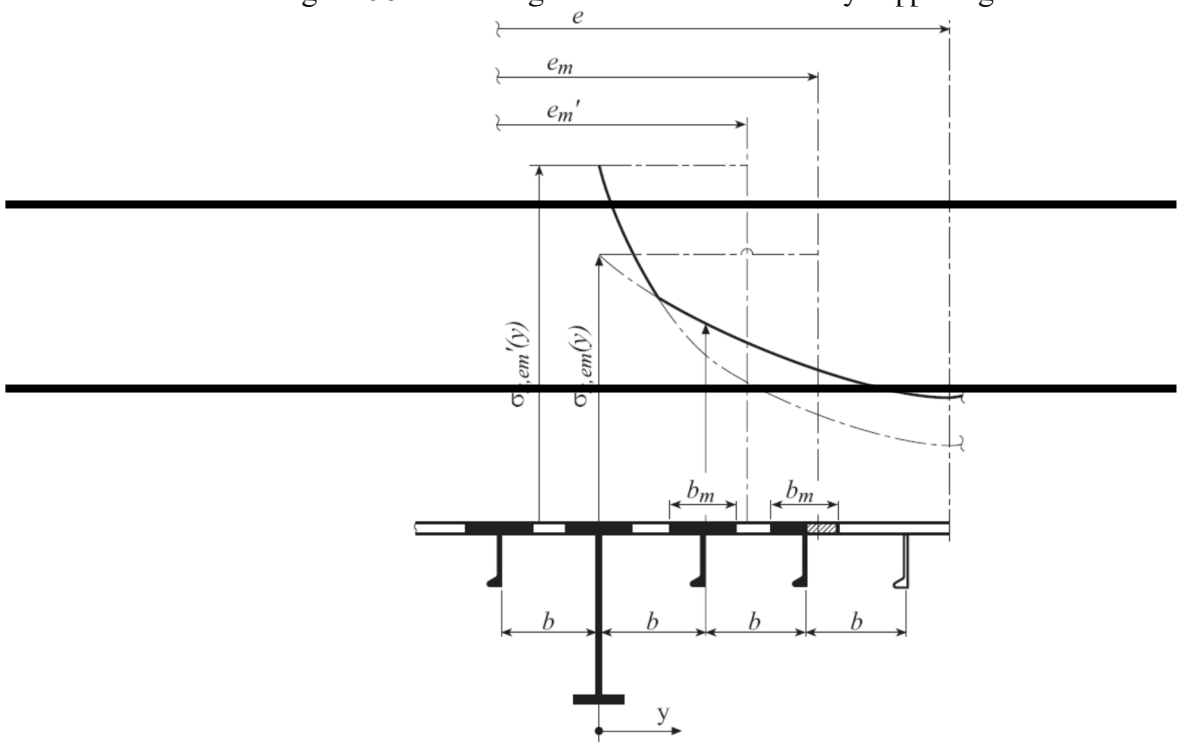
Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

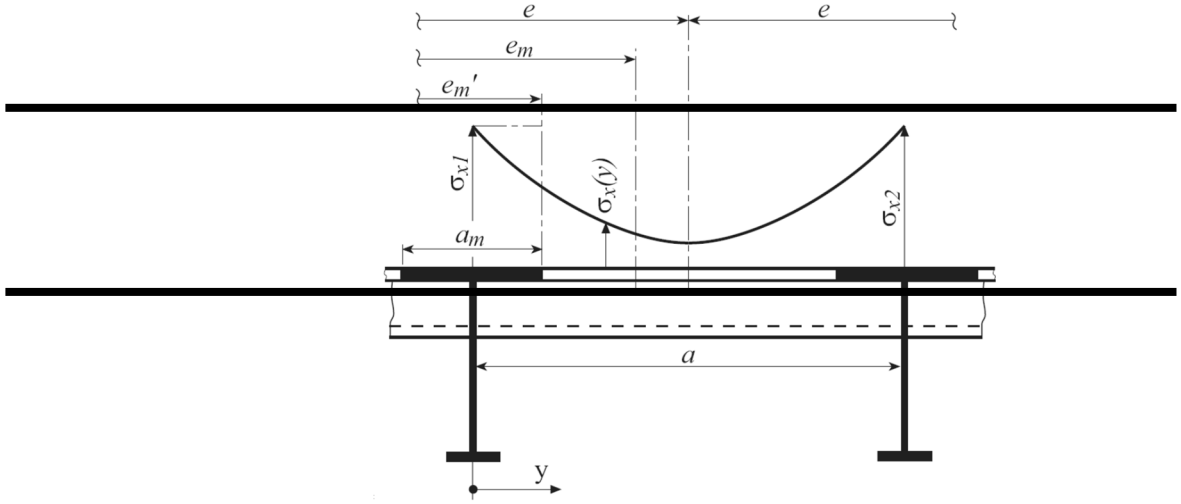
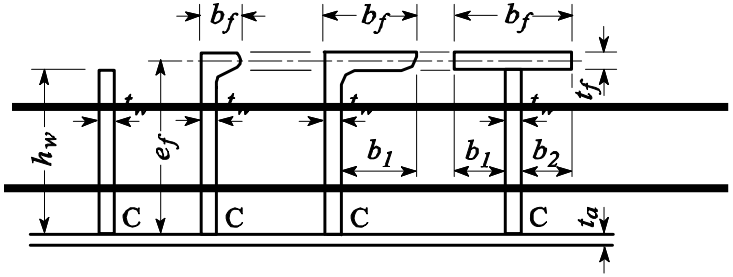
Amended	Original	Remarks
~~Table 14.6.5-5 Buckling and Reduction Factors for Plane Elementary Plate Panels~~		(Deleted)

~~Load case~~	~~Edge stress Ratio ψ~~	~~Aspect ratio $\alpha = a/b$~~	~~Buckling factor K~~	~~Reduction factor κ~~
~~1~~ 	~~$1 \geq \psi \geq 0$~~	~~$\alpha \geq 1$~~	~~$K = \frac{8.4}{\psi + 1.1}$~~	~~$\kappa_p = 1$ for $\lambda \leq \lambda_c$~~ ~~$\kappa_p = c\left(\frac{1}{\lambda} - \frac{0.22}{\lambda^2}\right)$ for $\lambda > \lambda_c$~~ ~~$c = (1.25 - 0.12\psi) \leq 1.25$~~ ~~$\lambda_c = \frac{c}{2}\left(1 + \sqrt{1 - \frac{0.88}{c}}\right)$~~
	~~$0 > \psi > -1$~~		~~$K = 7.63 - \psi(6.26 - 10\psi)$~~	
	~~$\psi \leq -1$~~		~~$K = 5.975(1 - \psi)^2$~~	
~~2~~ 	~~$1 \geq \psi \geq 0$~~	~~$\alpha \geq 1$~~	~~$K = F_F\left(1 + \frac{1}{\alpha^2}\right)^2 \frac{2.1}{(\psi + 1.1)}$~~	~~$\kappa_p = c\left(\frac{1}{\lambda} - \frac{R + F^2(H - R)}{\lambda^2}\right)$~~ ~~$c = (1.25 - 0.12\psi) \leq 1.25$~~ ~~$R = \lambda\left(1 - \frac{\lambda}{\epsilon}\right)$ for $\lambda < \lambda_c$~~ ~~$R = 0.22$ for $\lambda \geq \lambda_c$~~ ~~$\lambda_c = \frac{c}{2}\left(1 + \sqrt{1 - \frac{0.88}{c}}\right)$~~ ~~$F = \left(1 - \frac{\frac{K}{0.91} - 1}{\lambda_p^2}\right)c_F \geq 0$~~ ~~$\lambda_p^2 = \lambda^2 - 0.5$ for $1 \leq \lambda_p^2 \leq 3$~~ ~~$c_F = \left(1 - \frac{F_F}{\alpha}\right) \geq 0$~~ ~~$H = \lambda - \frac{2.1}{c\left(T + \sqrt{T^2 - 4}\right)} \geq R$~~ ~~$T = \lambda + \frac{14}{15.1} + \frac{1}{3}$~~
	~~$0 > \psi > -1$~~	~~$1 \leq \alpha \leq 1.5$~~	~~$K = F_F\left[\left(1 + \frac{1}{\alpha^2}\right)^2 \frac{2.1(1 + \psi)}{1.1} - \frac{\psi}{\alpha^2}(13.9 - 10\psi)\right]$~~	
		~~$\alpha > 1.5$~~	~~$K = F_F\left[\left(1 + \frac{1}{\alpha^2}\right)^2 \frac{2.1(1 + \psi)}{1.1} - \frac{\psi}{\alpha^2}\left(5.87 + 1.87\alpha^2 + \frac{8.6}{\alpha^2} - 10\psi\right)\right]$~~	
	~~$\psi \leq -1$~~	~~$1 \leq \alpha \leq \frac{3(1 - \psi)}{4}$~~	~~$K = 5.975F_F\left(\frac{1 - \psi}{\alpha}\right)^2$~~	

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended				Original	Remarks
		$\alpha > \frac{3(1-\psi)}{4}$	$K = F_{\sharp}\left[3.9675\left(\frac{1-\psi}{\alpha}\right)^{2} + 0.5375\left(\frac{1-\psi}{\alpha}\right)^{4} + 1.87\right]$		
3 	$1 \geq \psi \geq 0$	$\alpha > 0$	$K = \frac{4\left(0.425 + \frac{1}{\alpha^2}\right)}{3\psi + 1}$	$\kappa_{\sharp} = 1 \quad \text{for } \lambda \leq 0.7$ $\kappa_{\sharp} = \frac{1}{\lambda^2 + 0.51} \quad \text{for } \lambda > 0.7$	
	$0 > \psi > -1$		$K = 4\left(0.425 + \frac{1}{\alpha^2}\right)(1+\psi) - 5\psi(1 - 3.42\psi)$		
4 	$1 \geq \psi \geq -1$	$\alpha > 0$	$K = \left(0.425 + \frac{1}{\alpha^2}\right)\frac{3-\psi}{2}$		
5 	-		$K = K_{\sharp}\sqrt{3}$	$\kappa_{\sharp} = 1 \text{ for } \lambda \leq 0.84$ $\kappa_{\sharp} = \frac{0.84}{\lambda} \text{ for } \lambda > 0.84$	
		$\alpha \geq 1$	$K_{\sharp} = \left(5.34 + \frac{4}{\alpha^2}\right)$		
		$0 < \alpha < 1$	$K_{\sharp} = \left(4 + \frac{5.34}{\alpha^2}\right)$		
Boundary condition ——— plate edge free ——— plate edge simple support					

Amended	Original	Remarks
~~Fig. 14.6.5-4 Stiffening Parallel to Web of Primary Supporting Member~~  		(Deleted)

Amended	Original	Remarks
~~Fig. 14.6.5-5 Stiffening Perpendicular to Web of Primary Supporting Member~~  		(Deleted)
~~Fig. 14.6.5-6 Dimensions of Stiffener~~  		(Deleted)

Amended	Original	Remarks
~~Table 14.6.5.6 Moments of Inertia~~ ~~Section~~ / ~~I_z~~ / ~~I_y~~ / ~~I_w~~ ~~Flat bar~~ / ~~$\frac{h_w^3 t_w}{3 \cdot 10^4}$~~ / ~~$\frac{h_w t_w^3}{3 \cdot 10^4}\left(1 - 0.63\frac{t_w}{h_w}\right)$~~ / ~~$\frac{h_w^3 t_w^3}{36 \cdot 10^6}$~~ ~~Bulb, angle or T sections~~ / ~~$\left(\frac{A_w h_w^2}{3} + A_f e_f^2\right)10^{-4}$~~ / ~~$\frac{h_w t_w^3}{3 \cdot 10^4}\left(1 - 0.63\frac{t_w}{h_w}\right) + \frac{b_f t_f^3}{3 \cdot 10^4}\left(1 - 0.63\frac{t_f}{b_f}\right)$~~ / ~~For bulb and angle sections: $\frac{A_f e_f^2 b_f^2}{12 \cdot 10^6}\left(\frac{A_f + 2.6A_w}{A_f + A_w}\right)$ For T sections: $\frac{b_f^3 t_f e_f^2}{12 \cdot 10^6}$~~		(Deleted)
1 Buckling assessments for hatch cover structural members are to be performed in compliance with **Annex 14.6 "Buckling Strength Assessment of Ship Structural Elements"** for the conditions specified in **14.6.5.6**. For symbols not defined in **14.6.5.6**, refer to **Annex 14.6**. **2** Slenderness requirements are as follows: (1) The slenderness requirements are to be in accordance with **An2, Annex 14.6.** (2) Slenderness requirements need not be applied to the lower boundary of double skin hatch covers unless the cargo hold is designed for carriage of ballast or liquid cargo. (3) The breadth of the primary supporting member flange is to be not less than 40% of their depth for laterally unsupported spans greater than 3.0 *m*. However, tripping brackets attached to the flange may be considered as a lateral support for primary supporting members. **3** Buckling assessments are to be performed for the following	(Newly added)	(Newly added) UR S21 3.6

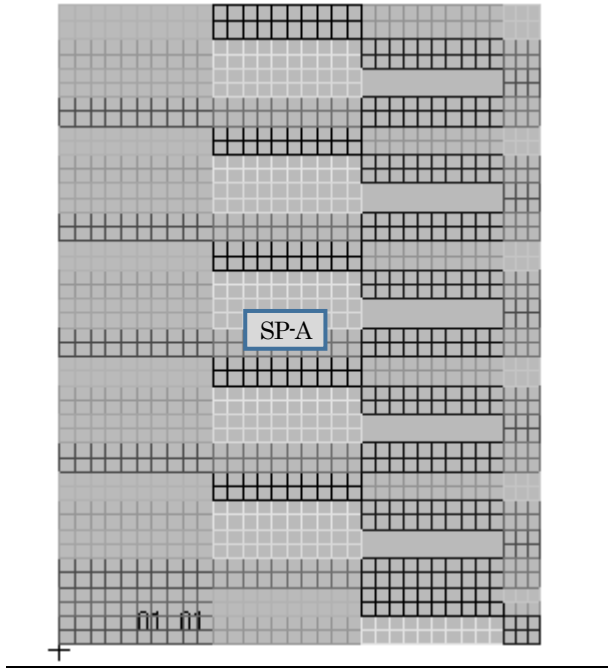
Amended	Original	Remarks
structural elements of hatch cover structures subjected to compressive stresses, shear stresses and lateral pressures: ・ Stiffened and unstiffened panels, including curved panels and panels stiffened with U-type stiffeners. ・ Web panels of primary supporting members in way of openings. Procedures and detailed requirements for buckling assessment are given in **An4, Annex 14.6**, including idealisation of irregular plate panels, definitions of reference stresses and buckling criteria. **4** Panel types and assessment methods are to be accordance with the following requirements: (1) Plate panels of hatch cover structures are to be modelled as stiffened panels (*SP*) or unstiffened panels (*UP*) as defined in **An 4.2, Annex 14.6**. In addition, Method A (-A) and Method B (-B) as defined in **An1.3, Annex 14.6** are to be used in accordance with **Table 14.6.5-2**, **Fig. 14.6.5-3** and **Fig. 14.6.5-4**, while the procedures for openings are to be used for buckling assessments of web panels with openings. (2) Hatch covers fitted with U-type stiffeners are also to be in accordance with the additional buckling assessment requirements specific for panels with U-type stiffeners in **An5.2.5, Annex 14.6**. **5** Buckling assessments of hatch covers are based on lateral pressure as defined in **4.10.2.1** and **4.10.2.2**, and stresses obtained from FE analyses (*See* **14.6.5.5**). **6** The safety factor for hatch cover structural members is to be taken as S=1.0 for the plating and stiffener buckling capacity formulae defined in **An5.2.2** and **An5.2.3, Annex 14.6**, respectively. **7** The buckling strength of structural members is to be in accordance with the following formula:		

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
$\eta_{act} \leq \eta_{all}$ Where: η_{act}: Buckling utilisation factor based on applied stress, as defined in **An1.3.2.2** and **An4, Annex 14.6**, and calculated per **An5, Annex 14.6** η_{act} : Allowable buckling utilisation factor, as given in **Table 14.6.5-3**		

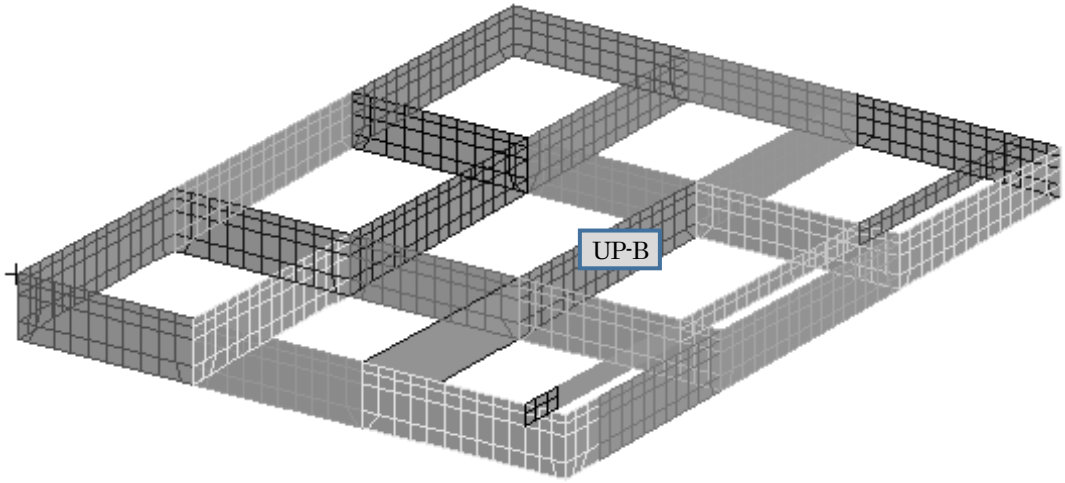
Amended	Original	Remarks
Table 14.6.5-2 Structural Members and Assessment Methods		(Newly added) UR S21 3.6.3.2 Tab.5

Structural elements	Assessment method(1)(2)	Normal panel definition
Hatch cover top/bottom plating structures, see **Fig. 14.6.5-3**		
Hatch cover top/bottom plating	SP-A	Length: between transverse girders Width: between longitudinal girders
Irregularly stiffened panels	UP-B	Plate between local stiffeners/PSM
Hatch cover web panels of primary supporting members, see **Fig. 14.6.5-4**		
Web of transverse/longitudinal girder (single skin type)	UP-B	Plate between local stiffeners/face plate/PSM
Web of transverse/longitudinal girder (double skin type)	SP-B(3)	Length: between PSM Width: full web depth
Web panel with opening	Procedure for opening	Plate between local stiffeners/face plate/PSM
Irregularly stiffened panels	UP-B	Plate between local stiffeners/face plate/PSM
Note 1: SP and UP stand for stiffened and unstiffened panel respectively. Note 2: A and B stand for Method A and Method B respectively. Note 3: In case that the buckling carlings/brackets are irregularly arranged in the web of transverse/longitudinal girder, UP-B method may be used.		

Amended	Original	Remarks
Fig. 14.6.5-3 Hatch Cover Top/Bottom Plating Structures  		(Newly added) UR S21 3.6.3.2 Tab.6

Amended	Original	Remarks

Fig. 14.6.5-4 Hatch Cover Webs of Primary Supporting Members



(Newly added)
UR S21 3.6.3.2 Tab.7

Table 14.6.5-3 Allowable Buckling Utilisation Factors

Structural component	Subject to	η_{all}, Allowable buckling utilisation factor
Plates and stiffeners Web of PSM	External pressure, as defined in **4.10.2.1**	0.80
	Other loads, as defined in **4.10.2.2** to **4.10.2.5**	0.90 for static+dynamic load case 0.72 for static load case

(Newly added)
UR S21 3.6.3.2 Tab.6

Amended	Original	Remarks
(Deleted)	**14.6.5.7 Finite Element Method** Where scantlings of structural members of steel hatch covers are determined based upon finite element method, the following requirements are to be applied. Those not specified in **14.6.5.7** are to comply with the requirements in **Chapter 8**. (1) Loads The design wave loads imposed on steel hatch covers are to be P_V specified in **4.10**. (2) Modelling of structures (a) The structural model is to be able to reproduce the behaviour of the structure with the highest possible fidelity. Stiffeners and primary supporting members subject to pressure loads are to be included in the modelling. However, buckling stiffeners may be disregarded for stress calculation. (b) Net scantlings which do not include corrosion additions are to be used for modelling. (c) In no case is element width to be larger than stiffener spacing. The ratio of element length to width is not to exceed 4. The element height of the webs of primary supporting members is not to exceed one-third of the web height. (d) The structural model is to be supported by pads. If the arrangement of pads differs from the arrangement of stiffeners, the edge elements of steel hatch covers are also to be modelled. (3) Permissible value When the loads specified in **(1)** act on the structural model specified in **(2)**, the net scantlings are to be determined so	(Deleted)

Amended	Original	Remarks
	that the stress and deflection generated in each structural member satisfy the allowable values specified in **14.6.5.1**. (4) Miscellaneous (a) The thickness of the top plating of steel hatch covers is to comply with the requirements in **14.6.5.2**. (b) The scantlings of the secondary stiffeners of steel hatch covers are to comply with the requirements in **14.6.5.3**. (c) The buckling strength for the structural members forming steel hatch covers is to comply with the requirements in **14.6.5.6**.	
(Deleted)	**14.6.6 Additional Requirements for Steel Hatch Covers Carrying Cargoes** **14.6.6.1** **1** Where concentrated loads, e.g. container loads, are acting on steel hatch covers, finite element method is to be required in accordance with the requirements in **(1)** to **(3)** below. Those not specified in **14.6.6.1** are to comply with the requirements in **Chapter 8**. (1) Loads (a) The loads acting on steel hatch covers are to be according to **4.10** based on the type of load and loading condition. Except as deemed necessary by the Society, no loads are to be assumed to act jointly. (b) No dynamic loads due to ship motion are to be assumed as the wheel loads from wheeled vehicles only used for loading/unloading while in port. (2) Modelling of Structures	(Deleted)

Amended	Original	Remarks
	(a) The structural model is to be able to reproduce the behavior of the structure with the highest possible fidelity. Stiffeners and primary supporting members subject to pressure loads are to be included in the modelling. However, buckling stiffeners may be disregarded for stress calculation. (b) Net scantlings which do not include corrosion additions are to be used for modelling. (c) In no case is element width to be larger than stiffener spacing. The ratio of element length to width is not to exceed 4. The element height of the webs of primary supporting members is not to exceed one-third of the web height. (d) The structural model is to be supported by pads. If the arrangement of pads differs from the arrangement of stiffeners, the edge elements of steel hatch covers are also to be modelled. (3) Permissible values When the loads specified in **(1)** act on the structural model specified in **(2)**, the net scantlings are to be determined so that the stress and deflection generated in each structural member satisfy the allowable values specified in **14.6.5.1**. **2** The details for steel hatch covers carrying cargoes are to comply with the following **(1)** to **(4)**: (1) To prevent damage to hatch covers and the ship structure, the location of stoppers is to be compatible with the relative movements between hatch covers and the ship structure. (2) Hatchway covers and supporting structures are to be adequately stiffened to accommodate the load from hatch covers.	

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
	(3) At the cross-joints of multi-panel covers, vertical guides (male/female) are to be fitted to prevent excessive relative vertical deflections between loaded/unloaded panels. (4) The construction and scantlings of hatchways on exposed parts or on the lower deck are to comply with the following requirements in addition to those of **14.6.** (a) The loading arrangement is to be clearly shown in drawings submitted for approval. In the case of freight containers, the type and location are to be additionally described. (b) Girders or stiffeners are to be provided for reinforcement beneath the corner fittings of freight containers. (c) The top plates of hatch covers, upon which wheeled vehicles are loaded, may be determined by finite element method or in accordance with **10.1, Part 2-6.** **3** The scantlings of sub structures subject to concentrated loads acting on steel hatch covers are to be determined taking into consideration the design cargo loads and permissible stresses specified in this section. **4** The scantlings of top plates and stiffeners of steel hatch covers subject to wheel loads are determined by direct calculation or any other method which deemed appropriate by the Society.	

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
14.6.7 Portable Beams, Hatchway Covers, Steel Pontoon Covers and Steel Weathertight Covers **14.6.7.1 Portable beams** (Omitted) **8** Scantling of hatch beam with variable cross-sections is to be not less than that obtained from the following formulae. The net section modulus (cm^3) of hatch beams at the mid-point $Z_{net} = Z_{net_{cs}}$ $Z_{net} = k_1 Z_{net_{cs}}$ The net moment of inertia (cm^4) of hatch beams at the mid-point $I_{net} = I_{net_{cs}}$ $I_{net} = k_2 I_{net_{cs}}$ $Z_{net_{cs}}$: Net section modulus (cm^3) complying with requirement **14.6.5.4-1** $I_{net_{cs}}$: Net moment of inertia (cm^4) complying with requirement **14.6.5.4-1** S : Spacing (m) of portable beams ℓ : Unsupported span (m) of portable beams b : Width (m) of steel hatch covers k_1 and k_2 : Coefficients obtained from the formulae given in Table **14.6.5-4**	**14.6.7 Portable Beams, Hatchway Covers, Steel Pontoon Covers and Steel Weathertight Covers** **14.6.7.1 Portable beams** (Omitted) (Newly added)	(Newly added)

Amended	Original	Remarks

Table 14.6.5-4 Coefficient k_1 and k_2

k_1	$1+\frac{3.2\alpha-\gamma-0.8}{7\gamma+0.4}$	k_1 is not to be taken as less than 1.0 $\alpha=\frac{\ell_1}{\ell}$, $\beta=\frac{I_1}{I_0}$, $\gamma=\frac{Z_1}{Z_0}$
k_2	$1+8\alpha^3\frac{1-\beta}{0.2+3\sqrt{\beta}}$	

ℓ : Overall length of hatch beam (m)

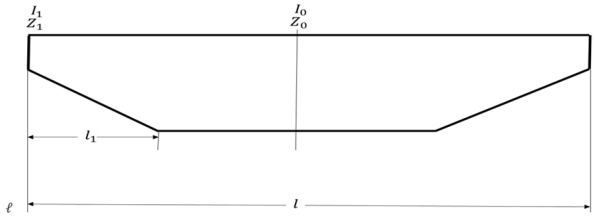
ℓ_1 : Distance from the end of parallel part to the end of portable beam (m)

I_0 : Moment of inertia at mid-span (cm^4)

I_1 : Moment of inertia at ends (cm^4)

Z_0 : Section modulus at mid-span (cm^3)

Z_1 : Section modulus at ends (cm^3)



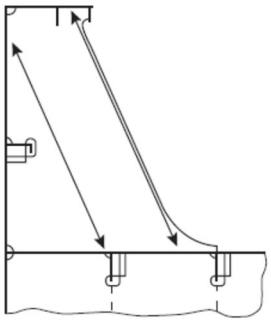
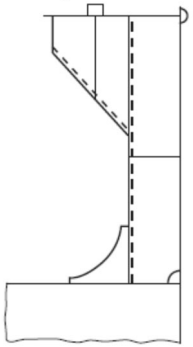
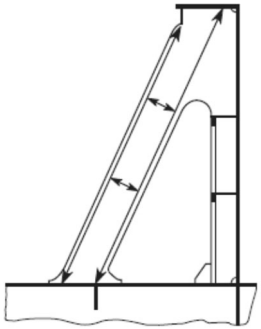
(Newly added)

Amended	Original	Remarks
14.6.9 Hatch Coaming Strength Criteria **14.6.9.2 Scantlings of hatch coamings** **1** The local net plate thickness of the hatch coaming plating $t_{coam,net}$ is not to be less than that obtained from following formula in **(1)** or **(2)**: (1) For Type 1 ships $t_{coam,net} = 0.0142s\sqrt{\frac{P_A}{0.95\sigma_Y}}\ (mm),$ but not to be less than $6 + \frac{L_{C300}}{100}\ (mm)$ s : Stiffener spacing (m) P_A : As specified in **4.10.2.2-1** σ_Y : Minimum yield stress (N/mm^2) of the material (2) For Type 2 ships $t_{coam,net} = 0.016s\sqrt{\frac{P_{coam}}{0.95\sigma_Y}}\ (mm),$ but not to be less than $9.5\ (mm)$ P_{coam} : As specified in **4.10.2.2-2** s and σ_Y : As specified in **(1)** above	**14.6.9 Hatch Coaming Strength Criteria** **14.6.9.2 Scantlings of hatch coamings** **1** The local net plate thickness of the hatch coaming plating $t_{coam,net}$ is not to be less than that obtained from following formula: $t_{coam,net} = 14.2S\sqrt{\frac{P_H}{\sigma_{a,coam}}}\ (mm),$ but not to be less than $6 + \frac{L_{C300}}{100}\ (mm)$ S : Stiffener spacing (m) P_H : As specified in **4.10.2.2** $\sigma_{a,coam} = 0.95\sigma_F$ σ_F : Minimum upper yield stress (N/mm^2) or proof stress (N/mm^2) of the material	UR S21 5.1
2 For Type 1 ships, where the hatch coaming stiffener is snipped at both ends, the gross thickness $t_{coam,gross}$ (mm) of the coaming plate at the sniped stiffener end is not to be less than that obtained from the following formula:	**2** Where the hatch coaming secondary stiffener is snipped at both ends, the gross thickness $t_{coam,gross}$ (mm) of the coaming plate at the sniped stiffener end is not to be less than that obtained from the following formula:	UR S21 5.1

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
$t_{coam,gross} = 19.6\sqrt{\frac{P_A s(\ell - 0.0005s)}{1000\sigma_Y}}$ (mm) ℓ : stiffener span (m) to be taken as the spacing of coaming stays s, P_A *and* σ_Y : As specified in **-1** above	$t_{coam,gross} = 19.6\sqrt{\frac{P_H S(\ell - 0.5S)}{\sigma_F}}$ (mm) ℓ : secondary stiffener span (m) to be taken as the spacing of coaming stays S, P_H *and* σ_F : As specified in **-1** above	
3 The net section modulus Z_{net} (cm^3) and net shear area A_{net} (cm^2) of hatch coaming stiffeners are not to be less than that obtained from the following formula. (1) For Type 1 ships $Z_{net} = \frac{P_A s l^2}{f_{bc}\sigma_Y}$ (cm^3) $A_{net} = \frac{P_A s \ell}{\sigma_Y} 10^{-2}$ (cm^2) s, ℓ, P_A and σ_Y : As specified in **-2** above f_{bc} : Coefficient according to the type of end connection of stiffeners given by the following formula: f_{bc} = 12 with both ends constant = 8 for the end spans of stiffeners sniped at the coaming corners For sniped stiffeners of coaming at hatch corners shear area obtained from the above formula has to be increased by 35%. (2) For Type 2 ships $Z_{net} = 1.21\frac{P_{coam} s l^2}{f_{bc} c_p \sigma_Y}$ (cm^3) f_{bc} : Coefficient according to the type of end connection of stiffeners given by the following formula: f_{bc} = 16 with both ends constant	**3** The net section modulus Z_{net} (cm^3) and net shear area A_{net} (cm^2) of hatch coaming secondary stiffeners are not to be less than that obtained from the following formula. For snipped stiffeners at coaming corners, section modulus and shear area at the fixed support are to be increased by 35%. $Z_{net} = \frac{83\, S\, \ell^2 P_H}{\sigma_F}$ $A_{net} = \frac{10\, S\, \ell\, P_H}{\sigma_F}$ S, ℓ, P_H and σ_F : As specified in **-2** above	UR S21 5.2

Amended	Original	Remarks
= 12 for the end spans of stiffeners sniped at the coaming corners c_p = Ratio of the plastic section modulus to the elastic section modulus of the stiffeners with an attached plate breadth (*mm*) equal to $40t_{coam,net}$, where $t_{coam,net}$ is the plate net thickness = 1.16 in the absence of more precise evaluation s, ℓ, $and\ \sigma_Y$: As specified in **-2** above P_{coam} : As specified in **4.10.2.2-2**		
(Omitted) **5** The net scantlings of hatch coaming stays are to be in accordance with following **(1)** to **(3)** and coaming stays are to be designed for the loads transmitted through them and permissible stresses according to **14.6.5.1**. (1) For hatch coaming stays considered to be simple beams (*See* **Examples 1 and 2 of Fig. 14.6.9-1**), the net section modulus Z_{net} (cm^3) of such stays at their deck connections and the net scantling $t_{w,net}$ (*mm*) of their webs are not to be less than that obtained from following formulae: $Z_{net} = \frac{{H_C}^2 s_C P}{1.9\sigma_Y}$ (cm^3) $t_{w,net} = \frac{2H_C s_C P}{\sigma_Y h}$ (mm) H_C : Hatch coaming stay height (*m*) h : Hatch coaming stay depth (*mm*) s_C : Hatch coaming stay spacing (*mm*) σ_Y : As specified in **-1** above	(Omitted) **5** The net scantlings of hatch coaming stays are to be in accordance with following **(1)** to **(3)**: (1) For hatch coaming stays considered to be simple beams (*See* **Examples 1 and 2 of Fig. 14.6.9-1**), the net section modulus Z_{net} (cm^3) of such stays at their deck connections and the net scantling $t_{w,net}$ (*mm*) of their webs are not to be less than that obtained from following formulae: $Z_{net} = \frac{526{H_C}^2 S P_H}{\sigma_F}$ $t_{w,net} = \frac{2H_C S P_H}{\sigma_F h}$ H_C : Hatch coaming stay height (*m*) h : Hatch coaming stay depth (*m*) S : Hatch coaming stay spacing (*m*) $\sigma_F\ and\ P_H$: As specified in **-1** above	UR S21 5.3.1

Amended	Original	Remarks
P : Pressure (kN/m^2) on coaming taken as P_A defined in **4.10.2.2-1** for Type 1 ships and as P_{Coam} defined in **4.10.2.2-2** for Type 2 ships. (2) For coaming stays other than those in **(1)** above (*See* **Example 3 of Fig.14.6.9-1**), stresses are generally to be determined through finite element method, and the calculated stresses are to satisfy the permissible stress criteria of **14.6.5.1**. (3) For calculating the net section modulus of coaming stays, the area of their face plates is to be taken into account only when it is welded with full penetration welds to the deck plating and an adequate underdeck structure is fitted to support the stresses transmitted by them.	(2) For coaming stays other than those in **(a)** above (*See* **Example 3 of Fig.14.6.9-1**), stresses are generally to be determined through grillage model analysis or finite element method, and the calculated stresses are to satisfy the permissible stress criteria of **14.6.5.1**. (3) For calculating the net section modulus of coaming stays, the area of their face plates is to be taken into account only when it is welded with full penetration welds to the deck plating and an adequate underdeck structure is fitted to support the stresses transmitted by them.	
Fig. 14.6.9-1 Examples of ~~e~~Coaming ~~s~~Stays  Example1  Example2  Example3		

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
14.6.9.3 Structure of the Hatch Coaming **1** Coamings are to be additionally supported by efficient brackets or stays provided from the horizontal stiffeners specified in **14.6.9.3** to the deck at intervals of approximately 3 *m*. **2** Coaming plates are to extend to the lower edge of the deck beams or hatch side girders are to be fitted that extend to the lower edge of the deck beams (*See* **Fig. 14.6.9-2**). Extended coaming plates and hatch side girders are to be flanged or fitted with face bars or half-round bars, except where specially approved by the Society. **3** The structure and scantlings of small hatch coamings may be given special consideration in regards to the requirements in **14.6.9.1** to **14.6.9.2** and **-1** to **-3** above. **4** Hatch coamings and hatch coaming stays are to comply with the following detail requirements: (Omitted.)	**14.6.9.3 Structure of the Hatch Combing** **1** The coamings for hatchways in Position I or coamings of 760 *mm* or more in height for hatchways in Position II are to be stiffened in a suitable position below the upper edge by a horizontal stiffener; the breadth of the horizontal stiffener is not to be less than 180 *mm*. **2** Coamings are to be additionally supported by efficient brackets or stays provided from the horizontal stiffeners specified in **14.6.9.3** to the deck at intervals of approximately 3 *m*. **3** Coaming plates are to extend to the lower edge of the deck beams or hatch side girders are to be fitted that extend to the lower edge of the deck beams (*See* **Fig. 14.6.9-2**). Extended coaming plates and hatch side girders are to be flanged or fitted with face bars or half-round bars, except where specially approved by the Society. **4** The structure and scantlings of small hatch coamings may be given special consideration in regards to the requirements in **14.6.9.1** to **14.6.9.2** and **-1** to **-3** above. **5** Hatch coamings and hatch coaming stays are to comply with the following detail requirements: (Omitted.)	
14.6.10 Closing Arrangements **14.6.10.1 Securing devices** (Omitted) **2** The means for securing and maintaining weathertightness by using gaskets and securing devices are to comply with the following **(1)** to **(6)**. The means for securing and maintaining weathertightness	**14.6.10 Closing Arrangements** **14.6.10.1 Securing devices** (Omitted) **2** The means for securing and maintaining weathertightness by using gaskets and securing devices are to comply with the following **(1)** to **(6)**. The means for securing and maintaining weathertightness	UR S21 6.1.1

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
of weathertight covers are to be to the satisfaction of the Society. Arrangements are to ensure that weathertightness can be maintained in any sea condition. (1) The weight of covers and any cargo stowed thereon are to be transmitted to the ship structure. (2) Gaskets and compression flat bars or angles which are arranged between covers and the ship structure and cross-joint elements are to be in compliance with the following **(a)** to **(d)**: (a) Compression bars or angles are to be well rounded where in contact with the gaskets and are to be made of corrosion-resistant materials. (b) The gaskets are to be of relatively soft elastic materials. The material is to be of a quality suitable for all environmental conditions likely to be experienced by the ship, and is to be compatible with the cargoes carried. (c) A continuous gasket is to be effectively secured to the cover. The material and form of gasket selected are to be considered in conjunction with the type of cover, the securing arrangement and the expected relative movement between the cover and ship structure. (d) The specification or grade of the packing material is to be indicated on the drawings.	of weathertight covers are to be to the satisfaction of the Society. Arrangements are to ensure that weathertightness can be maintained in any sea condition. (1) The weight of covers and any cargo stowed thereon are to be transmitted to the ship structure through steel to steel contact. (2) Gaskets and compression flat bars or angles which are arranged between covers and the ship structure and cross-joint elements are to be in compliance with the following **(a)** to **(c)**: (a) Compression bars or angles are to be well rounded where in contact with the gaskets and are to be made of corrosion-resistant materials. (b) The gaskets are to be of relatively soft elastic materials. The material is to be of a quality suitable for all environmental conditions likely to be experienced by the ship, and is to be compatible with the cargoes carried. (c) A continuous gasket is to be effectively secured to the cover. The material and form of gasket selected are to be considered in conjunction with the type of cover, the securing arrangement and the expected relative movement between the cover and ship structure. (Newly added)	(Newly added)

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

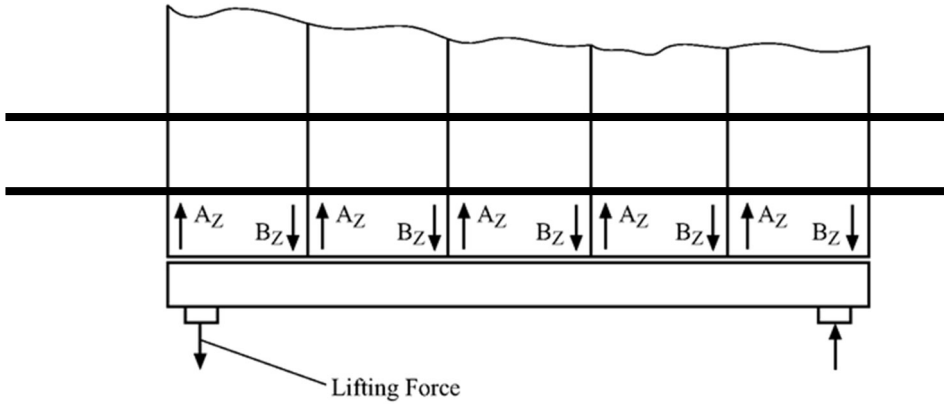
Amended	Original	Remarks
(3) Securing devices attached to hatchway coamings, decks or covers are to be in compliance with the following **(a)** to **(f)**: (a) Arrangement and spacing of securing devices are to be determined with due attention to the effectiveness for weathertightness, depending upon the type and the size of hatch cover as well as to the stiffness of the cover edges between the securing devices. (b) The moment of inertia (cm^4) of the edge elements of hatch covers is not to be less than that obtained from the following formula: $I = 6pa^4$ (cm^4) a : Spacing (m) between securing devices, not to be taken less than 2 m p : Packing line pressure (N/mm), minimum 5 N/mm (c) The gross sectional area (cm^2) of each securing device is not to be less than that obtained from the following formula. However, rods or bolts are to have a net diameter not less than 19 mm for hatchways exceeding 5 m^2 in area. $A = 0.28ap/f$ (cm^2) f : As obtained from the following formula: $f = (\sigma_Y/235)^e$ σ_Y : Minimum yield stress (N/mm^2) of the steel used for fabrication, but not to be taken greater than 70% of the ultimate tensile	(3) Securing devices attached to hatchway coamings, decks or covers are to be in compliance with the following **(a)** to **(e)**: (a) Arrangement and spacing of securing devices are to be determined with due attention to the effectiveness for weathertightness, depending upon the type and the size of hatch cover as well as to the stiffness of the cover edges between the securing devices. (Newly added) (b) The gross sectional area (cm^2) of each securing device is not to be less than that obtained from the following formula. However, rods or bolts are to have a net diameter not less than 19 mm for hatchways exceeding 5 m^2 in area. $A = 0.28\bar{a}p/f$ (cm^2) $\bar{a}$: Half the distance (m) between two adjacent securing devices, measured along the hatch cover periphery (*See* **Fig. 14.6.5-2**) p : Packing line pressure (N/mm), if less than 5 N/mm, then 5 N/mm f : As obtained from the following formula: $f = (\sigma_F/235)^e$ σ_F : Minimum upper yield stress (N/mm^2) of the steel used for fabrication, but not to be	UR S21 6.1.4 (Newly added)

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
strength e : A coefficient determined according to the value of σ_Y, as follows 1.0 for $\sigma_Y \leq 235$ *N/mm²* 0.75 for $\sigma_Y > 235$ *N/mm²* a and p : As specified in **(b)** above (d) Individual securing devices on each cover are to have approximately the same stiffness characteristics. (e) Where rod cleats are fitted, resilient washers or cushions are to be incorporated. (f) Where hydraulic cleating is adopted, a positive means is to be provided to ensure that it remains mechanically locked in the closed position in the event of failure of the hydraulic system.	taken greater than 70% of the ultimate tensile strength e : A coefficient determined according to the value of σ_F, as follows 1.0 for $\sigma_F \leq 235$ *N/mm²* 0.75 for $\sigma_F > 235$ *N/mm²* (c) Individual securing devices on each cover are to have approximately the same stiffness characteristics. (d) Where rod cleats are fitted, resilient washers or cushions are to be incorporated. (e) Where hydraulic cleating is adopted, a positive means is to be provided to ensure that it remains mechanically locked in the closed position in the event of failure of the hydraulic system.	
(4) A drainage arrangement equivalent to the standards specified in the following is to be provided. (a) Drainage is to be arranged inside the line of gaskets by means of a gutter bar or vertical extension of the hatch side and end coaming. If an application is made by the owner of a container carrier and the Society deems it to be appropriate, special consideration will be given to this requirement. (b) Drain openings are to be arranged at the ends of drain channels and are to be provided with effective means such as non-return valves or the equivalent for preventing the ingress of water from outside. It is unacceptable to connect fire hoses to the drain openings for this purpose.	(4) A drainage arrangement equivalent to the standards specified in the following is to be provided. (a) Drainage is to be arranged inside the line of gaskets by means of a gutter bar or vertical extension of the hatch side and end coaming. If an application is made by the owner of a container carrier and the Society deems it to be appropriate, special consideration will be given to this requirement. (b) Drain openings are to be arranged at the ends of drain channels and are to be provided with effective means such as non-return valves or the equivalent for preventing the ingress of water from outside.	(4)(a),(b),(d): UR S21 5.4.5 (4)(c): Rec.No14 3.2.2

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
(c) Cross-joints of multi-panel covers are to be arranged with a drainage channel for water from space above the gasket and a drainage channel below the gasket. (d) If a continuous outer steel contact between cover and ship structure is arranged, drainage from the space between the steel contact and the gasket is also to be provided for (e) Drain openings in hatch coamings are to be arranged with sufficient distance to areas of stress concentration (e.g. hatch corners, transitions to crane posts).	(c) Cross-joints of multi-panel covers are to be arranged with a drainage channel for water from space above the gasket and a drainage channel below the gasket. (d) If a continuous outer steel contact between cover and ship structure is arranged, drainage from the space between the steel contact and the gasket is also to be provided for (Newly added)	(Newly added)
(Omitted) (6) Securing devices of special design in which significant bending or shear stresses occur may be designed as anti-lifting devices according to **14.6.10.2** below. The packing line pressure q is to be specified, and as load, q multiplied by the spacing between securing devices a (m) is to be applied.	(Omitted) (6) Securing devices of special design in which significant bending or shear stresses occur may be designed as anti-lifting devices according to **14.6.10.2** below.	UR S21 6.1.4
14.6.10.2 Loading Cargo on Hatch Cover **1** The securing devices of hatch covers, on which cargo is to be lashed, are to be designed for a lifting force resulting from the loads. Unsymmetrical loading, which may occur in practice, is to be considered. Under such loading, the equivalent stress σ_E (N/mm^2) in securing devices is not to be greater than that obtained from the following formula. $\sigma_E = \frac{150}{k_l}$ k_l : As obtained from the following formula:	**14.6.10.2 Loading Cargo on Hatch Cover** **1** The securing devices of hatch covers, on which cargo is to be lashed, are to be designed for a lifting force resulting from the loads. Unsymmetrical loading, which may occur in practice, is to be considered. Under such loading, the equivalent stress σ_E (N/mm^2) in securing devices is not to be greater than that obtained from the following formula. (*See* **Fig. 14.6.10-1**). $\sigma_E = \frac{150}{k_l}$ k_l : As obtained from the following formula:	UR S21 6.1.5

Amended	Original	Remarks
$k_l = \left(\frac{235}{\sigma_Y}\right)^e$ σ_Y : Minimum yield stress (N/mm^2) of the material e : As given below: 0.75 for $\sigma_Y > 235$ 1.00 for $\sigma_Y \leq 235$	$k_l = \left(\frac{235}{\sigma_F}\right)^e$ σ_F : Minimum upper yield stress (N/mm^2) or proof stress (N/mm^2) of the material e : As given below: 0.75 for $\sigma_F > 235$ 1.00 for $\sigma_F \leq 235$	
~~Fig.14.6.10-1 Lifting Forces at a Hatch Cover~~  		(Deleted) UR S21 6.1.5
14.6.11 Hatch Cover Supports, Stoppers and Supporting Structures **14.6.11.1** **1** Hatch cover supports, stoppers and supporting structures subject to the requirements of **14.6** are to comply with the following **(1)** and **(2)**: (1) Stress in the stoppers is to comply with the criteria specified	**14.6.11 Hatch Cover Supports, Stoppers and Supporting Structures** **14.6.11.1** **1** Hatch cover supports, stoppers and supporting structures subject to the requirements of **14.6** are to comply with the following **(1)** to **(3)**: (1) For the design of the securing devices for the prevention of	UR S21 6.2.1

Amended	Original	Remarks
in **14.6.5.1-1.**	shifting, the horizontal mass forces F obtained from the following formula are to be considered. Acceleration in the longitudinal direction, a_X, and in the transverse direction, a_Y, does not need to be considered as acting simultaneously. $F = ma$ m : Sum of mass of cargo lashed on the hatch cover and mass of hatch cover a : Acceleration obtained from the following formula: $a_X = 0.2g$ for longitudinal direction $a_Y = 0.5g$ for transverse direction	
(Deleted)	(2) The design load for determining the scantlings of stoppers is not to be less than that obtained from **4.10.2.2** and **(1)**, whichever is greater.	(Deleted) UR S21 6.2.3
(2) The details of hatch cover supporting structures are to be in accordance with the following **(a)** to **(d)**: (Deleted)	(3) The details of hatch cover supporting structures are to be in accordance with the following **(a)** to **(g)**: (a) The nominal surface pressure (N/mm^2) of a hatch cover supports is not to be greater than that obtained from the following formula: $p_{n\,max} = dp_n$: in general $p_{n\,max} = 3p_n$: for metallic supporting surface not subjected to relative displacements d : As given by the following formula. Where d exceeds 3, d is to be taken as 3. Depending on the loading conditions, the value is to be not less than the following	UR S21 6.2.2 (Deleted)

Amended	Original	Remarks
(a) Where large relative displacements of the supporting surfaces are to be expected, the use of material having low wear and frictional properties is recommended. (b) Drawings of the supports are to be submitted. In these drawings, the permitted maximum pressure given by the material manufacturer is to be specified. (Deleted)	values. $d = 3.75 - 0.015L_C$ $d_{min} = 1.0$: in general $d_{min} = 2.0$: for partial loading conditions p_n : As obtained from Table **14.6.11-1** (b) Where large relative displacements of the supporting surfaces are to be expected, the use of material having low wear and frictional properties is recommended. (c) Drawings of the supports are to be submitted. In these drawings, the permitted maximum pressure given by the material manufacturer is to be specified. (d) When the manufacturer of the vertical hatch cover support material can provide proof that the material is sufficient for the increased surface pressure, not only statically but under dynamic conditions, the permissible nominal surface pressure $p_{n\,max}$ as specified in **(a)** above, may be relaxed at the discretion of the Society. However, realistic long term distributions of spectra for vertical loads and relative horizontal motion between hatch covers and hatch cover support are to be as deemed appropriate by the Society. (e) Irrespective of the arrangement of stoppers, the supports are to be able to transmit the following force p_h in the longitudinal and transverse direction. $p_h = \mu \frac{p_v}{\sqrt{d}}$ p_v : Vertical supporting force μ : Friction coefficient generally to be taken as 0.5. For non-metallic or low-friction materials, the friction	(Deleted)

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td>(c) Stresses in supporting structures are to comply with the criteria specified in 14.6.5.1-1.
(d) For substructures and adjacent constructions of supports subjected to horizontal forces P_h, special consideration is to be given to fatigue strength.</td><td>coefficient may be reduced as appropriate by the Society. However, in no case μ is to be less than 0.35.
(f) Stresses in supporting structures are to comply with the criteria specified in 14.6.5.1-1.
(g) For substructures and adjacent constructions of supports subjected to horizontal forces p_h, special consideration is to be given to fatigue strength.</td><td></td></tr>
<tr><td colspan="2">~~Table 14.6.11-1 Permissible Nominal Surface Pressure p_a~~
<table><tr><th rowspan="2">~~Material~~</th><th colspan="2">~~p_a~~</th></tr><tr><th>~~Vertical force~~</th><th>~~Horizontal force~~</th></tr><tr><td>~~Hull structure steel~~</td><td>~~25~~</td><td>~~40~~</td></tr><tr><td>~~Hardened steel~~</td><td>~~35~~</td><td>~~50~~</td></tr><tr><td>~~Lower friction materials~~</td><td>~~50~~</td><td>~~-~~</td></tr></table></td><td>(Deleted)
UR S21 6.2.2 Tab.7</td></tr>
<tr><td>2 For steel weathertight hatch covers of Type 2 ships, effective means for stoppers complying with the requirements in Table 14.6.11-2 against the horizontal green sea forces acting on them are to be provided.</td><td>(Newly added)</td><td>(Newly added)
UR S21 6.2.3</td></tr>
<tr><td>Table 14.6.11-2 Strength Requirements for Stoppers
<table><tr><td>Design pressure</td><td>As specified in 4.10.6.</td></tr><tr><td>Allowable equivalent stress</td><td>In stoppers, their supporting structures and the stopper welds (calculated at the throat of welds), the equivalent stress is not to exceed the allowable value of 0.8 times the yield stress of the material.</td></tr></table></td><td></td><td>(Newly added)
UR S21 6.2.3</td></tr>
</table>

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
14.6.12 Steel Hatchway Covers for Container Carriers **14.6.12.1 Application** **1** In the application of the requirements of **14.6** of the Rules, the height of coamings above the upper surface of the deck where the hatchway covers are fitted is to be at least 600 *mm*. **2** For container carriers with unusually large freeboards, upon requests by the applicant for classification, gaskets and securing devices for steel hatchway covers may be suitably dispensed in accordance with the requirements in **(1)** to **(4)**: (Omitted) **3** Treatment of towage and segregation of containers containing dangerous goods may be in accordance with the relevant requirements specified in MSC/Circ.1087. (Omitted)	**14.6.12 Steel Hatchway Covers for Container Carriers** **14.6.12.1 Application** **1** In the application of the requirements of **14.6** of the Rules, the height of coamings above the upper surface of the deck where the hatchway covers are fitted is to be at least 600 *mm* in Position II. **2** For container carriers with unusually large freeboards, upon requests by the applicant for classification, gaskets and securing devices for steel hatchway covers may be suitably dispensed in accordance with the requirements in **(1)** to **(4)**: (Omitted) **3** Treatment of towage and segregation of containers containing dangerous goods may be in accordance with the relevant requirements specified in MSC/Circ.1087. (Omitted)	-1.: UR S21 4.2.2/UI LL64 3 -2: UR S21 4.2.2 -3.: UR S21 4.2.2
14.6.13 Steel Hatchway of Ballast Holds **14.6.13.1 General** **1** Gross scantlings of steel hatchway covers and similar covers as well as hatch coamings provided on exposed upper decks in way of cargo holds used as deep water ballast tanks for ships are to comply with the following requirements. Special consideration is to be given to steel hatchway covers and similar covers as well as hatch coamings specified in **14.6.13.1** in order to ensure they are of sufficient strength to resist loads due to water ballast. (1) The thickness of top plating is not to be less than that obtained from the following formula. However, in the case of double plating type hatch covers, only the plates that actually bear the load need comply.	**14.6.13 Steel Hatchway of Ballast Holds** **14.6.13.1 General** **1** Gross scantlings of steel hatchway covers and similar covers as well as hatch coamings provided on exposed upper decks in way of cargo holds used as deep water ballast tanks for ships are to comply with the following requirements. Special consideration is to be given to steel hatchway covers and similar covers as well as hatch coamings specified in **14.6.13.1** in order to ensure they are of sufficient strength to resist loads due to water ballast. (1) The thickness of top plating is not to be less than that obtained from the following formula. However, in the case of double plating type hatch covers, only the plates that actually bear the load need comply.	

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
$1.15s\sqrt{h} \times 10^{-3} + 3.0$ *(mm)* s : Spacing (*mm*) of stiffeners h : As obtained from **4.10.3.1-1(1)** (kN/m^2) (2) The scantlings of stiffeners are to comply with the following formulae. Section modulus at mid-span : $C_1Kk_1shl^2 \times 10^{-3}$ (cm^3) Moment of inertia at mid-span : $C_2k_2shl^3 \times 10^{-3}$ (cm^4) Cross sectional area of web plates at the ends of stiffeners : $C_3Kshl \times 10^{-3}$(cm^2) s : As specified in **(1)** l : Span of stiffener (*m*) C_1, C_2 *and* C_3 : Coefficients given by **Table 14.6.13-1** K : Coefficient corresponding to the kind of steel as specified in **3.2** k_1 and k_2 : Coefficient given by **Table 14.6.13-1** h : As obtained from **4.10.3.1-1(2)** according to the arranged direction of stiffeners (kN/m^2) (Omitted) **2** Where scantlings of structural members of steel hatch covers are determined based upon finite element method, the scantlings are determined in accordance with **14.6.5** using the load specified in **4.10.3.1-2**. (Omitted)	$1.15S\sqrt{h} + 3.0$ *(mm)* S : Spacing (*m*) of stiffeners h : As obtained from **4.10.3.1-1(1)** (kN/m^2) (2) The scantlings of stiffeners are to comply with the following formulae. Section modulus at mid-span : $C_1Kk_1Sh\ell^2$ (cm^3) Moment of inertia at mid-span : $C_2k_2Sh\ell^3$ (cm^4) Cross sectional area of web plates at the ends of stiffeners : $C_3KSh\ell$(cm^2) S : As specified in **(1)** ℓ : Span of stiffener (*m*) C_1, C_2 *and* C_3 : Coefficients given by **Table 14.6.13-1** K : Coefficient corresponding to the kind of steel as specified in **3.2** k_1 and k_2 : Coefficient given by **Table 14.6.13-1** h : As obtained from **4.10.3.1-1(2)** according to the arranged direction of stiffeners (kN/m^2) (Omitted) **2** Where scantlings of structural members of steel hatch covers are determined based upon finite element method, the scantlings are determined in accordance with **14.6.5.6** using the load specified in **4.10.3.1-2**. (Omitted)	

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td>Part 2-2 BOX-SHAPED BULK CARRIERS

Chapter 3 STRUCTURAL DESIGN PRINCIPLES

<u>3.1 (Deleted)</u></td><td>Part 2-2 BOX-SHAPED BULK CARRIERS

Chapter 3 STRUCTURAL DESIGN PRINCIPLES

<u>3.1 Net Scantling Approach</u>

<u>3.1.1 Corrosion Addition</u>

<u>3.1.1.1 Hatch Cover and Hatch Coaming</u>
<u>The corrosion addition on both sides of the hatch cover and hatch coaming of the box-shaped bulk carriers which is subject to Part 2-2, is to be in accordance with Table 3.1.1-1 instead of Table 3.3.4-2 specified in 3.3.4, Part 1.</u></td><td>Left as “3.1 (Deleted)”</td></tr>
<tr><td colspan="2"><s>Table 3.1.1-1 Corrosion Addition on Both Sides of the Hatch Cover and Hatch Coaming</s>
<table>
<tr><td colspan="2"><s>Type of structural member</s></td><td><s>t_c (mm)</s></td></tr>
<tr><td colspan="2"><s>Single plating type hatch cover</s></td><td><s>2.0</s></td></tr>
<tr><td rowspan="2"><s>Double plating type hatch cover</s></td><td><s>Top and bottom plating</s></td><td><s>2.0</s></td></tr>
<tr><td><s>Internal structures</s></td><td><s>1.5</s></td></tr>
<tr><td colspan="2"><s>Hatch coamings, hatch coaming stays</s></td><td><s>1.5</s></td></tr>
</table></td><td>(Deleted)</td></tr>
</table>

Amended	Original	Remarks

Chapter 4 LOADS

4.1 General

4.1.1 Overview

4.1.1.1 Structure and Overview of this Chapter

Each section of this Chapter defines the additional requirements shown in **Table 4.1.1-1** as the loads used for each formula and each strength assessment to determine the structural dimensions specified in each Chapter of **Part 2-2** and **Part 1**.

Table 4.1.1-1 Overview of Chapter 4

Section	Title	Overview
4.1	General	Requirements for the general principles of **Chapter 4**
4.2	Loads to be Considered in Longitudinal Strength	Additional requirements for hull girder loads to be considered in the torsional strength requirements specified in **Chapter 5** and **Chapter 5, Part 1**.
4.3	Loads to be Considered in Local Strength	Additional requirements for loads to be considered in the local strength requirements specified in **Chapter 6** and **Chapter 6, Part 1**.
4.4	Loads to be Considered in Strength of Primary Supporting Structures	Additional requirements for loads to be considered in the requirements of strength of primary supporting structures specified in **Chapter 7** and **Chapter 7, Part 1**.
4.5	Loads to be Considered in Strength Assessment by Cargo Hold Analysis	Additional requirements for loading condition, etc. to be considered in the requirements for strength assessment by cargo hold analysis specified in **Chapter 8** and **Chapter 8, Part 1**.
4.6	Loads to be Considered in Fatigue	Additional requirements for loads to be considered in the fatigue strength assessment requirements specified in **Chapter 9** and **Chapter 9, Part 1**.
4.7	Loads to be Considered in Additional Structural Requirements	Additional requirements for loads to be considered in the additional structural requirements specified in **Chapter 10** and **Chapter 10,**

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td></td><td>
<table>
<tr><td></td><td></td><td>Part 1.</td></tr>
<tr><td>~~4.8~~</td><td>~~Loads to be Considered in Equipment~~</td><td>~~Additional requirements for loads to be considered in strength requirements for hatch covers, among other equipment requirements specified in Chapter 14 and Chapter 14, Part 1.~~</td></tr>
<tr><td>Annex 4.5</td><td>Operational Loading Conditions and Analytical Loading Conditions</td><td>Guidelines on the relationship between the loading condition to be considered in the strength assessment by cargo hold analysis and the loading condition described in the loading manual</td></tr>
</table>
</td><td></td></tr>
<tr><td>(Deleted)</td><td><u>4.8 Loads to be Considered in Equipment</u>

<u>4.8.1 General</u>

<u>4.8.1.1 General</u>
<u>1</u></u> <u>Loads to be considered in hatch covers and other equipment as specified in 14.1 are to be in accordance with the requirements of 4.8.2, instead of 4.10.2, Part 1. However, the relevant requirements in Part CSR-B&T may be applied where deemed appropriate by the Society.</u>
<u>2</u> <u>In applying the requirements of 4.8, the position of exposed decks (Position I, Position II, etc.) is to be in accordance with the requirements specified in 1.4.3.2, Part 1.</u></td><td>(Deleted)</td></tr>
<tr><td>(Deleted)</td><td><u>4.8.2 Loads to be Considered in Hatch Covers, etc.</u>

<u>4.8.2.1 General</u>
<u>1</u> <u>Loads to be considered in strength assessment of steel hatch covers, steel pontoon covers and steel weathertight hatch covers are to be in accordance with 4.8.2.2 and 4.8.2.3.</u>
<u>2</u> <u>Loads to be considered in strength assessment of hatch beams are to be in accordance with 4.8.2.4.</u>
<u>3</u> <u>Loads to be considered in strength assessment of the hatch</u></td><td>(Deleted)</td></tr>
</table>

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td></td><td>coaming are to be in accordance with 4.8.2.5.
4 Loads to be considered in strength assessment of closing arrangements are to be in accordance with 4.8.2.6.
5 Loads to be considered in strength assessment of stoppers are to be in accordance with 4.8.2.7.
6 Loads to be considered in strength assessment of the hatchway to ballast holds are to be in accordance with 4.8.2.8.</td><td></td></tr>
<tr><td>(Deleted)</td><td>4.8.2.2 Wave Loads to be Considered in Strength Assessments of Hatch Covers
The vertical wave load acting on the hatch cover P_V (kN/m^2) is to be in accordance with Table 4.8.2-1. In addition, where two or more hatch covers are joined at the hinges, the loads are to be considered for each panel. However, the loads may not be considered at the same time as cargo loads specified in 4.8.2.3.</td><td>(Deleted)</td></tr>
<tr><td colspan="2">~~Table 4.8.2-1 Vertical Wave Load P_V (kN/m^2)~~
<table>
<tr><td colspan="2"></td><td>~~$L_f \leq 100$~~</td><td>~~$L_f > 100$~~</td></tr>
<tr><td rowspan="2">~~Position I~~</td><td>~~Between Bow 0.25 L_f~~ (1)</td><td>~~$\frac{9.81}{76}\left[(4.28L_f + 28)\frac{x_{Lf}}{L_f} - 1.71L_f + 95\right]$~~</td><td>~~For B type ships according to ICLL,~~
~~$9.81\left\{(0.0296L_{f1} + 3.04)\frac{x_{Lf}}{L_f} - 0.0222L_{f1} + 1.22\right\}$~~
~~For B-60 and B-100 ships according to ICLL,~~
~~$9.81\left\{(0.1452L_{f1} - 8.52)\frac{x_{Lf}}{L_f} - 0.1089L_{f1} + 9.89\right\}$~~</td></tr>
<tr><td>~~Other~~</td><td>~~$\frac{9.81}{76}(1.5L_f + 116)$~~</td><td>~~$9.81 \times 3.5$~~</td></tr>
<tr><td colspan="2">~~Position II~~</td><td>~~$\frac{9.81}{76}(1.1L_f + 87.6)$~~</td><td>~~$9.81 \times 2.6$~~ (2)</td></tr>
<tr><td colspan="4">~~Notes:~~
~~x_{Lf}: The distance (m) from the aft end of L_f to the mid-ength of the steel hatch cover under consideration~~
~~L_{f1}: L_f (m). However, where it exceeds 340, it is to be taken as 340.~~</td></tr>
</table></td><td>(Deleted)</td></tr>
</table>

Amended	Original	Remarks
~~(1) Use the other load for first position for hatchways positioned at a height equal to, or above, the standard superstructure height from the freeboard deck.~~ ~~(2) 9.81×2.1 (kN/m^2) may be used for hatchways in exposed parts of the superstructure deck positioned at a height equal to, or above, the standard superstructure height from the deck at second position.~~ ~~(3) Loads deemed appropriate by the Society are to be applied as loads for hatchways in exposed parts other than first position and second position.~~		
(Deleted)	**4.8.2.3 Cargo Loads to be Considered in Strength Assessments of Hatch Covers** **1** For uniformly distributed loads, the designed cargo load P_{dk} (kN/m^2) is to be given by the following formula. However, it is not to be less than 0. $P_{dk} = P_{dks} + P_{dkd}$ P_{dks}: Static pressure (kN/m^2), as specified in the following **(1)**. P_{dkd}: Dynamic pressure (kN/m^2), as specified in the following **(2)**. (1) The static pressure P_{dks} (kN/m^2) is to be in accordance with the following **(a)** to **(c)**. (a) As given by the following formula. However, if the maximum designed cargo load weight per unit area on the deck (kN/m^2) is determined using a different formula with the following, use that value instead. When determining this, give due consideration to the height of the cargo load. $P_{dks} = 0.71gh_{gc}$ h_{gc}: The height of the cargo load according to the construction and arrangement directly above the location being considered. This is either the height	(Deleted)

Amended	Original	Remarks
	between decks at the ship's sides from the deck to the deck directly above it (*m*), or the height to the top of the hatch coaming of the deck directly above (*m*). (b) When loading timber and other cargo onto an exposed deck, this is the maximum designed cargo load weight per unit area on the deck (*kN/m²*). (c) When suspending cargo on a deck beam, or when auxiliary deck equipment is present, the weight is to take these into consideration. (2) P_{dkd} : Dynamic pressure (*kN/m²*), according to the following **(a)** to **(c)**. (a) As given the following formula. However, if the maximum designed cargo load weight per unit area on the deck (*kN/m²*) accounting for the envelope acceleration specified in **4.2.4, Part 1** is determined using a different formula with the following, use that value instead. When determining this, give due consideration to the height of the cargo load. $P_{dkd} = 0.71 a_{ze} h_{gc}$ a_{ze}: Vertical envelope acceleration specified in **4.2.4, Part 1** h_{gc}: The height of the cargo load according to the construction and arrangement directly above the location being considered. This is either the height between decks at the ship's sides from the deck to the deck directly above it (*m*), or the height to the top of the hatch coaming of the deck directly above (*m*). (b) When loading timber and other cargo onto an exposed	

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td></td><td>deck, this is the maximum designed cargo load weight per unit area on the deck (kN/m^2) taking into account the vertical envelope acceleration specified in 4.2.4, Part 1.
(c) When suspending cargo on a deck beam, or when auxiliary deck equipment is present, the weight is to take these into consideration while taking the vertical envelope acceleration specified in 4.2.4, Part 1 into account.
2 For concentrated loads, the maximum designed cargo load applied to each load point is to be considered.</td><td></td></tr>
<tr><td>~~4.8.2.4 Vertical Wave Loads to be Considered in Strength Assessments of Hatch Beams~~
~~The vertical wave load P_{VF} (kN/m^2) to be considered in strength assessments of hatch beams is to be in accordance with Table 4.8.2-2.~~

~~Table 4.8.2-2 Vertical wave load P_{VF} (1) (kN/m^2)~~
<table><tr><td></td><td>~~$L_F \leq 100$~~</td><td>~~$L_F > 100$~~</td></tr><tr><td>~~Position I~~</td><td>~~$\frac{9.81}{76}(1.5L_F + 116)$~~</td><td>~~$9.81 \times 3.5$~~</td></tr><tr><td>~~Position II~~</td><td>~~$\frac{9.81}{76}(1.1L_F + 87.6)$~~</td><td>~~$9.81 \times 2.6$ (2)~~</td></tr><tr><td colspan="3">~~Notes:
(1) Loads deemed appropriate by the Society are to be applied as loads for each hatchway in exposed parts other than Position I and Position II.
(2) 9.81×2.1 (kN/m^2) may be used for hatchways in exposed parts of the superstructure deck positioned at a height equal to, or above, the standard superstructure height from the deck at Position II.~~</td></tr></table></td><td>(Deleted)</td></tr>
</table>

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
(Deleted)	**4.8.2.5 Wave Loads to be Considered in Strength Assessments of the Hatch Coaming** The wave load P_{coam} to be considered in strength assessments of the hatch coaming is to be in accordance with the following **(1)** or **(2)**. (1) Front-end hatch coaming of the foremost cargo hold: 290 (kN/m^2) However, where a forecastle is installed in accordance with the requirements of **11.1, Part 2-3**, this value may be 220 kN/m^2. (2) Hatch coaming other than **(1)** above: 220 (kN/m^2)	(Deleted)
(Deleted)	**4.8.2.6 Loads to be Considered in Strength Assessments of Closing Arrangements** When determining the cross-section area of bolts and rods used in securing arrangements, the packing line pressure acting on the gaskets p(N/mm) is to be considered. However, if this value is less than 5 N/mm, 5 N/mm is to be used.	(Deleted)
(Deleted)	**4.8.2.7 Wave Load to be Considered in Strength Assessments of Stoppers** The designed wave load $P_{stopper}$ to be considered in strength assessments of stoppers is to be in accordance with the following **(1)** or **(2)**. (1) Stoppers for the hatch cover to the foremost cargo hold (a) Pressure acting in the direction of the stern on the front-end of the hatch cover: 230 (kN/m^2) However, where a forecastle is installed in accordance	(Deleted)

Amended	Original	Remarks
	with the requirements of **11.1, Part 2-3**, this value may be 175 kN/m^2. (b) Pressure in the transverse direction of the ship: 175 kN/m^2 (2) Stoppers for hatch covers other than that specified in **(1)** above Pressure acting in the direction of the stern on the front-end of the hatch cover and pressure in the transverse direction the ship: 175 kN/m^2	
(Deleted)	**4.8.2.8 Loads to be Considered in Strength Assessments of the Hatchway to Ballast Holds** Loads to be considered when conducting strength assessment of the hatchway to ballast holds are to be in accordance with **4.10.3, Part 1**.	(Deleted)
(Deleted)	**Chapter 14 EQUIPMENT** **14.1 Hatch Covers** **14.1.1 Application** **14.1.1.1 General** **1** The requirements of **14.1** are to be applied instead of the requirements prescribed in **14.6, Part 1**. **2** The construction and the means for closing of cargo and other hatchways in ships which complies with **Part 2-2** are to be those that are not less effective than those specified in **14.1**. However, the relevant requirements in **Part CSR-B&T** may be applied instead of the requirements of **14.1**.	(Deleted)

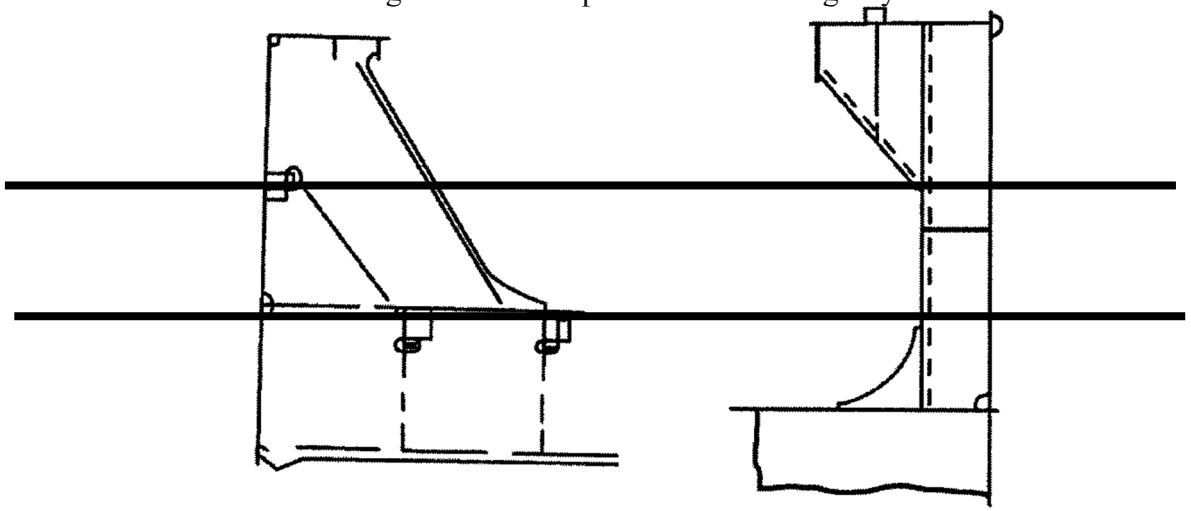
Amended	Original	Remarks
	3 Where hatch covers serve as helicopter decks, it is to comply with the requirements in **10.4.6, Part 1**.	
(Deleted)	**14.1.1.2 Net Scantling Approach** **1** Unless otherwise specified, the structural scantlings specified in **14.1** are to be net scantlings which do not include any corrosion additions. **2** Required gross scantlings are not to be less than the scantlings obtained from adding the corrosion addition t_c specified in **3.3** to the net scantlings obtained from the requirements in **3.1**. **3** According to the requirements of **14.1.1.1-2**, where applying the relevant requirements of **Part CSR-B&T**, the corrosion addition of the stiffener attached to the hatch coamings, hatch coaming stays and stays is to be read as 1.5 *mm* in the requirements of **Part CSR-B&T**.	(Deleted)
(Deleted)	**14.1.2 Hatch Coaming Strength Criteria** **14.1.2.1 Height of Hatch Coamings** Height of hatch coamings is to comply with **14.6.9.1, Part 1**.	(Deleted)
(Deleted)	**14.1.2.2 Scantlings of Hatch Coamings** Scantlings of hatch coamings are not to be less than that obtained from the following formula: However, For aft end hatch coamings, only the requirements in **(2)(b)** need be applied. (1) The local net plate thickness of the hatch coaming plating $t_{coam,net}$ is not to be less than that obtained from following formula: (a) For forward and side hatch coamings	(Deleted)

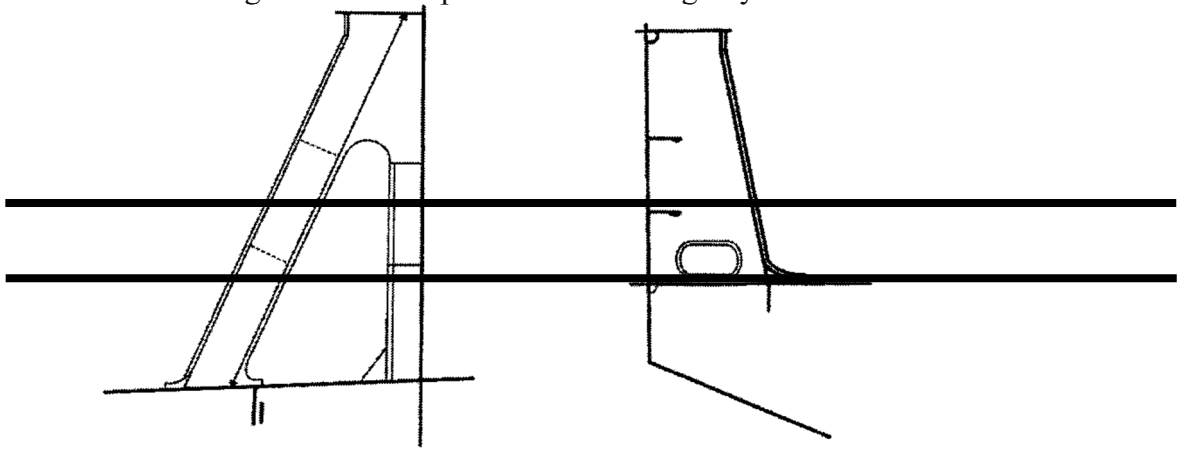
Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
	$t_{coam,net} = 14.9S\sqrt{\frac{1.15P_{coam}}{\sigma_{a,coam}}}$ (mm), however, not to be less than 9.5 mm. S: Secondary stiffener spacing (m) P_{coam}: Wave load (kN/m^2), as specified in **4.8.2.5.** $\sigma_{a,coam} = 0.95\sigma_F$ σ_F: Minimum upper yield stress or proof stress (N/mm^2) of the material (b) For aft hatch coamings Where L_C is 100 m and under: $t_{coam,net} = 4.5 + 0.05L_C$ (mm) Where L_C is greater than 100 m: $t_{coam,net} = 9.5$ (mm)	
(Deleted)	(2) The net section modulus of secondary stiffeners of the hatch coaming, based on net member thickness, is not to be less than that obtained from following formula: $Z_{net} = \frac{1150\ell^2 SP_{coam}}{mc_p\sigma_{a,coam}}$ (cm^3) m: 16 in general 12 for the end spans of stiffeners sniped at the coaming corners ℓ: Span of secondary stiffeners (m) S, P_{coam} and $\sigma_{a,coam}$: As specified in **(1)** above. c_p: Ratio of the plastic section modulus to the elastic section modulus of the secondary stiffeners with an attached plate breadth equal to $40t_{coam,net}$ (mm). The value may be 1.16 in the absence of more precise evaluation.	(Deleted)

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
(Deleted)	(3) The net scantlings of hatch coaming stays are to be in accordance with following **(a)**, **(b)** and **(c)**: (a) The net section modulus and web thickness of coaming stays designed as beams with flanges connected to the deck or sniped and fitted with a bracket (*See* **Fig.14.1.2-1**) at their connections with the deck, based on member net thickness, are not to be less than that obtained from following formulae: $Z_{net} = \frac{1000 {H_C}^2 S P_{coam}}{2\sigma_{a,coam}}$ (cm^3) $t_{w,net} = \frac{1000 H_C S P_{coam}}{h\tau_{a,coam}}$ (mm) H_C: Stay height (m) S: Stay spacing (m) h: Stay depth (mm) $\tau_{a,coam} = 0.5\sigma_F$ σ_F, P_{coam} and $\sigma_{a,coam}$: As specified in **(1)** above. (b) For calculating the net section modulus of coaming stays, the area of their face plates is to be taken into account only when it is welded with full penetration welds to the deck plating and an adequate underdeck structure is fitted to support the stresses transmitted by them. (c) For designs of coaming stays other than those specified in **(a)** above (*See* **Fig. 14.1.2-2**), the stress levels given by following formulae apply and are to be checked at the highest stressed locations. Normal Stresses σ_a: $0.8\sigma_F$	(Deleted)

Amended	Original	Remarks
	Shear stress τ_a: $0.46\sigma_F$	
~~Fig. 14.1.2-1 Example of Hatch Coaming Stay~~ 		(Deleted)

Amended	Original	Remarks
~~Fig. 14.1.2-2 Example of Hatch Coaming Stay~~ 		(Deleted)
(Deleted)	**14.1.2.3 Hatch Coaming Structure** **1** Coamings for hatchways in Position I or coamings of 760 *mm* or more in height for hatchways in Position II are to be stiffened in a suitable position below the upper edge by a horizontal stiffener; the breadth of the horizontal stiffener is not to be less than 180 *mm*. **2** Coamings are to be additionally supported by efficient brackets or stays provided from the horizontal stiffeners specified in **-1** above to the deck at intervals of approximately 3 *m*. **3** Coamings for all exposed hatchways are to be stiffened on their upper edges by half-round bars or similar section bars and their lower parts are to be constructed efficiently by flanging or other suitable means. **4** For the construction and scantlings of coamings of small hatchways, the requirements in **14.1.2.2-1** and **-1** to **-3** above may be	(Deleted)

Amended	Original	Remarks
	suitably modified. **5** The construction and scantlings of coamings over 900 *mm* in height, coamings of hatchways to deep tanks, and coamings of hatchways closed by special types of closing appliances to which the requirements in **14.1.2.2** are not applicable are to be to the satisfaction of the Society. **6** The design of local details is to comply with the following requirements. (1) The secondary stiffeners of the hatch coamings are to be continuous over the breadth and length of the hatch coamings. (2) The local details of the structures are to be designed so as to transfer the pressures on the hatch covers to the hatch coamings and, through them, to the deck structures below. Hatch coamings and supporting structures are to be adequately stiffened to accommodate the loading from hatch covers, in longitudinal, transverse and vertical directions. (3) Underdeck structures are to be checked against the load transmitted by the stays, adopting the same allowable stresses specified in the preceding **-1(4)** above. (4) Double continuous welding is to be adopted for the connections of stay webs with deck plating and the weld throat is to be not less than 0.44 $t_{w,gross}$, where $t_{w,gross}$ is the gross thickness of the stay web. (5) Toes of stay webs are to be connected to the deck plating with deep penetration double bevel welds extending over a distance not less than 15% of the stay width.	

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
(Deleted)	**14.1.3 Hatch Beams, Hatch Plates, Steel Pontoon Covers and Steel Weathertight Covers** **14.1.3.1 General** **1** The scantlings of structural members of steel hatchway covers, steel pontoon covers and steel weathertight covers (hereinafter referred to as "steel hatch covers"), and of portable beams are to comply with the requirements in **14.1.3**. When the loading condition or the type of construction differs from that specified in this paragraph, the calculation method is to be as deemed appropriate by the Society. **2** The allowable normal and shear stresses in the steel hatch covers are as specified in **Table 14.1.3-1.** **3** For grillage or similar constructions, the stresses in steel hatch cover primary supporting members are to be determined by grillage or a finite element method. For modelling the structural members, the net scantlings are to be used. **4** The scantlings of steel hatch covers intended to carry cargoes on them in exposed positions are to be of the values obtained from the requirements for steel hatch covers in exposed positions specified in **14.1.3** or the values obtained from the requirements for steel hatch covers intended to carry cargoes specified in **14.1.4**, whichever is greater. **5** The secondary stiffeners and primary supporting members of the steel hatch covers are to be continuous over the breadth and length of the steel hatch covers, as far as practical. When this is impractical, sniped end connections are not to be used and appropriate arrangements are to be adopted to ensure sufficient load carrying capacity.	(Deleted)

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td></td><td><u>6</u> <u>Load bearing connections between the hatch cover panels are to be fitted with the purpose of restricting the relative vertical displacements.</u></td><td></td></tr>
<tr><td>~~Table 14.1.3-1 Allowable Stresses~~
<table><tr><th>~~Kind of load~~</th><th>~~Target member~~</th><th>~~Normal stresses σ_{Σ}~~</th><th>~~Shear stress: τ_{Σ}~~</th></tr><tr><td rowspan="2">~~Design wave load~~</td><td>~~Steel hatchway covers and steel weathertight covers~~</td><td>~~$0.8\sigma_{\Sigma}$~~</td><td>~~$0.46\sigma_{\Sigma}$~~</td></tr><tr><td>~~Portable beams and steel pontoon covers~~</td><td>~~$0.68\sigma_{\Sigma}$~~</td><td>~~$0.39\sigma_{\Sigma}$~~</td></tr></table>~~Notes:~~
~~σ_{Σ}: Minimum upper yield stress or proof stress of the material (*N/mm²*)~~</td><td>(Deleted)</td></tr>
<tr><td>(Deleted)</td><td><u>14.1.3.2 Local net plate thickness of hatch covers</u>
<u>The local net thickness t_{net} of steel hatch cover top plating is not to be less than that obtained from the following formula, and it is not to be less than 1% of the spacing of the stiffeners or 6 *mm*, whichever is greater:</u>
$$t_{net} = 15.8F_pS\sqrt{\frac{P_V}{0.95\sigma_F}}\ (mm)$$
<u>F_p: Coefficient given by the following formula:</u>
<u>$1.9\sigma/\sigma_a$ (for $\sigma/\sigma_a \geq 0.8$, for the attached plate flange of primary supporting members)</u>
<u>1.5 (for $\sigma/\sigma_a < 0.8$, for the attached plate flange of primary supporting members)</u>
<u>σ: Normal stress (*N/mm²*) of the attached plate flange of primary supporting members</u></td><td>(Deleted)</td></tr>
</table>

Amended	Original	Remarks
	σ_a: Allowable normal stresses specified in **Table 14.1.3-1**. (N/mm^2) S: Stiffener spacing (m) P_V: Design wave load (kN/m^2) specified in **4.8.2.2** σ_F: Minimum upper yield stress or proof stress (N/mm^2) of the material	
(Deleted)	**14.1.3.3 Secondary Stiffeners of Steel Hatch Covers** **1** The net section modulus Z_{net} of the secondary stiffeners of hatch cover top plates, based on stiffener net member thickness, is not to be less than that obtained from the following formula. The net section modulus of the secondary stiffeners is to be determined based on an attached plate width that is assumed to be equal to the stiffener spacing. $$Z_{net} = \frac{1000SP_V\ell^2}{12\sigma_a} \ (cm^3)$$ ℓ : Secondary stiffener span (m) is to be taken as the spacing of primary supporting members or the distance between a primary supporting member and the edge support, as applicable. When brackets are fitted at both ends of all secondary stiffener spans, the secondary stiffener span may be reduced by an amount equal to 2/3 of the minimum brackets arm length, but not greater than 10% of the gross span, for each bracket. S: Stiffener spacing (m) P_V: Design wave load (kN/m^2) specified in **4.8.2.2** σ_a: Allowable normal stress specified in **Table 14.1.3-1**. **2** The net shear sectional area A_{net} of the secondary stiffener webs of hatch cover top plates is not to be less than that obtained from	(Deleted)

Amended	Original	Remarks
	the following formula: $A_{net} = \frac{5SP_V\ell}{\tau_a}$ (cm^2) ℓ and P_V: As specified in -1 above. τ_a: As specified in Table 14.1.3-1. **3** For flat bar secondary stiffeners and buckling stiffeners, the following formula is to be applied: $\frac{h}{t_{W,net}} \leq 15\sqrt{k}$ h: Height (mm) of the stiffener $t_{W,net}$: Net thickness (mm) of the stiffener $k = 235/\sigma_F$ σ_F: Minimum upper yield stress or proof stress (N/mm^2) of the material	
(Deleted)	**14.1.3.4 Steel Hatch Cover Girders and Hatch Beams** **1** The net scantlings of hatch beams and primary supporting members of steel hatch covers, which are simply supported between hatch coamings with uniformly distributed loads imposed thereupon are to comply with the following formulae. For steel hatchway covers, S and l are to read as b and S, respectively. Net section modulus at mid-span of hatch beams or primary supporting members: $Z_{net} = \frac{1000SP_V\ell^2k_1}{8\sigma_a}$ (cm^3) Net moment of inertia at mid-span of hatch beams or primary supporting members: $I_{net} = \frac{0.0063SP_V\ell^3k_2}{\mu}$ (cm^4)	(Deleted)

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td></td><td>Net cross-sectional area of web plates at the ends of hatch beams or primary supporting members:
$A_{net} = \frac{5SP_V\ell}{\tau_a}$ (cm^2)
S: Spacing (m) of the hatch beam or primary supporting members considered
ℓ: Length (m) of the hatch beam or primary supporting members considered
B : Width (m) of steel hatch covers
P_V: Design wave load (kN/m^2) specified in 4.8.2.4 or 4.8.2.2
k_1 and k_2: Coefficien specified in Table 14.6.5-1, Chapter 14, Part 1.
σ_a and τ_a: As specified in Table 14.1.3-1.
μ: Coefficient specified in Table 14.1.3-2.</td><td></td></tr>
<tr><td>~~Table 14.1.3-2 μ~~
<table><tr><th></th><th>~~μ~~</th></tr><tr><td>~~Steel hatch covers and steel weathertight covers~~</td><td>~~0.0056~~</td></tr><tr><td>~~Hatch beams and steel pontoon hatch cover~~</td><td>~~0.0044~~</td></tr></table></td><td></td><td>(Deleted)</td></tr>
<tr><td>(Deleted)</td><td>2 When calculating the normal and shear stresses in the hatch cover structural members by means of finite element method, these values are not to exceed the allowable stresses specified in Table 14.1.3-1. For modelling structural members, net scantlings are to be used. When calculated by means of a beam or grillage model, the effective flange area $A_{F,net}$ (cm^2) of the attached plating to be considered for the yielding and buckling checks of primary supporting members is to be obtained by the following formula. In</td><td>(Deleted)</td></tr>
</table>

Amended	Original	Remarks
	this case, the secondary stiffeners are not to be included in the attached flange area of the primary members. $A_{F,net} = \sum_{nf}(10 b_{ef} t_{net})$ (cm^2) nf: 2 if attached plate flange extends on both sides of girder web 1 if attached plate flange extends on one side of girder web only t_{net}: Net thickness (mm) of considered attached plate b_{ef}: Half the distance (m) between the considered primary supporting member and the adjacent one, but not to be taken greater than 0.165ℓ ℓ: Span (m) of primary supporting members **3** The spacing of primary supporting members parallel to the direction of secondary stiffeners is not to exceed 1/3 of the span of primary supporting members. **4** The breadth of the flange of primary supporting members is to be not less than 40% of their depth for laterally unsupported spans greater than 3.0 m. Tripping brackets attached to the flange may be considered as a lateral support for primary supporting members. The flange outstand is not to exceed 15 *times* the gross flange thickness.	
(Deleted)	**14.1.3.5 Critical buckling stress check** The buckling strength for primary supporting members forming the steel hatch cover is to be in accordance with the requirements of the following **(1)** to **(3)**. (1) The buckling strength for hatch cover top plating is to be in accordance with the requirements of the following **(a)** to **(c)**. (a) The compressive stress in the hatch cover plate panels induced by the bending of primary supporting members parallel to the direction of secondary	(Deleted)

Amended	Original	Remarks
	stiffeners is not to exceed 0.8 *times* the critical buckling stress σ_{C1}, to be evaluated as defined below: $\sigma_{C1} = \sigma_{E1}$ (For $\sigma_{E1} \leq \frac{\sigma_F}{2}$) $\sigma_{C1} = \sigma_F\left(1 - \frac{\sigma_F}{4\sigma_{E1}}\right)$ (For $\sigma_{E1} > \frac{\sigma_F}{2}$) σ_F: Minimum upper yield stress or proof stress of the material (*N/mm²*) $\sigma_{E1} = 3.6E\left(\frac{t_{net}}{1000S}\right)^2$ t_{net}: Net thickness (*mm*) of the panel S: Spacing (*m*) of secondary stiffeners (b) The mean compressive stress in each of the hatch cover plate panels induced by the bending of primary supporting members perpendicular to the direction of secondary stiffeners is not to exceed 0.8 *times* the critical buckling stress σ_{C2}, to be evaluated as defined below: $\sigma_{C2} = \sigma_{E2}$ (For $\sigma_{E2} \leq \frac{\sigma_F}{2}$) $\sigma_{C2} = \sigma_F\left(1 - \frac{\sigma_F}{4\sigma_{E2}}\right)$ (For $\sigma_{E2} > \frac{\sigma_F}{2}$) $\sigma_{E2} = 0.9mE\left(\frac{t_{net}}{1000S_s}\right)^2$ σ_F, E and t_{net}: As specified in **(a)** above. $m = c\left\{1 + \left(\frac{S_s}{\ell_s}\right)^2\right\}^2 \frac{2.1}{\psi + 1.1}$ S_s: Length (*m*) of the shorter side of the plate panel	

Amended	Original	Remarks
	ℓ_s: Length (*m*) of the longer side of the plate panel ψ: Ratio between smallest and largest compressive stress c: Coefficients obtained according to the kind of stiffeners at compressive side, which are given by the following: 1.30: when plating is stiffened by primary supporting members 1.21: when plating is stiffened by secondary stiffeners of angle or T type 1.10: when plating is stiffened by secondary stiffeners of bulb type 1.05: when plating is stiffened by flat bar (c) The biaxial compressive stress in the hatch cover panels, when calculated by means of a FEM shell element model, is to be in accordance with **Annex 8.6, Chapter 8, Part 1**. (2) The compressive stress in the top flange of secondary stiffeners, induced by the bending of primary supporting members parallel to the direction of secondary stiffeners, is not to exceed 0.8 *times* the critical buckling stress σ_{CS}, to be evaluated as defined below: $\sigma_{CS} = \sigma_{ES}$ (For $\sigma_{ES} \leq \frac{\sigma_F}{2}$) $\sigma_{CS} = \sigma_F\left(1 - \frac{\sigma_F}{4\sigma_{ES}}\right)$ (For $\sigma_{ES} > \frac{\sigma_F}{2}$) σ_F: Minimum upper yield stress or proof stress (N/mm^2) of the material σ_{ES}: σ_{E3} or σ_{E4} obtained from following formulae, whichever is smaller	

Amended	Original	Remarks
	$\sigma_{E3} = \frac{0.001EI_{a,net}}{A_{net}\ell^2}$ $I_{a,net}$: Moment of inertia (cm^4) of the secondary stiffener, including a top flange that has a width equal to the spacing of secondary stiffeners A_{net}: Cross-sectional area (cm^2) of the secondary stiffener including a top flange that has a width equal to the spacing of secondary stiffeners ℓ: Span of the secondary stiffener (m) $\sigma_{E4} = \frac{\pi^2 EI_{w,net}}{10^4 I_{p,net}\ell^2}\left(m^2 + \frac{K}{m^2}\right) + 0.385E\frac{I_{t,net}}{I_{p,net}}$ $K = \frac{C\ell^4}{\pi^4 EI_{w,net}} \times 10^6$ m: As specified in **Table 14.1.3-3**. $I_{w,net}$: Sectorial moment of inertia (cm^6) of the secondary stiffener about its connection with the plating: $I_{w,net} = \frac{{h_w}^3 {t_{w,net}}^3}{36} \times 10^{-6}$ (cm^6) for flat bar secondary stiffeners $I_{w,net} = \frac{t_{f,net}{b_f}^3{h_w}^2}{12} \times 10^{-6}$ (cm^6) for T secondary stiffeners $I_{w,net} = \frac{{b_f}^3{h_w}^2}{12(b_f+h_w)^2}\left[t_{f,net}\left({b_f}^2 + 2b_f h_w + 4{h_w}^2\right) + 3t_{w,net}b_f h_w\right] \times 10^{-6}(cm^6)$ for angles and bulb secondary stiffeners $I_{p,net}$: Polar moment of inertia (cm^4) of the	

Amended	Original	Remarks
	secondary stiffener about its connection with the plating: $I_{p,net} = \frac{{h_w}^3 t_{w,net}}{3} \times 10^{-4}$ (cm^4) for flat bar secondary stiffeners $I_{p,net} = \left(\frac{{h_w}^3 t_{w,net}}{3} + {h_w}^2 b_f t_{f,net}\right) \times 10^{-4}$ (cm^4) for flanged secondary stiffeners $I_{t,net}$: St Venant's moment of inertia (cm^4) of the secondary stiffener without top flange: $I_{t,net} = \frac{h_w {t_{w,net}}^3}{3} \times 10^{-4}$ (cm^4) for flat bar secondary stiffeners $I_{t,net} = \frac{1}{3}\left[{h_w t_{w,net}}^3 + b_f {t_{f,net}}^3 \left(1 - 0.63\frac{t_{f,net}}{b_f}\right)\right] \times 10^{-4}$ (cm^4) for flanged secondary stiffeners h_w: Height (mm) of the secondary stiffener web $t_{w,net}$: Net thickness (mm) of the secondary stiffener web b_f: Width (mm) of the secondary stiffener bottom flange $t_{f,net}$: Net thickness (mm) of the secondary stiffener bottom flange C: As given by the following:	

Amended	Original	Remarks
	$C = \dfrac{k_p E {t_{p,net}}^3}{3s\left(1 + \dfrac{1.33 k_p h_w {t_{p,net}}^3}{s {t_{w,net}}^3}\right)}$ s: Spacing (*mm*) of secondary stiffener k_p: As given by the following, but not less than zero For longitudinals with flanges, the value is not to be taken as less than 0.1. $k_p = 1 - \eta_p$ $\eta_p = \dfrac{\sigma}{\sigma_{E1}}$ σ_{E1}: As specified in (1) above. $t_{p,net}$: Net thickness (*mm*) of the hatch cover plate panel (3) The shear stress in the hatch cover primary supporting members web panels is not to exceed 0.8 *times* the critical buckling stress τ_C, to be evaluated as defined below. For primary supporting members perpendicular to the direction of secondary stiffeners or for hatch covers built without secondary stiffeners, the average shear stress between the values calculated at the ends of this panel is to be considered: $\tau_C = \tau_E \quad (\text{For } \tau_E \le \dfrac{\tau_F}{2})$ $\tau_C = \tau_F\left(1 - \dfrac{\tau_F}{4\tau_E}\right) \quad (\text{For } \tau_E > \dfrac{\tau_F}{2})$ $\tau_F = \dfrac{\sigma_F}{\sqrt{3}}$ σ_F: As specified in (1) above.	

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td></td><td>$\tau_E = 0.9k_tE\left(\frac{t_{pr,net}}{1000d}\right)^2$
$t_{pr,net}$: Net thickness (mm) of primary supporting member
$k_t = 5.35 + \frac{4.0}{(a/d)^2}$
a: The greater dimension (m) of the web panel of primary supporting member. For primary supporting members perpendicular to the direction of secondary stiffeners or for hatch covers built without secondary stiffeners, the smaller dimension d is to be considered
d: Smaller dimension (m) of web panel of primary supporting member</td><td></td></tr>
<tr><td>~~Table 14.1.3-3 Value of m~~
<table><tr><td></td><td>~~$1 < K < 4$~~</td><td>~~$4 \leq K < 36$~~</td><td>~~$36 \leq K < 144$~~</td><td>~~$(m-1)^2m^2 \leq K < m^2(m+1)^2$~~</td></tr><tr><td>~~$m$~~</td><td>~~1~~</td><td>~~2~~</td><td>~~3~~</td><td>~~m~~</td></tr></table></td><td></td><td>(Deleted)</td></tr>
<tr><td>(Deleted)</td><td><u>14.1.3.6 Deflection limit</u>
<u>The vertical deflection of primary supporting members and portable beams are to be not more than μl, where l is the greatest span of primary supporting members or portable beams, and μ is as specified in Table 14.1.3-2.</u></td><td>(Deleted)</td></tr>
</table>

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
(Deleted)	**14.1.4 Requirements for Hatch Covers Carrying Cargoes** **14.1.4.1 General** **1** The scantlings of steel hatch covers carrying cargoes in exposed positions are to comply with the requirements in **14.1.4** in addition to the requirements in **14.1.3**. When the loading condition or the type of construction differs from the requirements of **14.1.4**, the calculation method is to be as deemed appropriate by the Society. **2** The values obtained from the requirements of **14.1.4** include corrosion addition. **3** Where cargo loads and wave loads act jointly due to the height of the loaded cargo or its shape, special considerations are to be given for calculating the superposition of the wave load and cargo load.	(Deleted)
(Deleted)	**14.1.4.2 Thickness of the Steel Hatch Cover Top Plate** For hatch covers carrying cargoes, the thickness of the top plating t is not to be less than that obtained from following formula. $t = 1.25S\sqrt{KP_{dk}} + 2.5$ (mm) S: Spacing (m) of stiffeners P_{dk}: Design cargo load (kN/m^2) specified in **4.8.2.3**. (kN/m^2) K: Material factor of the steel material used, as specified in **3.2, Part 1**.	(Deleted)
(Deleted)	**14.1.4.3 Secondary Stiffeners of Steel Hatch Covers** The section modulus of stiffeners supported by girders and subjected to uniformly distributed loads may be obtained from finite element method, or obtained from the following formulae. $0.71CKSP_{dk}\ell^2$ (cm^3) C: Coefficient given below according to the type of end	(Deleted)

Amended	Original	Remarks
	connections of stiffeners; For lug at both ends: 1.0 For snip at both ends or snip on one end and a lug on the other: 1.5 K: Coefficient corresponding to the kind of steel as specified in **3.2, Part 1**. S: Spacing (m) of stiffeners P_{dk}: Design cargo load (kN/m^2) as specified in **4.8.2.3**. (kN/m^2) ℓ: Unsupported span of stiffeners (m)	
(Deleted)	**14.1.4.4 Steel Hatch Cover Girders and Hatch Beams** The net scantlings of portable beams and primary supporting members of steel hatch covers, which are simply supported between hatch coamings with uniformly distributed loads imposed thereupon are to comply with the following formulae. For steel hatchway covers, S and ℓ are to read as b and S, respectively. Net section modulus at mid-span of portable beams or primary supporting members: $C_1 K k_1 S P_{dk} \ell^2$ (cm^3) Net moment of inertia at mid-span of portable beams or primary supporting members: $C_2 k_2 S P_{dk} \ell^3$ (cm^4) Net cross-sectional area of web plates at the ends of portable beams or primary supporting members: $C_3 K S P_{dk} \ell$ (cm^2) S, b, ℓ, k_1 and k_2: As specified in **14.1.3.4**. C_1, C_2 and C_3: Coefficients given in **Table 14.1.4-1**. P_{dk}: The designed cargo load, in accordance with **4.8.2.3**. (kN/m^2)	(Deleted)

Amended	Original	Remarks
	K: Material factor corresponding to the kind of steel as specified in **3.2, Part 1**.	
~~Table 14.1.4-1 Coefficients C_1, C_2 and C_3~~ ~~C_1 | C_2 | C_3~~ ~~1.07 | 1.81 | 0.064*~~ ~~Notes:~~ ~~*: Not applicable to steel hatch plates.~~		(Deleted)
(Deleted)	**14.1.4.5 Compressive Buckling Strength of Steel Hatch Covers** Steel hatch covers are to satisfy the following formula. However, for double plated steel hatch covers, the plate that actually bears the compressive stress need only comply. $\sigma_{cr}/\sigma \geq 1.2$ σ_{cr}: Critical compressive buckling stress given by the following formulae. For $\sigma'_{cr} \leq \frac{\sigma_F}{2}$: σ'_{cr} For $\sigma'_{cr} > \frac{\sigma_F}{2}$: $\sigma_F\left(1-\frac{\sigma_F}{4\sigma'_{cr}}\right)$ $\sigma'_{cr} = 0.74(t/S)^2 (N/mm^2)$ t: Thickness of steel plate considered (mm) S: Spacing (m) of stiffeners for the steel plate considered	(Deleted)

Amended	Original	Remarks
	σ_F: Minimum upper yield stress or proof stress (N/mm^2) of the material σ: Compressive stress acting on the steel plate considered (N/mm^2)	
(Deleted)	**14.1.4.6 Deflection limit** The vertical deflection of primary supporting members and portable beams are to be not more than 0.0035l, where l is the greatest span of primary supporting members or portable beams.	(Deleted)
(Deleted)	**14.1.4.7 Considering Container Loads and Other Concentrated Loads** Where concentrated loads are imposed such as in the carriage of container cargoes, the requirements in **(1)** to **(4)** are to be taken into consideration. However, other than those specified in **14.1.4.7** are to be in accordance with **Chapter 8, Part 1**. (1) Loads The loads acting on steel hatch covers are to be according to the following **(a)** or **(b)** according to the type of load. Except for **-4**, no loads are to be assumed to act jointly. (a) Where the load is uniformly distributed, P_{dk} specified in **4.8.2.3** is used, and where the load is concentrated, the maximum design cargo load at each loading point is to be used. (b) The load due to liquid cargoes or water ballast are to be	(Deleted)

Amended	Original	Remarks
	in accordance with **4.8.2.8-2**. (2) Modelling of Structure (a) The structural model is to be able to reproduce the behaviour of the structure with the highest possible fidelity. (b) The scantlings including corrosion additions which are shown on the plans may be used for the model. (c) When modelling using beam elements, each beam element may generally include the plates up to a width of 0.1*l* on either side of the beam, where *l* is the span of the members. The plates are to be effectively reinforced by other members or are to be deemed by the Society to have sufficient thickness. However, the width of the plate is not to exceed half the distance to the neighbouring member. (d) The structural model is to be supported by pads (cleats in the case of loads due to liquid cargoes or water ballast). If the arrangement of pads (or cleats) differs from the arrangement of stiffeners, the edge elements of hatch covers are also to be modelled. (3) Allowable Values When the loads specified in **(1)** act on the structural model specified in **(2)**, the scantlings are to be determined so that the stress and deflection generated in each structural member satisfy the allowable values specified in **Table 14.1.4-2**. (4) Miscellaneous (a) The thickness of the top plating of steel hatch covers is to comply with the requirements in **14.1.4.2** and **14.6.13.1-1 (1), Part 1**.	

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td></td><td>(b) The section modulus of stiffeners supported by girders and subjected to uniformly distributed loads may be obtained from finite element method, or obtained from the requirements in 14.2.5.4.</td><td></td></tr>
<tr><td>~~Table 14.1.4-2 Allowable Values~~
<table><tr><th>~~Kind of loads~~</th><th>~~Bending stress~~</th><th>~~Shear Stress~~</th><th>~~Deflection/ span~~</th></tr><tr><td>~~Loads due to solid and liquid cargoes or water ballast~~</td><td>~~$0.5\eta\sigma_E$~~</td><td>~~$0.33\eta\sigma_E$~~</td><td>~~0.0035~~</td></tr><tr><td>~~Wheel load from wheeled vehicles used for loading/unloading only during port~~</td><td>~~$0.625\eta\sigma_E$~~</td><td>~~$0.415\eta\sigma_E$~~</td><td>~~0.0035~~</td></tr></table>~~Notes:~~
~~σ_E: Minimum upper yield stress or proof stress (N/mm^2) of the material~~
~~η: Coefficient according to grades of material as follows:~~
~~*KA*, *KB*, *KD*, and *KE* 1.00~~
~~*KA*32, *KD*32, *KE*32 and *KF*32 0.96~~
~~*KA*36, *KD*36, *KE*36 and *KF*36 0.92~~
~~*KA*40, *KD*40, *KE*40 and *KF*40 0.89~~</td><td>(Deleted)</td><td>(Deleted)</td></tr>
<tr><td>(Deleted)</td><td>14.1.5 Special Requirements for Hatch Beams, Hatch Plates, Steel Pontoon Covers and Steel Weathertight Covers

14.1.5.1 Hatch Beams
Hatch beams are to comply with the following (1) to (4) in addition to 14.6.7, Chapter 14, Part 1.
(1) The diameter of lightening holes provided in portable beams is to be smaller than one third of the depth of portable beams in the section. Where the loading of lumber is planned, lightening holes are recommended not to be provided.
(2) The thickness of web plates is not to be less than the value</td><td>(Deleted)</td></tr>
</table>

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
	obtained from the following formula. $10h + 4$ (mm) h: Depth (m) of the hatch beam at the mid-point (3) In applying **14.1.3** and **14.1.4**, the distance between the inner sides of hatchway coamings may be used as the span (l) of the portable beams.	
(Deleted)	**14.1.5.2 Hatch Plates** Hatch plates are to be in accordance with **14.6.7.2, Part 1**.	(Deleted)
(Deleted)	**14.1.5.3 Pontoon Hatch Plates** Steel pontoon hatch covers are to comply with **14.6.7.3, Part 1**.	(Deleted)
(Deleted)	**14.1.5.4 Weathertight Hatch Covers** Steel weathertight hatch covers are to comply with the following **(1)** to **(5)**: (1) The depth of steel weathertight covers at the supports is not to be less than one-third the depth at the mid-point or 150 mm, whichever is greater.	(Deleted)
(Deleted)	(2) The scantlings and construction of small or special types of steel weathertight covers to which the requirements in **14.1.3**, **14.1.4** and **(1)** are not applicable and covers for hatchways that need no coaming under the requirements of **14.1.2.1** will be specially considered by the Society.	(Deleted)

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
(Deleted)	(3) The means for securing and maintaining weathertightness are to comply with the following **(a)** to **(g)**: However, Special consideration is to be given to the gasket and securing arrangements in ships with large relative movements between the cover and ship structure or between cover elements. Arrangements are to ensure that weathertightness can be maintained in any sea condition.	(Deleted)
(Deleted)	(a) The weight of covers and any cargo stowed thereon are to be transmitted to the ship structure through steel to steel contact.	(Deleted)
(Deleted)	(b) Gaskets and compression flat bars or angles which are arranged between covers and the ship structure and cross-joint elements are to be in compliance with the following i) to iii): i) Compression bars or angles are to be well rounded where in contact with the gaskets and are to be made of corrosion-resistant materials. ii) The gaskets are to be of relatively soft elastic materials. The material is to be of a quality suitable for all environmental conditions likely to be experienced by the ship, and is to be compatible with the cargoes carried. iii) A continuous gasket is to be effectively secured to the cover. The material and form of gasket selected are to be considered in conjunction with the type of cover, the securing arrangement and the expected relative movement between the cover and ship structure.	(Deleted)

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
(Deleted)	(c) Securing devices attached to hatchway coamings, decks or covers are to be in compliance with the following **(i)** to **(vi)**: i) Arrangement and spacing of securing devices are to be determined with due attention to the effectiveness for weathertightness, depending upon the type and the size of hatch cover as well as to the stiffness of the cover edges between the securing devices. ii) The gross sectional area of each securing device is not to be less than that obtained from the following formula. However, rods or bolts are to have a net diameter not less than 19 *mm* for hatchways exceeding 5 m^2 in area. $A = 1.4\bar{a}/f$ (cm^2) $\bar{a}$: Half the distance (*m*) between two adjacent securing devices, measured along the hatch cover periphery (*See* **Fig. 14.1.5-1**). f: As obtained from the following formula $f = (\sigma_Y/235)^e$ σ_Y: Minimum upper yield stress (N/mm^2) of the steel used for fabrication, but not to be taken greater than 70% of the ultimate tensile strength e: Coefficient determining according to the value of σ_Y, as follows. For $\sigma_Y \leq 235$ N/mm^2: 1.0 For $\sigma_Y > 235$ N/mm^2: 0.75 iii) If the packing line pressure exceeds 5 *N/mm*, the sectional area of bolts and rods used in the securing arrangement is to be equal to, or greater	(Deleted)

Amended	Original	Remarks
	than, the value obtained by multiplying the formula in **ii)** by the ratio of the line pressure acting on the value obtained and 5 *N/mm*. iv) Individual securing devices on each cover are to have approximately the same stiffness characteristics. v) Where rod cleats are fitted, resilient washers or cushions are to be incorporated. vi) Where hydraulic cleating is adopted, a positive means is to be provided to ensure that it remains mechanically locked in the closed position in the event of failure of the hydraulic system.	
(Deleted)	(d) The moment of inertia of the edge elements of hatch covers is not to be less than that obtained from the following formula: $I = 6pa^4$ (cm^4) a: Maximum of the distance (m), between two consecutive securing devices, measured along the hatch cover periphery, not to be taken as less than $2.5a_c$. $a_c: max(a_{1,1}, a_{1,2})$ (m) (*See* **Fig. 14.1.5-1**) p: As specified in **4.8.2.6**. When calculating the actual gross moment of inertia of edge elements, the effective breadth of the attached plating of hatch covers is to be taken as equal to the lesser of the following values: i) $0.165a$ ii) Half the distance between the edge element and the adjacent primary member	(Deleted)

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

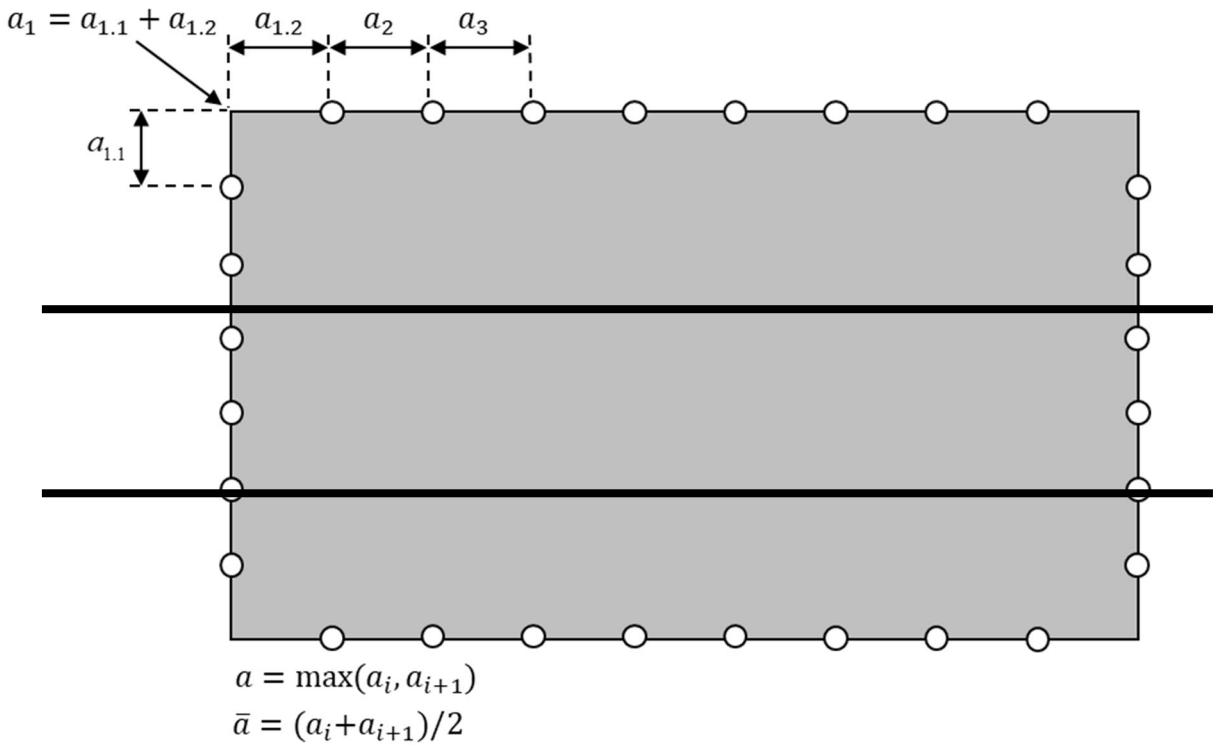
Amended	Original	Remarks
(Deleted)	(e) The cross-section of the shaped steel or rubber seal supporting member is to be of sufficient size, and is to connect to both ends of the hatch cover so as to ensure linear contact while maintaining a uniform pressure across the entire circumference of the hatch cover.	(Deleted)
(Deleted)	(f) A drainage arrangement equivalent to the standards specified in the following **i)** to **iv)** are to be provided. i) Drainage is to be arranged inside the line of gaskets by means of a gutter bar or vertical extension of the hatch side and end coaming. If an application is made by the owner of a container carrier and the Society deems it to be appropriate, special consideration will be given to this requirement. ii) Drain openings are to be arranged at the ends of drain channels and are to be provided with effective means such as non-return valves or the equivalent for preventing the ingress of water from outside. iii) Cross-joints of multi-panel covers are to be arranged with a drainage channel for water from space above the gasket and a drainage channel below the gasket. iv) If a continuous outer steel contact between cover and ship structure is arranged, drainage from the space between the steel contact and the gasket is also to be provided for.	(Deleted)

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
(Deleted)	(g) It is recommended that ships with steel weathertight covers are supplied with an operation and maintenance manual which includes the following **i)** to **v)**: i) Opening and closing instructions ii) Maintenance requirements for packing, securing devices and operating items iii) Cleaning instructions for drainage systems iv) Corrosion prevention instructions v) List of spare parts	(Deleted)
(Deleted)	(4) In addition to the **(3)** above, hatch covers carrying deck cargoes are to be in compliance with the following **(a)** to **(e)**. (a) Hatch covers carrying deck cargoes are to be effectively secured against the horizontal and vertical forces arising from ship motion. (b) To prevent damage to hatch covers and the ship structure, the location of stoppers is to be compatible with the relative movements between hatch covers and the ship structure. (c) Hatch covers and supporting structures are to be adequately stiffened to accommodate the load from hatch covers. (d) At the cross-joints of multi-panel covers, vertical guides (male/female) are to be fitted to prevent excessive relative vertical deflections between loaded/unloaded panels. (e) The construction and scantlings of hatchways on exposed parts are to comply with the following requirements in addition to those of **14.1.3** and **14.1.4**. i) The loading arrangement is to be clearly shown in drawings submitted for approval. In the case of	(Deleted)

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
	freight containers, the type and location are to be additionally described. ii) Girders or stiffeners are to be provided for reinforcement beneath the corner fittings of freight containers iii) The top plates of hatch covers, upon which wheeled vehicles are loaded, are to comply with **10.1, Part 2-6.**	
(Deleted)	(5) For steel weathertight hatch covers, effective means for stoppers complying with the requirements in **Table 14.1.5-1** against the horizontal green sea forces acting on them are to be provided.	(Deleted)

Amended	Original	Remarks
~~Fig. 14.1.5-1 Distance between Securing Devices, Measured Along Hatch Cover Periphery~~  		(Deleted)
~~Table 14.1.5-1 Strength Requirements for Stoppers~~ ~~Design pressure~~ | ~~As specified in 4.8.2.7.~~ ~~Allowable equivalent stress~~ | ~~In stoppers, their supporting structures and the stopper welds (calculated at the throat of welds), the equivalent stress is not to exceed the allowable value of 0.8 times the yield stress of the material.~~		(Deleted)

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
(Deleted)	**14.1.6 Tarpaulins and Securing Arrangements for Hatchways Closed by Portable Covers** **14.1.6.1** Tarpaulins and securing arrangements for hatchways closed by portable covers are to be in accordance with **14.6.8, Part 1**.	(Deleted)
(Deleted)	**14.1.7 Steel Hatchway Covers of Ballast Holds** **14.1.7.1** Scantlings of steel hatch covers or similar covers provided on exposed upper decks and hatch coaming in way of cargo holds used as deep water ballast tanks are to comply with the requirement in **14.6.13, Part 1**.	(Deleted)
Part 2-3 ORE CARRIERS **Chapter 3 STRUCTURAL DESIGN PRINCIPLES** **3.1 (Deleted)**	**Part 2-3 ORE CARRIERS** **Chapter 3 STRUCTURAL DESIGN PRINCIPLES** **3.1 Net Scantling Approach** **3.1.1 Corrosion Addition** **3.1.1.1 Hatch Cover and Hatch Coaming** The corrosion addition on both sides of the hatch cover and hatch coaming of the ore carriers which is subject to **Part 2-3**, is to be in accordance with **Table 3.1.1-1** specified in **3.1.1, Part 2-2** instead of **Table 3.3.4-2** specified in **3.3.4, Part 1**.	Left as "3.1 (Deleted)"

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
Chapter 4 LOADS (Deleted)	**Chapter 4 LOADS** **4.5 Loads to be Considered in Equipment** **4.5.1 General** **4.5.1.1 General** Loads to be considered in hatch covers and other equipment as specified in **14.1** are to be in accordance with the requirements of **4.8, Part 2-2**, instead of **4.10, Part 1**. However, the relevant requirements in **Part CSR-B&T** may be applied where deemed appropriate by the Society.	(Deleted)
Chapter 11 STRUCTURES OUTSIDE THE CARGO REGION **11.1 Superstructures** **11.1.1 Forecastles** **11.1.1.1** **1** Bulk Carriers defined in **1.3.1 (13), Part B**, are to be provided with forecastles in accordance with the following **(1)** to **(5)**. However, the forecastle deck arrangements of ships for which the application of this requirement is, for some reason, difficult are to be at the direction of the Society. ((1) to (3) are omitted.) (4) To reduce the load on the hatch coaming of the foremost cargo hold specified in **4.10.2.2-2, Part 1** and/or the pressure applying abaft on the forward transverse hatch cover	**Chapter 11 STRUCTURES OUTSIDE THE CARGO REGION** **11.1 Superstructures** **11.1.1 Forecastles** **11.1.1.1** **1** Bulk Carriers defined in **1.3.1 (13), Part B**, are to be provided with forecastles in accordance with the following **(1)** to **(5)**. However, the forecastle deck arrangements of ships for which the application of this requirement is, for some reason, difficult are to be at the direction of the Society. ((1) to (3) are omitted.) (4) To reduce the load on the hatch coaming of the foremost cargo hold specified in **4.8.2.5, Part 2-2** and/or the pressure applying abaft on the forward transverse hatch cover	

Amended	Original	Remarks
specified in **4.10.6, Part 1**, the horizontal distance ℓ_F (m) from the hatch coaming to all points of the aft edge of the forecastle deck is to satisfy the following formula. $\ell_F \leq 5\sqrt{H_F - H_C}$ H_F and H_C: As specified in **(3)** above. (5) A breakwater is not to be fitted on the forecastle deck with the purpose of protecting the hatch coaming or hatch covers. If fitted for other purposes, it is to be located such that its aft edge at the centre line is forward of the aft edge of the forecastle deck a horizontal distance ℓ_w (m) satisfying the following formula: $\ell_w \geq H_B/\tan 20^\circ$ H_B: Height of the breakwater above the forecastle (m)	specified in **4.8.2.7, Part 2-2**, the horizontal distance ℓ_F (m) from the hatch coaming to all points of the aft edge of the forecastle deck is to satisfy the following formula. $\ell_F \leq 5\sqrt{H_F - H_C}$ H_F and H_C: As specified in **(3)** above. (5) A breakwater is not to be fitted on the forecastle deck with the purpose of protecting the hatch coaming or hatch covers. If fitted for other purposes, it is to be located such that its aft edge at the centre line is forward of the aft edge of the forecastle deck a horizontal distance ℓ_w (m) satisfying the following formula: $\ell_w \geq H_B/\tan 20^\circ$ H_B: Height of the breakwater above the forecastle (m)	
(Deleted)	**Chapter 14 EQUIPMENT** **14.1 Hatch Covers** **14.1.1 Application** **14.1.1.1 General** The construction and the means for closing of cargo and other hatchways are to be in accordance with the requirements in **14.1, Part 2-2.**	(Deleted)

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
Part 2-5 GENERAL CARGO SHIPS AND REFRIGERATED CARGO SHIPS **Chapter 3 STRUCTURAL DESIGN PRINCIPLES** **3.1 （Deleted）**	**Part 2-5 GENERAL CARGO SHIPS AND REFRIGERATED CARGO SHIPS** **Chapter 3 STRUCTURAL DESIGN PRINCIPLES** **3.1 Net Scantling Approach** **3.1.1 Corrosion Additions** **3.1.1.1 Hatch Cover and Hatch Coaming** Corrosion additions for both sides of the hatch covers and the hatch coamings of the self-unloading ships defined in **1.3.1 (19), Part B** that are subject to this part are to be in accordance with **Table 3.1.1-1** in **3.1.1, Part 2-2** instead of **Table 3.3.4-2** in **3.3.4, Part 1.**	Left as "3.1 (Deleted)"
Chapter 10 ADDITIONAL STRUCTURAL REQUIREMENTS **10.5 Additional Requirements for Self-Unloading Ships** **10.5.1 General** **10.5.1.1 Application** Self-unloading ships specified in **1.3.1(19), Part B** are to be in accordance with the following **(1)** to **(3)**. (1) **14.6, Part 1, 3.2** and **11.1, Part 2-3**, are to be applied. (2) The side frames of self-unloading ships with single-side structures in cargo hold areas are to comply with *IACS* Unified Requirement S12, as may be amended.	**Chapter 10 ADDITIONAL STRUCTURAL REQUIREMENTS** **10.5 Additional Requirements for Self-Unloading Ships** **10.5.1 General** **10.5.1.1 Application** Self-unloading ships specified in **1.3.1(19), Part B** are to be in accordance with the following **(1)** to **(3)**. (1) **14.1, Part 2-2, 3.2** and **11.1, Part 2-3**, are to be applied. (2) The side frames of self-unloading ships with single-side structures in cargo hold areas are to comply with *IACS* Unified Requirement S12, as may be amended.	

Amended	Original	Remarks
(3) For self-unloading ships to which **Annex 1.1 "Additional Requirements for Bulk Carriers in Chapter XII of the SOLAS Convention", Chapter 1, Part 2-2** applies according to **1.1.1.2**, regardless of **Annexes A3** and **A5** when applying said **Annex 1.1**, in cases where self-unloading ships with unloading systems that do not maintain watertightness, the combination loads acting on the bulkheads in the flooded conditions are to be considered using the extent to which the flooding may occur.	(3) For self-unloading ships to which **Annex 1.1 "Additional Requirements for Bulk Carriers in Chapter XII of the SOLAS Convention", Chapter 1, Part 2-2** applies according to **1.1.1.2**, regardless of **Annexes A3** and **A5** when applying said **Annex 1.1**, in cases where self-unloading ships with unloading systems that do not maintain watertightness, the combination loads acting on the bulkheads in the flooded conditions are to be considered using the extent to which the flooding may occur.	
EFFECTIVE DATE AND APPLICATION **1.** The effective date of the amendments is 1 July 2024. **2.** Notwithstanding the amendments to the Rules, the current requirements apply to ships for which the date of contract for construction* is before the effective date. **3.** For ships subject to Part C of the Rules for the Survey and Construction of Steel Ships and the Guidance for the Survey and Construction of Steel Ships prior to its comprehensive revision by Rule No.62 on 1 July 2022 and Notice No.47 on 1 July 2022 (herein after referred to as "old Part C of the Rules" and "old Part C of the Guidance"), and which the date of contract for construction* is on and after the effective date, this amendment also applies to following requirements. Chapter 20, old Part C of the Rules C20, old Part C of the Guidance * "contract for construction" is defined in the latest version of IACS Procedural Requirement (PR) No.29.		

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
IACS PR No.29 (Rev.0, July 2009) **1.** The date of "contract for construction" of a vessel is the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. This date and the construction numbers (i.e. hull numbers) of all the vessels included in the contract are to be declared to the classification society by the party applying for the assignment of class to a newbuilding. **2.** The date of "contract for construction" of a series of vessels, including specified optional vessels for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective owner and the shipbuilder. For the purpose of this Procedural Requirement, vessels built under a single contract for construction are considered a "series of vessels" if they are built to the same approved plans for classification purposes. However, vessels within a series may have design alterations from the original design provided: (1) such alterations do not affect matters related to classification, or (2) If the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the shipbuilder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval. The optional vessels will be considered part of the same series of vessels if the option is exercised not later than 1 year after the contract to build the series was signed. **3.** If a contract for construction is later amended to include additional vessels or additional options, the date of "contract for construction" for such vessels is the date on which the amendment to the contract, is signed between the prospective owner and the shipbuilder. The amendment to the contract is to be considered as a "new contract" to which **1.** and **2.** above apply. **4.** If a contract for construction is amended to change the ship type, the date of "contract for construction" of this modified vessel, or vessels, is the date on which revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder. Note: This Procedural Requirement applies from 1 July 2009.		

Amended	Original	Remarks
RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS **Part CS HULL CONSTRUCTION AND EQUIPMENT OF SMALL SHIPS** **Chapter 19 HATCHWAYS, MACHINERY SPACE OPENINGS AND OTHER DECK OPENINGS**		
19.1 General **19.1.3 Definitions** The terms used in **19.2** are defined as follows. (1) "Type 1 ship" means any ship other than "Type 2 ship". (2) "Type 2 ship" means ore carriers and combination carriers designed to carry either oil or solid cargoes in bulk(e.g. ore/oil carriers) defined in **1.3.1(13), Part B** (excluding those affixed with the notation "*CSR*"), and self-unloading ships defined in **1.3.1(19), Part B**.	**19.1 General** (Newly added)	UR S21 1.1 (Newly added)
19.2 Hatchways **19.2.1 Application*** **1** The construction and the means for closing of cargo and other hatchways on exposed decks are to comply with the requirements in **19.2**. **2** When the loading condition or the type of construction differs	**19.2 Hatchways** **19.2.1 Application*** **1** The construction and the means for closing of cargo and other hatchways are to comply with the requirements in **19.2**. **2** Notwithstanding the provisions in this paragraph, the construction and means for closing of cargo and other hatchways of bulk carriers defined in **1.3.1(13)** of **Part B**, self-unloading ships defined in **1.3.1(19)** of **Part B** and ships intended to be registered as "bulk carriers" are to be at the discretion of the Society. **3** When the loading condition or the type of construction	UR S21 1.1

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
from that specified in this section, the calculation method used is to be as deemed appropriate by the Society. **3** Hatch covers and hatch coamings on non-exposed decks of ships and those of fishing vessels are to be as deemed appropriate by the Society.	differs from that specified in this section, the calculation method used is to be as deemed appropriate by the Society. (Newly added)	(Newly added)
19.2.2 General Requirement **1** Primary supporting members and stiffeners of hatch covers are to be continuous over the breadth and length of hatch covers. When this is impractical, appropriate arrangements are to be adopted to ensure sufficient load carrying capacity and sniped end connections are not to be allowed. **2** The spacing of primary supporting members parallel to the direction of stiffeners is not to exceed 1/3 of the span of the primary supporting members. **3** Stiffeners of hatch coamings are to be continuous as far as practical over the breadth and length of said hatch coamings.	**19.2.2 General Requirement** **1** Primary supporting members and secondary stiffeners of hatch covers are to be continuous over the breadth and length of hatch covers. When this is impractical, appropriate arrangements are to be adopted to ensure sufficient load carrying capacity and sniped end connections are not to be allowed. **2** The spacing of primary supporting members parallel to the direction of secondary stiffeners is not to exceed 1/3 of the span of the primary supporting members. **3** Secondary stiffeners of hatch coamings are to be continuous over the breadth and length of said hatch coamings.	UR S21 1.4
19.2.3 Net Scantling Approach (Omitted.) **5** Strength calculations using FEM are to be performed with net scantlings.	**19.2.3 Net Scantling Approach** (Omitted.) **5** Strength calculations using grillage analysis or FEM are to be performed with net scantlings.	UR S21 1.5

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks

~~Table CS19.1 Corrosion Additions~~

~~Type of ship~~	~~Type of structural member~~		~~Corrosion addition t_c (mm)~~
~~Container carriers and car carriers~~	~~Steel hatch covers~~		~~1.0~~
	~~Hatchway coamings~~		~~1.5~~
~~Ships other than those specified above and subject to the application of this section~~	~~Single plating type hatch cover~~		~~2.0~~
	~~Double plating type hatch cover~~	~~Top, side and bottom plating~~	~~1.5~~
		~~Internal structures~~	~~1.0~~
	~~Hatchway coamings, hatch coaming stays and stiffeners~~		~~1.5~~

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Table CS19.1 Corrosion Additions t_c

Type	Ship type	Framing system		t_c (mm)
Type 1 ship	Ships other than the below	Single skin hatch covers		2.0
		Double skin hatch covers	Top, side and bottom plating	1.5
			Internal structural members	1.0
		Hatch coamings, hatch coaming stays and stiffeners		1.5
	Container carrier Car carrier	Hatch covers (in general)		1.0
		Hatch coamings		1.5
Type 2 ship	Ore carrier Combination carriers which are designed to carry either oil or solid cargoes in bulk, like ore/oil carriers. Self-unloading ships (Ships specified in **1.3.1(13), Part B**(excluding those affixed with the notation "*CSR*") and **(19)**)	Single skin hatch covers		2.0
		Double skin hatch covers	Top, side and bottom plating	2.0
			Internal structural members	1.5
		Hatch coamings, hatch coaming stays and stiffeners		1.5

Notes
(1) Corrosion additions for both sides of hatch covers and hatch coamings on non-exposed decks are to be as deemed appropriate by the Society.
(2) The definitions of Type 1 ship and Type 2 ship are given **19.1.3**.

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
19.2.4 Design Load for Steel Hatch Covers, Portable Beams and Hatchway Coamings The design loads for steel hatchway covers, steel pontoon covers, steel weathertight covers, portable beams and hatchway coamings applying the requirements in **19.2** are specified in following **(1)** to **(5)**: (1) Design vertical wave load $P_{\underline{HC}}$ (kN/m^2) is not to be less than that obtained from **Table CS19.2**. Design vertical wave loads need not to be combined with cargo loads according to **(3)** and **(4)** simultaneously.	**19.2.4 Design Load for Steel Hatch Covers, Portable Beams and Hatchway Coamings** The design loads for steel hatchway covers, steel pontoon covers, steel weathertight covers, portable beams and hatchway coamings applying the requirements in **19.2** are specified in following **(1)** to **(5)**: (1) Design vertical wave load $P_{\underline{V}}$ (kN/m^2) is not to be less than that obtained from **Table CS19.2**. Design vertical wave loads need not to be combined with cargo loads according to **(3)** and **(4)** simultaneously.	UR S21 2.1

Amended	Original	Remarks

Table CS19.2 Design Vertical Wave Load $P_{\underline{HC}}$ (*1) (*2) (kN/m^2)

		$P_{\underline{HC}}$ (kN/m^2)
Position I	For 0.25 L_f forward	$\frac{9.81}{76}\left\{\left(4.28L_f + 28\right)\frac{x}{L_f} - 1.71L_f + 95\right\}$ (*3)
	Elsewhere	$\frac{9.81}{76}\left(1.5L_f + 116\right)$
Position II		$\frac{9.81}{76}\left(1.1L_f + 87.6\right)$

Notes:

(*1) L_f: length of ship for freeboard defined in **2.1.3**, **Part A** of the Rules (m)
x: distance of the mid length of the hatch cover under examination from the aft end of L_f (m)

(*2) For exposed hatchways in positions other than Position I or II, the value of each design wave load will be specially considered.

(*3) Where a Position I hatchway is located at least one superstructure standard height higher than the freeboard deck, P_I may be taken as $\frac{9.81}{76}\left(1.5L_f + 116\right)$ (kN/m^2).

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(2) Design horizontal wave load $P_{\underline{A}}$ (kN/m^2) is not to be less than that obtained from the following formulae. However, $P_{\underline{A}}$ is not to be taken less than the minimum values given in **Table CS19.3**. $P_{\underline{A}}$ need not be included in the direct strength calculation of the hatch cover, expect where structures supporting stoppers are assessed.

$P_{\underline{A}} = \underline{f_n f_c}\left[\underline{f_b} C_1 - \mathrm{y}\right]$

$\underline{f_n}$: As given by the following:

$20 + \frac{L'}{12}$ for unprotected front coamings and hatch cover skirt plates

$10 + \frac{L'}{12}$ for unprotected front coamings and hatch cover skirt plates, where the

(2) Design horizontal wave load $P_{\underline{H}}$ (kN/m^2) is not to be less than that obtained from the following formulae. However, $P_{\underline{H}}$ is not to be taken less than the minimum values given in **Table CS19.3**. $P_{\underline{H}}$ need not be included in the direct strength calculation of the hatch cover, expect where structures supporting stoppers are assessed.

$P_{\underline{H}} = \underline{ac}(\underline{b} C_1 - y)$

$\underline{a}$: As given by the following:

$20 + \frac{L'}{12}$ for unprotected front coamings and hatch cover skirt plates

$10 + \frac{L'}{12}$ for unprotected front coamings and hatch cover skirt plates, where the distance from the actual freeboard deck

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Amended	Original	Remarks
distance from the actual freeboard deck to the summer load line exceeds the minimum non-corrected tabular freeboard according to the ILCC by at least one superstructure standard height $5 + \frac{L'}{15}$ for side and protected front coamings and hatch cover skirt plates $7 + \frac{L'}{100} - 8\frac{x}{L_1}$ for aft ends of coamings and aft hatch cover skirt plates abaft amidships $5 + \frac{L'}{100} - 4\frac{x}{L_1}$ for aft ends of coamings and aft hatch cover skirt plates forward of amidships L': Length of ship L_1 (m) L_1: Distance (m) measured on the waterline at the scantling draught d_S from the forward side of the stem to the centre of the rudder stock. L_1 is to be not less than 96% and need not exceed 97% of the extreme length on the waterline at the scantling draught d_S. In ships without rudder stocks (e.g. ships fitted with azimuth thrusters), the Rule length L_1 is to be taken equal to 97% of the extreme length on the waterline at the scantling draught d_S. d_S: Scantling draught (m) at which the strength requirements for the scantlings of the ship are met and represents the full load condition; it is to be not less than that corresponding to the assigned freeboard. C_1: As given by the following formula: $C_1 = 10.75 - \left(\frac{300 - L_1}{100}\right)^{1.5}$	to the summer load line exceeds the minimum non-corrected tabular freeboard according to the ILCC by at least one superstructure standard height $5 + \frac{L'}{15}$ for side and protected front coamings and hatch cover skirt plates $7 + \frac{L'}{100} - 8\frac{x}{L_1}$ for aft ends of coamings and aft hatch cover skirt plates abaft amidships $5 + \frac{L'}{100} - 4\frac{x}{L_1}$ for aft ends of coamings and aft hatch cover skirt plates forward of amidships L': Length of ship L_1 (m) L_1: Distance (m) measured on the waterline at the scantling draught d_S from the forward side of the stem to the centre of the rudder stock. L_1 is to be not less than 96% and need not exceed 97% of the extreme length on the waterline at the scantling draught d_S. In ships without rudder stocks (e.g. ships fitted with azimuth thrusters), the Rule length L_1 is to be taken equal to 97% of the extreme length on the waterline at the scantling draught d_S. d_S: Scantling draught (m) at which the strength requirements for the scantlings of the ship are met and represents the full load condition; it is to be not less than that corresponding to the assigned freeboard. C_1: As given by the following formula: $C_1 = 10.75 - \left(\frac{300 - L_1}{100}\right)^{1.5}$ c_L: Coefficient to be taken as 1.0	

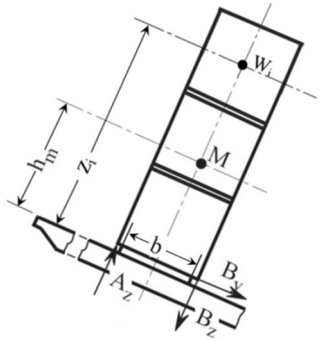
Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
c_L: Coefficient to be taken as 1.0 $\underline{f_b}$: As given by the following formulae: $1.0 + \left(\frac{0.45 - \frac{x}{L_1}}{C_{b1}+0.2}\right)^2$ for $\frac{x}{L_1} < 0.45$ $1.0 + 1.5\left(\frac{\frac{x}{L_1} - 0.45}{C_{b1}+0.2}\right)^2$ for $\frac{x}{L_1} \geq 0.45$ x: Distance (m) from the hatchway coamings or hatch cover skirt plates to after perpendicular, or distance from mid-point of the side hatchway coaming or hatch cover skirt plates to after perpendicular. However, where the length of the side hatchway coaming or hatch cover skirt plates exceeds 0.15 L_1, the side hatchway coaming or hatch cover skirt plates are to be equally subdivided into spans not exceeding 0.15 L_1 and the distance from the mid-point of the subdivisions to the after perpendicular is to be taken. C_{b1}: Block coefficient. However, where C_b is 0.6 or under, C_{b1} is to be taken as 0.6 and where C_b is 0.8 and over, C_{b1} is to be taken as 0.8. When determining scantlings of the aft ends of coamings and aft hatch cover skirt plates forward of amidships, C_{b1} does not need to be taken as less than 0.8. $\underline{f_c}$: As given by the following formula. However, where $\frac{b'}{B'}$ is less than 0.25, $\frac{b'}{B'}$ is to be taken as 0.25. $0.3 + 0.7\frac{b'}{B'}$ b': Breadth (m) of hatchway coamings at the position under consideration	$\underline{b}$: As given by the following formulae: $1.0 + \left(\frac{0.45 - \frac{x}{L_1}}{C_{b1}+0.2}\right)^2$ for $\frac{x}{L_1} < 0.45$ $1.0 + 1.5\left(\frac{\frac{x}{L_1} - 0.45}{C_{b1}+0.2}\right)^2$ for $\frac{x}{L_1} \geq 0.45$ x: Distance (m) from the hatchway coamings or hatch cover skirt plates to after perpendicular, or distance from mid-point of the side hatchway coaming or hatch cover skirt plates to after perpendicular. However, where the length of the side hatchway coaming or hatch cover skirt plates exceeds 0.15 L_1, the side hatchway coaming or hatch cover skirt plates are to be equally subdivided into spans not exceeding 0.15 L_1 and the distance from the mid-point of the subdivisions to the after perpendicular is to be taken. C_{b1}: Block coefficient. However, where C_b is 0.6 or under, C_{b1} is to be taken as 0.6 and where C_b is 0.8 and over, C_{b1} is to be taken as 0.8. When determining scantlings of the aft ends of coamings and aft hatch cover skirt plates forward of amidships, C_{b1} does not need to be taken as less than 0.8. $\underline{c}$: As given by the following formula. However, where $\frac{b'}{B'}$ is less than 0.25, $\frac{b'}{B'}$ is to be taken as 0.25. $0.3 + 0.7\frac{b'}{B'}$ b': Breadth (m) of hatchway coamings at the position under consideration B': Breadth (m) of ship on the exposed weather deck at the position under consideration	

Amended	Original	Remarks
B': Breadth (m) of ship on the exposed weather deck at the position under consideration y: Vertical distance (m) from the designed maximum load line to the mid-point of the span of stiffeners when determining the scantlings of stiffeners and to the mid-point of the plating when determining the thickness of plating	y: Vertical distance (m) from the designed maximum load line to the mid-point of the span of stiffeners when determining the scantlings of stiffeners and to the mid-point of the plating when determining the thickness of plating	
Table CS19.3 Minimum Value of $P_{\underline{HA}}$ (kN/m^2) Unprotected front coamings and hatch cover skirt plates: $25 + \frac{L_1}{10}$ others: $12.5 + \frac{L_1}{20}$		
(3) The load on hatch covers due to cargo loaded on said covers is to be obtained from the following **(a)** and **(b)**. Load cases with partial loading are also to be considered. (a) Distributed load due to cargo load $P_{\underline{L}}$ (kN/m^2) resulting from heave and pitch (i.e., ship in upright condition) is to be determined according to the following formula: $P_{\underline{L}} = P_{\underline{Cargo}}(1 + a_V)$ $P_{\underline{Cargo}}$: Static uniform cargo load (kN/m^2) av: Vertical acceleration addition given by the following formula: $a_V = \frac{0.11mV'}{\sqrt{L_1}}$ m: As given by the following formulae:	(3) The load on hatch covers due to cargo loaded on said covers is to be obtained from the following **(a)** and **(b)**. Load cases with partial loading are also to be considered. (a) Distributed load due to cargo load $P_{\underline{cargo}}$ (kN/m^2) resulting from heave and pitch (i.e., ship in upright condition) is to be determined according to the following formula: $P_{\underline{cargo}} = P_{\underline{C}}(1 + a_V)$ $P_{\underline{C}}$: Static uniform cargo load (kN/m^2) av: Vertical acceleration addition given by the following formula: $a_V = \frac{0.11mV'}{\sqrt{L_1}}$ m: As given by the following formulae:	UR S21 2.3

Amended	Original	Remarks
$m_0 - 5(m_0 - 1)\frac{x}{L_1}$ for $0 \le \frac{x}{L_1} \le 0.2$ 1.0 for $0.2 < \frac{x}{L_1} \le 0.7$ $1 + \frac{m_0+1}{0.3}\left(\frac{x}{L_1} - 0.7\right)$ for $0.7 < \frac{x}{L_1} \le 1.0$ m_0: As given by the following formula: $m_0 = 1.5 + \frac{0.11V'}{\sqrt{L_1}}$ V': Speed of ship (*knots*) specified in **2.1.8, Part A**. However, where V' is less than $\sqrt{L_1}$, V' is to be taken as $\sqrt{L_1}$. x and L_1: As specified in **(2)** above (b) Point load $\underline{P}$ (*kN*) due to a single force resulting from heave and pitch (i.e., ship in upright condition) is to be determined by the following formula. However, container loads are to comply with the provisions of **(4)** below. $\underline{P} = \underline{P_S}(1 + a_V)$ $\underline{P_S}$: Static point load due to cargo (*kN*) a_V: As specified in **(a)** above	$m_0 - 5(m_0 - 1)\frac{x}{L_1}$ for $0 \le \frac{x}{L_1} \le 0.2$ 1.0 for $0.2 < \frac{x}{L_1} \le 0.7$ $1 + \frac{m_0+1}{0.3}\left(\frac{x}{L_1} - 0.7\right)$ for $0.7 < \frac{x}{L_1} \le 1.0$ m_0: As given by the following formula: $m_0 = 1.5 + \frac{0.11V'}{\sqrt{L_1}}$ V': Speed of ship (*knots*) specified in **2.1.8, Part A**. However, where V' is less than $\sqrt{L_1}$, V' is to be taken as $\sqrt{L_1}$. x and L_1: As specified in **(2)** above (b) Point load $\underline{F_{cargo}}$ (*kN*) due to a single force resulting from heave and pitch (i.e., ship in upright condition) is to be determined by the following formula. However, container loads are to comply with the provisions of **(4)** below. $\underline{F_{cargo}} = \underline{F_S}(1 + a_V)$ $\underline{F_S}$: Static point load due to cargo (*kN*) a_V: As specified in **(a)** above	
(4) Where containers are stowed on hatch covers, cargo loads determined by following **(a)** to **(c)** are to be considered: (a) Cargo loads (*kN*), acting on each corner of a container stack, due to heave, pitch and roll motion of the ship (i.e., ship in heel condition) are to be determined by the following formulae (see **Fig. CS19.1**). When the load case of a partially loaded container is considered, the	(4) Where containers are stowed on hatch covers, cargo loads determined by following **(a)** to **(c)** are to be considered: (a) Cargo loads (*kN*), acting on each corner of a container stack, due to heave, pitch and roll motion of the ship (i.e., ship in heel condition) are to be determined by the following formulae (see **Fig. CS19.1**). When the load case of a partially loaded container is considered, the	UR S21 2.4.3

Amended	Original	Remarks
cargo load is at the discretion of the Society. $A_Z = 9.81\frac{M}{2}(1+a_V)\left(0.45-0.42\frac{h_m}{b}\right)$ $B_Z = 9.81\frac{M}{2}(1+a_V)\left(0.45+0.42\frac{h_m}{b}\right)$ $B_Y = 2.4M$ M: Maximum designed mass of container stack (t) $M = \sum W_i$ h_m: Design height of the centre of gravity of the stack above hatch cover top plates (m) may be calculated as the weighted mean value of the stack, where the centre of gravity of each tier is assumed to be located at the centre of each container. $h_m = \sum \frac{(z_i W_i)}{M}$ z_i: Distance from hatch cover top plate to the centre of ith container (m) W_i: Weight of ith container (t) b: Distance between midpoints of foot points (m) A_Z and B_Z: Support forces in vertical direction at the forward and aft stack corners (kN) B_Y: Support force in transverse direction at the forward and aft stack corners (kN) a_V: As specified in **(3)** above	cargo load is at the discretion of the Society. $A_Z = 9.81\frac{M}{2}(1+a_V)\left(0.45-0.42\frac{h_m}{b}\right)$ $B_Z = 9.81\frac{M}{2}(1+a_V)\left(0.45+0.42\frac{h_m}{b}\right)$ $B_Y = 2.4M$ M: Maximum designed mass of container stack (t) $M = \sum W_i$ h_m: Design height of the centre of gravity of the stack above hatch cover top plates (m) may be calculated as the weighted mean value of the stack, where the centre of gravity of each tier is assumed to be located at the centre of each container. $h_m = \sum \frac{(z_i W_i)}{M}$ z_i: Distance from hatch cover top plate to the centre of ith container (m) W_i: Weight of ith container (t) b: Distance between midpoints of foot points (m) A_Z and B_Z: Support forces in vertical direction at the forward and aft stack corners (kN) B_Y: Support force in transverse direction at the forward and aft stack corners (kN) a_V: As specified in **(3)** above	

Amended	Original	Remarks
Fig. CS19.1 Forces due to Container Loads  		UR S21 Fig.3
(b) Details of the application of **(a)** above are to be in accordance with the following: i) The values of A_Z and B_Z applied for the assessment of hatch cover strength are to be shown in the drawings of the hatch covers. ii) It is recommended that container loads, as calculated in **(a)** above, be considered as the limit for foot point loads of container stacks in cargo securing (container lashing) calculations. (c) Stack load P_{stack} (*kN*), acting on each corner of a container stack, due to heave and pitch (i.e,. ship in upright condition) is to be determined by the following formula. $P_{stack} = 9.81\frac{M}{4}(1 + a_V)$	(b) Details of the application of **(a)** above are to be in accordance with the following: i) When the strength of a hatch cover structure is assessed by grillage analysis according to **19.2.5-5**, h_m and z_i need to be measured from the hatch cover supports, not hatch cover top plates. Force B_Y does not need to be considered in this case. ii) The values of A_Z and B_Z applied for the assessment of hatch cover strength are to be shown in the drawings of the hatch covers. iii) It is recommended that container loads, as calculated in **(a)** above, be considered as the limit for foot point loads of container stacks in cargo securing (container lashing) calculations. (c) Stack load P_{stack} (*kN*), acting on each corner of a container stack, due to heave and pitch (i.e,. ship in upright condition) is to be determined by the following formula. $P_{stack} = 9.81\frac{M}{4}(1 + a_V)$	UR S21 2.4.2 UR S21 2.4.3

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
a_V: As specified in **(3)** above M: As specified in **(a)** above	a_V: As specified in **(3)** above M: As specified in **(a)** above	
(5) The wave load P_{coam} to be considered in strength assessments of the hatch coaming of Type 2 ships is to be in accordance with the following **(a)** or **(b)**. (a) Front-end hatch coaming of the foremost cargo hold: 290 (kN/m^2) However, where a forecastle is installed in accordance with the requirements of **11.1, Part 2-3**, this value may be 220 kN/m^2. (b) Hatch coaming other than **(a)** above: 220 (kN/m^2)	(Newly added)	(Newly added) UR S21 2.2.2
(6) In addition to the loads specified in **(1)** to **(5)** above, when the load in the ship's transverse direction by forces due to elastic deformation of the ship's hull is acting on the hatch covers, the sum of stresses is to comply with the permissible values specified in **19.2.5-1(1)**.	(5) In addition to the loads specified in **(1)** to **(4)** above, when the load in the ship's transverse direction by forces due to elastic deformation of the ship's hull is acting on the hatch covers, the sum of stresses is to comply with the permissible values specified in **19.2.5-1(1)**.	UR S21 2.5
(7) The designed wave load $P_{stopper}$ to be considered in strength assessments of stoppers of Type 2 ships is to be in accordance with the following **(a)** or **(b)**. (a) Stoppers for the hatch cover to the foremost cargo hold i) Pressure acting in the direction of the stern on the front-end of the hatch cover: 230 (kN/m^2) However, where a forecastle is installed in accordance with the requirements of **11.1, Part 2-3**, this value may be 175 kN/m^2. ii) Pressure in the transverse direction of the ship: 175 kN/m^2	(Newly added)	(Newly added) UR S21 6.2.3

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
(b) Stoppers for hatch covers other than that specified in **(a)** above Pressure acting in the direction of the stern on the front-end of the hatch cover and pressure in the transverse direction the ship: 175 kN/m^2		

Amended	Original	Remarks
19.2.5 Strength Criteria of Steel Hatch Covers and Hatch Beams **1** Permissible stresses and deflections (1) All hatch cover structural members are to comply with the following formulae: $\sigma_{vm} \leq \sigma_a$ for shell elements in general. $\sigma_{axial} \leq \sigma_a$ for rod or beam elements in general. Where: σ_a: Allowable stress as defined in **Table CS19.4** σ_{vm} : Von Mises stress (N/mm^2) to be taken as follows: $\sigma_{vm} = \sqrt{\sigma_x{}^2 - \sigma_x\sigma_y + \sigma_y{}^2 + 3\tau_{xy}^2}$ σ_{axial}: Axial stress (N/mm^2) in rod or beam elements σ_x: Normal stress (N/mm^2) in the *x*-direction σ_y: Normal stress (N/mm^2) in the *y*-direction τ_{xy}: Shear stress (N/mm^2) in the *x*-*y* plane *x*, *y*: Coordinates of a two dimensional Cartesian system in the plane of the considered structural	**19.2.5 Strength Criteria of Steel Hatch Covers and Hatch Beams** **1** Permissible stresses and deflections (1) The equivalent stress σ_E (N/mm^2) in steel hatchway covers and steel weathertight covers are to be complied with the criteria as following **(a)** and **(b)**: (a) For grillage analysis: $\sigma_E = \sqrt{\sigma^2 + 3\tau^2} \leq 0.8\sigma_F$ σ: Nominal stress (N/mm^2) τ: Shear stress (N/mm^2) σ_F: Minimum upper yield stress (N/mm^2) or proof stress (N/mm^2) of the material. However, when material with a σ_F of more than 355 N/mm^2 is used, the value for σ_F is to be taken as deemed appropriate by the Society. (b) For FEM calculations, in cases where the calculations use shell or plane strain elements, the stresses are to be taken from the centre of the individual element. $\sigma_E = \sqrt{\sigma_x^2 - \sigma_x\sigma_y + \sigma_y^2 + 3\tau^2} \leq 0.8\sigma_F$ when assessed using the design load specified in **19.2.4(1)** $\sigma_E = \sqrt{\sigma_x^2 - \sigma_x\sigma_y + \sigma_y^2 + 3\tau^2} \leq 0.9\sigma_F$ when assessed using any other design loads σ_x: Normal stress (N/mm^2) in the *x*-direction σ_y: Normal stress (N/mm^2) in the *y*-direction τ: Shear stress (N/mm^2) in the *x*-*y* plane *x*, *y*: Coordinates of a two dimensional Cartesian system in the plane of the considered structural	UR S21 3.1.1

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td>element
σ_Y : Specified minimum yield stress (N/mm^2) of the material. However, when material with σ_Y of more than 355 N/mm^2 is used, the value for σ_Y is to be as deemed appropriate by the Society.</td><td>element
σ_F: As specified in (a) above</td><td></td></tr>
<tr><td colspan="2">Table CS19.4 Allowable Stresses
<table><tr><th>Members of</th><th>Subject to</th><th>σ_a (N/mm^2)</th></tr><tr><td rowspan="2">Hatch cover structure</td><td>External pressure, as defined in 19.2.4(1)</td><td>$0.80\sigma_Y$</td></tr><tr><td>Other loads, as defined in 19.2.4(2) to 19.2.4(5)</td><td>$0.90\sigma_Y$ for static+dynamic load case
$0.72\sigma_Y$ for static load case</td></tr></table></td><td>(Newly added)
UR S21 3.1.1</td></tr>
<tr><td>(2) The equivalent stress σ_{vm} (N/mm^2) in steel pontoon covers and hatch beams is not to be greater than $0.68\sigma_Y$, where σ_Y is as specified in (1) above.
(3) For FEM calculations, equivalent stress σ_{vm} (N/mm^2) in girders with unsymmetrical flanges of steel hatchway covers and steel weathertight covers is to be determined according to the following (a) or (b):
(a) FEM calculations using the stress obtained for fine mesh elements.
(b) FEM calculations using the stress at the edge of the element or the stress at the centre of the element, whichever is greater.
(Omitted)</td><td>(2) The equivalent stress σ_E (N/mm^2) in steel pontoon covers and hatch beams is not to be greater than $0.68\sigma_F$, where σ_F is as specified in (1) above.
(3) For FEM calculations, equivalent stress σ_E (N/mm^2) in girders with unsymmetrical flanges of steel hatchway covers and steel weathertight covers is to be determined according to the following (a) or (b):
(a) FEM calculations using the stress obtained for fine mesh elements.
(b) FEM calculations using the stress at the edge of the element or the stress at the centre of the element, whichever is greater.
(Omitted)</td><td>(2) International Convention on Load Lines, AnnexI ChapterII Reg.15(4)(6)
(3) UR S21 3.1.1</td></tr>
</table>

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

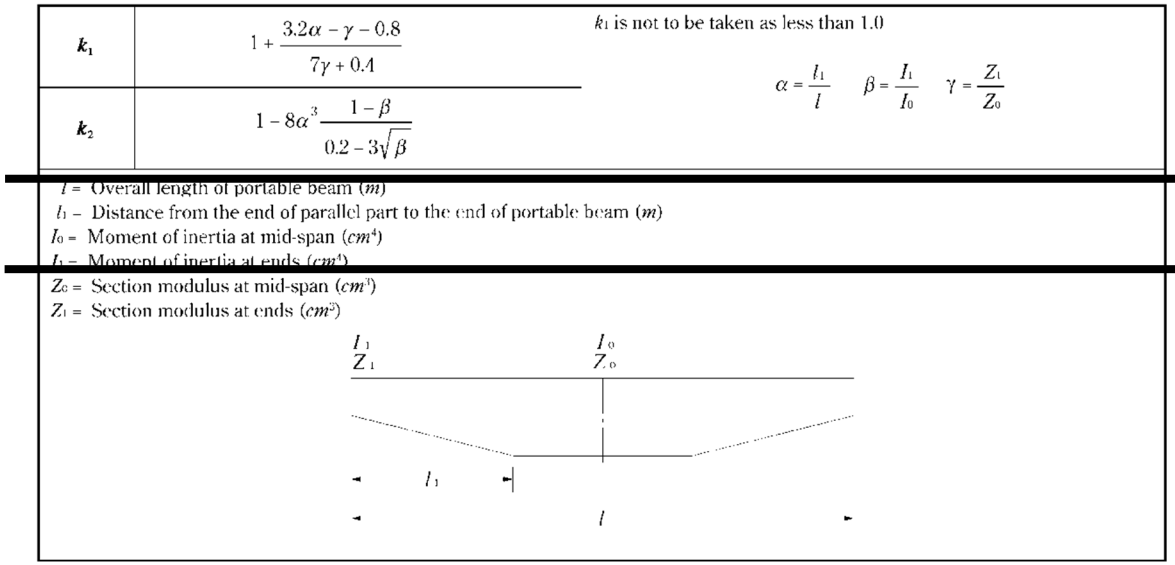
Amended	Original	Remarks
2 Local net plate thickness of steel hatch covers (1) The local net thickness t_{net} (mm) of steel hatch cover top plating is not to be less than that obtained from the following formula, and it is not to be less than 1% of the spacing of the stiffeners or 6 mm, whichever is greater: $t_{net} = 0.0158F_p s\sqrt{\frac{P}{0.95\sigma_Y}}$ (mm) F_p: Coefficient given by the following formula: 1.9 σ/σ_a (for $\sigma/\sigma_a \geq 0.8$, for the attached plate flange of primary supporting members) 1.5 (for $\sigma/\sigma_a < 0.8$, for the attached plate flange of primary supporting members) σ: Maximum normal stress (N/mm^2) of the attached plate flange of primary supporting members (see **Fig. CS19.2**). σ_a: Permissible stress (N/mm^2) specified in **Table CS19.4** s: Stiffener spacing (m) P: Design load (kN/m^2) specified in **19.2.4(1)** and **19.2.4(3)(a)** σ_F: Minimum yield stress (N/mm^2) of the material (Omitted) (5) When cargo likely to cause shear buckling is intended to be carried on a hatch cover, the net thickness t_{net} (mm) is not to be less than that obtained from following formulae. In such cases, "cargo likely to cause shear buckling" refers particularly to especially large or bulky cargo lashed to the	**2** Local net plate thickness of steel hatch covers (1) The local net thickness t_{net} (mm) of steel hatch cover top plating is not to be less than that obtained from the following formula, and it is not to be less than 1% of the spacing of the stiffeners or 6 mm, whichever is greater: $t_{net} = 15.8F_p S\sqrt{\frac{P_{HC}}{0.95\sigma_F}}$ (mm) F_p: Coefficient given by the following formula: 1.9 σ/σ_a (for $\sigma/\sigma_a \geq 0.8$, for the attached plate flange of primary supporting members) 1.5 (for $\sigma/\sigma_a < 0.8$, for the attached plate flange of primary supporting members) σ: Maximum normal stress (N/mm^2) of the attached plate flange of primary supporting members (see **Fig. CS19.2**). σ_a: Permissible stress (N/mm^2) is to be as given by following formula: $\sigma_a = 0.8\sigma_F$ S: Stiffener spacing (m) P_{HC}: Design load (kN/m^2) specified in **19.2.4(1)** and **19.2.4(3)(a)** σ_F: Minimum upper yield stress (N/mm^2) or proof stress (N/mm^2) of the material (Omitted) (5) When cargo likely to cause shear buckling is intended to be carried on a hatch cover, the net thickness t_{net} (mm) is not to be less than that obtained from following formulae. In such cases, "cargo likely to cause shear buckling" refers particularly to especially large or bulky cargo lashed to the	(1)UR S21 3.2 (5)UR S21 3.2.2

Amended	Original	Remarks
hatch cover, such as parts of cranes or wind power stations, turbines, etc. Cargo that is considered to be uniformly distributed over the hatch cover (e.g., timber, pipes or steel coils) does not need to be considered. $t_{net} = 6.5s \times 10^{-3}$ $t_{net} = 5$ s: As specified in **(1)** above	hatch cover, such as parts of cranes or wind power stations, turbines, etc. Cargo that is considered to be uniformly distributed over the hatch cover (e.g., timber, pipes or steel coils) does not need to be considered. $t_{net} = 6.5S$ $t_{net} = 5$ S: As specified in **(1)** above	
3 Net scantling of stiffeners (1) The net section modulus Z_{net} (cm^3) of the stiffeners of hatch cover top plates, based on stiffener net member thickness, is not to be less than that obtained from the following formula. The net section modulus of the stiffeners is to be determined based on an attached plate width that is assumed to be equal to the stiffener spacing. $Z_{net} = \frac{Ps\ell^2}{f_{bc}\sigma_a}$ (cm^3) ℓ: Stiffener span (m) is to be taken as the spacing of primary supporting members or the distance between a primary supporting member and the edge support, as applicable. When brackets are fitted at both ends of all stiffener spans, the stiffener span may be reduced by an amount equal to 2/3 of the minimum brackets arm length, but not greater than 10% of the gross span, for each bracket. s: Stiffener spacing (mm) P: Design load (kN/m^2) as specified in **-2(1)** above σ_a : Permissible stress (N/mm^2) specified in **Table CS19.4** f_{bc}: Boundary coefficient of stiffener, taken equal to: f_{bc} = 12, in the case of stiffener clamped at both ends.	**3** Net scantling of secondary stiffeners (1) The net section modulus Z_{net} (cm^3) of the secondary stiffeners of hatch cover top plates, based on stiffener net member thickness, is not to be less than that obtained from the following formula. The net section modulus of the secondary stiffeners is to be determined based on an attached plate width that is assumed to be equal to the stiffener spacing. $Z_{net} = \frac{104SP_{HC}l^2}{\sigma_F}$ for the design loads specified in **19.2.4(1)** above $Z_{net} = \frac{93SP_{HC}l^2}{\sigma_F}$ for the design loads specified in **19.2.4(3)(a)** above l: Secondary stiffener span (m) is to be taken as the spacing of primary supporting members or the distance between a primary supporting member and the edge support, as applicable. S: Stiffener spacing (m) P_{HC}: Design load (kN/m^2) as specified in **-2(1)** above σ_F: Minimum upper yield stress (N/mm^2) or proof stress (N/mm^2) of the material	UR S21 3.3

Amended	Original	Remarks
f_{bc} = 8, in the case of stiffener simply supported at both ends or simply supported at one end and clamped at the other end (2) The net shear sectional area A_{net} (cm^2) of the stiffener webs of hatch cover top plates is not to be less than that obtained from the following formula: $A_{net} = \frac{8.7Ps\ell}{\sigma_a}10^{-3}$ (cm^2) ℓ, s and P: As specified in (1) above	(2) The net shear sectional area A_{net} (cm^2) of the secondary stiffener webs of hatch cover top plates is not to be less than that obtained from the following formula: $A_{net} = \frac{10.8SP_{HC}l}{\sigma_F}$ for the design loads specified in 19.2.4(1) above $A_{net} = \frac{9.6SP_{HC}l}{\sigma_F}$ for the design loads specified in 19.2.4(3)(a) above l, S and P_{HC}: As specified in (1) above	
(Deleted)	(3) For flat bar secondary stiffeners and buckling stiffeners, the following formula is to be applied: $\frac{h}{t_{W,net}} \leq 15\sqrt{k}$ h: Height (mm) of the stiffener $t_{W,net}$: Net thickness (mm) of the stiffener $k = 235/\sigma_F$ σ_F: As specified in (1) above	(Deleted)
(3) Stiffeners parallel to primary supporting members are to be continuous at crossing primary supporting member and may be regarded for calculating the cross sectional properties of primary supporting members. (4) The combined stress of those stiffeners induced by the bending of primary supporting members and lateral pressures is not to exceed the permissible stresses according	(4) Stiffeners parallel to primary supporting members and arranged within the effective breadth according to 19.2.5-5(2) are to be continuous at crossing primary supporting member and may be regarded for calculating the cross sectional properties of primary supporting members. (5) The combined stress of those stiffeners induced by the bending of primary supporting members and lateral	

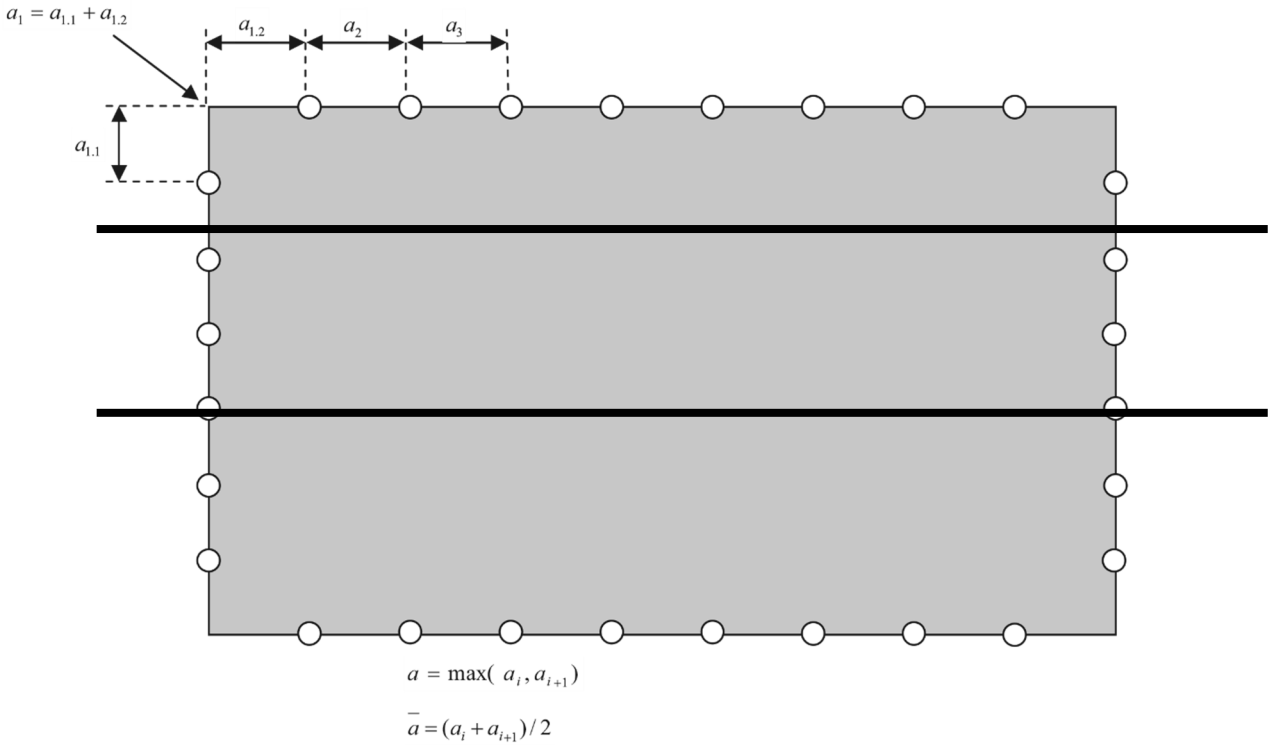
Amended	Original	Remarks
to **19.2.5-1(1)**.	pressures is not to exceed the permissible stresses according to **19.2.5-1(1)**.	
(5) For hatch cover stiffeners under compression, sufficient safety against lateral and torsional buckling according to **19.2.5-6** is to be verified.	(6) For hatch cover stiffeners under compression, sufficient safety against lateral and torsional buckling according to **19.2.5-6(3)** is to be verified.	
(6) For stiffeners of the lower plating of double skin hatch covers, the requirements in **(1)** and **(2)** above do not need to be applied due to the absence of lateral loads and the requirements in this **-3** do not need to be applied to stiffeners in cases where the lower plating is not considered to be a strength member.	(7) For secondary stiffeners of the lower plating of double skin hatch covers, the requirements in **(1)** and **(2)** above do not need to be applied due to the absence of lateral loads.	
(7) The net thicknesses (*mm*) of a stiffener (except for U-type stiffeners) web is to not be taken as less than 4 *mm*.	(8) The net thicknesses (*mm*) of a stiffener (except for U-type stiffeners) web is to not be taken as less than 4 *mm*.	
(Deleted)	(9) Single-side welding is not permitted for secondary stiffeners, except for U-type stiffeners.	(Deleted)
(Deleted)	(10) The requirements in this **-3** do not to be applied to stiffeners of the lower plating of double skin hatch covers in cases where the lower plating is not considered to be a strength member.	(Deleted)
4 Primary supporting members of steel hatch covers	**4** Primary supporting members of steel hatch covers and hatch beams	UR S21 3.4.1
(1) The scantlings of the primary supporting members of steel hatch covers and hatch beams are to be determined according to **-5** below taking into consideration the permissible stresses specified in **19.2.5-1(1)**.	(1) The scantlings of the primary supporting members of steel hatch covers and hatch beams are to be determined according to **-5** below taking into consideration the permissible stresses specified in **19.2.5-1(1)**.	
(Deleted)	(2) The scantlings of the primary supporting members of steel hatch covers and hatch beam with variable cross-sections are to be not less than that obtained from the following formulae. For steel hatchway covers, S and l are to be read as b and S, respectively.	(Deleted)

Amended	Original	Remarks
	The net section modulus (cm^3) of hatch beams or primary supporting members at the mid-point ~~$Z_{net} = Z_{net\_cs}$~~ ~~$Z_{net} = k_1 Z_{net\_cs}$~~ The net moment of inertia (cm^4) of hatch beams or primary supporting members at the mid-point ~~$I_{net} = I_{net\_cs}$~~ ~~$I_{net} = k_2 I_{net\_cs}$~~ Z_{net_cs}: Net section modulus (cm^3) complying with requirement **(1)** above I_{net_cs}: Net moment of inertia (cm^4) complying with requirement **(1)** above S: Spacing (m) of portable beams or primary supporting members l: Unsupported span (m) of portable beams or primary supporting members b: Width (m) of steel hatch covers k_1 and k_2: Coefficients obtained from the formulae given in **Table CS19.4**	

Amended	Original	Remarks
~~Table CS19.4 Coefficient k_1 and k_2~~  		(Deleted)
(2) In addition to **(1)** above, the scantlings of the primary supporting members of steel hatch cover are to comply with the requirements specified in **-6**.	(3) In addition to **(1)** and **(2)** above, the scantlings of the primary supporting members of steel hatch cover are to comply with the requirements specified in **-6**.	UR S21 3.4.1
(Deleted)	(4) When biaxial compressed flange plates are considered, the effective width of flange plates is to comply with **19.2.5-6(3)**.	(Deleted)
(3) In addition to **(1)** and **(2)** above, net thickness t_{net} (mm) of the webs of primary supporting members is not to be less than that obtained from the following formulae, whichever is greater: $t_{net} = 6.5s \times 10^{-3}$ $t_{net} = 5$	(5) In addition to **(1)** to **(4)** above, net thickness t_{net} (mm) of the webs of primary supporting members is not to be less than that obtained from the following formulae, whichever is greater: $t_{net} = 6.5S$ $t_{net} = 5$	

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
s: Stiffener spacing (mm)	S: Stiffener spacing (m)	
(4) In addition to **(1)** to **(3)** above, the net thickness t_{net} (mm) of edge girders exposed to sea wash is not to be less than that obtained from the following formulae, whichever is greater: $t_{net} = 0.0158s\sqrt{\frac{P_A}{0.95\sigma_Y}}$ $t_{net} = 8.5s \times 10^{-3}$ P_A: Design horizontal wave load (kN/m^2) as specified in **19.2.4(2)** s: Stiffener spacing (mm) σ_Y : Minimum yield stress (N/mm^2) of the material	(6) In addition to **(1)** to **(5)** above, the net thickness t_{net} (mm) of edge girders exposed to sea wash is not to be less than that obtained from the following formulae, whichever is greater: $t_{net} = 15.8S\sqrt{\frac{P_H}{0.95\sigma_F}}$ $t_{net} = 8.5S$ P_H: Design horizontal wave load (kN/m^2) as specified in **19.2.4(2)** S: Stiffener spacing (m) σ_F: Minimum upper yield stress (N/mm^2) or proof stress (N/mm^2) of the material	
(Deleted)	(7) The moment of inertia (cm^4) of the edge elements of hatch covers is not to be less than that obtained from the following formula: $I = 6pa^4$ a: Maximum of the distance (m), a_i, between two consecutive securing devices, measured along the hatch cover periphery, not to be taken as less than 2.5 a_C (m), (see **Fig. CS19.3**) a_C: $\max(a_{1.1}, a_{1.2})$ (m) (see **Fig. CS19.3**) p: Packing line pressure (N/mm), minimum 5 N/mm When calculating the actual gross moment of inertia of the edge element, the effective breadth of the attached plating of hatch covers is to be taken as equal to the lesser of the following values: 0.165 a Half the distance between the edge element and the adjacent primary member	(Deleted)

Amended	Original	Remarks
~~Fig. CS19.3 Distance between Securing Devices, Measured Along Hatch Cover Periphery~~  		(Deleted)
5 Strength calculation (Deleted)	**5** Strength calculation (1) Strength calculation for steel hatch covers may be carried out by using grillage analysis or FEM. Net scantlings are to be used for modeling. Strength calculations for double skin hatch covers or hatch covers with box girders are to be assessed using FEM, as specified in **19.2.5-5(3)**.	UR S21 3.5 (Deleted)

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
(Deleted)	(2) Effective cross-sectional properties for calculation by grillage analysis are to be determined by the following **(a)** to **(e)**: (a) The effective breadth of attached plating e_m of the primary supporting members specified in **Table CS19.5** according to the ratio of l and e is to be considered for the calculation of effective cross-sectional properties. For intermediate values of l/e, e_m is to be obtained by linear interpolation. (b) Separate calculations may be required for determining the effective breadth of one-sided or non-symmetrical flanges. (c) The effective cross sectional areas of plates is not to be less than the cross sectional area of the face plate. (d) The cross sectional area of secondary stiffeners parallel to the primary supporting member under consideration within the effective breadth may be included in the calculations (see **Fig. CS19.5**). (e) For flange plates under compression with secondary stiffeners perpendicular to the web of the primary supporting member, the effective width is to be determined according to **19.2.5-6(3).**	(Deleted)

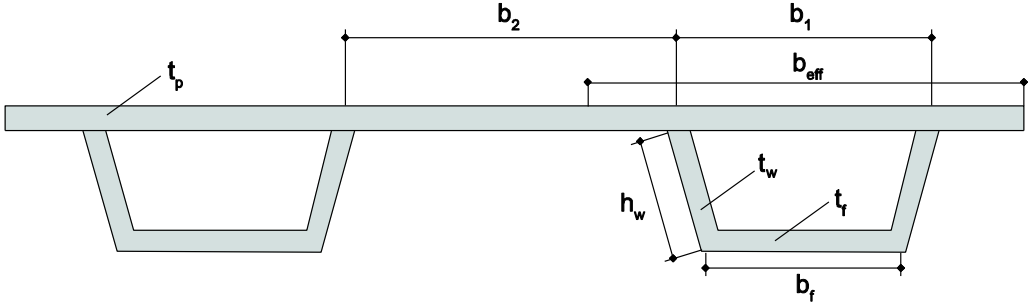
<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td>~~Table CS19.5 Effective Breadth e_m of Plating of Primary Supporting Members~~
<table>
<tr><td>~~l/e~~</td><td>~~0~~</td><td>~~1~~</td><td>~~2~~</td><td>~~3~~</td><td>~~4~~</td><td>~~5~~</td><td>~~6~~</td><td>~~7~~</td><td>~~8 and over~~</td></tr>
<tr><td>~~e_{m1}/e~~</td><td>~~0~~</td><td>~~0.36~~</td><td>~~0.64~~</td><td>~~0.82~~</td><td>~~0.91~~</td><td>~~0.96~~</td><td>~~0.98~~</td><td>~~1.00~~</td><td>~~1.00~~</td></tr>
<tr><td>~~e_{m2}/e~~</td><td>~~0~~</td><td>~~0.20~~</td><td>~~0.37~~</td><td>~~0.52~~</td><td>~~0.65~~</td><td>~~0.75~~</td><td>~~0.84~~</td><td>~~0.89~~</td><td>~~0.90~~</td></tr>
</table>
~~(Notes)~~
~~e_{m1}: Effective breadth (mm) to be applied where primary supporting members are loaded by uniformly distributed loads or by not less than 6 equally spaced single loads~~
~~e_{m2}: Effective breadth (mm) to be applied where primary supporting members are loaded by 3 or less single loads~~
~~l: Length between zero-points of bending moment curve taken equal to:~~
~~For simply supported primary supporting members : l_0~~
~~For primary supporting members with both ends constant : $0.6l_0$~~
~~l_0: Unsupported length of the primary supporting members~~
~~e: Width of plating supported, measured from centre to centre of the adjacent unsupported fields~~</td><td></td><td>(Deleted)</td></tr>
<tr><td>Strength calculation for hatch covers is to be carried out by using the following finite element method. Those not specified in this paragraph are to comply with the requirements in Chapter 8, Part 1, Part C.
(1) Loads
The design wave loads imposed on steel hatch covers are to be P_{HC} specified in 19.2.4 of the Rules.
(2) Modelling of Structures
(a) The structural model is to be able to reproduce the behaviour of the structure with the highest possible fidelity. Stiffeners and primary supporting members subject to pressure loads are to be included in the modelling. However, buckling stiffeners may be disregarded for stress calculation.
(b) Net scantlings which exclude corrosion additions are to</td><td>(3) General requirements for FEM are as follows:
(Newly added)
(a) The structural model is to be able to reproduce the behaviour of the structure with the highest possible fidelity. Stiffeners and primary supporting members subject to pressure loads are to be included in the modelling. However, buckling stiffeners may be disregarded for stress calculation.
(b) Net scantlings which exclude corrosion additions are to</td><td>UR S21 3.5.1
(Newly added)</td></tr>
</table>

Amended	Original	Remarks
be used for modeling.	be used for modeling.	
(Deleted)	(c) Element size is to be suitable to take effective breadth into account.	(Deleted)
(c) In no case is element width to be larger than stiffener spacing. The ratio of element length to width is not to exceed 3.	(d) In no case is element width to be larger than stiffener spacing. The ratio of element length to width is not to exceed 4.	
(d) The element height of the webs of primary supporting members is not to exceed one-third of the web height.	(e) The element height of the webs of primary supporting members is not to exceed one-third of the web height.	
(e) Stiffeners may be modelled using shell elements, plane stress elements or beam elements.	(f) Stiffeners may be modelled using shell elements, plane stress elements or beam elements.	
(f) Hatch covers fitted with U-type stiffeners as shown in **Fig. CS19.3** are to be assessed by means of FE analysis.	(Newly added)	(Newly added)
(g) The geometry of the U-type stiffeners is to be accurately modelled using shell/plate elements.		
(h) Nodal points are to be properly placed on the intersections between the webs of a U-type stiffener and the hatch cover plate, and between the webs and flange of the U-type stiffener.		
(3) Boundary Conditions Wherever applicable the following boundary conditions are to be applied to the FE model:		
(a) Boundary nodes in way of a bearing pad on the hatch coamings are to be fixed against displacement in the direction perpendicular to the pad.		
(b) Lifting stoppers are to be fixed against displacements in the direction determined by the stoppers.		
(c) For a folding type hatch cover, the FE nodes connected through a hinge are to have the same translational displacement in the direction perpendicular to the hatch cover top plating.		

Amended	Original	Remarks
(4) Permissible value When the loads specified in **(1)** act on the structural model specified in **(2)**, the net scantlings are to be determined so that the stress and deflection generated in each structural member satisfy the allowable values specified in **19.2.5-1**. (5) Miscellaneous (a) The thickness of the top plating of steel hatch covers is to comply with the requirements in **19.2.5-2**. (b) The scantlings of the secondary stiffeners of steel hatch covers are to comply with the requirements in **19.2.5-3**. (c) The buckling strength for the structural members forming steel hatch covers is to comply with the requirements in **19.2.5-6**. (6) Additional requirements for steel hatch covers carrying cargoes In addition to **(1)** to **(5)**, the details for steel hatch covers carrying cargoes are to comply with the following **(a)** to **(f)**: (a) To prevent damage to hatch covers and the ship structure, the location of stoppers is to be compatible with the relative movements between hatch covers and the ship structure. (b) Hatch covers and supporting structures are to be adequately stiffened to accommodate the load from hatch covers. (c) At the cross-joints of multi-panel covers, vertical guides (male/female) are to be fitted to prevent excessive relative vertical deflections between loaded/unloaded panels. (d) The construction and scantlings of hatchways on exposed parts or on the lower deck are to comply with		

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
the following requirements in addition to those of **19.2**. i) The loading arrangement is to be clearly shown in drawings submitted for approval. In the case of freight containers, the type and location are to be additionally described. ii) Girders or stiffeners are to be provided for reinforcement beneath the corner fittings of freight containers. (e) The scantlings of sub structures subject to concentrated loads acting on steel hatch covers are to be determined taking into consideration the design cargo loads and permissible stresses specified in **19.2**. (f) The top plates of hatch covers, upon which wheeled vehicles are loaded, are to comply with the following: i) The thickness of hatch cover top plating may be determined by direct calculation or in accordance with **17.4.5**. ii) The scantlings of the stiffeners of hatch covers may be determined by direct calculation or in accordance with **10.7.1**.		

Amended	Original	Remarks
Fig. CS19.3 Example of Hatch Cover Fitted with U-type Stiffeners  		(Newly added)
6 Buckling strength of steel hatch covers (Deleted)	**6** Buckling strength of steel hatch covers The buckling strength of the structural members of steel hatch covers is to be in accordance with the following (1) to (3): (1) The buckling strength of a single plate panel of the top and lower steel hatch cover plating is to comply with following formulae: $\left(\frac{\lvert\sigma_x\rvert C_{sf}}{\kappa_x\sigma_F}\right)^{e_1}+\left(\frac{\lvert\sigma_y\rvert C_{sf}}{\kappa_y\sigma_F}\right)^{e_2}-B\left(\frac{\sigma_x\sigma_y C_{sf}^2}{\sigma_F^2}\right)+\left(\frac{\lvert\tau\rvert C_{sf}\sqrt{3}}{\kappa_\tau\sigma_F}\right)^{e_3}\leq 1.0$ $\left(\frac{\sigma_x C_{sf}}{\kappa_x\sigma_F}\right)^{e_1}\leq 1.0$ $\left(\frac{\sigma_y C_{sf}}{\kappa_y\sigma_F}\right)^{e_2}\leq 1.0$ $\left(\frac{\lvert\tau\rvert C_{sf}\sqrt{3}}{\kappa_\tau\sigma_F}\right)^{e_3}\leq 1.0$	(Deleted)

Amended	Original	Remarks
	σ_x, σ_y: Membrane stress in the *x*-direction and the *y*-direction (*N/mm*^{2}). In cases where the stresses are obtained from FEM and already contain the Poisson-effect, the following modified stress values may be used. Both stresses σ_x^* and σ_y^* are to be compressive stress in order to apply stress reduction according to the following formulae: $\sigma_x = \left(\sigma_x^* - 0.3\sigma_y^*\right)/0.91$ $\sigma_y = \left(\sigma_y^* - 0.3\sigma_x^*\right)/0.91$ σ_x^* and σ_y^*: Stresses containing the Poisson-effect. These values are to comply with the following formulae: $\sigma_y = 0$ and $\sigma_x = \sigma_x^*$ for $\sigma_y^* < 0.3\sigma_x^*$ $\sigma_x = 0$ and $\sigma_y = \sigma_y^*$ for $\sigma_x^* < 0.3\sigma_y^*$ τ: Shear stress (*N/mm*^{2}) in *x*-*y* plane σ_F: Minimum yield stress (*N/mm*^{2}) of the material. Compressive and shear stresses are to be taken as positive values and tension stresses are to be taken as negative values. *C*$_{sf}$: Safety factor taken as equal to: *C*$_{sf}$ = 1.25 for hatch covers when subjected to design vertical wave loads according to **19.2.4(1)** *C*$_{sf}$ = 1.10 for hatch covers when subjected to loads according to **19.2.4(3)** to **(5)** *F*$_1$: Correction factor for the boundary condition of stiffeners on the longer side of elementary plate panels according to **Table CS19.6** *e*$_1$, *e*$_2$, *e*$_3$ and *B*: Coefficient obtained from **Table CS19.7** κ_x, κ_y and κ_τ: Reduction factor obtained from **Table**	

Amended	Original	Remarks
	CS19.8. However, these values are to comply with the following formulae: $\kappa_x = 1.0$ for $\sigma_x \leq 0$ (tension stress) $\kappa_y = 1.0$ for $\sigma_y \leq 0$ (tension stress) *a*: Length (*mm*) of the longer side of the partial plate field (*x*-direction) *b*: Length (*mm*) of the shorter side of the partial plate field (*y*-direction) *n*: Number of the elementary plate panel breadths within the partial or total plate panel (see **Fig. CS19.4**) α: Aspect ratio of a single plate field obtained from the following formula: $\alpha = \frac{a}{b}$ λ: Reference degree of slenderness, taken as equal to: $\lambda = \sqrt{\frac{\sigma_F}{K\sigma_e}}$ *K*: Buckling factor according to **Table CS19.8** σ_e: Reference stress (N/mm^2), taken as equal to: $\sigma_e = 0.9E\left(\frac{t}{b}\right)^2$ *E*: Modulus of elasticity (N/mm^2) of the material, taken equal to: $E = 2.06 \times 10^5$ *t*: Net thickness (*mm*) of plate under consideration ψ: Edge stress ratio taken as equal to: $\psi = \frac{\sigma_2}{\sigma_1}$	

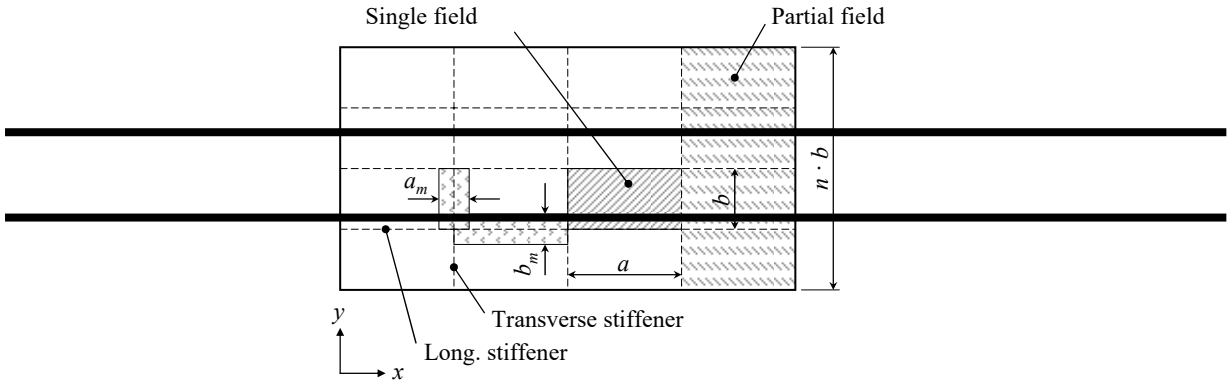
Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
	σ_1 : Maximum compressive stress (N/mm^2) σ_2 : Minimum compressive stress or tension stress (N/mm^2)	

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks

~~Fig. CS19.4 General Arrangement of Panels~~



Longitudinal : stiffener in the direction of the length *a*
Transverse : stiffener in the direction of the breath *b*

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~~Table CS19.6 Correction Factor F_1~~

~~Boundary condition~~	~~F_1(2)~~	~~Edge stiffener~~
~~Stiffeners sniped at both ends~~	~~1.00~~	
~~Guidance value(1) where both ends are effectively connected to adjacent structures~~	~~1.05~~	~~Flat bars~~
	~~1.10~~	~~Bulb sections~~
	~~1.20~~	~~Angles and tee sections~~
	~~1.30~~	~~U type sections(3) and girders of high rigidity~~

~~(1) Exact values may be determined by direct calculations~~

~~(2) An average value of F_1 is to be used for plate panels having different edge stiffeners~~

~~(3) A higher value may be taken if it is verified by a buckling strength check of the partial plate field using non-linear FEA and deemed appropriate by the Society. However, such values are not to be greater than 2.0~~

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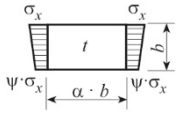
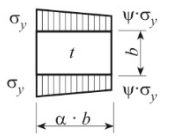
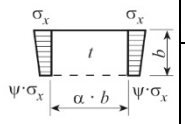
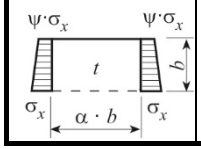
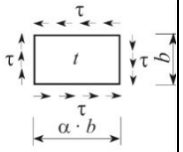
Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
~~Table CS19.7 Coefficient c_1, c_2, c_3 and B~~ ~~Exponents c_1, c_2, c_3 and B | Plate panel~~ ~~c_1 | $1 + \kappa_x^4$~~ ~~c_2 | $1 + \kappa_y^4$~~ ~~c_3 | $1 + \kappa_x \kappa_y \kappa_c^2$~~ ~~$B$ | For σ_x and σ_y positive (compressive stress) | $(\kappa_x \kappa_y)^5$~~ ~~For σ_x or σ_y negative (tension stress) | 1~~		(Deleted)
~~Table CS19.8 Buckling and Reduction Factors for Plane Elementary Plate Panels~~ ~~Load case | Edge stress ratio ψ | Aspect ratio $\alpha = a/b$ | Buckling factor K | Reduction factor κ~~ ~~1~~  ~~$1 \geq \psi \geq 0$ | $\alpha \geq 1$ | $K = \frac{8.4}{\psi + 1.1}$~~ ~~$0 > \psi > -1$ | $\alpha \geq 1$ | $K = 7.63 - \psi(6.26 - 10\psi)$~~ ~~$\psi \leq -1$ | $\alpha \geq 1$ | $K = 5.975(1 - \psi)^2$~~ ~~$\kappa_x = 1$ for $\lambda \leq \lambda_c$~~ ~~$\kappa_x = c\left(\frac{1}{\lambda} - \frac{0.22}{\lambda^2}\right)$ for $\lambda > \lambda_c$~~ ~~$c = (1.25 - 0.12\psi) \leq 1.25$~~ ~~$\lambda_c = \frac{c}{2}\left(1 + \sqrt{1 - \frac{0.88}{c}}\right)$~~ ~~2~~  ~~$1 \geq \psi \geq 0$ | $\alpha \geq 1$ | $K = F_x\left(1 + \frac{1}{\alpha^2}\right)^2 \frac{2.1}{(\psi + 1.1)}$~~ ~~$0 > \psi > -1$ | $1 \leq \alpha \leq 1.5$ | $K = F_x\left[\left(1 + \frac{1}{\alpha^2}\right)^2 \frac{2.1(1 + \psi)}{1.1} - \frac{\psi}{\alpha^2}(13.9 - 10\psi)\right]$~~ ~~$\kappa_y = c\left(\frac{1}{\lambda} - \frac{R + F^2(H - R)}{\lambda^2}\right)$~~ ~~$c = (1.25 - 0.12\psi) \leq 1.25$~~ ~~$R = \lambda\left(1 - \frac{\lambda}{c}\right)$ for $\lambda < \lambda_c$~~ ~~$R = 0.22$ for $\lambda \geq \lambda_c$~~ ~~$\lambda_c = \frac{c}{2}\left(1 + \sqrt{1 - \frac{0.88}{c}}\right)$~~		(Deleted)

Amended			Original		Remarks
		~~$\alpha > 1.5$~~	~~$K = F_1\left[\left(1+\frac{1}{\alpha^2}\right)^2 \frac{2.1(1+\psi)}{1.1} - \frac{\psi}{\alpha^2}\left(5.87 + 1.87\alpha^2 + \frac{8.6}{\alpha^2} - 10\psi\right)\right]$~~	~~$F = \left(1 - \frac{\frac{K}{0.91} - 1}{\lambda_p^2}\right) c_1 \geq 0$~~ ~~$\lambda_p^2 - \lambda^2 = 0.5$ for $-1 \leq \lambda_p^2 \leq 3$~~ ~~$c_1 = \left(1 - \frac{F_1}{\alpha}\right) \geq 0$~~ ~~$H = \lambda - \frac{2\lambda}{c\left(T + \sqrt{T^2 - 4}\right)} \geq R$~~ ~~$T = \lambda + \frac{14}{15\lambda} + \frac{1}{3}$~~	
	~~$\psi \leq -1$~~	~~$1 \leq \alpha \leq \frac{3(1-\psi)}{4}$~~	~~$K = 5.975 F_1 \left(\frac{1-\psi}{\alpha}\right)^2$~~		
		~~$\alpha \geq \frac{3(1-\psi)}{4}$~~	~~$K = F_1\left[3.9675\left(\frac{1-\psi}{\alpha}\right)^2 + 0.5375\left(\frac{1-\psi}{\alpha}\right)^4 + 1.87\right]$~~		
~~3~~ 	~~$1 \geq \psi \geq 0$~~	~~$\alpha > 0$~~	~~$K = \frac{4\left(0.425 + \frac{1}{\alpha^2}\right)}{3\psi + 1}$~~		
	~~$0 > \psi > -1$~~		~~$K = 4\left(0.425 + \frac{1}{\alpha^2}\right)(1+\psi) - 5\psi(1 - 3.42\psi)$~~	~~$\kappa_\psi = 1$ for $\lambda \leq 0.7$~~ ~~$\kappa_\psi = \frac{1}{\lambda^2 + 0.51}$ for $\lambda > 0.7$~~	
~~4~~ 	~~$1 \geq \psi \geq -1$~~	~~$\alpha > 0$~~	~~$K = \left(0.425 + \frac{1}{\alpha^2}\right)\frac{3-\psi}{2}$~~		

Amended	Original	Remarks

~~Table CS19.8 Buckling and Reduction Factors for Plane Elementary Plate Panels (continued)~~

~~Load case~~	~~Edge stress ratio ψ~~	~~Aspect ratio $\alpha = a/b$~~	~~Buckling factor K~~	~~Reduction factor κ~~
~~5~~ 	-		$K = K_\tau\sqrt{3}$	$\kappa_\tau = 1$ for $\lambda \leq 0.84$ $\kappa_\tau = \frac{0.84}{\lambda}$ for $\lambda > 0.84$
		$\alpha \geq 1$	$K_\tau = \left[5.34 + \frac{4}{\alpha^2}\right]$	
		$0 < \alpha < 1$	$K_\tau = \left[4 + \frac{5.34}{\alpha^2}\right]$	
~~Boundary condition~~ ~~plate edge free~~ ~~plate edge simple support~~				

(Deleted)

(2) The buckling strength of non-stiffened webs and the flanges of primary supporting members are to be according to requirement of **(1)** above.

(3) The buckling strength of partial and total fields included in the structural members of steel hatch covers is to comply with the following **(a)** to **(e)**:

(a) The buckling strength of longitudinal and transverse secondary stiffeners is to comply with following **(d)** and **(e)**. For U-type stiffeners, however, the requirements in **(e)** below may be omitted.

(b) When buckling calculation is carried out according to **(d)** and **(e)**, the effective breadth of steel hatch cover plating may be in accordance with following **i)** and **ii)**:

i) The effective breadth a_m or b_m of attached plating may be determined by the following formulae (see **Fig. CS19.4**). However, the effective breadth of plating is not to be taken greater than the value obtained from **19.2.5-5.**

$b_m = \kappa_x b$ for longitudinal stiffeners

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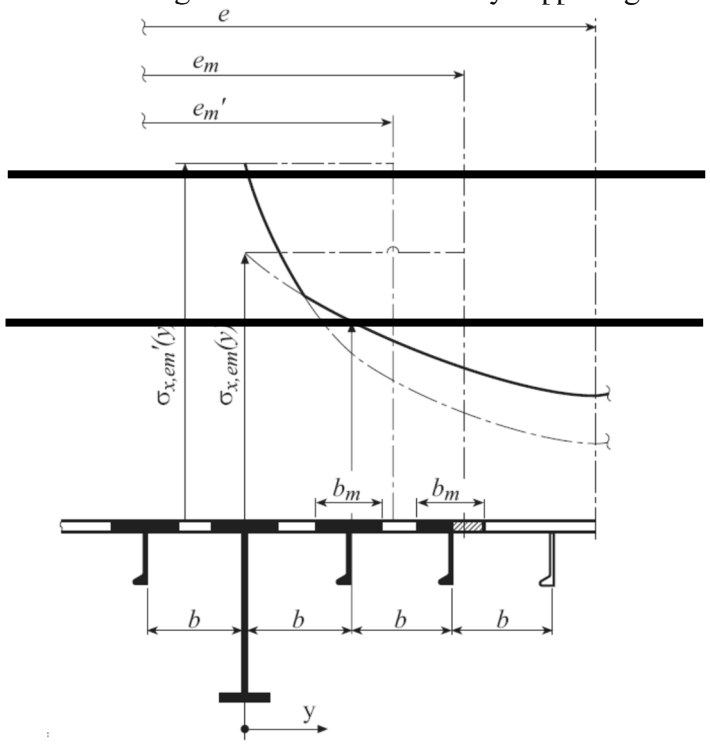
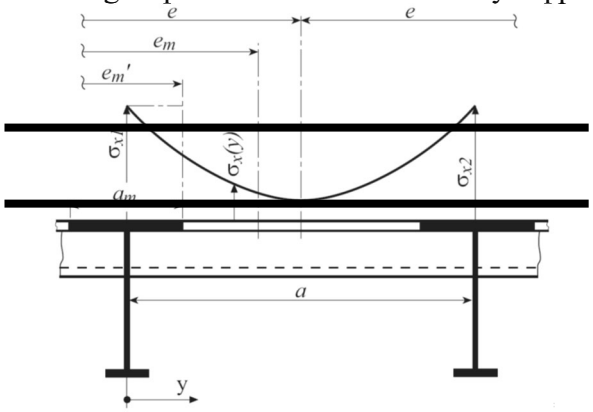
Amended	Original	Remarks
	$a_m = \kappa_y a$ for transverse stiffeners κ_x and κ_y: As obtained from **Table CS19.8** a and b : As specified **(1)** above ii) The effective breadth e'_m of stiffened flange plates of primary supporting members may be determined according to the following **1)** and **2)**. However, a_m and b_m for flange plates are in general to determined for $\psi = 1$. 1) Stiffening parallel to the webs of primary supporting members (see **Fig. CS19.5**). For $b \geq e_m$, b and a have to be exchanged. $b < e_m$ $e'_m = nb_m$ n: Integer number of stiffener spacing b inside the effective breadth e_m according to **19.2.5-5**, taken as equal to: $n = \mathrm{int}\left(\frac{e_m}{b}\right)$	

Amended	Original	Remarks
~~Fig. CS19.5 Stiffening Parallel to Web of Primary Supporting Member~~  		(Deleted)
(Deleted)	2) Stiffening perpendicular to the webs of primary supporting members (see **Fig. CS19.6**). For $a < e_m$, a and b have to be exchanged. $a \geq e_m$ $e_m' = n a_m < e_m$ $n = 2.7 \frac{e_m}{a} \leq 1$	(Deleted)

Amended	Original	Remarks
~~Fig. CS19.6 Stiffening Perpendicular to Web of Primary Supporting Member~~  		(Deleted)
(Deleted)	(c) Stresses obtained from the calculation of the scantlings of plating and the stiffeners of steel hatch covers are to comply with the following: i) The scantlings of plates and stiffeners are in general to be determined according to the maximum stresses $\sigma_x(y)$ at the webs of primary supporting members and stiffeners respectively. ii) For stiffeners with spacing b under compression arranged parallel to primary supporting members no value less than $0.25\sigma_F$ is to be inserted for $\sigma_x(y = b)$. iii) The stress distribution between two primary supporting members may be obtained by the following formula:	(Deleted)

Amended	Original	Remarks
	$\sigma_x(y) = \sigma_{x1}\left\{1 - \frac{y}{e}\left[3 + c_1 - 4c_2 - 2\frac{y}{e}(1 + c_1 - 2c_2)\right]\right\}$ c_1: As given by the following formula: $c_1 = \frac{\sigma_{x1}}{\sigma_{x2}}$, however $0 \leq c_1 \leq 1$ c_2: As given by the following formula: $c_2 = \frac{1.5}{e}(e''_{m1} + e''_{m2}) - 0.5$ σ_{x1} and σ_{x2} : Normal stresses in the flange plates of adjacent primary supporting members 1 and 2 with spacing e, based on cross-sectional properties considering the effective breadth or effective width, as appropriate e''_{m1}: Proportionate effective breadth e_{m1} or proportionate effective width e'_{m1} of primary supporting member 1 within the distance e, as appropriate e''_{m2}: Proportionate effective breadth e_{m2} or proportionate effective width e'_{m2} of primary supporting member 2 within the distance e, as appropriate iv) The shear stress distribution in flange plates may be assumed to be linear. (d) For lateral buckling, longitudinal and transverse stiffeners are to comply with following **i)** to **iii)**: i) Secondary stiffeners subject to lateral loads are to	

Amended	Original	Remarks
	comply with the following criteria: $\frac{\sigma_a + \sigma_b}{\sigma_F} C_{sf} \leq 1$ σ_a: Uniformly distributed compressive stress (N/mm^2) in the direction of the stiffener axis, given by the following formula: $\sigma_a = \sigma_x$ for longitudinal stiffeners $\sigma_a = \sigma_y$ for transverse stiffeners σ_b: Bending stress (N/mm^2) in the stiffeners, given by the following formula: $\sigma_b = \frac{M_0 + M_1}{Z_{st} 10^3}$ M_0: Bending moment (N-mm) due to deformation w of stiffener, given by the following formula: $M_0 = F_{Ki} \frac{p_z w}{c_f - p_Z}$ with $(c_f - p_z) > 0$ M_1: Bending moment (N-mm) due to lateral load P given by the following formula: $M_1 = \frac{Pba^2}{24 \cdot 10^3}$ for longitudinal stiffeners $M_1 = \frac{P(nb)^2}{8 c_S 10^3}$ for transverse stiffeners. Where n is to be taken as equal to 1 for ordinary transverse stiffeners Z_{st}: Section modulus of stiffener (cm^3) including the effective breadth of plating according to **19.2.5-6(3)**	

Amended	Original	Remarks
	c_S: Factor accounting for the boundary conditions of the transverse stiffener taken as equal to: c_S = 1.0 for a stiffener that is simply supported c_S = 2.0 for a stiffener that is partially constrained P: Lateral load (kN/m^2) as specified in **19.2.4** according to the condition under consideration F_{Ki}: Ideal buckling force (N) of the stiffener given by the following formula: $F_{Kix} = \frac{\pi^2}{a^2} EI_x 10^4$ for longitudinal stiffeners $F_{Kiy} = \frac{\pi^2}{(nb)^2} EI_y 10^4$ for transverse stiffeners I_x and I_y: Net moments of inertia (cm^4) of the longitudinal or transverse stiffener, including the effective breadth of attached plating according to **19.2.5-6(3)**. I_x and I_y are to comply with the following criteria: $I_x \geq \frac{bt^3}{12 \cdot 10^4}$ $I_y \geq \frac{at^3}{12 \cdot 10^4}$ p_z: Nominal lateral load (N/mm^2) of the stiffener due to σ_x, σ_y and τ	

Amended	Original	Remarks
	$p_{zx} = \frac{t_a}{b}\left(\sigma_{xl}\left(\frac{\pi b}{a}\right)^2 + 2c_y\sigma_y + \tau_1\sqrt{2}\right)$ for longitudinal stiffeners ~~$p_{zy} = \frac{t_a}{b}\left(2c_x\sigma_{xl} + \sigma_y\left(\frac{\pi a}{nb}\right)^2\left(1 + \frac{A_y}{at_a}\right) + \tau_1\sqrt{2}\right)$~~ for transverse stiffeners t_a: Net thickness (*mm*) of attached plating c_x and c_y: Factor taking into account the stresses vertical to the stiffener's axis and distributed variable along the stiffener's length taken as equal to: $0.5(1+\psi)$ for $0 \le \psi \le 1$ $\frac{0.5}{1-\psi}$ for $\psi < 0$ A_x and A_y: Net sectional area (mm^2) of the longitudinal or transverse stiffener respectively without attached plating $\sigma_{xl} = \sigma_x\left(1 + \frac{A_x}{bt_a}\right)$ $\tau_1 = \left[\tau - t\sqrt{\sigma_F E\left(\frac{m_1}{a^2} + \frac{m_2}{b^2}\right)}\right] \ge 0$ m_1 and m_2: Coefficient given by the following formulae: For longitudinal stiffeners: $m_1 = 1.47$ $m_2 = 0.49$ for $\frac{a}{b} \ge 2.0$	

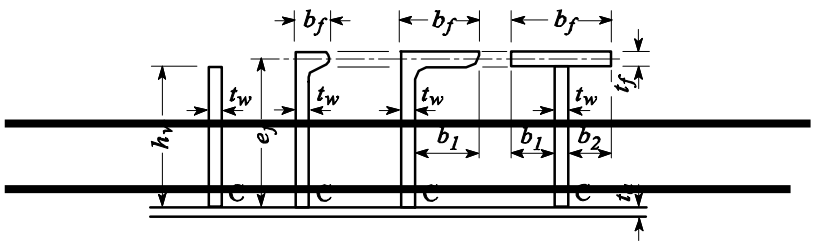
Amended	Original	Remarks
	$m_1 = 1.96 \quad m_2 = 0.37 \quad$ for $\frac{a}{b} < 2.0$ For transverse stiffeners: $m_1 = 0.37 \quad m_2 = \frac{1.96}{n^2} \quad$ for $\frac{a}{nb} \geq 0.5$ $m_1 = 0.49 \quad m_2 = \frac{1.47}{n^2} \quad$ for $\frac{a}{nb} < 0.5$ $w = w_0 + w_1$ w_0: Assumed imperfection (*mm*) taken as equal to: $w_0 = \min\left(\frac{a}{250}, \frac{b}{250}, 10\right)$ for longitudinal stiffeners $w_0 = \min\left(\frac{a}{250}, \frac{nb}{250}, 10\right)$ for transverse stiffeners For stiffeners sniped at both ends w_0 is not to be taken as less than the distance from the mid-point of attached plating to the neutral axis of the stiffener calculated with the effective width of its attached plating. w_1: Deformation of stiffener (*mm*) at the mid-point of stiffener span due to lateral load p. In the case of uniformly distributed loads, the following values for w_1 may be used: $w_1 = \frac{Pba^4}{384 \cdot 10^7 EI_x}$ for longitudinal stiffeners $w_1 = \frac{5Pa(nb)^4}{384 \cdot 10^7 EI_y c_S^2}$ for transverse	

Amended	Original	Remarks
	stiffeners c_f: Elastic support (N/mm^2) provided by the stiffener taken as equal to: For longitudinal stiffeners: $c_f = F_{Kix}\frac{\pi^2}{a^2}(1 + c_{px})$ $c_{px} = \frac{1}{1 + \frac{0.91\left(\frac{12 \cdot 10^4 I_x}{t^3 b} - 1\right)}{c_{xa}}}$ c_{xa}: Coefficient taken as equal to: $c_{xa} = \left[\frac{a}{2b} + \frac{2b}{a}\right]^2$ for $a \geq 2b$ $c_{xa} = \left[1 + \left(\frac{a}{2b}\right)^2\right]^2$ for $a \leq 2b$ For transverse stiffeners: $c_f = c_S F_{Kiy}\frac{\pi^2}{(n \cdot b)^2}(1 + c_{py})$ $c_{py} = \frac{1}{1 + \frac{0.91\left(\frac{12 \cdot 10^4 I_y}{t^3 b} - 1\right)}{c_{ya}}}$ c_{ya}: Coefficient taken as equal to:	

Amended	Original	Remarks
	$c_{ya} = \left[\frac{nb}{2a} + \frac{2a}{nb}\right]^2$ for $nb \geq 2a$ $c_{ya} = \left[1 + \left(\frac{nb}{2a}\right)^2\right]^2$ for $nb < 2a$ ii) For stiffeners not subject to lateral loads, the bending moment σ_b is to be calculated at the mid-point of the stiffener. iii) When lateral loads are acting, stress calculations are to be carried out for both fibres of the stiffener's cross sectional area (if necessary for the biaxial stress field at the plating side). (e) For torsional buckling, longitudinal and transverse stiffeners are to comply with the following **i)** and **ii)**: i) Longitudinal stiffeners are to comply with following criteria: $\frac{\sigma_x}{\kappa_T \sigma_F} C_{sf} \leq 1.0$ κ_T: Coefficient taken as equal to: $\kappa_T = 1.0$ for $\lambda_T \leq 0.2$ $\kappa_T = \frac{1}{\Phi + \sqrt{\Phi^2 - \lambda_T^2}}$ for $\lambda_T > 0.2$ $\Phi = 0.5(1 + 0.21(\lambda_T - 0.2) + \lambda_T^2)$ λ_T: Reference degree of slenderness taken as equal to:	

Amended	Original	Remarks
	$\lambda_T = \sqrt{\frac{\sigma_F}{\sigma_{KiT}}}$ $\sigma_{KiT} = \frac{E}{I_P}\left(\frac{\pi^2 I_\omega 10^2}{a^2}\varepsilon + 0.385 I_T\right)$ (N/mm^2) I_P: Net polar moment of inertia of the stiffener (cm^4) defined in **Table CS19.9**, and related to point C as shown in **Fig. CS19.7**. I_T: Net St. Venant's moment of inertia of the stiffener (cm^4) defined in **Table CS19.9** I_ω: Net sectorial moment of inertia of the stiffener (cm^6) defined in **Table CS19.9**, related to point C as shown in **Fig. CS19.7** ε: Degree of fixation taken as equal to: $\varepsilon = 1 + 10^{-3} \cdot \sqrt{\frac{a^4}{\frac{3}{4}\pi^4 I_w \left(\frac{b}{t^3} + \frac{4h_w}{3t_w^3}\right)}}$ A_w: Net web area (mm^2) equal to: $A_w = h_w t_w$ A_f: Net flange area (mm^2) equal to: $A_f = b_f t_f$ $e_f = h_w + \frac{t_f}{2}$ (mm) h_w, t_w, b_f and t_f: Dimensions of stiffener (mm) as specified in **Fig. CS19.7** ii) For transverse secondary stiffeners loaded by compressive stress which are not supported by longitudinal stiffeners, sufficient torsional buckling strength is to be performed analogously	

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
	in accordance with **i)** above.	
~~Fig. CS19.7 Dimensions of Stiffener~~  		(Deleted)

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td>~~Table CS19.9 Moments of Inertia~~
<table><tr><td>~~Section~~</td><td>~~I_P~~</td><td>~~I_T~~</td><td>~~I_ω~~</td></tr><tr><td>~~Flat bar~~</td><td>~~$\frac{h_w^3 t_w}{3 \cdot 10^4}$~~</td><td>~~$\frac{h_w t_w^3}{3 \cdot 10^4}\left(1 - 0.63\frac{t_w}{h_w}\right)$~~</td><td>~~$\frac{h_w^3 t_w^3}{36 \cdot 10^6}$~~</td></tr><tr><td>~~Bulb, angle or tee sections~~</td><td>~~$\left(\frac{A_w h_w^2}{3} + A_f e_f^2\right) 10^{-4}$~~</td><td>~~$\frac{h_w t_w^3}{3 \cdot 10^4}\left(1 - 0.63\frac{t_w}{h_w}\right)$~~ + ~~$\frac{b_f t_f^3}{3 \cdot 10^4}\left(1 - 0.63\frac{t_f}{b_f}\right)$~~</td><td>~~For bulb and angle sections:~~ ~~$\frac{A_f e_f^2 b_f^2}{12 \cdot 10^6}\left(\frac{A_f + 2.6A_w}{A_f + A_w}\right)$~~ ~~For tee sections:~~ ~~$\frac{b_f^3 t_f e_f^2}{12 \cdot 10^6}$~~</td></tr></table></td><td>(Deleted)</td></tr>
<tr><td>(1) Buckling assessments for hatch cover structural members are to be performed in compliance with Annex 14.6 “Buckling Strength Assessment of Ship Structural Elements”, Part 1, Part C for the conditions specified in 19.2.5-6. For symbols not defined in 19.2.5-6, refer to Annex 14.6, Part 1, Part C.
(2) Slenderness requirements are as follows:
(a) The slenderness requirements are to be in accordance with An2, Annex 14.6, Part 1, Part C.
(b) Slenderness requirements need not be applied to the lower boundary of double skin hatch covers unless the cargo hold is designed for carriage of ballast or liquid cargo.
(c) The breadth of the primary supporting member flange is to be not less than 40% of their depth for laterally unsupported spans greater than 3.0 m. However, tripping brackets attached to the flange may be considered as a lateral support for primary supporting members.</td><td>(Newly added)</td><td>(Newly added)
UR S21 3.6</td></tr>
</table>

Amended	Original	Remarks
(3) Buckling assessments are to be performed for the following structural elements of hatch cover structures subjected to compressive stresses, shear stresses and lateral pressures: ・ Stiffened and unstiffened panels, including curved panels and panels stiffened with U-type stiffeners. ・ Web panels of primary supporting members in way of openings. Procedures and detailed requirements for buckling assessment are given in **An4, Annex 14.6, Part 1, Part C**, including idealisation of irregular plate panels, definitions of reference stresses and buckling criteria. (4) Panel types and assessment methods are to be accordance with the following requirements: (a) Plate panels of hatch cover structures are to be modelled as stiffened panels (*SP*) or unstiffened panels (*UP*) as defined in **An 4.2, Annex 14.6, Part 1, Part C**. In addition, Method A (-A) and Method B (-B) as defined in **An1.3, Annex 14.6, Part 1, Part C** are to be used in accordance with **Table CS19.5, Fig. CS19.4** and **Fig. CS19.5**, while the procedures for openings are to be used for buckling assessments of web panels with openings. (b) Hatch covers fitted with U-type stiffeners are also to be in accordance with the additional buckling assessment requirements specific for panels with U-type stiffeners in **An5.2.5, Annex 14.6, Part 1, Part C**. (5) Buckling assessments of hatch covers are based on lateral pressure as defined in **19.2.4-1(1), 19.2.4-1(2)** and **19.2.4-1(5)**, and stresses obtained from FE analyses (*See* **19.2.5-5**). (6) The safety factor for hatch cover structural members is to be		

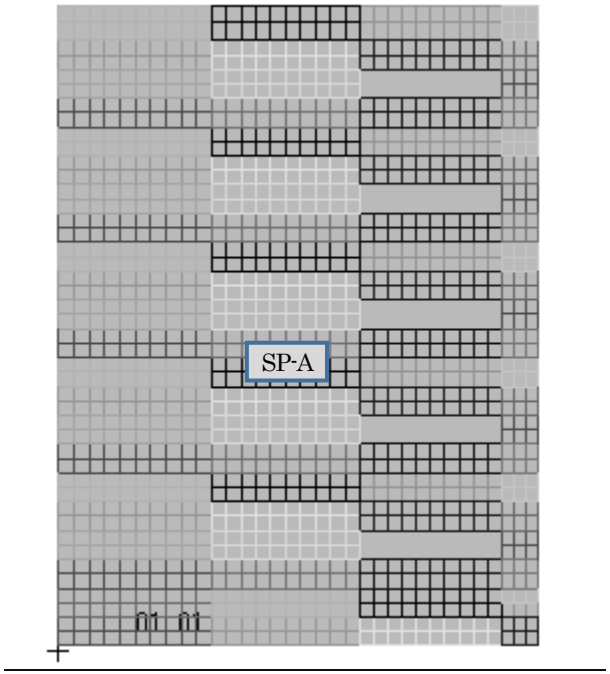
Amended	Original	Remarks
taken as S=1.0 for the plating and stiffener buckling capacity formulae defined in **An5.2.2** and **An5.2.3, Annex 14.6, Part 1, Part C** respectively. (7) The buckling strength of structural members is to be in accordance with the following formula: $\eta_{act} \leq \eta_{all}$ Where: η_{act}: Buckling utilisation factor based on applied stress, as defined in **An1.3.2.2** and **An4, Annex 14.6, Part 1, Part C**, and calculated per **An5, Annex 14.6, Part 1, Part C.** η_{act} : Allowable buckling utilisation factor, as given in **Table CS19.6**		

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

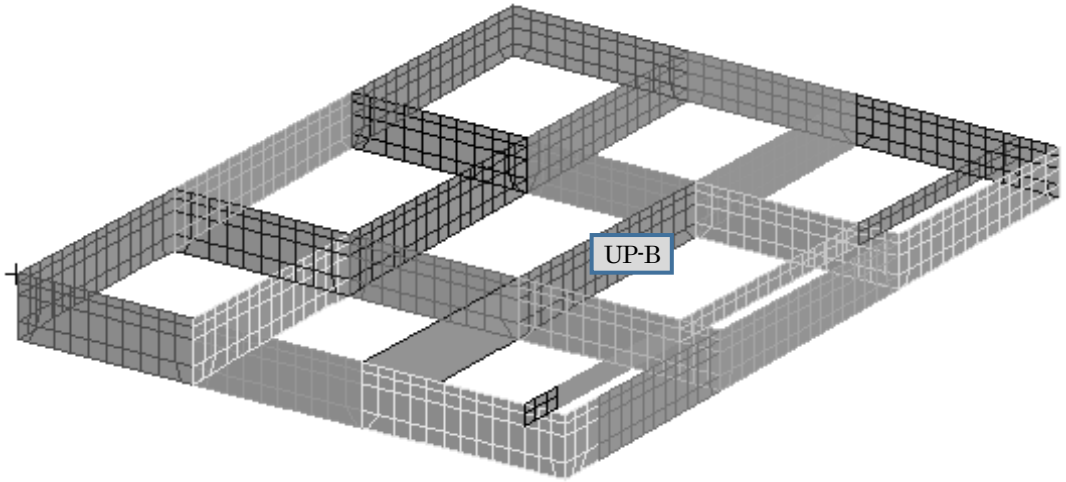
Amended	Original	Remarks
Table CS19.5 Structural Members and Assessment Methods		(Newly added) UR S21 3.6.3.2 Tab.5

Structural elements	Assessment method(1)(2)	Normal panel definition
Hatch cover top/bottom plating structures, see **Fig. CS19.4**		
Hatch cover top/bottom plating	SP-A	Length: between transverse girders Width: between longitudinal girders
Irregularly stiffened panels	UP-B	Plate between local stiffeners/PSM
Hatch cover web panels of primary supporting members, see **Fig. CS19.5**		
Web of transverse/longitudinal girder (single skin type)	UP-B	Plate between local stiffeners/face plate/PSM
Web of transverse/longitudinal girder (double skin type)	SP-B(3)	Length: between PSM Width: full web depth
Web panel with opening	Procedure for opening	Plate between local stiffeners/face plate/PSM
Irregularly stiffened panels	UP-B	Plate between local stiffeners/face plate/PSM
Note 1: SP and UP stand for stiffened and unstiffened panel respectively. Note 2: A and B stand for Method A and Method B respectively. Note 3: In case that the buckling carlings/brackets are irregularly arranged in the web of transverse/longitudinal girder, UP-B method may be used.		

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
Fig. CS19.4 Hatch Cover Top/Bottom Plating Structures 		(Newly added) UR S21 3.6.3.2 Fig.6

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td>Fig. CS19.5 Hatch Cover Webs of Primary Supporting Members
 
</td><td></td><td>(Newly added)
UR S21 3.6.3.2 Fig.7</td></tr>
<tr><td>Table CS19.6 Allowable Buckling Utilisation Factors
<table>
<tr><th>Structural component</th><th>Subject to</th><th>η_{all}, Allowable buckling utilisation factor</th></tr>
<tr><td rowspan="2">Plates and stiffeners
Web of PSM</td><td>External pressure, as defined in 19.2.4-1(1)</td><td>0.80</td></tr>
<tr><td>Other loads, as defined in
19.2.4-1(2) to 19.2.4-1(5)</td><td>0.90 for static+dynamic load case
0.72 for static load case</td></tr>
</table></td><td></td><td>(Newly added)
UR S21 3.6.3.2 Tab.6</td></tr>
</table>

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
19.2.6 (Deleted)	**19.2.6 Additional Requirements for Steel Hatch Covers Carrying Cargoes** **1** Where concentrated loads, e.g. container loads, are acting on steel hatch covers, direct calculations deemed appropriate by the Society are required. **2** The scantlings of sub structures subject to concentrated loads acting on steel hatch covers are to be determined taking into consideration the design cargo loads and permissible stresses specified in this section. **3** The scantlings of top plates and stiffeners of steel hatch covers subject to wheel loads are determined by direct calculation or any other method which deemed appropriate by the Society.	Left as "19.2.6 (Deleted)"
19.2.7 Portable Beams, Hatchway Covers, Steel Pontoon Covers and Steel Weathertight Covers **1** Portable beams are to comply with the following (1) to (8): (1) The carriers and sockets for portable beams are to be of substantial construction, having a minimum beaming surface of 75 *mm*, and are to be provided with means for the efficient fitting and securing of the beams. (2) Coamings are to be stiffened in way of carriers and sockets by providing stiffeners from these fittings to the deck or by equivalent strengthening. (3) Where beams of a sliding type are used, the arrangement is to ensure that the beams remain properly in position when the hatchway is closed. (4) The depth of portable beams and the width of their face plates are to be suitable to ensure the lateral stability of the beams. The depth of beams at their ends is not to be less than	**19.2.7 Portable Beams, Hatchway Covers, Steel Pontoon Covers and Steel Weathertight Covers** **1** Portable beams are to comply with the following (1) to (7): (1) The carriers and sockets for portable beams are to be of substantial construction, having a minimum beaming surface of 75 *mm*, and are to be provided with means for the efficient fitting and securing of the beams. (2) Coamings are to be stiffened in way of carriers and sockets by providing stiffeners from these fittings to the deck or by equivalent strengthening. (3) Where beams of a sliding type are used, the arrangement is to ensure that the beams remain properly in position when the hatchway is closed. (4) The depth of portable beams and the width of their face plates are to be suitable to ensure the lateral stability of the beams. The depth of beams at their ends is not to be less than	

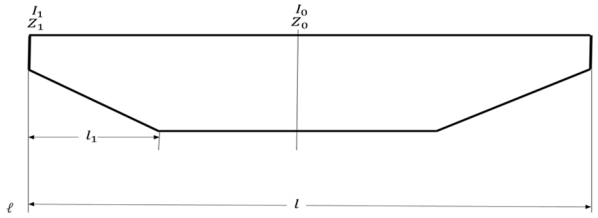
Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
0.40 *times* the depth at their mid-point or 150 *mm*, whichever is greater. (5) The upper face plates of portable beams are to extend to the ends of the beams. The web plates are to be increased in thickness to at least twice that at the mid-point for at least 180 *mm* from each end or to be reinforced with doubling plates. (6) Portable beams are to be provided with suitable gear for releasing them from slings without the need for personnel to get on the beam. (7) Portable beams are to be clearly marked to indicate the deck, hatchway and position to which they belong. (8) Scantling of hatch beam with variable cross-sections is to be not less than that obtained from the following formulae. The net section modulus (cm^3) of hatch beams at the mid-point $Z_{net} = Z_{net_{cs}}$ $Z_{net} = k_1 Z_{net_{cs}}$ The net moment of inertia (cm^4) of hatch beams at the mid-point $I_{net} = I_{net_{cs}}$ $I_{net} = k_2 I_{net_{cs}}$ $Z_{net_{cs}}$: Net section modulus (cm^3) complying with requirement **19.2.5-4(1)** $I_{net_{cs}}$: Net moment of inertia (cm^4) complying with requirement **19.2.5-4(1)** S : Spacing (m) of portable beams ℓ : Unsupported span (m) of portable beams b : Width (m) of steel hatch covers	0.40 *times* the depth at their mid-point or 150 *mm*, whichever is greater. (5) The upper face plates of portable beams are to extend to the ends of the beams. The web plates are to be increased in thickness to at least twice that at the mid-point for at least 180 *mm* from each end or to be reinforced with doubling plates. (6) Portable beams are to be provided with suitable gear for releasing them from slings without the need for personnel to get on the beam. (7) Portable beams are to be clearly marked to indicate the deck, hatchway and position to which they belong. (Newly added)	(Newly added)

Amended	Original	Remarks
k_1 and k_2 : Coefficients obtained from the formulae given in Table CS19.7		
Table CS19.7 Coefficient k_1 and k_2		(Newly added)

k_1	$1 + \frac{3.2\alpha - \gamma - 0.8}{7\gamma + 0.4}$	k_1 is not to be taken as less than 1.0 $\alpha = \frac{\ell_1}{\ell}$, $\beta = \frac{I_1}{I_0}$, $\gamma = \frac{Z_1}{Z_0}$
k_2	$1 + 8\alpha^3 \frac{1 - \beta}{0.2 + 3\sqrt{\beta}}$	

ℓ : Overall length of hatch beam (*m*)
ℓ_1 : Distance from the end of parallel part to the end of portable beam (*m*)
I_0 : Moment of inertia at mid-span (cm^4)
I_1 : Moment of inertia at ends (cm^4)
Z_0 : Section modulus at mid-span (cm^3)
Z_1 : Section modulus at ends (cm^3)

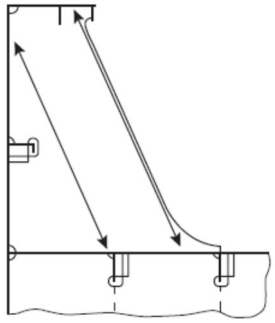
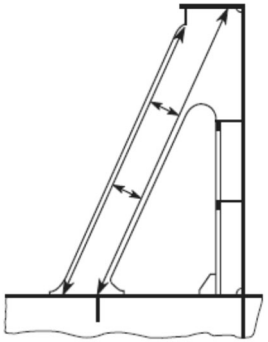
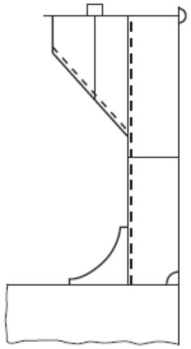


Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
19.2.9 Hatch Coaming Strength Criteria (Omitted) **2** Scantlings of hatch coamings are to be in accordance with the followings. (1) The local net plate thickness (*mm*) of the hatch coaming plating $t_{coam,net}$ is not to be less than that obtained from following formula in **(a)** or **(b)**: (a) For Type 1 ships $t_{coam,net} = 0.0142s\sqrt{\frac{P_A}{0.95\sigma_Y}}\ (mm)$, but not to be less than $6 + \frac{L'}{100}\ (mm)$ s: Stiffener spacing (*mm*) P_A: As specified in **19.2.4(2)** σ_Y : Minimum yield stress (N/mm^2) of the material L': Length of shipL_1 (*m*) (b) For Type 2 ships $t_{coam,net} = 0.016s\sqrt{\frac{P_{coam}}{0.95\sigma_Y}}$ (mm) , but not to be less than 9.5 (*mm*) P_{coam} : As specified in **19.2.4(5)** s and σ_Y : As specified in **(a)** above (2) For Type 1 ships, where the hatch coaming stiffener is snipped at both ends, gross thickness $t_{coam,gross}$ (*mm*) of the coaming plate at the sniped stiffener end is not to be less than that obtained from the following formula:	**19.2.9 Hatch Coaming Strength Criteria** (Omitted) **2** Scantlings of hatch coamings are to be in accordance with the followings. (1) The local net plate thickness (*mm*) of the hatch coaming plating $t_{coam,net}$ is not to be less than that obtained from following formula: $t_{coam,net} = 14.2S\sqrt{\frac{P_H}{\sigma_{a,coam}}}(mm)$, but not to be less than $6 + \frac{L'}{100}\ (mm)$ S: Secondary stiffener spacing (*m*) P_H: As specified in **19.2.4(2)** $\sigma_{a,coam} = 0.95\sigma_F$ σ_F: Minimum upper yield stress (N/mm^2) or proof stress (N/mm^2) of the material L': Length of shipL_1 (*m*) (2) Where the hatch coaming secondary stiffener is snipped at both ends, gross thickness $t_{coam,gross}$ (*mm*) of the coaming plate at the sniped stiffener end is not to be less than that obtained from the following formula:	(1),(2): UR S21 5.1 (3): UR S21 5.1 (4): UR S21 3.6.1 (5): UR S21 5.3.1

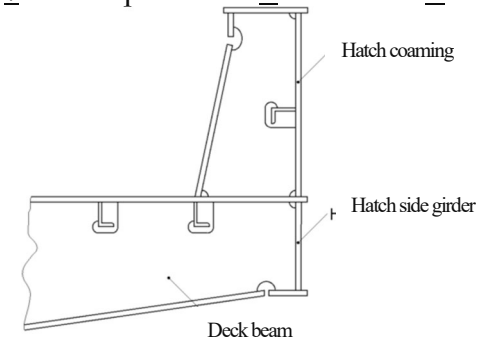
Amended	Original	Remarks
$t_{coam,gross} = 19.6\sqrt{\frac{P_A s(\ell - 0.0005s)}{1000\sigma_Y}}$ (mm) ℓ: Stiffener span (m) to be taken as the spacing of coaming stays s, P_A and σ_Y: As specified in **(1)** above (3) The net section modulus Z_{net} (cm^3) and net shear area (cm^2) of hatch coaming stiffeners are not to be less than that obtained from the following formula. (a) For Type 1 ships $Z_{net} = \frac{P_A s l^2}{f_{bc}\sigma_Y}$ (cm^3) $A_{net} = \frac{P_A s \ell}{\sigma_Y} 10^{-2}$ (cm^2) s, ℓ, P_A and σ_Y: As specified in **(2)** above f_{bc} : Coefficient according to the type of end connection of stiffeners given by the following formula: f_{bc} = 12 with both ends constant = 8 for the end spans of stiffeners sniped at the coaming corners For sniped stiffeners of coaming at hatch corners shear area obtained from the above formula has to be increased by 35%. (b) For Type 2 ships $Z_{net} = 1.21\frac{P_{coam} s \ell^2}{f_{bc} c_p \sigma_Y}$ (cm^3) f_{bc} : Coefficient according to the type of end connection of stiffeners given by the following formula: f_{bc} = 16 with both ends constant = 12 for the end spans of stiffeners sniped at the coaming corners	$t_{coam,gross} = 19.6\sqrt{\frac{P_H S(l-0.5S)}{\sigma_F}}$ (mm) l: Secondary stiffener span (m) to be taken as the spacing of coaming stays S, P_H and σ_F: As specified in **(1)** above (3) The net section modulus Z_{net} (cm^3) and net shear area (cm^2) of hatch coaming secondary stiffeners are not to be less than that obtained from the following formula. For snipped stiffeners at coaming corners, section modulus and shear area at the fixed support are to be increased by 35%. $Z_{net} = \frac{83\, S l^2\, P_H}{\sigma_F}$ (cm^3) $A_{net} = \frac{10\, S l\, P_H}{\sigma_F}$ (cm^2) S, l, P_H and σ_F As specified in **(2)** above	

Amended	Original	Remarks
c_p = Ratio of the plastic section modulus to the elastic section modulus of the stiffeners with an attached plate breadth (*mm*) equal to $40t_{coam,net}$, where $t_{coam,net}$ is the plate net thickness = 1.16 in the absence of more precise evaluation s, ℓ, *and* σ_Y : As specified in **(2)** above P_{coam} : As specified in **19.2.4(5)**		
(4) Buckling strength assessment of hatch coaming is to be carried out by the method as deemed appropriate by the Society.	(4) Buckling strength assessment of hatch coaming is to be carried out by the method as deemed appropriate by the Society.	
(5) The net scantlings of hatch coaming stays are to be in accordance with following **(a)** to **(c)** and coaming stays are to be designed for the loads transmitted through them and permissible stresses according to **19.2.5-1**.	(5) The net scantlings of hatch coaming stays are to be in accordance with following **(a)** to **(c)**:	
(a) For hatch coaming stays considered to be simple beams (see **Examples 1** and **2** of **Fig. CS19. 6**), the net section modulus Z_{net} (cm^3) of such stays at their deck connections and the net scantling $t_{w,net}$ (*mm*) of their webs are not to be less than that obtained from following formulae. $Z_{net} = \frac{{H_C}^2 s_C P}{1.9\sigma_Y}$ (cm^3) $t_{w,net} = \frac{2H_C s_C P}{\sigma_Y h}$ (mm) H_C: Hatch coaming stay height (*m*) h: Hatch coaming stay depth (*m*) s_C: Hatch coaming stay spacing (*mm*) σ_Y: As specified in **(1)** above P : Pressure (kN/m^2) on coaming taken as P_A defined in	(a) For hatch coaming stays considered to be simple beams (see **Examples 1** and **2** of **Fig. CS19.8**), the net section modulus Z_{net} (cm^3) of such stays at their deck connections and the net scantling $t_{w,net}$ (*mm*) of their webs are not to be less than that obtained from following formulae. $Z_{net} = \frac{526H_C^2 S P_H}{\sigma_F}$ (cm^3) $t_{w,net} = \frac{2H_C S P_H}{\sigma_F h}$ (*mm*) H_C: Hatch coaming stay height (*m*) h: Hatch coaming stay depth (*m*) S: Hatch coaming stay spacing (*m*) σ_F and P_H: As specified in **(1)** above	

Amended	Original	Remarks
19.2.4(2) for Type 1 ships and as P_{Coam} defined in **19.2.4(5)** for Type 2 ships. (b) For coaming stays other than those in **(a)** above (see **Example 3** of **Fig. CS19.6**), the stresses are generally to be determined through FEM, and the calculated stresses are to satisfy the permissible stress criteria of **19.2.5-1**. (c) For calculating the net section modulus of coaming stays, the area of their face plates is to be taken into account only when it is welded with full penetration welds to the deck plating and an adequate underdeck structure is fitted to support the stresses transmitted by them.	(b) For coaming stays other than those in **(a)** above (see **Example 3** of **Fig. CS19.8**), the stresses are generally to be determined through grillage analysis or FEM, and the calculated stresses are to satisfy the permissible stress criteria of **19.2.5-1**. (c) For calculating the net section modulus of coaming stays, the area of their face plates is to be taken into account only when it is welded with full penetration welds to the deck plating and an adequate underdeck structure is fitted to support the stresses transmitted by them.	
Fig. CS19.~~8~~6 Examples of ~~c~~Coaming ~~s~~Stays  Example1  Example2  Example3		

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
(Deleted)	**3** The coamings for hatchways in Position I or coamings of 760 *mm* or more in height for hatchways in Position II are to be stiffened in a suitable position below the upper edge by a horizontal stiffener; the breadth of the horizontal stiffener is not to be less than 180 *mm*.	(Deleted)
3 Coamings are to be additionally supported by efficient brackets or stays provided from the horizontal stiffeners to the deck at intervals of approximately 3 metres.	**4** Coamings are to be additionally supported by efficient brackets or stays provided from the horizontal stiffeners specified in -3 to the deck at intervals of approximately 3 metres.	
4 Coaming plates are to extend to the lower edge of the deck beams or hatch side girders are to be fitted that extend to the lower edge of the deck beams (see **Fig. CS19.7**). Extended coaming plates and hatch side girders are to be flanged or fitted with face bars or half-round bars, except where specially approved by the Society.	**5** Coaming plates are to extend to the lower edge of the deck beams or hatch side girders are to be fitted that extend to the lower edge of the deck beams (see **Fig. CS19.9**). Extended coaming plates and hatch side girders are to be flanged or fitted with face bars or half-round bars, except where specially approved by the Society.	
5 Hatch coamings and hatch coaming stays are to comply with the following requirements: (Omitted)	**6** Hatch coamings and hatch coaming stays are to comply with the following requirements: (Omitted)	

Amended	Original	Remarks
Fig. CS19.~~9~~7 Example for the ~~e~~Extension of ~~e~~Coaming ~~p~~Plates  		

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
19.2.10 Closing Arrangements **1** Securing devices (1) Securing devices between covers and coamings and at cross-joints are to ensure weathertightness. (2) The means for securing and maintaining weathertightness by using gaskets and securing devices are to comply with the following **(a)** to **(f)**. The means for securing and maintaining weathertightness of weathertight covers are to be to the satisfaction of the Society. Arrangements are to ensure that weathertightness can be maintained in any sea condition. (a) The weight of covers and any cargo stowed thereon are to be transmitted to the ship structure. (b) Gaskets and compression flat bars or angles which are arranged between covers and the ship structure and cross-joint elements are to be in compliance with the following **i)** to **iv)**: i) Compression bars or angles are to be well rounded where in contact with the gaskets and are to be made of corrosion-resistant materials. ii) The gaskets are to be of relatively soft elastic materials. The material is to be of a quality suitable for all environmental conditions likely to be experienced by the ship, and is to be compatible with the cargoes carried. iii) A continuous gasket is to be effectively secured to the cover. The material and form of gasket selected are to be considered in conjunction with the type of cover, the securing arrangement and the expected relative movement between the	**19.2.10 Closing Arrangements** **1** Securing devices (1) Securing devices between covers and coamings and at cross-joints are to ensure weathertightness. (2) The means for securing and maintaining weathertightness by using gaskets and securing devices are to comply with the following **(a)** to **(f)**. The means for securing and maintaining weathertightness of weathertight covers are to be to the satisfaction of the Society. Arrangements are to ensure that weathertightness can be maintained in any sea condition. (a) The weight of covers and any cargo stowed thereon are to be transmitted to the ship structure through steel to steel contact. (b) Gaskets and compression flat bars or angles which are arranged between covers and the ship structure and cross-joint elements are to be in compliance with the following **i)** to **iii)**: i) Compression bars or angles are to be well rounded where in contact with the gaskets and are to be made of corrosion-resistant materials. ii) The gaskets are to be of relatively soft elastic materials. The material is to be of a quality suitable for all environmental conditions likely to be experienced by the ship, and is to be compatible with the cargoes carried. iii) A continuous gasket is to be effectively secured to the cover. The material and form of gasket selected are to be considered in conjunction with the type of cover, the securing arrangement and	UR S21 6.1

Amended	Original	Remarks
cover and ship structure. iv) The specification or grade of the packing material is to be indicated on the drawings.	the expected relative movement between the cover and ship structure. (Newly added)	(Newly added)
(c) Securing devices attached to hatchway coamings, decks or covers are to be in compliance with the following **i)** to **vi)**: i) Arrangement and spacing of securing devices are to be determined with due attention to the effectiveness for weathertightness, depending upon the type and the size of hatch cover as well as to the stiffness of the cover edges between the securing devices. ii) The moment of inertia (cm^4) of the edge elements of hatch covers is not to be less than that obtained from the following formula: $I = 6pa^4$ (cm^4) a : Spacing (m) between securing devices, not to be taken less than 2 m p : Packing line pressure (N/mm), minimum 5 N/mm iii) The gross sectional area (cm^2) of each securing device is not to be less than that obtained from the following formula. However, rods or bolts are to have a net diameter not less than 19 mm for hatchways exceeding 5 m^2 in area. $A = 0.28ap/f$	(c) Securing devices attached to hatchway coamings, decks or covers are to be in compliance with the following **i)** to **v)**: i) Arrangement and spacing of securing devices are to be determined with due attention to the effectiveness for weathertightness, depending upon the type and the size of hatch cover as well as to the stiffness of the cover edges between the securing devices. (Newly added) ii) The gross sectional area (cm^2) of each securing device is not to be less than that obtained from the following formula. However, rods or bolts are to have a net diameter not less than 19 mm for hatchways exceeding 5 m^2 in area. $A = 0.28\bar{a}p/f$ $\bar{a}$: Half the distance (m) between two adjacent securing devices, measured along the hatch	UR S21 6.1.4 (Newly added)

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
	cover periphery (see **Fig. CS19.3**) *p*: Packing line pressure (*N/mm*), minimum 5 *N/mm*	
f: As obtained from the following formula: $f = (\sigma_Y/235)^e$ σ_Y : Minimum yield stress (N/mm^2) of the steel used for fabrication, but not to be taken greater than 70% of the ultimate tensile strength *e*: A coefficient determined according to the value of σ_Y, as follows: 1.0 for $\sigma_Y \leq 235$ N/mm^2 0.75 for $\sigma_Y > 235$ N/mm^2 a and p: As specified in **(ii)** above	*f*: As obtained from the following formula: $f = (\sigma_F/235)^e$ σ_F: Minimum upper yield stress (N/mm^2) of the steel used for fabrication, but not to be taken greater than 70% of the ultimate tensile strength *e*: Coefficient taken as equal to 1.0 for $\sigma_F \leq 235$ N/mm^2 0.75 for $\sigma_F > 235$ N/mm^2	
iv) Individual securing devices on each cover are to have approximately the same stiffness characteristics.	iii) Individual securing devices on each cover are to have approximately the same stiffness characteristics.	
v) Where rod cleats are fitted, resilient washers or cushions are to be incorporated.	iv) Where rod cleats are fitted, resilient washers or cushions are to be incorporated.	
vi) Where hydraulic cleating is adopted, a positive means is to be provided to ensure that it remains mechanically locked in the closed position in the event of failure of the hydraulic system.	v) Where hydraulic cleating is adopted, a positive means is to be provided to ensure that it remains mechanically locked in the closed position in the event of failure of the hydraulic system.	

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

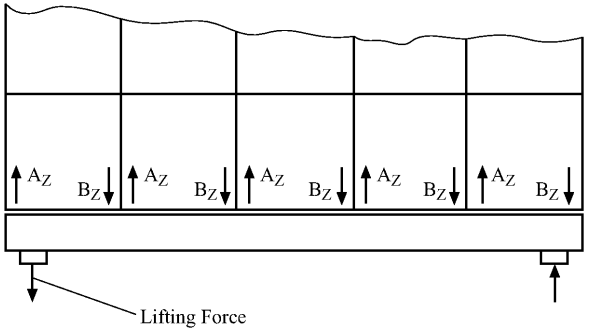
Amended	Original	Remarks
(d) A drainage arrangement equivalent to the standards specified in the following is to be provided. i) Drainage is to be arranged inside the line of gaskets by means of a gutter bar or vertical extension of the hatch side and end coaming. If an application is made by the owner of a container carrier and the Society deems it to be appropriate, special consideration will be given to this requirement. ii) Drain openings are to be arranged at the ends of drain channels and are to be provided with effective means such as non-return valves or the equivalent for preventing the ingress of water from outside. <u>It is unacceptable to connect fire hoses to the drain openings for this purpose.</u> iii) Cross-joints of multi-panel covers are to be arranged with a drainage channel for water from space above the gasket and a drainage channel below the gasket. iv) If a continuous outer steel contact between cover and ship structure is arranged, drainage from the space between the steel contact and the gasket is also to be provided for. <u>v) Drain openings in hatch coamings are to be arranged with sufficient distance to areas of stress concentration (e.g. hatch corners, transitions to crane posts).</u>	(d) A drainage arrangement equivalent to the standards specified in the following is to be provided. i) Drainage is to be arranged inside the line of gaskets by means of a gutter bar or vertical extension of the hatch side and end coaming. If an application is made by the owner of a container carrier and the Society deems it to be appropriate, special consideration will be given to this requirement. ii) Drain openings are to be arranged at the ends of drain channels and are to be provided with effective means such as non-return valves or the equivalent for preventing the ingress of water from outside. iii) Cross-joints of multi-panel covers are to be arranged with a drainage channel for water from space above the gasket and a drainage channel below the gasket. iv) If a continuous outer steel contact between cover and ship structure is arranged, drainage from the space between the steel contact and the gasket is also to be provided for. (Newly added)	(d)(i),(ii),(iv): UR S21 5.4.5 (d)(iii): Rec.No14 3.2.2 (f): UR S21 6.1.4 (Newly added)
(e) It is recommended that ships with steel weathertight covers are supplied with an operation and maintenance manual which includes the following **i)** to **v)**:	(e) It is recommended that ships with steel weathertight covers are supplied with an operation and maintenance manual which includes the following **i)** to **v)**:	

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
i) Opening and closing instructions ii) Maintenance requirements for packing, securing devices and operating items iii) Cleaning instructions for drainage systems iv) Corrosion prevention instructions v) List of spare parts (f) Securing devices of special design in which significant bending or shear stresses occur may be designed as anti-lifting devices according to **-2** below. The packing line pressure q is to be specified, and as load, q multiplied by the spacing between securing devices a (m) is to be applied.	i) Opening and closing instructions ii) Maintenance requirements for packing, securing devices and operating items iii) Cleaning instructions for drainage systems iv) Corrosion prevention instructions v) List of spare parts (f) Securing devices of special design in which significant bending or shear stresses occur may be designed as anti-lifting devices according to **-2** below.	
2 The securing devices of hatch covers, on which cargo is to be lashed, are to be designed for a lifting force resulting from the loads according to **19.2.4(4)** (see **Fig. CS19.8**). Unsymmetrical loading, which may occur in practice, is to be considered. Under such loading, the equivalent stress (N/mm^2) in securing devices is not to be greater than that obtained from the following formula. Anti-lifting devices may be dispensed with at the discretion of the Society. $\sigma_E = \frac{150}{k_l}$ k_l: As obtained from the following formula: $k_l = \left(\frac{235}{\sigma_Y}\right)^e$ σ_Y : Minimum yield stress (N/mm^2) of the material e: As given below 0.75 for $\sigma_Y > 235$	**2** The securing devices of hatch covers, on which cargo is to be lashed, are to be designed for a lifting force resulting from the loads according to **19.2.4(4)** (see **Fig. CS19.10**). Unsymmetrical loading, which may occur in practice, is to be considered. Under such loading, the equivalent stress (N/mm^2) in securing devices is not to be greater than that obtained from the following formula. Anti-lifting devices may be dispensed with at the discretion of the Society. $\sigma_E = \frac{150}{k_l}$ k_l: As obtained from the following formula: $k_l = \left(\frac{235}{\sigma_F}\right)^e$ σ_F: Minimum upper yield stress (N/mm^2) or proof stress (N/mm^2) of the material e: As given below 0.75 for $\sigma_F > 235$	UR S21 6.1.5

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
1.00 for $\underline{\sigma_Y} \leq 235$	1.00 for $\underline{\sigma_F} \leq 235$	

Amended	Original	Remarks
Fig. CS19.~~108~~8 Lifting ~~f~~Forces at a ~~h~~Hatch ~~c~~Cover  		

Amended	Original	Remarks
19.2.11 Hatch Cover Supports, Stoppers and Supporting Structures **1** Hatch cover supports, stoppers and supporting structures subject to the provisions of **19.2** are to comply with the following **(1)** to **(3)**: (1) For the design of the securing devices for the prevention of shifting, the horizontal mass forces F obtained from the following formula are to be considered. Acceleration in the longitudinal direction, a_X , and in the transverse direction, a_Y , does not need to be considered as acting simultaneously. $F = ma$ m: Sum of mass of cargo lashed on the hatch cover and mass of hatch cover a: Acceleration obtained from the following formula $a_X = 0.2g$ for longitudinal direction $a_Y = 0.5g$ for transverse direction (2) The design load for determining the scantlings of stoppers is not to be less than that obtained from **19.2.4(2)** and **(1)**, whichever is greater. Stress in the stoppers is to comply with the criteria specified in **19.2.5-1(1)**. (3) The details of hatch cover supporting structures are to be in accordance with the following **(a)** to **(g)**: (a) The nominal surface pressure (N/mm^2) of a hatch cover supports is not to be greater than that obtained from the following formula: $\underline{P_{n\,max}} = d\underline{P_n}$ in general $\underline{P_{n\,max}} = 3\underline{P_n}$ for metallic supporting	**19.2.11 Hatch Cover Supports, Stoppers and Supporting Structures** Hatch cover supports, stoppers and supporting structures subject to the provisions of **19.2** are to comply with the following **(1)** to **(3)**: (1) For the design of the securing devices for the prevention of shifting, the horizontal mass forces F obtained from the following formula are to be considered. Acceleration in the longitudinal direction, a_X , and in the transverse direction, a_Y , does not need to be considered as acting simultaneously. $F = ma$ m: Sum of mass of cargo lashed on the hatch cover and mass of hatch cover a: Acceleration obtained from the following formula $a_X = 0.2g$ for longitudinal direction $a_Y = 0.5g$ for transverse direction (2) The design load for determining the scantlings of stoppers is not to be less than that obtained from **19.2.4(2)** and **(1)**, whichever is greater. Stress in the stoppers is to comply with the criteria specified in **19.2.5-1(1)**. (3) The details of hatch cover supporting structures are to be in accordance with the following **(a)** to **(g)**: (a) The nominal surface pressure (N/mm^2) of a hatch cover supports is not to be greater than that obtained from the following formula: $\underline{p_{n\,\max}} = d\underline{p_n}$ in general $\underline{p_{n\,\max}} = 3\underline{p_n}$ for metallic supporting	UR S21 6.2

Amended	Original	Remarks
surface not subjected to relative displacements *d*: As given by the following formula. Where *d* exceeds 3, *d* is to be taken as 3. $d = 3.75 - 0.015L_1$ $d_{\min} = 1.0$ in general $d_{\min} = 2.0$ for partial loading conditions L_1: Distance (*m*) measured on the waterline at the scantling draught *ds* from the forward side of the stem to the centre of the rudder stock. L_1 is to be not less than 96% and need not exceed 97% of the extreme length on the waterline at the scantling draught *ds*. In ships without rudder stocks (e.g. ships fitted with azimuth thrusters), the Rule length L_1 is to be taken equal to 97% of the extreme length on the waterline at the scantling draught *ds*. *ds*: Scantling draught (*m*) at which the strength requirements for the scantlings of the ship are met and represents the full load condition; it is to be not less than that corresponding to the assigned freeboard. $\underline{P_n}$: As obtained from **Table CS19.8**	surface not subjected to relative displacements *d*: As given by the following formula. Where *d* exceeds 3, *d* is to be taken as 3. $d = 3.75 - 0.015L_1$ $d_{\min} = 1.0$ in general $d_{\min} = 2.0$ for partial loading conditions L_1: Distance (*m*) measured on the waterline at the scantling draught *ds* from the forward side of the stem to the centre of the rudder stock. L_1 is to be not less than 96% and need not exceed 97% of the extreme length on the waterline at the scantling draught *ds*. In ships without rudder stocks (e.g. ships fitted with azimuth thrusters), the Rule length L_1 is to be taken equal to 97% of the extreme length on the waterline at the scantling draught *ds*. *ds*: Scantling draught (*m*) at which the strength requirements for the scantlings of the ship are met and represents the full load condition; it is to be not less than that corresponding to the assigned freeboard. $\underline{p_n}$: As obtained from **Table CS19.10**	

Amended	Original	Remarks
Table CS19.~~10~~8 Permissible ~~n~~Nominal ~~s~~Surface ~~p~~Pressure ~~p_n~~ P_n | Material	p_n when loaded by	
	Vertical force	Horizontal force (on stoppers)
Hull structure steel	25	40
Hardened steel	35	50
Lower friction materials	50	-		Table CS19.~~10~~8 Permissible ~~n~~Nominal ~~s~~Surface ~~p~~Pressure ~~p_n~~ P_n | Material	p_n when loaded by	
	Vertical force	Horizontal force (on stoppers)
Hull structure steel	25	40
Hardened steel	35	50
Lower friction materials	50	-		UR S21 6.2.2 Tab.7
(b) Where large relative displacements of the supporting surfaces are to be expected, the use of material having low wear and frictional properties is recommended. (c) Drawings of the supports are to be submitted. In these drawings, the permitted maximum pressure given by the material manufacturer is to be specified. (d) When the manufacturer of the vertical hatch cover support material can provide proof that the material is sufficient for the increased surface pressure, not only statically but under dynamic conditions, the permissible nominal surface pressure $P_{n\,max}$, as specified in **(a)** above, may be relaxed at the discretion of the Society. However, realistic long term distributions of spectra for vertical loads and relative horizontal motion between hatch covers and hatch cover stoppers are as deemed appropriate by the Society. (e) Irrespective of the arrangement of stoppers, the supports are to be able to transmit the following force P_h in the longitudinal and transverse direction. $P_h = \mu \frac{P_V}{\sqrt{d}}$ P_V: Vertical supporting force	(b) Where large relative displacements of the supporting surfaces are to be expected, the use of material having low wear and frictional properties is recommended. (c) Drawings of the supports are to be submitted. In these drawings, the permitted maximum pressure given by the material manufacturer is to be specified. (d) When the manufacturer of the vertical hatch cover support material can provide proof that the material is sufficient for the increased surface pressure, not only statically but under dynamic conditions, the permissible nominal surface pressure $p_{n\,max}$ as specified in **(a)** above, may be relaxed at the discretion of the Society. However, realistic long term distributions of spectra for vertical loads and relative horizontal motion between hatch covers and hatch cover stoppers are as deemed appropriate by the Society. (e) Irrespective of the arrangement of stoppers, the supports are to be able to transmit the following force p_h in the longitudinal and transverse direction. $p_h = \mu \frac{p_v}{\sqrt{d}}$ p_v: Vertical supporting force	UR S21 6.2

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td>μ: Friction coefficient generally to be taken as 0.5. For non-metallic or low-friction materials, the friction coefficient may be reduced as appropriate by the Society. However, in no case μ is to be less than 0.35.
(f) Stresses in supporting structures are to comply with the criteria specified in 19.2.5-1(1).
(g) For substructures and adjacent constructions of supports subjected to horizontal forces $\underline{P_h}$, special consideration is to be given to fatigue strength.</td><td>μ: Friction coefficient generally to be taken as 0.5. For non-metallic or low-friction materials, the friction coefficient may be reduced as appropriate by the Society. However, in no case μ is to be less than 0.35.
(f) Stresses in supporting structures are to comply with the criteria specified in 19.2.5-1(1).
(g) For substructures and adjacent constructions of supports subjected to horizontal forces $\underline{p_h}$, special consideration is to be given to fatigue strength.</td><td></td></tr>
<tr><td>2 For steel weathertight hatch covers of Type 2 ships, effective means for stoppers complying with the requirements in Table CS19.9 against the horizontal green sea forces acting on them are to be provided.</td><td>-2. (Newly added)</td><td>(Newly added)
UR S21 6.2.3</td></tr>
<tr><td>Table CS19.9 Strength Requirements for Stoppers
<table><tr><td>Design pressure</td><td>As specified in 19.2.4(7).</td></tr><tr><td>Allowable equivalent stress</td><td>In stoppers, their supporting structures and the stopper welds (calculated at the throat of welds), the equivalent stress is not to exceed the allowable value of 0.8 times the yield stress of the material.</td></tr></table></td><td></td><td>(Newly added)
UR S21 6.2.3</td></tr>
</table>

Amended	Original	Remarks
EFFECTIVE DATE AND APPLICATION **1.** The effective date of the amendments is 1 July 2024. **2.** Notwithstanding the amendments to the Rules, the current requirements apply to ships for which the date of contract for construction* is before the effective date. * "contract for construction" is defined in the latest version of IACS Procedural Requirement (PR) No.29. IACS PR No.29 (Rev.0, July 2009) **1.** The date of "contract for construction" of a vessel is the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. This date and the construction numbers (i.e. hull numbers) of all the vessels included in the contract are to be declared to the classification society by the party applying for the assignment of class to a newbuilding. **2.** The date of "contract for construction" of a series of vessels, including specified optional vessels for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective owner and the shipbuilder. For the purpose of this Procedural Requirement, vessels built under a single contract for construction are considered a "series of vessels" if they are built to the same approved plans for classification purposes. However, vessels within a series may have design alterations from the original design provided: (1) such alterations do not affect matters related to classification, or (2) If the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the shipbuilder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval. The optional vessels will be considered part of the same series of vessels if the option is exercised not later than 1 year after the contract to build the series was signed. **3.** If a contract for construction is later amended to include additional vessels or additional options, the date of "contract for construction" for such vessels is the date on which the amendment to the contract, is signed between the prospective owner and the shipbuilder. The amendment to the contract is to be considered as a "new contract" to which **1.** and **2.** above apply. **4.** If a contract for construction is amended to change the ship type, the date of "contract for construction" of this modified vessel, or vessels, is the date on which revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder. Note: This Procedural Requirement applies from 1 July 2009.		

Amended	Original	Remarks
GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS **Part B CLASS SURVEYS** **B1 GENERAL**		
B1.3 Definitions **B1.3.1 Terms** (Omitted.) **3** "Hatch covers and hatch coamings for cargo holds of ships stipulated otherwise by the Society" in **1.3.1(6)(b), Part B of the Rules** is as specified in the following **(1)** to **(5)**. (Omitted) (4) Hatch covers and hatch coamings of ships which are contracted for construction on or after 1 July 2012 except bulk carriers defined in **1.3.1(13), Part B** (excluding those affixed with the notation "*CSR*"), self-unloading ships defined in **1.3.1(19), Part B** and ships other than ordinary bulk carriers with a single deck, and bilge hopper tanks, topside tanks and a double bottom for the length of the cargo area. Renewal thickness ($t_{renewal}$) is given by the following formula. If a voluntary addition is included in as built thickness, the value may be at the discretion of the Society. $t_{renewal} = t_{as\text{-}built} - t_c + 0.5$ (*mm*) $t_{as\text{-}built}$: as built thickness (*mm*) t_c: Corrosion addition specified in **Table B1.3.1-1(d)** Where corrosion addition t_c is 1.0 (*mm*), renewal	**B1.3 Definitions** **B1.3.1 Terms** (Omitted) **3** "Hatch covers and hatch coamings for cargo holds of ships stipulated otherwise by the Society" in **1.3.1(6)(b), Part B of the Rules** is as specified in the following **(1)** to **(4)**. (Omitted) (4) Hatch covers and hatch coamings of ships complying with the requirements in **14.6, Part 1, Part C of the Rules** or **19.2, Part CS of the Rules,** and ships which are contracted for construction on or after 1 July 2012. Renewal thickness ($t_{renewal}$) is given by the following formula. If a voluntary addition is included in the as built thickness, the value may be at the discretion of the Society. $t_{renewal} = t_{as\text{-}built} - t_c + 0.5$ (*mm*) $t_{as\text{-}built}$: as built thickness (*mm*) t_c: Corrosion addition specified in **Table B1.3.1-1(d)** Where corrosion addition t_c is 1.0 (*mm*), renewal	UR S21 7.2

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
thickness may be given by the formula $t_{renewal} = t_{as\text{-}built} - t_c$ (*mm*) (Omitted) (5) Hatch covers and hatch coamings of ships which are contracted for construction on or after 1 July 2024 (excluding those affixed with the notation "*CSR*"). Renewal thickness ($t_{renewal}$) is given by the following formula. If a voluntary addition is included in as built thickness, the value may be at the discretion of the Society. $t_{renewal} = t_{as\text{-}built} - t_c + 0.5$ (*mm*) $t_{as\text{-}built}$: as built thickness (*mm*) t_c: Corrosion addition specified in **Table B1.3.1-1(e)** Where corrosion addition t_c is 1.0 (*mm*), renewal thickness may be given by the formula $t_{renewal} = t_{as\text{-}built} - t_c$ (*mm*)	thickness may be given by the formula $t_{renewal} = t_{as\text{-}built} - t_c$ (*mm*) (Omitted) (Newly added)	(Newly added)

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

<table>
<tr><th>Amended</th><th>Original</th><th>Remarks</th></tr>
<tr><td>

Table B1.3.1-1(e)

<table>
<tr><th>Type</th><th>Ship type</th><th colspan="2">Framing system</th><th>t_c (mm)</th></tr>
<tr><td rowspan="5">Type 1 ship</td><td rowspan="4">Ships other than the below</td><td colspan="2">Single skin hatch covers</td><td>2.0</td></tr>
<tr><td rowspan="2">Double skin hatch covers</td><td>Top, side and bottom plating</td><td>1.5</td></tr>
<tr><td>Internal structural members</td><td>1.0</td></tr>
<tr><td colspan="2">Hatch coamings, hatch coaming stays and stiffeners</td><td>1.5</td></tr>
<tr><td rowspan="2">Container carrier
Car carrier</td><td colspan="2">Hatch covers (in general)</td><td>1.0</td></tr>
<tr><td colspan="2">Hatch coamings</td><td>1.5</td></tr>
<tr><td rowspan="4">Type 2 ship</td><td rowspan="4">Ore carrier
Combination carriers which are designed to carry either oil or solid cargoes in bulk, like ore/oil carriers.
Self-unloading ships
(Ships specified in 1.3.1(13), Part B(excluding those affixed with the notation "CSR") and (19))</td><td colspan="2">Single skin hatch covers</td><td>2.0</td></tr>
<tr><td rowspan="2">Double skin hatch covers</td><td>Top, side and bottom plating</td><td>2.0</td></tr>
<tr><td>Internal structural members</td><td>1.5</td></tr>
<tr><td colspan="2">Hatch coamings, hatch coaming stays and stiffeners</td><td>1.5</td></tr>
<tr><td colspan="5">Notes
(1) Corrosion additions for both sides of hatch covers and hatch coamings on non-exposed decks are to be as deemed appropriate by the Society.
(2) The definitions of Type 1 ship and Type 2 ship are given 14.6.1.2, Part 1, Part C.</td></tr>
</table>

</td><td></td><td>(Newly added)
UR S21 7.1</td></tr>
<tr><td>

EFFECTIVE DATE AND APPLICATION

1. The effective date of the amendments is 1 July 2024.
2. Notwithstanding the amendments to the Guidance, the current requirements apply to the surveys for which the application is submitted to the Society before the effective date.

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</table>

Amended	Original	Remarks
Part CS HULL CONSTRUCTION AND EQUIPMENT OF SMALL SHIPS **CS19 HATCHWAYS, MACHINERY SPACE OPENINGS AND OTHER DECK OPENINGS**		
CS19.2 Hatchways (Deleted)	**CS19.2 Hatchways** **CS19.2.1 Application** **1** Notwithstanding ship length, the construction and means for closing cargo and other hatchways of bulk carriers defined in **1.3.1(13), Part B of the Rules**, self-unloading ships defined in **1.3.1(19), Part B of the Rules** and ships intended to be registered as "bulk carriers" are to comply with relevant requirements in **Part CSR-B&T** or **Part CSR-B of the Rules**. **2** When the requirements for hatchways in **Part CSR-B&T** or **Part CSR-B of the Rules** apply to hatchways of ships in accordance with **-1** above, the corrosion additions for hatch coamings, hatch coaming stays and stiffeners may be taken as 1.5 *mm*.	(Deleted)
CS19.2.4 Design Loads for Steel Hatch Covers, Portable Beams and Hatchway Coamings **1** Design vertical wave load P_{HC} as specified in **19.2.4(1), Part CS** of the Rules is to comply with the following requirements. (1) Positions I and II may be determined in accordance with **Fig. CS19.2.4-1** and **-2**. (2) Where an increased freeboard is assigned, the design load for hatch covers according to **19.2.4(1), Part CS** of the Rules on the actual freeboard deck may be as required for a superstructure deck, provided the summer freeboard is such	**CS19.2.4 Design Loads for Steel Hatch Covers, Portable Beams and Hatchway Coamings** **1** Design vertical wave load P_V as specified in **19.2.4(1), Part CS** of the Rules is to comply with the following requirements. (1) Positions I and II may be determined in accordance with **Fig. CS19.2.4-1** and **-2**. (2) Where an increased freeboard is assigned, the design load for hatch covers according to **19.2.4(1), Part CS** of the Rules on the actual freeboard deck may be as required for a superstructure deck, provided the summer freeboard is such	UR S21 1.2.2

Amended	Original	Remarks
that the resulting draught will not be greater than that corresponding to the minimum freeboard calculated from an assumed freeboard deck situated at a distance at least equal to one superstructure standard height (as per Regulation 33 of the "*International Convention on Load Lines,* 1966 *and Protocol of* 1988 *relating to the International Convention on Load Lines,* 1966") below the actual freeboard deck (see **Fig. CS19.2.4-2**). (Omitted)	that the resulting draught will not be greater than that corresponding to the minimum freeboard calculated from an assumed freeboard deck situated at a distance at least equal to one superstructure standard height (as per Regulation 33 of the "*International Convention on Load Lines,* 1966 *and Protocol of* 1988 *relating to the International Convention on Load Lines,* 1966") below the actual freeboard deck (see **Fig. CS19.2.4-2**). (Omitted)	
(Deleted)	**CS19.2.5 Strength Criteria of Steel Hatch Covers and Hatch Beams** **1** Where scantlings of structural members of steel hatch covers are determined based upon direct calculations, the following requirements are to be applied. Those not specified in this paragraph are to comply with the requirements in **Chapter 8, Part 1, Part C of the Rules.** (1) Loads The design wave loads imposed on steel hatch covers are to be P_V specified in **19.2.4(1), Part CS** of the Rules. (2) Modelling of structures (a) The structural model is to be able to reproduce the behaviour of the structure with the highest possible fidelity. Stiffeners and primary supporting members subject to pressure loads are to be included in the modelling. However, buckling stiffeners may be disregarded for stress calculation. (b) Net scantlings which do not include corrosion additions are to be used for modelling. (c) In no case is element width to be larger than stiffener	(Deleted)

Amended	Original	Remarks
	spacing. The ratio of element length to width is not to exceed 4. The element height of the webs of primary supporting members is not to exceed one-third of the web height. (d) The structural model is to be supported by pads. If the arrangement of pads differs from the arrangement of stiffeners, the edge elements of steel hatch covers are also to be modelled. (3) Permissible value When the loads specified in **(1)** act on the structural model specified in **(2)**, the net scantlings are to be determined so that the stress and deflection generated in each structural member satisfy the allowable values specified in **19.2.5-1**, **Part CS** of the Rules. (4) Miscellaneous (a) The thickness of the top plating of steel hatch covers is to comply with the requirements in **19.2.5-2, Part CS** of the Rules. (b) The scantlings of the secondary stiffeners of steel hatch covers are to comply with the requirements in **19.2.5-3, Part CS** of the Rules. (c) The buckling strength for the structural members forming steel hatch covers is to comply with the requirements in **19.2.5-6, Part CS** of the Rules.	

Amended-Original Requirements Comparison Table (Hatch Covers, Hatch Coamings and Closing Arrangements)

Amended	Original	Remarks
(Deleted)	**CS19.2.6 Additional Requirements for Steel Hatch Covers Carrying Cargoes** **1** "Direct calculations deemed appropriate by the Society" in 19.2.6-1, Part CS of the Rules refers to calculations that comply with the following requirements. Those not specified in this paragraph are to comply with the requirements in Chapter 8, Part 1, Part C of the Rules.. (1) Loads (a) The loads acting on steel hatch covers are to be according to 19.2.4, Part CS of the Rules based on the type of load and loading condition. Except as deemed necessary by the Society, no loads are to be assumed to act jointly. (b) No dynamic loads due to ship motion are to be assumed as the wheel loads from wheeled vehicles only used for loading/unloading while in port. (2) Modelling of Structures (a) The structural model is to be able to reproduce the behaviour of the structure with the highest possible fidelity. Stiffeners and primary supporting members subject to pressure loads are to be included in the modelling. However, buckling stiffeners may be disregarded for stress calculation. (b) Net scantlings which do not include corrosion additions are to be used for modelling. (c) In no case is element width to be larger than stiffener spacing. The ratio of element length to width is not to exceed 4. The element height of the webs of primary supporting members is not to exceed one-third of the	(Deleted)

Amended	Original	Remarks
	web height. (d) The structural model is to be supported by pads. If the arrangement of pads differs from the arrangement of stiffeners, the edge elements of steel hatch covers are also to be modelled. (3) Permissible values When the loads specified in **(1)** act on the structural model specified in **(2)**, the net scantlings are to be determined so that the stress and deflection generated in each structural member satisfy the allowable values specified in **19.2.5-1**, **Part CS** of the Rules. **2** The details for steel hatch covers carrying cargoes are to comply with the following **(1)** to **(4)**: (1) To prevent damage to hatch covers and the ship structure, the location of stoppers is to be compatible with the relative movements between hatch covers and the ship structure. (2) Hatchway covers and supporting structures are to be adequately stiffened to accommodate the load from hatch covers. (3) At the cross-joints of multi-panel covers, vertical guides (male/female) are to be fitted to prevent excessive relative vertical deflections between loaded/unloaded panels. (4) The construction and scantlings of hatchways on exposed parts or on the lower deck are to comply with the following requirements in addition to those of **19.2, Part CS** of the Rules. (a) The loading arrangement is to be clearly shown in drawings submitted for approval. In the case of freight containers, the type and location are to be additionally described.	

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	(b) Girders or stiffeners are to be provided for reinforcement beneath the corner fittings of freight containers. (c) The top plates of hatch covers, upon which wheeled vehicles are loaded, are to comply with the following: i) The thickness of hatch cover top plating may be determined by direct calculation or in accordance with **CS17.4.5.** ii) The scantlings of the stiffeners of hatch covers may be determined by direct calculation or in accordance with **CS10.7.1.**	
CS19.2.12 Steel Hatchway Covers for Container Carriers **1** In the application of the requirements of **19.2.12, Part CS** of the Rules, the height of coamings above the upper surface of the deck where the hatchway covers are fitted is to be at least 600 *mm*. (Omitted)	**CS19.2.12 Steel Hatchway Covers for Container Carriers** **1** In the application of the requirements of **19.2.12, Part CS** of the Rules, the height of coamings above the upper surface of the deck where the hatchway covers are fitted is to be at least 600 *mm* in Position II. (Omitted)	UR S21 4.2.2

Amended	Original	Remarks
EFFECTIVE DATE AND APPLICATION **1.** The effective date of the amendments is 1 July 2024. **2.** Notwithstanding the amendments to the Guidance, the current requirements apply to ships for which the date of contract for construction* is before the effective date. * "contract for construction" is defined in the latest version of IACS Procedural Requirement (PR) No.29. IACS PR No.29 (Rev.0, July 2009) **1.** The date of "contract for construction" of a vessel is the date on which the contract to build the vessel is signed between the prospective owner and the shipbuilder. This date and the construction numbers (i.e. hull numbers) of all the vessels included in the contract are to be declared to the classification society by the party applying for the assignment of class to a newbuilding. **2.** The date of "contract for construction" of a series of vessels, including specified optional vessels for which the option is ultimately exercised, is the date on which the contract to build the series is signed between the prospective owner and the shipbuilder. For the purpose of this Procedural Requirement, vessels built under a single contract for construction are considered a "series of vessels" if they are built to the same approved plans for classification purposes. However, vessels within a series may have design alterations from the original design provided: (1) such alterations do not affect matters related to classification, or (2) If the alterations are subject to classification requirements, these alterations are to comply with the classification requirements in effect on the date on which the alterations are contracted between the prospective owner and the shipbuilder or, in the absence of the alteration contract, comply with the classification requirements in effect on the date on which the alterations are submitted to the Society for approval. The optional vessels will be considered part of the same series of vessels if the option is exercised not later than 1 year after the contract to build the series was signed. **3.** If a contract for construction is later amended to include additional vessels or additional options, the date of "contract for construction" for such vessels is the date on which the amendment to the contract, is signed between the prospective owner and the shipbuilder. The amendment to the contract is to be considered as a "new contract" to which **1.** and **2.** above apply. **4.** If a contract for construction is amended to change the ship type, the date of "contract for construction" of this modified vessel, or vessels, is the date on which revised contract or new contract is signed between the Owner, or Owners, and the shipbuilder. Note: This Procedural Requirement applies from 1 July 2009.		