RULES CHANGE NOTICE No.1

Part 1 Seagoing Ships

# RULES FOR CONTAINER SHIPS

## Volume XVIII

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# Foreword

This Rules Change Notice (RCN) No.1 gives new additions and amandments to the “Rules for Container Ships (Pt.1, Vol.XVIII), Edition 2018” along with the effective dates from which these changes are applicable.

Amendments to the preceding Edition are marked by strikethrough, red color, and expanded text. These new additions and amendments are to be read in conjunction with the requirements given in the Edition 2018 of the Rules.

The summary of current amendments for each section including the implementation date are indicated in *Table 1 - Amendments Incorporates in This Notice.*

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Further queries or comments concerning this Rules are welcomed through communication to BKI Head Office.

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# Rules Changes Notice No. 1 – April 2023

## Table 1 – Amendments Incorporates in This Notice

These amendments will come into force from 1st July 2023 unless specify otherwise below

| Paragraph | Title/Subject | Status/Remark |
|---|---|---|
| Section 27 - Requirements for Use of Extremely Thick Steel Plates in Container Ships | | |
| A, B, C, D, E | | Deleted and refer to Rules for Hull (Pt.1, Vol.II) Sec.39 |
| Annex B – Global Strength Analysis of Container Ships | | |
| I | Basic Principles | |
| C | Structural Modelling | |
| 1.1 | Global model of the hull | Add new information from IACS UR S34.4.1 |
| 1.2 | Partial model of the hull (Cargo Hold Model) | Add new title and new information from IACS UR S34.4.2 |
| D | Loads and Loading Conditions | |
| 1.4 | Loading conditions | Add new requirement from IACS UR S34.7 |

# Section 27 Requirements for Use of Extremely Thick Steel Plates in Container Ships



## A. General

Paragraphs of this section are based on the following reference:

- IACS UR S33 Rev.1

All materials to be used for the structural members indicated in this Rules are to be in accordance with The Rules for Materials (Pt.1, Vol.V) Sec.4.B and Sec.4.L.

### 1. Application

**1.1** This sub-section is to be complied with for container ships incorporating extremely thick steel plates having steel grade and thickness in accordance with 1.2 and 1.3 respectively.

**1.2** This requirements identifies when measures for the prevention of brittle fracture of extremely thick steel plates are required for longitudinal structural members.

**1.3** This requirements gives the basic concepts for application of extremely thick steel plates to longitudinal structural members in the upper deck and hatch coaming structural region (i.e. upper deck plating, hatch side coaming and hatch coaming top).

**1.4** The application of the measures specified in B, C and D is to be in accordance with E.

**1.5** The requirements given in F shall be applied additionally in cases where YP47 material is applied according to 2.2.

**1.6** Furthermore and particularly if no additional requirements are stated in these rules is to be in accordance with Rules for Materials (Pt.1, Vol.V) and Rules for Welding (Pt.1, Vol.VI).

### 2. Steel Grade

**2.1** This sub-section is to be applied when any of YP36, YP40 and YP47 steel plates are used for the longitudinal structural members.

YP36 YP40 and YP47 refers to the minimum specified yield strength of steel defined 355, 390 and 460 N/mm$^2$, respectively. The grade of YP36 and YP40 steel plates are KI-A/D/E/F 36 and KI-A/D/E/F 40 specified in Rules for Materials (Pt.1, Vol.V) Sec.4.B.

**2.2** In the case that YP47 steel plates are used for longitudinal structural members in the upper deck region such as upper deck plating, hatch side coaming and hatch coaming top and their attached longitudinal, the grade of YP47 steel plates is to be KI-E47 specified in Rules for Materials (Pt.1, Vol.V) Sec.4.L.

~~3. Thickness~~

~~3.1 For steel plates with thickness of over 50 mm and not greater than 100 mm, the measures for prevention of brittle crack initiation and propagation specified in B, C and D are to be taken.~~

~~3.2 For steel plates with thickness exceeding 100 mm, appropriate measures for prevention of brittle crack initiation and propagation are to be taken in accordance with BKI's procedures.~~

~~3.3 Welding procedures (WPS) shall be qualified through welding procedure qualification test (WPQT) according to Rules for Welding (Pt.1, Vol.VI) Sec.12.~~

~~4. Hull structures (for the purpose of design)~~

~~4.1 Material factor k for YP36, YP40 and YP47 steel~~

~~For scantling purpose the material factor k of YP47 steel for the assessment of hull girder strength is to be taken as 0,62. Material factor k of YP36 and YP40 are to be taken as 0,72 and 0,66 respectively.~~

~~4.2 Fatigue assessment~~

~~Fatigue assessment on the longitudinal structural members is to be evaluated by on case by case basis.~~

~~4.3 Details of construction design~~

~~Special consideration is to be paid to the construction details where extremely thick steel plates are applied as structural members such as connections between outfitting and hull structures. Connections details are to be in accordance with BKI's requirements.~~

## ~~B. Non-Destructive Testing (NDT) during construction (Measure No.1 of Table 27.1)~~

~~Where NDT during construction is required in E, the NDT is to be in accordance with 1. and 2. Enhanced NDT as specified in D.3.e) is to be carried out in accordance with an appropriate standard.~~

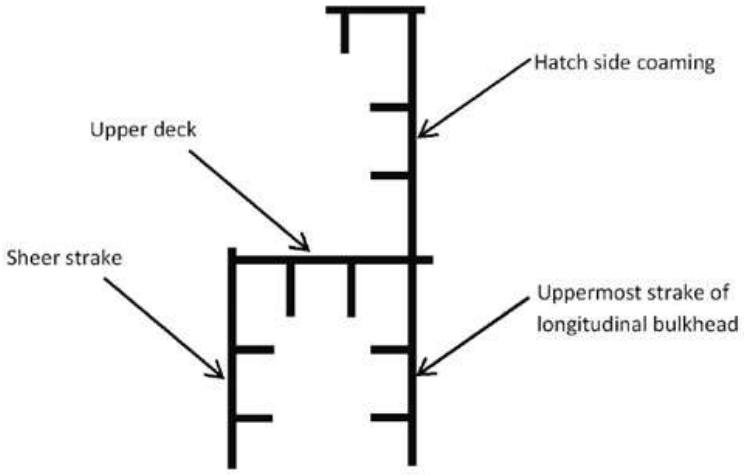
~~1. General~~

~~1.1 Ultrasonic testing (UT) in accordance with Rules for Welding (Pt.1, Vol.VI) Sec.10 requirement is to be carried out on all block-to-block butt joints of all upper flange longitudinal structural members in the cargo hold region. Upper flange longitudinal structural members include the topmost strakes of the inner hull/bulkhead, the sheer strake, main deck, coaming plate, coaming top plate, and all attached longitudinal stiffeners. These members are defined in Fig.27.1.~~

~~2. Acceptance criteria of UT~~

~~2.1 Acceptance criteria of UT are to be in accordance with Rules for Welding (Pt.1, Vol.VI) Sec.10, Table 10.5.~~

~~2.2 The acceptance criteria may be adjusted under consideration of the appertaining brittle crack initiation prevention procedure and where this is more severe than that found in Rules for Welding (Pt.1, Vol.VI) Sec.10, Table 10.5, the UT procedure is to be amended accordingly to a more severe sensitivity.~~




~~Fig. 27.1 Upper Flange Longitudinal Structural Members~~

## ~~C. Periodic NDT after delivery (Measure No.2 of Table 27.1)~~

### ~~1. General~~

~~1.1 The procedure of the NDT is to be in accordance with Rules for Welding (Pt.1, Vol.VI) Sec.10, Table 10.5.~~

~~1.2 Timing of UT~~

~~1.2.1 Where UT is carried out, the frequency of survey is to be in accordance with BKI's requirements.~~

~~1.3 Acceptance criteria of UT~~

~~1.3.1 Where UT is carried out, acceptance criteria of UT are to be in accordance with Rules for Welding (Pt.1, Vol.VI) Sec.10, Table 10.5.~~

## ~~D. Brittle crack arrest design (Measure No.3, 4, and 5 of Table 27.1)~~

### ~~1. General~~

~~1.1 Measures for prevention of brittle crack propagation, which is the same meaning as Brittle crack arrest design, are to be taken within the cargo hold region, see Table 27.1.~~

~~1.2 The approach given in this section generally applies to the block-to-block joints but it should be noted that cracks can initiate and propagate away from such joints. Therefore, appropriate measures should be considered in accordance with 2.1.b).ii.~~

~~1.3 Brittle crack arrest steel is defined in Rules for Materials (Pt.1, Vol.V) Sec.4.L.3.5. Only for the scope of this Rules, the definition in Rules for Materials (Pt.1, Vol.V) Sec.4.L.3.5 also applies to YP36 and YP40 steels.~~

### ~~2. Functional requirements of brittle crack arrest design~~

~~2.1 The purpose of the brittle crack arrest design is aimed at arresting propagation of a crack at a proper position and to prevent large scale fracture of the hull girder.~~

a) The point of a brittle crack initiation is to be considered in the block-to-block butt joints both of hatch side coaming and upper deck.

b) Both of the following cases are to be considered:

i. where the brittle crack runs straight along the butt joint, and

ii. where the brittle crack initiates in the butt joint but deviates away from the weld and into the plate, or where the brittle crack initiates from any other weld (see the figure below for definition of other welds) and propagates into the plate.

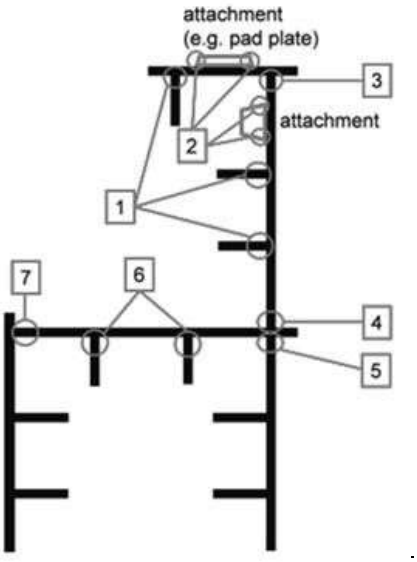



Fig. 27.2 OtherWeld Areas

"Other weld areas" includes the following (refer to Fig. 27.2):

1) Fillet welds where hatch side coaming plating, including top plating, meet longitudinal;

2) Fillet welds where hatch side coaming plating, including top plating and longitudinal, meet attachments. (e.g., Fillet welds where hatch side top plating meet hatch cover pad plating.);

3) Fillet welds where hatch side coaming top plating meet hatch side coaming plating;

4) Fillet welds where hatch side coaming plating meet upper deck plating;

5) Fillet welds where upper deck plating meet inner hull/bulkheads;

6) Fillet welds where upper deck plating meet longitudinal; and

7) Fillet welds where sheer strakes meet upper deck plating.

## 3. Concept examples of brittle crack arrest design

The following are considered to be acceptable examples of brittle crack arrest design. The detail design arrangements are to be submitted for approval by BKI. Other concept designs may be considered and accepted for review by BKI.

Brittle crack arrest design for 2.1.b).ii:

a) Brittle crack arresting steel is to be used for the upper deck plating along the cargo hold region in a way suitable to arrest a brittle crack initiating from the coaming and propagating into the structure below.

Brittle crack arrest design for 2.1.b).i:

b) ~~Where the block to block butt welds of the hatch side coaming and those of the upper deck are shifted, this shift is to be greater than or equal to 300 mm. Brittle crack arrest steel is to be provided for the hatch side coaming plating.~~

c) ~~Where crack arrest holes are provided in way of the block-to-block butt welds at the region where hatch side coaming weld meets the deck weld, the fatigue strength of the lower end of the butt weld is to be assessed. Additional countermeasures are to be taken for the possibility that a running brittle crack may deviate from the weld line into upper deck or hatch side coaming. These countermeasures are to include the application of brittle crack arrest steel in hatch side coaming plating.~~

d) ~~Where Arrest Insert Plates of brittle crack arrest steel or Weld Metal Inserts with high crack arrest toughness properties are provided in way of the block to block butt welds at the region where hatch side coaming weld meets the deck weld, additional countermeasures are to be taken for the possibility that a running brittle crack may deviate from the weld line into upper deck or hatch side coaming. These countermeasures are to include the application of brittle crack arrest steel in hatch side coamings plating.~~

e) ~~The application of enhanced NDT particularly time of flight diffraction (TOFD) technique using stricter defect acceptance in lieu of standard UT technique specified in B can be an alternative to b), c) and d).~~

## ~~E. Measures for Extremely Thick Steel Plates~~

~~The thickness and the yield strength shown in the following Table 27.1 apply to the hatch coaming top plating and side plating, and are the controlling parameters for the application of countermeasures.~~

~~Table 27.1 Measures depending on thickness and yield strength of hatch coaming structures.~~

| ~~Yield Strength ($kgf/mm^2$)~~ | ~~Thickness (mm)~~ | ~~Option~~ | ~~Measures~~ | | | |
|---|---|---|---|---|---|---|
| | | | ~~1~~ | ~~2~~ | ~~3 + 4~~ | ~~5~~ |
| ~~36~~ | ~~50 < t ≤ 85~~ | ~~-~~ | ~~N.A~~ | ~~N.A~~ | ~~N.A~~ | ~~N.A~~ |
| | ~~85 < t ≤ 100~~ | ~~-~~ | ~~X~~ | ~~N.A~~ | ~~N.A~~ | ~~N.A~~ |
| ~~40~~ | ~~50 < t ≤ 85~~ | ~~-~~ | ~~X~~ | ~~N.A~~ | ~~N.A~~ | ~~N.A~~ |
| | ~~85 < t ≤ 100~~ | ~~A~~ | ~~X~~ | ~~N.A~~ | ~~X~~ | ~~X~~ |
| | | ~~B~~ | ~~X*~~ | ~~N.A**~~ | ~~N.A~~ | ~~X~~ |
| ~~47 (FCAW)~~ | ~~50 < t ≤ 100~~ | ~~A~~ | ~~X~~ | ~~N.A~~ | ~~X~~ | ~~X~~ |
| | | ~~B~~ | ~~X*~~ | ~~N.A**~~ | ~~N.A~~ | ~~X~~ |
| ~~47 (EGW)~~ | ~~50 < t ≤ 100~~ | ~~-~~ | ~~X~~ | ~~N.A~~ | ~~X~~ | ~~X~~ |

~~Symbols:~~

~~(a) "X" means "To be applied".~~
~~(b) "N.A." means "Need not to be applied".~~
~~(c) Selectable from option "A" and "B".~~

~~Measures:~~

~~1. NDT other than visual inspection on all target block joints (during construction) See B.~~
~~2. Periodic NDT other than visual inspection on all target block joints (after delivery) See C.~~
~~3. Brittle crack arrest design against straight propagation of brittle crack along weldline to be taken (during construction) See D.3.1.b), c) or d).~~
~~4. Brittle crack arrest design against deviation of brittle crack from weldline (during construction) See D.3.1.a).~~
~~5. Brittle crack arrest design against propagation of cracks from other weld areas (see Fig.27.2) such as fillets and attachment welds. (during construction) See D.3.1.a).~~

~~Notes:~~

~~* : See D.3.e).~~
~~** : may be required at the discretion of BKI~~

~~If the as built thickness of the hatch coaming top plating and side plating is below the values contained in the Table 27.1, countermeasures are not necessary regardless of the thickness and yield strength of the upper deck plating.~~

The requirements for use of extremely thick steel plates in container ships, see Rules for Hull (Pt.1, Vol.II) Sec.39.

# Annex B Global Strength Analysis of Container Ships

## I. Basic Principles

## C. Structural Modelling

### 1. Types of structural models

#### 1.1 Global model of the hull

A global model of the hull girder is normally used for the global strength analysis of the entire hull girder and its primary structural components. For 3D modelling of all the primary structural components, the loads can be applied realistically, and the structural behaviour of complex ship structures, including the interactions between the individual components, can be taken into account, see II. Global strength analysis. A Global Strength Analysis is to be carried out for ships of length 290 m or above.

#### 1.2 Partial model of the hull **(Cargo Hold Model)**

Partial models of the hull girder are used for the analyses of global and local stresses of the respective part and its primary structural components, e.g. midship cargo hold area. Like 3D global models, Cargo hold models are generally used to analyse the complex, three dimensional strength behaviour of the primary structural components. Cargo Hold Analysis is to be carried out for ships of length 150 m or above.

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## D. Loads and Loading Conditions

### 1. General notes

**1.1** The relevant loads for the strength analyses of ship structures can generally be classified into the following types:

- static (stillwater) loads from the deadweight of the ship and cargo and from the hydrostatic pressure caused by the buoyancy and tank contents
- wave-induced loads, i.e. dynamic pressure, loads from accelerated masses and tank contents, as well as internal and external hydrodynamic impact forces
- other variable loads from the ship's operation, e.g. from the action of the engines or the rudder, and also wind loads and ice loads
- loads due to container handling or special cargo types.
- loads in case of accidents, e.g. collision, grounding or flooding of compartments

**1.2** The selection and generation of the load cases to be analysed shall be done in such a way that, with respect to the sum of the forces and moments, either fully balanced load cases are created or clearly defined, realistic sectional forces and/or deformations are obtained at the model boundaries or supports.

**1.3** Since several of the load components mentioned are of a stochastic nature, and because the selection and determination of the relevant load cases might be very complex, there are simplified procedures which can be used for practical cases. Moreover, there are special procedures which refer particularly to wave-induced loads, but can also be applied to other stochastic load effects.

## 1.4 Loading conditions

### 1.4.1. Global Strength Analysis

Loading conditions to be considered for the Global Analysis are to be in accordance with II.D.3

### 1.4.2. Cargo Hold Analysis

The minimum set of loading conditions is specified in Table B.1. In addition, loading conditions from the Loading Manual are to be considered in the Cargo Hold Analysis where deemed necessary.

Table B.1 Minimum set of loading conditions for Cargo Hold Analysis

| Loading Condition | Draught | Container weight | Ballast and fuel oil tanks | Still water hull girder moment |
|---|---|---|---|---|
| Full load condition | Scantling draught | Heavy cargo weight[1] (40'containers) | Empty | Permissible hogging |
| Full load condition | Scantling draught | Light cargo weight[2] (40'containers) | Empty | Permissible hogging |
| Full load condition | Reduced draught[3] | Heavy cargo weight[1] (20'containers) | Empty | Permissible hogging (minimum hogging) |
| One bay empty condition[4] | Scantling draught | Heavy cargo weight[1] (40'containers) | Empty | Permissible hogging |

[1] Heavy cargo weight of a container unit is to be calculated as the permissible stacking eight divided by the maximum number of tiers planned.

[2] Light cargo weight corresponds to the expected cargo weight when light cargo is loaded in the considered holds.

- Light cargo weight of a container unit in hold is not to be taken more than 55% of its related heavy cargo weight (see 1 above).
- Light cargo weight of a container unit on deck is not to be taken more than 90% of its related heavy cargo weight (see 1 above) or 17 metric tons, whichever is the lesser.

[3] Reduced draught corresponds to the expected draught amidships when heavy cargo is loaded in the considered holds while lighter cargo is loaded in other holds. Reduced draught is not to be taken more than 90% of scantling draught.

[4] For one bay empty condition, if the cargo hold consists of two or more bays, then each bay is to be considered entirely empty in hold and on deck (other bays full) in turn as separate load cases.

----------*end*----------