RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

Part CS Hull Construction and Equipment of Small Ships

Rules for the Survey and Construction of Steel Ships
Part CS 2020 AMENDMENT NO.2
Guidance for the Survey and Construction of Steel Ships
Part CS 2020 AMENDMENT NO.1

Rule No.112 / Notice No.61 24 December 2020
Resolved by Technical Committee on 5 August 2020

ClassNK
NIPPON KAIJI KYOKAI

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

RULES

RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

Part CS Hull Construction and Equipment of Small Ships

2020 AMENDMENT NO.2

Rule No.112 24 December 2020

Resolved by Technical Committee on 5 August 2020

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

Rule No.112 24 December 2020
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 CS HULL CONSTRUCTION AND EQUIPMENT OF SMALL SHIPS

Chapter 2 STEMS AND STERN FRAMES

2.2 Stern Frames

Paragraph 2.2.7 has been amended as follows.

2.2.7 Rudder trunk

1 The requirements of this paragraph apply to trunk configurations which are extended below stern frames and arranged in such a way that the trunk is stressed by forces due to rudder action.

~~**1**~~**2** Materials, welding and connection to hull

~~This requirement applies to both trunk configurations (extending or not below stern frame).~~

The steel used for the rudder trunk is to be of weldable quality, with a carbon content not exceeding 0.23% on ladle analysis or a carbon equivalent C_{EQ} not exceeding 0.41%.

The weld at the connection between the rudder trunk and the shell or the bottom of the skeg is to be full penetration.

The fillet shoulder radius r (*mm*) (*See* **Fig.CS2.3**) is to be as large as practicable and to comply with the following formulae:

$r = 0.1d_l$

without being less than:

$r = 60$ when $\sigma \geq 40 / K_s$ (N/mm^2)

$r =$ ~~$0.1d_l$, without being less than 30~~, when $\sigma < 40 / K_s$ (N/mm^2)

Where

d_l: rudder stock diameter axis defined in **3.5.2**.

σ: bending stress in the rudder trunk (N/mm^2).

K_s: material factor as given in **3.1.2**.

The radius may be obtained by grinding. If disk grinding is carried out, score marks are to be avoided in the direction of the weld. The radius is to be checked with a template for accuracy. Four profiles at least are to be checked. A report is to be submitted to the Surveyor.

Rudder trunks comprising of materials other than steel are to be specially considered by the Society.

~~**2**~~**3** Scantlings

~~Where the rudder stock is arranged in a trunk in such a way that the trunk is stressed by forces due to rudder action, t~~The scantlings of the trunk are to be such that:

- the equivalent stress due to bending and shear does not exceed $0.35\,\sigma_Y$,
- the bending stress on welded rudder trunk is to be in compliance with the following formula:

  $\sigma \leq 80 / K_s$ (N/mm^2)

  with:

  σ: As defined in ~~**1**~~**2**.

K_s: Material factor for the rudder trunk as given in **3.1.2**, not to be taken less than 0.7

σ_Y: Specified minimum ~~Y~~yield stress (N/mm^2) of the material used

For calculation of bending stress, the span to be considered is the distance between the mid-height of the lower rudder stock bearing and the point where the trunk is clamped into the shell or the bottom of the skeg.

Chapter 3 RUDDERS

3.1 General

3.1.2 Materials

Sub-paragraphs -4 and -5 have been amended as follows.

4 For rudder stocks, pintles, coupling bolts, keys, and edge bars, the specified minimum yield stress is not to be less than 200 N/mm^2. The requirements in this Chapter are for materials with a specified minimum yield stress of 235 N/mm^2. If materials having a specified minimum yield stress differing from 235 N/mm^2 are used, the material factor K is to be determined by the following formula.

$$K = \left[\frac{235}{\sigma_Y}\right]^e$$

Where:

e: 0.75 for $\sigma_Y > 235$ N/mm^2

e: 1.00 for $\sigma_Y \leq 235$ N/mm^2

Where:

σ_Y: Specified minimum ~~Y~~yield stress (N/mm^2) of material used, and is not to be taken as greater than 0.7 σ_B or 450 N/mm^2, whichever is the smaller

σ_B: Tensile strength (N/mm^2) of material used

5 When the rudder stock diameter is reduced because of using steels with a specified minimum yield stresses exceeding 235 N/mm^2, special consideration is to be given to deformation of the rudder stock to avoid excessive edge pressures at the edge of bearings.

3.1.3 Welding and Design Details

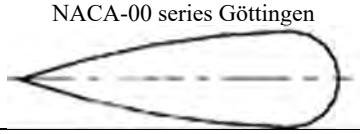
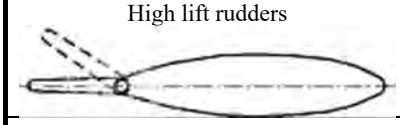
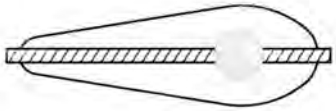
Sub-paragraph -2 has been amended as follows.

2 In way of the rudder horn recess of Type *A* rudder the radii in the rudder plating (except in way of solid part in cast steel) are not to be less than 5 *times* the plate thickness, but in no case less than 100 *mm*. Welding in side plate are to be avoided in or at the end of the radii. Edges of side plate and weld adjacent to radii are to be ground smooth.

3.2 Rudder Force*

Table CS3.1 has been amended as follows.

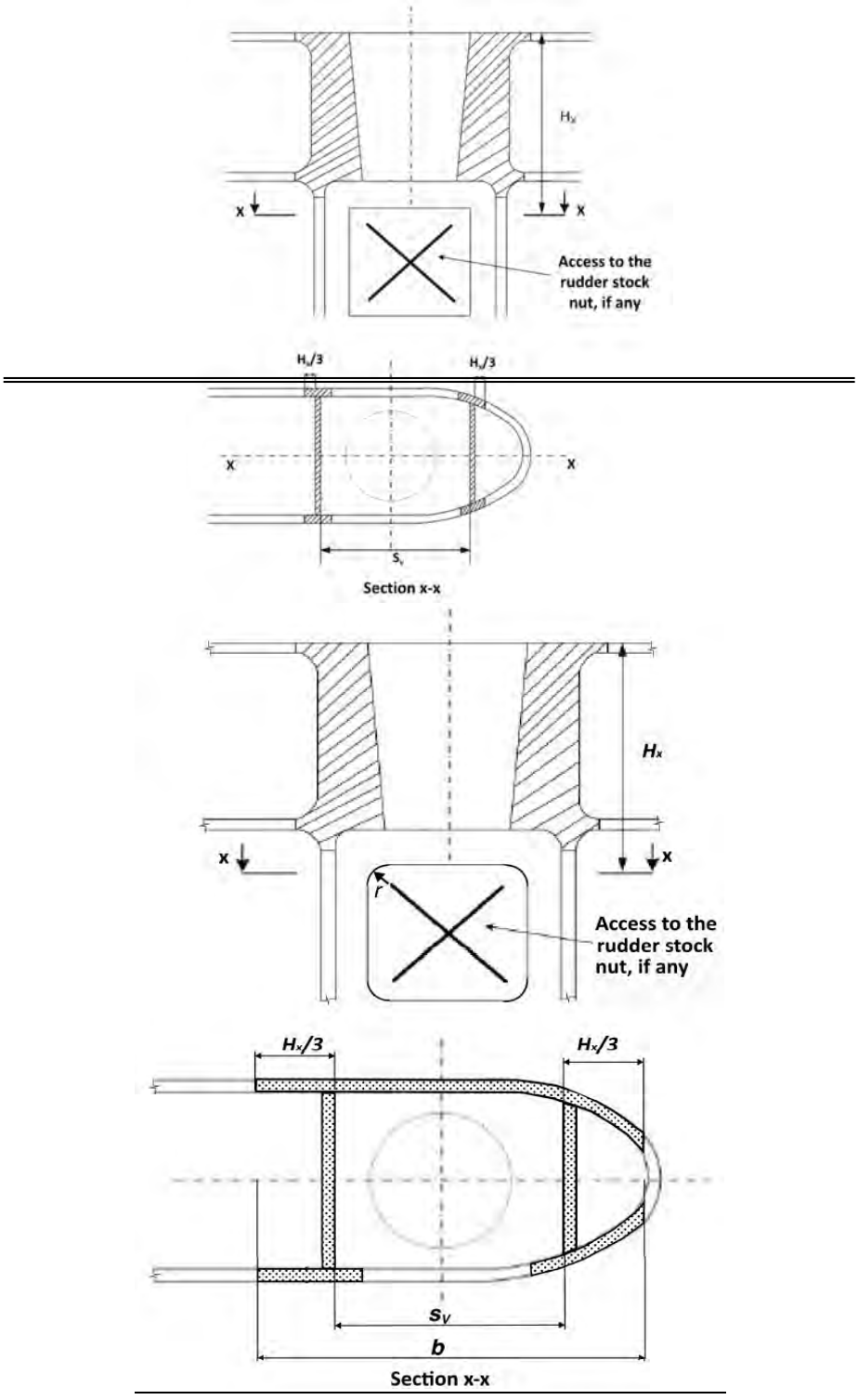
Table CS3.1 Factor K_2

Profile Type	K_2	
	Ahead condition	Astern condition
NACA-00 series Göttingen 	1.10	0.80
Flat side 	1.10	0.90
Hollow 	1.35	0.90
High lift rudders 	1.70	~~to be specially considered; if not known:~~ 1.30
Fish tail 	1.40	0.80
Single plate 	1.00	1.00
Mixed profiles (e.g. HSVA)	1.21	0.90

3.7 Connections of Rudder Blade Structure with Solid Parts

Fig. CS3.5 has been amended as follows.

Fig. CS3.5 Cross-section of the Connection between Rudder Blade Structure and Rudder Stock Housing (in cases where there is an opening on only one side)



3.9 Couplings between Rudder Stocks and Main Pieces

Paragraph 3.9.3 has been amended as follows.

3.9.3 Cone Couplings with Key

1 Tapering and coupling length

Cone couplings that are mounted or dismounted without hydraulic arrangements (e.g. oil injection and hydraulic nut) are to have a taper c on diameter of 1:8 ~ 1:12. (*See* **Fig. CS3.7** and **Fig.CS3.9**)

Where:

~~$c = (d_0 - d_e)/\ell$~~

$c = (d_0 - d_e)/\ell_c$

The diameters d_0 and d_u are shown in **Fig. CS3.7** and the cone length ℓ_c is defined in **Fig. CS3.9**.

The cone coupling is to be secured by a slugging nut. The nut is to be secured, e.g. by a securing plate.

The cone shapes are to fit exactly. The coupling length ℓ is to be, in general, not less than $1.5d_0$.

2 For couplings between stock and rudder a key is to be provided, the shear area of which is not to be less than:

$$a_s = \frac{17.55 M_Y}{d_k \sigma_{Y1}} \quad (cm^2)$$

Where:

M_Y : Design yield moment of rudder stock (*N-m*)

$$M_Y = 0.02664 \frac{{d_u}^3}{K_S}$$

Where the actual diameter d_{ua} is greater than the calculated diameter d_u, the diameter d_{ua} is to be used. However, d_{ua} applied to the above formula need not be taken greater than 1.145 d_u.

d_u : Stock diameter (*mm*) according to **3.5.1**

K_S : Material factor for stock as given in **3.1.2**

d_k : Mean diameter of the conical part of the rudder stock (*mm*) at the key

σ_{Y1} : Specified ~~M~~minimum yield stress of the key material (N/mm^2)

The effective surface area (cm^2) of the key (without rounded edges) between key and rudder stock or cone coupling is not to be less than:

$$a_k = \frac{5 M_Y}{d_k \sigma_{Y2}} \quad (cm^2)$$

Where:

σ_{Y2} : Specified ~~M~~minimum yield stress of the key, stock or coupling material (N/mm^2) whichever is less.

Fig. CS3.7 has been amended as follows.

Fig. CS3.7 Cone Coupling with Key

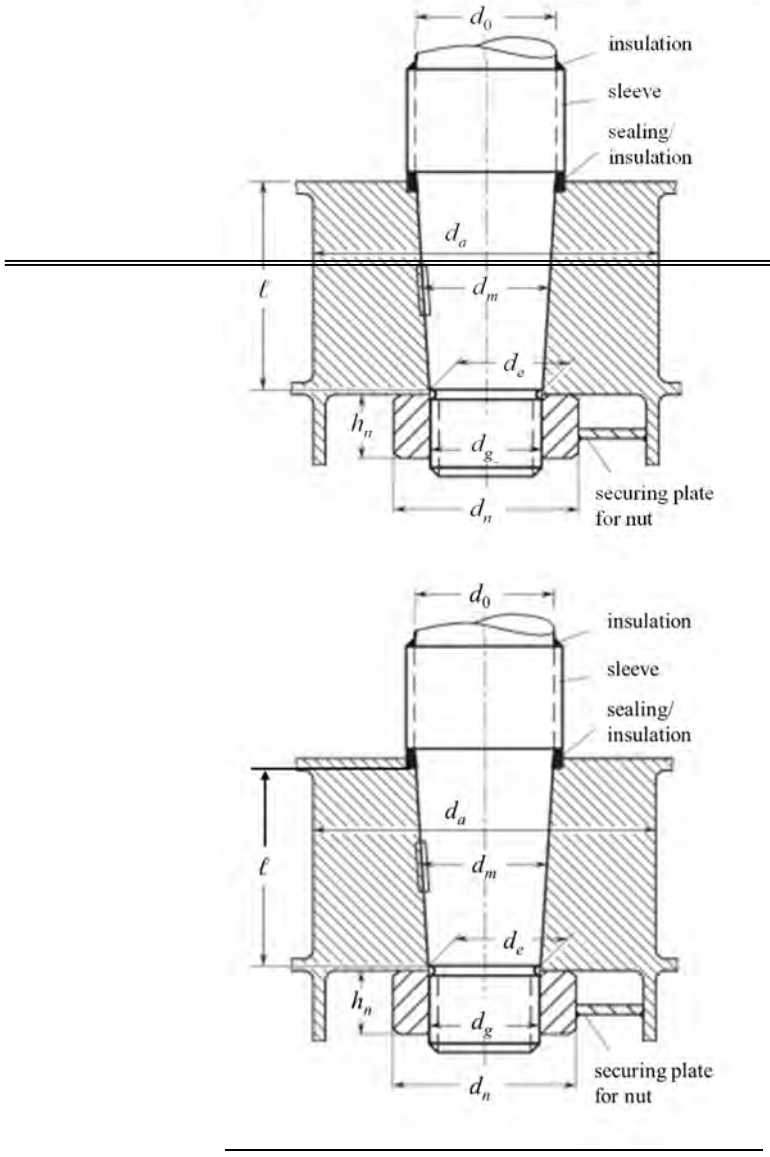


Fig. CS3.8 has been renumbered to Fig. CS3.10, and Fig. CS3.8 and Fig. CS3.9 have been added as follows.

Fig. CS3.8 Gudgeon Outer Diameter

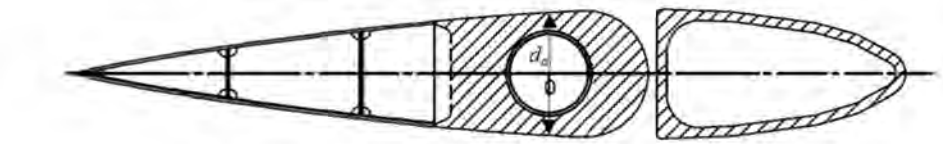


Fig. CS3.9 Cone Length and Coupling Length

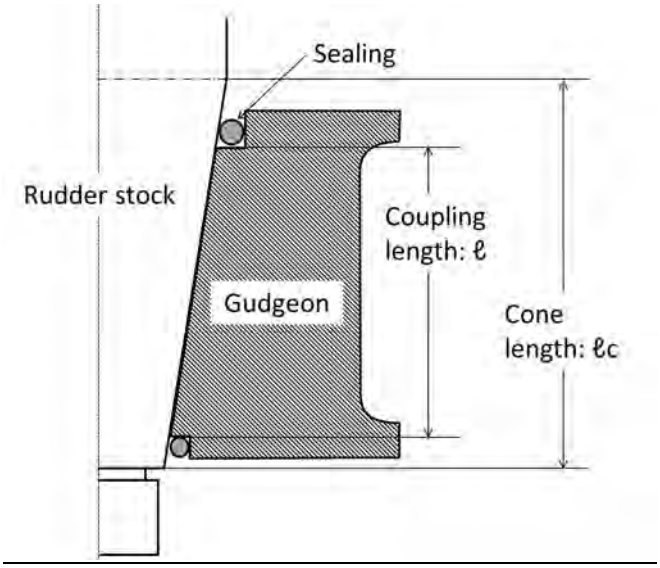
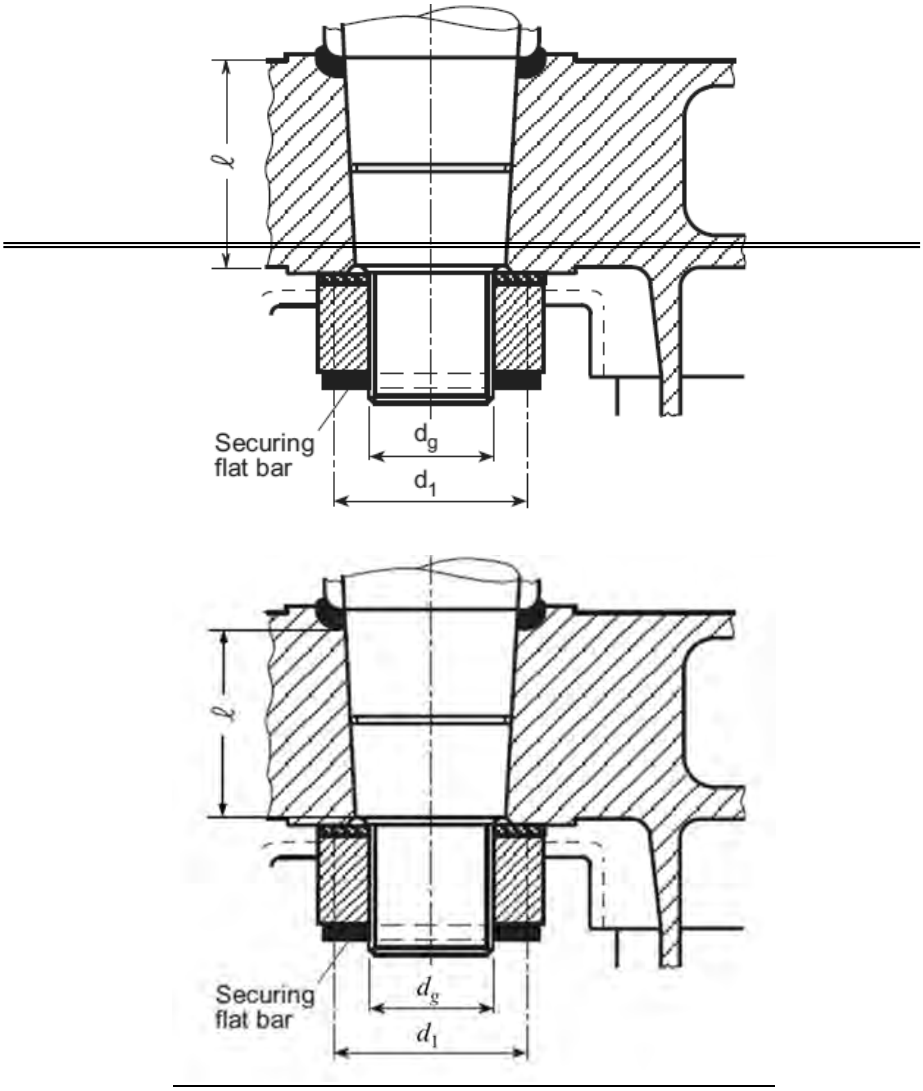


Fig. CS3.10 has been amended as follows.

Fig. CS3.~~8~~10 Cone Coupling without Key



3.9.4 Cone Couplings with Special Arrangements for Mounting and Dismounting the Couplings

Sub-paragraph -2 has been amended as follows.

2 Push-up pressure

The push-up pressure is not to be less than the greater of the two following values:

$$p_{req1} = \frac{2M_Y}{d_m^2 \ell \pi \mu_0} 10^3 \quad (N/mm^2)$$

$$p_{req2} = \frac{6M_b}{\ell^2 d_m} 10^3 \quad (N/mm^2)$$

Where:

M_Y : Design yield moment of rudder stock, as defined in **3.9.3-2** (*N-m*)

d_m : Mean cone diameter (*mm*) (*See* **Fig. CS3.7**)

ℓ : ~~Cone~~Coupling length (*mm*)

μ_0 : Frictional coefficient, equal to 0.15

M_b : Bending moment in the cone coupling (e.g. in case of spade rudders) (*N-m*)

It has to be proved by the designer that the push-up pressure does not exceed the permissible surface pressure in the cone. The permissible surface pressure is to be determined by the following formula:

$$p_{perm} = \frac{0.95\sigma_Y(1-\alpha^2)}{\sqrt{3+\alpha^4}} - p_b$$

$$p_b = \frac{3.5M_b}{d_m \ell^2} 10^3$$

Where:

σ_Y : Specified ~~M~~minimum yield stress (N/mm^2) of the material of the gudgeon

$$\alpha = \frac{d_m}{d_a}$$

d_m : Mean cone diameter (*mm*) (*See* **Fig. CS3.7**)

d_a : Outer diameter of the gudgeon (*See* **Fig. CS3.7** and **Fig. CS3.8**. The least diameter is to be considered.) (*mm*)

The outer diameter of the gudgeon is not to be less than 1.25 d_0, with d_0 defined in **Fig. CS3.7**.

3.11 Bearings of Rudder Stocks and Pintles

Table CS3.3 has been amended as follows.

Table CS3.3 Allowable Surface Pressure q_a

Bearing material	q_a (N/mm^2)
Lignum vitae	2.5
White metal(oil-lubricated)	4.5
Synthetic material with hardness ~~between~~ greater than 60 ~~and 70,~~ Shore *D* [1)]	5.5[2)]
Steel[3)], bronze and hot-pressed bronze-graphite materials	7.0

Notes:

1: Indentation hardness test at the temperature of 23°C and the humidity of 50%, is to be carried out according to a recognized standard. Synthetic bearings are to be of the type as deemed appropriate by the Society.

2: Surface pressures exceeding 5.5 N/mm^2 may be accepted in accordance with bearing manufacturer's specification and tests, but in no case more than 10 N/mm^2.

3: Stainless and wear-resistant steel in an approved combination with a stock liner.

EFFECTIVE DATE AND APPLICATION

1. The effective date of the amendments is 1 January 2021.

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.

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE

Part CS Hull Construction and Equipment of Small Ships

2020 AMENDMENT NO.1

Notice No.61 24 December 2020
Resolved by Technical Committee on 5 August 2020

Notice No.61 24 December 2020
AMENDMENT TO THE GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

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

Part CS HULL CONSTRUCTION AND EQUIPMENT OF SMALL SHIPS

CS3 RUDDERS

CS3.9 Couplings between Rudder Stocks and Main Pieces

Paragraph CS3.9.4 has been added as follows.

CS3.9.4 Cone Couplings with Special Arrangements for Mounting and Dismounting the Couplings

The outer diameter of gudgeon (d_a) is recommended to be taken at the same plane in which the mean cone diameter (d_m).

EFFECTIVE DATE AND APPLICATION

1. The effective date of the amendments is 1 January 2021.

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.