Common Structural Rules for
Bulk Carriers and Oil Tankers

Technical Background
for
Urgent Rule Change Notice 1
to 01 JAN 2014 version

Pt 1, Ch 4, Sec 4, [3.4.1]

Please see technical background report "Fatigue Assessment of Hatch Corner".

Pt 1, Ch 5, Sec 1, [1.2.9] Definitions of openings

1. Reason for the Rule Change

It is to clarify the Rule requirement.

2. Background

It is clarified that manhole is to be categorized itself separating from small openings.

3. Impact in Scantlings

There is no impact on scantlings due to this change.

Pt 1, Ch 5, Sec 1, [1.2.10] Definitions of openings

1. Reason for the Rule Change

The proposal is to clearly define how to deal with manholes when calculating of section modulus.

3. Impact in Scantlings

There is no impact on scantlings due to this change.

Pt 1, Ch 7, Sec 2, [2.4.9] and Table 1 Openings

1. Reason for the Rule Change

It is to clarify the Rule requirement.

2. Background

It is clarified that the geometry of manholes are to be included in the cargo hold model in order to make a reasonable accurate representation of the opening and to achieve an acceptable result with the loss in shear area due to the opening.
It should be noted that a general screening criteria is proposed in Ch 7, Sec 3 of the Rules for determining whether it is necessary to perform a fine mesh analysis of the manhole.
Table 1 has been further updated to clarify the modelling decision and analysis requirements in order to avoid confusion.

3. Impact in Scantlings

There is no impact on scantlings due to this change.

Pt 1, Ch 7, Sec 3, [3.2.1, a] Cargo hold region

1. Reason for the Rule Change

It is to clarify the Rule requirement for manholes and openings.

2. Background

It is clarified that all manholes and openings, except large openings which are evaluated by mandatory fine mesh assessment, are to be evaluated by the screening procedure based on the screening criteria defined in Pt.1, Ch 7, Sec 3, Table 4.

3. Impact in Scantlings

There is no impact on scantlings due to this change.

Pt 1, Ch 7, Sec 3, [3.3.1] Table 1, 2, and 3

1. Reason for the Rule Change

The tables 1, 2 and 3 dealing with the screening areas have been updated to clarify the screening assessment requirements for openings and manholes.

2. Background

The proposal clarifies how to deal with openings and manholes in the shaded and unshaded regions. Screening check is to be performed for openings except if the opening satisfy the criterion ($h_o/h < 0.35$ and $g_o < 1.2$) and the opening is located in the unshaded regions. However this criterion is not applicable and manholes are to be evaluated by screening regardless of size and location.

3. Impact in Scantlings

There is no impact on scantlings due to this change.

Pt 1, Ch 7, Sec 3, [3.2.2]

1. Reason for the Rule Change

The modifications in paragraph 3.2.2 are due to the proposed amendments in Table 4 (Screening factors and permissible screening factors).

2. Background

For items other than item d) a new screening criteria is proposed based on the coarse mesh stress assessment. The existing screening criterion based on screening stress concentration factor, K_{sc}, is retained for connections of corrugation to adjoining structure.

3. Impact in Scantlings

There is no impact on scantlings due to this change.

Pt 1, Ch 7, Sec 3, [3.3.1] Table 4

1. Reason for the Rule Change

Table 4 has been updated based on further study and calculations.

2. Background

The study of the FE yielding screening Rule criteria by consequence assessment team found that the permissible screening criteria is not satisfied even the fine mesh analysis is satisfied.

Based on the finding from consequence assessment results, the permissible screening factors for manholes and the structural details for outside midship cargo hold region have been reconsidered with study of correlation between stresses from 'coarse mesh' and 'fine mesh' analysis.

Please see technical background report "Procedure for updating FE Yield Screening criteria for cargo hold region".

3. Impact in Scantlings

There is no impact on scantlings due to this change.

Pt 1, Ch 7, Sec 3, [3.3.1] Table 6

1. Reason for the Rule Change
Table 6 has been updated based on further study and calculations.

2. Background
The coefficient of 0.68 and 0.50 are a factor recalibrated from correlation of stresses obtained from the 'coarse mesh' and 'fine mesh' analysis as same reason in Pt.1, Ch 7, Sec 3, Table 4. Please see technical background report "Procedure for updating FE Yield Screening criteria for cargo hold region".

3. Impact in Scantlings
There is no impact on scantlings due to this change.

Pt 1, Ch 7, Sec 3, [3.3.1] Table 7

1. Reason for the Rule Change
Table 7 has been updated based on further study and calculation.

2. Background
A stress concentration factor of 1.67 for the location 1, 2 and 3 and 3.2 for the location 4 were recalibrated from correlation of stresses obtained from the 'coarse mesh' and 'fine mesh' analysis as same reason in Pt.1, Ch 7, Sec 3, Table 4.
Please see technical background report "Procedure for updating FE Yield Screening criteria for cargo hold region".

3. Impact in Scantlings
There is no impact on scantlings due to this change.

Pt 1, Ch 7, Sec 3, [4.8.4], and [4.8.5]

1. Reason for the Rule Change
It is to clarify the Rule requirement.

3. Impact in Scantlings
There is no impact on scantlings due to this change.

Pt 1, Ch 9, Sec 3, [3.1.2]
Please see technical background report "Correction factor for Hot Spot Stress for web stiffened cruciform joint".

Pt 1, Ch 9, Sec 3, [4.1.5], Table 3 and Figure 4
Please see technical background report "Fatigue Assessment of Hatch Corner".

Pt 1, Ch 9, Sec 3, [4.2], Table 4: Non-welded joints: thickness exponent and surface finishing factor

1. Reason for the Rule Change
Fatigue assessment of BC hatch corners shows in general low fatigue life which is not reflected by frequent damage cases of ships after a few years in service. So an increased FAT class is proposed to implement.

2. Background
In 2010 fatigue tests [1] have been performed with thermal cut edges made of 80 mm thick plates. The overall picture is that basic FAT class 140 (B-curve with surface finishing factor K_{SF}=1.07) is conservative and an increased FAT class 150 (B-curve with surface finishing factor K_{SF}=1.0) can be established. The application of this increased FAT class requires a high cutting surface quality as well as a refined stress range calculation by means of finite element technique.

3. Impact in Scantlings
Currently the highest S-N curve for thermal cut edges is FAT 140 (B-curve with surface finishing factor K_{SF}=1.07). The new implemented FAT class 150 (B-curve with surface finishing factor K_{SF}=1.0) lead to and increase permissible stress range of 7%.

4. Literature
[1] **Fatigue Tests of Butt Welds and Plates Edges of 80 mm Thick Plates**
H. von Selle & O. Doerk, Germanischer Lloyd SE, Germany
J. K. Kang & J. H. Kim, Daewoo Shipbuilding & Marine Engineering Co., Ltd., Korea
Marstruct conference 2011, Hamburg

Pt 1, Ch 9, Sec 4, [4.1.1]
1. Reason for the Rule Change
In order to resolve the gap between CSR-BC and CSR-H, the treatment of internal pressure of the topside tank for bulk carriers is modified.

2. Background
Internal pressure acting on the deck longitudinal stiffener
In the CSR-BC, it is considered that the internal pressure of the topside tank is not acting on the deck longitudinal stiffeners. Meanwhile in the CSR-OT, it is considered that the internal pressure is acting. This is because the shapes of ballast tanks of oil tanker and bulk carrier are different. Therefore, it is considered that an ullage space exists in the case of top side tanks of bulk carrier.
Therefore neglecting the internal pressure of the topside tank acting on the deck longitudinal stiffeners according to the CSR-BC is reasonable for bulk carriers.

Pt 1, Ch 9, Sec 4, Table 4, ID31 and ID32

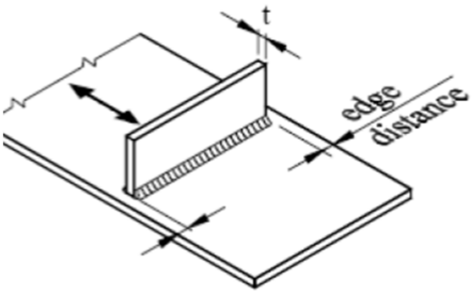
1. Reason for the Rule Change

In order to resolve the gap between CSR-BC and CSR-H, the stress concentration factor for the connection type of ID31 and ID32 are modified.

2. Background

The 1.13 factor for Ka comes from the picture below also taken from CN30.7, i.e. it is simply a transverse attachment to the longitudinally loaded plate. This is also given in IIW. It is dependent on the attachment thickness, but the frames are in generally less than 25mm, so 1.13 should be OK to consider in CSR.
The 1.2 factor used in detail 31 and 32 includes some additional uncertainty related to the design of the collar/lug and bending effects.

K–factors for stiffeners welded to a plate

Geometry	*K-factor*
	$K_g = 1.13$ if $t \le 25$ mm $K_g = 1.27$ if $t > 25$ mm

Pt 1, Ch 9, Sec 4, Table 4, note (2)

1. Reason for the Rule Change

In order to resolve the gap between CSR-BC and CSR-H, the stress concentration factor for the attachment on flat bar is modified.

2. Background

Effect of attachment on flat bar
It is commonly known that the hot spot stress is affected by the distance from the plate edge to the attachment. According to the standard of UK-DEn [1], down grade of S-N curve is recommended when the edge distance is small.
According to the recommendation of IIW [2], it is clarified for the welded joint that the attachment is welded on the flat bar, that the FAT rises 12% when the thickness of attachment is thinner than the 0.7 times flat bar thickness. This recommendation is necessary to incorporate in the CSR-H.

Pt 1, Ch 9, Sec 5, [4.2.1]

Please see technical background report "Correction factor for Hot Spot Stress for web stiffened cruciform joint".

Pt 2, Ch 1, Sec 2, [3.3.4], Openings in strength deck - Corner of hatchways

1. Reason for the Rule Change
Fatigue assessment of BC hatch corners shows in general low fatigue life which is not reflected by frequent damage cases of ships after a few years in service. So circular hatch corner shapes instead of elliptical ones are proposed to recommend.

2. Background
For ships with hatches longitudinally arranged elliptical hatch corners are beneficial in case of pure vertical bending. In case of torsional loads the deck strips between the hatches are bent and in this case transversely arranged elliptical hatch corners are beneficial. Large BCs are affected by vertical bending as well as by torsion and consequently circular shaped hatch corners are a good compromise. This is also the finding of the IACS internal project team HPT06.

3. Impact in Scantlings
The impact in scantlings and impact on stress ranges depend on the individual design and the magnitude of torsion and bending induced tangential stress along the hatch corner. For a sample corner an increase in life time of about 35% has been found. In any case for ships having length L of 150 m or above direct strength assessment has to be performed.