19-393

RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

Part CSR-B&T Common Structural Rules for Bulk Carriers and Oil Tankers

Rules for the Survey and Construction of Steel Ships
Part CSR-B&T 2019 AMENDMENT NO.1

Rule No.3 20 February 2019
Resolved by Technical Committee on 30 January 2019

ClassNK
NIPPON KAIJI KYOKAI

Rule No.3 20 February 2019
AMENDMENT TO THE RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

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

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

Part 1 GENERAL HULL REQUIREMENTS

Chapter 2 GENERAL ARRANGEMENT DESIGN

Section 3 COMPARTMENT ARRANGEMENT

2. Double Bottom

2.3 Height of Double Bottom

Paragraph 2.3.1 has been amended as follows.

2.3.1

Unless otherwise specified, the height of the double bottom is not to be less than the lesser of:

- For oil tankers: *B*/15 or 2 *m*, however not less than 1.0 *m* measured at right angles to the shell plating at any cross section.
- For bulk carriers: *B*/20 or 2 *m*, however not less than 0.76 *m* measured vertically from the plane parallel with keel line to inner bottom.

Chapter 3 STRUCTURAL DESIGN PRINCIPLES

Section 3 CORROSION ADDITIONS

Table 1 has been amended as follows.

Table 1 Corrosion Addition for One Side of a Structural Member

Compartment type	Structural member		t_{c1} or t_{c2}		
			Oil tankers	*BC-A* or *BC-B* ships with $L_{CSR} \geq 150m$	Other *BC* ships
Ballast water tank, bilge tank, drain storage tank, chain locker (1)	Face plate of PSM	Within 3 *m* below top of tank (4)	2.0		
		Elsewhere	1.5		
	Other members (2) (3)	Within 3 *m* below top of tank (4)	1.7		
		Elsewhere	1.2		
Cargo oil tank, slop tank	Face plate of PSM	Within 3 *m* below top of tank (4)	1.7	N/A	
		Elsewhere	1.4		
	Inner-bottom plating/bottom of tank		2.1		
	Other members	Within 3 *m* below top of tank (4)	1.7		
		Elsewhere	1.0		
Dry bulk cargo hold (5)	Transverse bulkhead	Upper part (6)	N/A	2.4	1.0
		Lower stool: sloping plate, vertical plate and top plate (7)		5.2	2.6
		Other parts		3.0	1.5
	Sloped plating of hopper tank, inner bottom plating			3.7	2.4
	Other members	Upper part (6)		1.8	1.0
		Webs and flanges of the upper end brackets of side frames of single side bulk carriers			
		Webs and flanges of lower brackets of side frames of single side bulk carriers		2.2	1.2
		Other parts		2.0	1.2
Exposed to atmosphere	Weather deck plating		1.7		
	Other members		1.0		
Exposed to seawater	Shell plating between the minimum design ballast draught waterline and the scantling draught waterline		1.5		
	Shell plating elsewhere		1.0		

Fuel and lube oil tank		0.7
Fresh water tank		0.7
Void spaces [8]	Spaces not normally accessed, e.g. access only via bolted manhole openings, pipe tunnels, inner surface of stool space not common with a dry bulk cargo hold or ballast cargo hold, etc.	0.7
Dry spaces	Internals of machinery spaces, pump room, store rooms, steering gear space, etc.	0.5

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

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

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

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

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

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

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

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

Section 6 STRUCTURAL DETAIL PRINCIPLES

3. Stiffeners

3.4 Sniped Ends

Paragraph 3.4.1 has been amended as follows.

3.4.1

Sniped ends may be used where dynamic loads are small, provided the net thickness of plating supported by the stiffener, t_p, is not less than:

$$t_p = c_1 \sqrt{\left(1000\ell - \frac{s}{2}\right)\frac{s\,P\,k}{10^6}}$$

where:

P : Design pressure for the stiffener for the design load set being considered, in kN/m^2.

c_1 : Coefficient for the design load set being considered, to be taken as:

$c_1 = 1.2$ for acceptance criteria set AC-S.

$c_1 = 1.1$ for acceptance criteria set AC-SD.

Sniped stiffeners are not to be used on structures in the vicinity of engines or generators in the machinery space, propeller impulse zone in the stern area nor on the shell envelope.

Paragraph 3.4.2 has been amended as follows.

3.4.2

Bracket toes and sniped stiffeners ends are to be terminated close to the adjacent member. The distance is not to exceed 40 *mm* unless the bracket or member is supported by another member on the opposite side of the plating. Tapering of the sniped end is not to be more than 30 *deg*, where it is not practical to comply with this requirement, alternative arrangements are specially considered. The depth of toe or sniped end is, generally, not to exceed the thickness of the bracket toe or sniped end member, but need not be less than 15 *mm*.

Chapter 4 LOADS

Section 5 EXTERNAL LOADS

Symbols

Symbols has been amended as follows.

(Omitted)

Z_{SD} : *Z* coordinate, in *m*, of the midpoint of stiffener span, or of the middle of the ~~plate field~~ elementary plate panel.

Chapter 6 HULL LOCAL SCANTLING

Section 5 STIFFENERS

1. Stiffeners subject to Lateral Pressure

1.1 Yielding Check

Paragraph 1.1.4 has been amended as follows.

1.1.4 Plate and stiffener of different materials

When the minimum specified yield stress of a stiffener exceeds the minimum specified yield stress of the attached plate by more than 35%, the following criterion is to be satisfied:

$$\sout{R_{eH-S} \le \left(R_{eH-P} - \frac{\sigma_S |\sigma_{hg}|}{\beta_S} \right) \frac{Z_P}{Z} + \frac{\alpha_s |\sigma_{hg}|}{\beta_S}} \quad \underline{R_{eH-S} \le \left(R_{eH-P} - \frac{\alpha_s |\sigma_{hg}|}{\beta_S} \right) \frac{Z_P}{Z} + \frac{\alpha_s |\sigma_{hg}|}{\beta_S}}$$

where:

R_{eH-S}: Minimum specified yield stress of the material of the stiffener, in N/mm^2.

R_{eH-P}: Minimum specified yield stress of the material of the attached plate, in N/mm^2.

σ_{hg}: Hull girder bending stress, in N/mm^2, as defined in **Ch 6, Sec 2, 1.1** with $|\sigma_{hg}|$ not to be taken less than $0.4R_{eH-P}$.

Z: Net section modulus, in way of face plate/free edge of the stiffener, in cm^3.

Z_P: Net section modulus, in way of the attached plate of stiffener, in cm^3.

α_s, β_s: Coefficients defined in **Table 2**.

Chapter 7 DIRECT STRENGTH ANALYSIS

Section 3 LOCAL STRUCTURAL STRENGTH ANALYSIS

2. Local Areas to be Assessed by Fine Mesh Analysis

2.1 List of Mandatory Structural Details

Paragraph 2.1.1 has been amended as follows.

2.1.1 List of structural details

In the midship cargo hold region, the following structural details are to be assessed according to the fine mesh analysis procedure defined in **1.1.3**:

(a) Hopper knuckles for ship with double side as given in **2.1.2**,
(b) Side frame end brackets and lower hopper knuckle for single side bulk carrier as given in **2.1.3**,
(c) Large openings as given in **2.1.4**,
(d) Connections of deck and double bottom longitudinal stiffeners to transverse bulkhead as given in **2.1.5**,
(e) Connections of corrugated bulkhead to adjoining structure as given in **2.1.6**,
(f) Bracket at the heel of horizontal stringer as given in **2.1.7**,

For each above mentioned structural detail, one fine mesh model is required within all the cargo hold models covering the midship cargo hold region. The selection of the location of this fine mesh model is to be based on requirements given from **2.1.2** to ~~**2.1.6**~~**2.1.7** from all cargo hold analyses in the midship cargo hold region.

Paragraph 2.1.7 has been added as follows.

2.1.7 Bracket at the heel of horizontal stringer

Fine mesh analysis is to be carried out for the bracket at the heel of horizontal stringers. All structural elements adjacent to the heel including the inner hull, longitudinal and transverse bulkhead are to satisfy the stress acceptance criteria. The heel of horizontal stringer which, in the cargo hold analysis, has the maximum yield utilization factor, λ_y, is to be selected for the fine mesh analysis. Where there is a significant variation in the arrangement of the bracket at the heel and the horizontal stringer, analysis of additional locations may be required by the Society.

3. Screening Procedure

3.2 List of Structural Details

Paragraph 3.2.1 has been amended as follows.

3.2.1 Cargo hold region

The following structural details and areas in the cargo hold region are to be evaluated by screening:

(Omitted)

(c) ~~9~~Heels of transverse bulkhead horizontal stringers specified in **Table 3**.

(Omitted)

Paragraph 3.2.2 has been amended as follows.

3.2.2 Outside midship cargo hold region

The following structural details outside midship cargo hold region are to be evaluated by screening:

(a) Hopper knuckle, as defined in **2.1.2** and **2.1.3**,

(b) Side frame end bracket, as defined in **2.1.3**,

(c) Large openings, as defined in **2.1.4**,

(d) Connections of corrugation to adjoining structure, as defined in **2.1.6**,

(e) Bracket at the heel of horizontal stringers in **2.1.7**,

The connections of corrugation to adjoining structure and the bracket at the heel of horizontal stringers to be screened are to be similar in its geometry, its proportion and its relative location to the corresponding detail modelled in fine mesh in the midship cargo hold region.

When the connections of corrugation to adjoining structure and the bracket at the heel of horizontal stringers outside the midship cargo hold region are different from the corresponding detail modelled in fine mesh in the midship cargo hold region, a fine mesh analysis is to be performed for the detail located where the yield utilisation factor, λ_y, is maximum for structural details having the same geometry and the same relative location,

When it is deemed necessary, the Society may request a fine mesh analysis to be performed according to **1.1.3**.

3.3 Screening Criteria

Table 4 has been amended as follows.

Table 4 Screening Factors and Permissible Screening Factors

Type of Details	Screening factors, λ_{sc}	Permissible screening factors, λ_{scperm}	
Within the whole cargo hold region		$S+D$	S
Openings for which their geometry is not required to be represented in the cargo hold model in accordance with **Ch 7, Sec 2, 2.4.9** in way of webs of primary supporting members, such as transverse web frame as indicated in **Table 1** and **Table 2**, horizontal stringers as indicated in **Table 3**, floors and longitudinal girders in double bottom.	**Table 5**	1.70	1.36
Manholes (2)	λ_y	0.85 λ_{yperm}	
Bracket toes on transverse web frames as indicated in **Table 1** and **Table 2**, horizontal stringers and transverse plane bulkhead to double bottom connection or buttress structure specified in **Table 3**.	**Table 6**	1.50	1.20
Heels of transverse bulkhead horizontal stringers specified in **Table 3**.	**Table 7**	1.50	1.20
Connections of transverse lower stool to double bottom girders and longitudinal lower stool to double bottom floors as indicated in **Fig. 5**. The connection of lower hopper to transverse lower stool structure as indicated in **Fig. 5**. The connection of topside tank to inner side as indicated in **Fig. 6**. The connection of corrugation and upper supporting structure to upper stool as indicated in **Fig. 7**.	λ_y	0.75 λ_{yperm}	
Hatch corner area.	λ_y	0.95 λ_{yperm}	
Outside midship cargo hold region			
Hopper knuckle	λ_y	0.65 λ_{yperm}	
Side frame end bracket		0.85 λ_{yperm}	
Large openings (2)		0.85 λ_{yperm}	
Connections of corrugation to adjoining structure and bracket at the heel of horizontal stringer	$\lambda_{sc} = \frac{K_{sc} \cdot \sigma_c}{R_y}$ (1)	$1.50 f_f$	$1.20 f_f$

where:

λ_y : Coarse mesh yield utilisation factor, as defined in **Ch 7, Sec 2, 5.2.4**.

λ_{yperm} : Coarse mesh permissible yield utilisation factor, as defined in **Ch 7, Sec 2, 5.2.4**.

K_{sc}: Screening stress concentration factor, taken as:

$$K_{sc} = \frac{\sigma_{FM}}{\sigma_{CM}}$$

σ_{FM} : Von Mises fine mesh stress, in N/mm^2, for the considered detail calculated in the midship cargo hold region according to **2**.

σ_{CM} : Von Mises coarse mesh stress, in N/mm^2, for the considered detail calculated in the midship cargo hold region according to **Ch 7, Sec 2**.

σ_C : Von Mises coarse mesh stress, in N/mm^2, for the area in way of considered detail.

f_f : Fatigue factor defined in **6.2.1**.

(1) For each screened detail, σ_{FM} and σ_{CM} are to be taken from the corresponding elements in the same plane position.

(2) The representative element which has maximum yield utilisation factor around the manhole and the large opening is to be verified against criterion.

Chapter 8 BUCKLING

Section 5 BUCKLING CAPACITY

2. Buckling Capacity of Plates and Stiffeners

2.3 Stiffeners

Paragraph 2.3.4 has been amended as follows.

2.3.4 Ultimate buckling capacity

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

(Omitted)

C_i: Pressure coefficient:

$C_i = C_{SI}$ for stiffener induced failure (*SI*).

$C_i =$ ~~C_{SI}~~$\underline{C_{PI}}$ for plate induced failure (*PI*).

(Omitted)

Chapter 10 OTHER STRUCTURES

Section 1 FORE PART

3. Structure subjected to Impact Loads

3.2 Bottom Slamming

Paragraph 3.2.4 has been amended as follows.

3.2.4 Shell plating

The net thickness of the hull envelope plating, t, in *mm*, <u>except for the transversely stiffened bilge plating within the cylindrical part of the ship,</u> is not to be less than：

$$t = \frac{0.0158\alpha_p\, b}{C_d}\sqrt{\frac{P_{SL}}{C_a\, R_{eH}}}$$

where：

C_d : Plate capacity correction coefficient taken as：

$C_d = 1.3$

C_a : Permissible bending stress coefficient taken as：

$C_a = 1.0$ for acceptance criteria set AC-I.

<u>The transversely stiffened bilge plating within the cylindrical part of the ship is to comply with the requirement given in **Ch 6, Sec 4, 2.2**.</u>

Section 3 AFT PART

3. Stern Frames

3.2 Propeller Posts

Paragraph 3.2.1 has been amended as follows.

3.2.1 Gross scantlings of propeller posts

The gross scantlings of propeller posts are not to be less than those obtained from the formulae in **Table 1** for single screw ships and **Table 2** for twin screw ships.

Scantlings and proportions of the propeller post which differ from ~~those above~~ **Table 1** and **Table 2** may be considered acceptable provided that the section modulus of the propeller post section about its longitudinal axis is not less than that calculated with the propeller post scantlings in **Table 1** or **Table 2**, as applicable.

Paragraph 3.2.2 has been deleted.

~~3.2.2 Section modulus below the propeller shaft bossing~~

~~In the case of a propeller post without a sole piece, the section modulus of the propeller post may be gradually reduced below the propeller shaft bossing down to 85% of the value calculated with the scantlings in **Table 1** or **Table 2**, as applicable.~~

~~In any case, the thicknesses of the propeller posts are not to be less than those obtained from the formulae in the **Table 1** and **Table 2**.~~

Chapter 12 CONSTRUCTION

Section 3 DESIGN OF WELD JOINTS

2. Tee or Cross Joint

2.5 Weld Size Criteria

Table 1 has been amended as follows.

Table 1 Minimum Leg Size

Area	Type of space		Minimum length, in *mm*
Cargo hold region	Cargo tanks and holds	~~Welds w~~Within 3 *m* below top of ~~compartment~~ tank (2)	6.5 (1)
		Elsewhere	6.0 (1)
	Water ballast ~~and fresh water~~ tanks	~~Welds w~~Within 3 *m* below top of ~~compartment~~ tank (2)	6.5 (1)
		Elsewhere	6.0 (1)
	Dry spaces and voids		5.0
	Other tanks		6.0 (1)
Other areas	Water ballast ~~and fresh water~~ tanks	~~Welds w~~Within 3 *m* below top of ~~compartment~~ tank (2)	6.0 (1)
		Elsewhere	5.5 (1)
	Fuel oil, diesel oil, fresh water and other tanks	~~Welds within 3 *m* below top of compartment~~	~~5.0~~
		~~Elsewhere~~	4.5
	Dry spaces and voids	~~Welds within 3 *m* below top of compartment~~	~~4.5~~
		~~Elsewhere~~	4.0
	Superstructures and deckhouses		3.5

(1) If the as-built thickness of the element is less than 12 *mm*, the minimum leg length may be reduced by 0.5 *mm*.

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

Table 2 has been amended as follows.

Table 2 Weld Factors for Different Structural Members

<table>
<tr><td rowspan="2">Hull area</td><td colspan="4">Connection</td><td rowspan="2">f_{weld}</td></tr>
<tr><td colspan="2">Of</td><td colspan="2">To</td></tr>
<tr><td colspan="6">(Omitted)</td></tr>
<tr><td rowspan="9">Deck</td><td rowspan="3">Strength deck</td><td rowspan="2">$t_{as\text{-}built} \geq 13$</td><td colspan="2">Side shell plating within $0.6L_{CSR}$ midship</td><td>PPW (3)</td></tr>
<tr><td colspan="2">Elsewhere</td><td>0.48</td></tr>
<tr><td>$t_{as\text{-}built} < 13$</td><td colspan="2">Side shell plating</td><td>0.48</td></tr>
<tr><td colspan="2" rowspan="2">Other deck</td><td colspan="2">Side shell plating</td><td>0.38</td></tr>
<tr><td colspan="2">Stiffeners</td><td>0.20</td></tr>
<tr><td colspan="2" rowspan="3">Hatch coamings</td><td rowspan="3">Deck plating</td><td>~~At~~ Longitudinal hatch coaming at corners of hatchways ~~for~~ on a length of 15% of the hatch ~~length~~ coaming height</td><td>FPW (4) (1)</td></tr>
<tr><td>Longitudinal hatch coaming on a length starting from 15% of the hatch coaming height from the corners of hatchways up to 15% of the hatch length</td><td>0.48</td></tr>
<tr><td>Elsewhere</td><td>0.38</td></tr>
<tr><td colspan="2">Web stiffeners</td><td colspan="2">Coaming webs</td><td>0.20 (2)</td></tr>
<tr><td rowspan="2">Bulkheads(5)</td><td colspan="2">Non-watertight bulkhead structure</td><td>Boundaries</td><td>Swash bulkheads</td><td>0.24</td></tr>
<tr><td colspan="2">Stiffener</td><td>Bulkhead plating</td><td>At ends (25% of span), where no end brackets are fitted</td><td>0.48</td></tr>
<tr><td colspan="6">(Omitted)</td></tr>
<tr><td rowspan="2">Superstructure and deckhouse</td><td colspan="2">External bulkhead (first and second tier erections)</td><td colspan="2">Deck, external bulkhead</td><td>0.48</td></tr>
<tr><td colspan="2">External bulkheads and internal bulkheads</td><td colspan="2">Elsewhere</td><td>0.20</td></tr>
</table>

(1) f_{weld} =0.43 for hatch coaming other than in cargo holds.
(2) Continuous welding.
(3) PPW: Partial penetration welding in accordance with **2.4.2**.
(4) FPW: Full penetration welding in accordance with **2.4.2**.
(5) Bulkheads of superstructure and deckhouse are to be considered in the row corresponding to ”Superstructure and deck house”.

EFFECTIVE DATE AND APPLICATION

1. The effective date of the amendments is 1 July 2019.
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. Notwithstanding the provision of preceding **2.**, the amendments to the Rules may apply to ships for which the date of contract for construction* is before the effective date upon request.
   * "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.