RULES FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

RULES

Part C Hull Construction and Equipment

2018 AMENDMENT NO.1

Rule No.100 29 June 2018

Resolved by Technical Committee on 31 January 2018

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

Rule No.100 29 June 2018
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 C HULL CONSTRUCTION AND EQUIPMENT

Amendment 1-1

Chapter 1 GENERAL

1.1 General

1.1.7 Materials*

Sub-paragraph -2(1) has been amended as follows.

2 Where high tensile steel specified in **Chapter 3, Part K of the Rules** is used, the construction and scantlings of the ship are to comply with the following requirements in **(1)** to **(3)**:

(1) The section modulus of the transverse section of the hull is not to be less than the value obtained by multiplying the following coefficient with the value specified in **32.2.4** for ships subject to the requirements in **Chapter 32** and **15.2** for other ships. ~~However, where special consideration is given to the type of high tensile steel used, this value may be different, subject to the approval of the Society, from the following coefficients.~~ Moreover, the extent of high tensile steel use is to be at the discretion of the Society.

0.78: where high tensile steels *KA*32, *KD*32, *KE*32 or *KF*32 are used.

0.72: where high tensile steels *KA*36, *KD*36, *KE*36 or *KF*36 are used.

0.68: where high tensile steels *KA*40, *KD*40, *KE*40 or *KF*40 are used <u>(However, 0.66 may be taken where a fatigue assessment of the structure is performed to verify compliance with the requirements of the Society)</u>.

0.62: where high tensile steel *KE*47 is used (However, only applies to ships subject to **Chapter 32**).

EFFECTIVE DATE AND APPLICATION (Amendment 1-1)

1. The effective date of the amendments is 1 July 2018.

Amendment 1-2

Chapter 27 EQUIPMENT

Title of Section 27.1 has been amended as follows.

27.1 Anchors, Chain Cables and Mooring Ropes

Paragraph 27.1.1 has been amended as follows.

27.1.1 General*

1 All ships, according to their equipment numbers, are to be provided with anchors, chain cables and mooring ~~lines~~ropes which are not less than that given in **Table C27.1**, and **Table C27.2** or **27.1.5**. In the case of anchoring equipment for ships in deep and unsheltered waters, the Society may require special consideration be given to such equipment. All ships are to be provided with suitable appliances for handling anchors and lines.

2 Anchors, chain cables and mooring ~~lines~~ropes for ships having equipment numbers not more than 50 or more than 16,000 are to be as determined by the Society.

3 Two of the anchors given in **Table C27.1** are to be connected to their cables and be positioned on board ready for use.

4 Anchors, chain cables, wire ropes and fibre ropes used for mooring lines are to be in compliance with the requirements in **Chapter 2**, **3.1** of **Chapter 3**, **Chapters 4** and **5, Part L**, respectively.

Paragraph 27.1.5 has been amended as follows.

27.1.5 Mooring Lines*

1 As for wire ropes and ~~hemp~~ fibre ropes used as mooring lines, the breaking test load specified in **Chapter 4** or **5, Part L** is not to be less than the breaking load given in ~~**Table C27.1,**~~ **Table C27.2** or **27.1.5-3** respectively.

2 The number of mooring lines for ships whose equipment numbers do not exceed 2,000 is to be in accordance with **Table C27.2**. For ships having the ratio *A*/*EN* above 0.9, the following number of ropes should be added to the number required by **Table C27.~~1~~2** for mooring lines.

Where *A/EN* is above 0.9 up to 1.1: 1
Where *A/EN* is above 1.1 up to 1.2: 2
Where *A/EN* is above 1.2: 3
EN : Equipment number.
A : Value specified in **27.1.2-1(2)**.

~~**3** For individual mooring lines with a required breaking load above 490 *kN* according to **Table C27.1**, the required strength may be reduced by the corresponding increase of the number of mooring lines and *vice versa*, provided that the total breaking load of all mooring lines aboard the ship is not less than the value obtained from multiplying the required breaking load in **Table C27.1** by the sum of the numbers required in **Table C27.1** and **-2**, irrespective of the requirements in **-1**. However, the number of mooring lines is not to be less than 6 lines in any case, and one of the lines is not to have a breaking load of less than 490 *kN*.~~

3 The number and strength of mooring lines for ships whose equipment numbers exceed 2,000 are to be in accordance with the followings **(1)** to **(4)**.

(1) Minimum breaking strength (*MBL*) is not to be less than that obtained from the following

formula:

$MBL = 0.1A_1 + 350$ (*kN*)

A_1: Ship side-projected area specified in **-5**.

(2) Head lines, stern lines, breast lines or spring lines in the same service are to be of the same characteristics in terms of strength and elasticity. The strength of spring lines is to be the same as that of the head, stern and breast lines.

(3) The total number of head, stern and breast lines is to be obtained from the following formula and rounded to the nearest whole number:

(a) for oil tankers, chemical tankers, bulk carriers and ore carriers

$n = 8.3 \times 10^{-4} A_1 + 4$

(b) for others

$n = 8.3 \times 10^{-4} A_1 + 6$

(4) The total number of spring lines is to be taken as not less than:

Two lines when the equipment number < 5,000

Four lines when the equipment number ≧ 5,000

4 Notwithstanding the requirement in **-3**, the number of head, stern and breast lines may be increased or decreased in conjunction with an adjustment to the strength of the lines. The adjusted strength, MBL^*, is to be taken as:

$MBL^* = 1.2MBL \cdot n/n^* \leq MBL$ (*kN*) for an increased number of lines

$MBL^* = MBL \cdot n/n^*$ (*kN*) for a reduced number of lines

n^*: The increased or decreased total number of head, stern and breast lines

n: The number of lines for the considered ship type as calculated by the formulae specified in **-3(3)** without rounding.

In the same manner, the strength of head, stern and breast lines may be increased or decreased in conjunction with an adjustment to the number of lines. If the number of head, stern and breast lines is increased in conjunction with an adjustment to the strength of the lines, the number of spring lines is to be likewise increased, but rounded up to the nearest even number.

5 The ship side-projected area A_1 is to be obtained from the same formula specified in **27.1.2-1(2)**. However, following **(1)** to **(4)** are to be considered.

(1) For oil tankers, chemical tankers, bulk carriers and ore carriers, the lightest ballast draft is to be considered for the calculation of the side-projected area A_1. For other ships, the lightest draft of usual loading conditions is to be considered if the ratio of the freeboard in the lightest draft and the full load condition is equal to or above two.

(2) Wind shielding of the pier can be considered for the calculation of the side-projected area A_1 unless the ship is intended to be regularly moored to jetty-type piers. A height of the pier surface of 3 *m* over waterline may be assumed; in other words, the lower part of the side-projected area with a height of 3 *m* above the waterline for the considered loading condition may be disregarded for the calculation of the side-projected area A_1.

(3) Deck cargo is to be included for the determination of side-projected area A_1. Deck cargo may not need to be considered if a usual light draft condition without cargo on deck generates a larger side-projected area A_1 than the full load condition with cargo on deck. The larger of both side-projected areas is to be chosen as side-projected area A_1.

(4) Usual loading conditions mean loading conditions as given by the trim and stability booklet that are to be expected to regularly occur during operation and, in particular, excluding light weight conditions, propeller inspection conditions, etc.

6 The mooring lines specified in **-3** and **-4** are based on the following environmental conditions:

(1) Maximum current speed: 1.0 *m/s*

(2) Maximum wind speed v_w in *m/s* as follows.

(a) $v_w = 25.0 - 0.002(A_1 - 2000)$ *(m/s)* for passenger ships, ferries, and car carriers with 2,000 $m^2 < A_1 \leqq 4{,}000\ m^2$

(b) $v_w = 21.0$ *(m/s)* for passenger ships, ferries, and car carriers with 4,000 $m^2 > A_1$

(c) $v_w = 25.0$ *(m/s)* for other ships

7 Among the environmental conditions specified in **-6**, the maximum wind speed v_w may be increased and decreased in conjunction with an adjustment to the strength of the lines as the acceptable wind speed v_w^*. In this case, the acceptable wind speed v_w^* is to be obtained from the following formula:

$$v_w^* = v_w \sqrt{\frac{MBL^*}{MBL}}$$

MBL^*: The adjusted strength of mooring lines (*kN*)

However, the maximum wind speed v_w can be decreased where maximum breaking strength, *MBL*, specified in **-3(1)** is more than 1,275 *kN*. The acceptable wind speed v_w^* is to be not less than 21 *m/s*.

8 The length of mooring lines for ships whose equipment numbers are less than or equal to 2,000 is to be in accordance with **Table C27.2**. For ships whose equipment numbers exceed 2,000 the length of mooring lines is to be taken as 200 *m*.

~~**4**~~**9** Application of synthetic fibre ropes for mooring lines is to be as deemed appropriate by the Society.

~~**5**~~**10** For mooring lines connected with powered winches where the rope is stored on the drum, steel cored wire ropes of suitable flexible construction may be used instead of fibre cored wire ropes subject to the approval by the Society.

~~**6**~~**11** The length of individual mooring lines may be reduced by up to 7% of the lengths given in **-8** ~~**Table C27.1**~~, provided that the total length of the stipulated number of mooring lines is not less than that obtained from multiplying the length by the number given in ~~**Table C27.1**~~ **-2** or **-4**.

Paragraph 27.1.6 has been amended as follows.

27.1.6 Tow Lines

Where ships are provided with tow lines, it is advised that tow lines are in accordance with the following:

(1) The length of tow lines is not less than that given in **Table C27.1** according to ships' equipment numbers.

(2) As for wire ropes and ~~hemp~~ fibre ropes used as tow lines, the breaking test load specified in **Chapter 4** or **5, Part L** is not to be less than the breaking load given in **Table C27.1** according to the ships' equipment numbers. The application of synthetic fibre ropes for tow lines is as deemed appropriate by the Society.

(3) Wire ropes, ~~hemp ropes or synthetic~~ fibre ropes used as tow lines are to be in compliance with the requirements in **Chapter 4** or **5, Part L**, respectively.

Paragraph 27.1.7 has been amended as follows.

27.1.7 Chain Lockers*

1 Chain lockers are to be of capacities and depths adequate to provide an easy direct lead of the cables through the chain pipes and a self-stowing of the cables.

~~**1**~~**2** Chain lockers including spurling pipes are to be watertight up to the weather deck and to be

provided with a means for drainage.

~~2~~**3** Chain lockers are to be subdivided by centre line screen walls.

~~3~~**4** Where a means of access is provided, it is to be closed by a substantial cover and secured by closely spaced bolts.

~~4~~**5** Where a means of access to spurling pipes or cable lockers is located below the weather deck, the access cover and its securing arrangements are to be to the satisfaction of the Society. Butterfly nuts and/or hinged bolts are prohibited as the securing mechanism for the access cover.

~~5~~**6** Spurling pipes through which anchor cables are led are to be provided with permanently attached closing appliances to minimize water ingress.

7 The inboard ends of the chain cables are to be secured to the structures by fasteners able to withstand a force not less than 15% and not more than 30% breaking load of the chain cable.

8 Fasteners are to be provided with a means suitable to permit, in case of emergency, an easy slipping of chain cables to the sea, operable from an accessible position outside the chain locker.

Paragraph 27.1.8 has been amended as follows.

27.1.8 ~~Miscellaneous~~Supporting Hull Structures of Anchor Windlasses and Chain Stoppers

1 ~~All ships are to be provided with suitable appliances for handling anchors.~~The supporting hull structures of anchor windlasses and chain stoppers are to be sufficient to accommodate operating loads and sea loads

(1) Operating loads are to be taken as not less than the following:

(a) For chain stoppers, 80% of the chain cable breaking load

(b) For windlasses, where no chain stopper is fitted or a chain stopper is attached to the windlass, 80% of the chain cable breaking load

(c) For windlasses, where chain stoppers are fitted but not attached to the windlass, 45% of the chain cable breaking load

(2) Sea loads are to be taken according to **2.1.6, Section 4, Chapter 11, Part 1 of Part CSR-B&T**

2 ~~The inboard end of the chain cable is to be secured to the hull through a strong eye plate by means of a shackle or other equivalent means.~~The permissible stresses for supporting hull structures of windlasses and chain stoppers, based on gross thicknesses, are not to be greater than the following permissible values:

(1) Normal stress: 1.00 R_{eH}

(2) Shear stress: 0.60 R_{eH}

R_{eH}: The specified minimum yield stress of the material

Section 27.2 has been amended as follows.

27.2 Towing and Mooring Fittings

27.2.1 General*

1 The requirements in **27.2** apply to shipboard fittings used for ~~normal~~ towing ~~(hereinafter referred to as 'towing fittings')~~ and ~~normal~~ mooring ~~(hereinafter referred to as 'mooring fittings')~~operations associated with the normal operation of the ship, and their supporting hull structures ~~(hereinafter referred to as 'supporting structures')~~. With respect to this requirement, towing is limited to the following:

(1) Normal towing: towing operations necessary for manoeuvring in ports and sheltered waters associated with the normal operation of the ship

(2) Other towing: emergency towing by another ship or a tug.

2 Ships are to be adequately provided with ~~towing and mooring~~shipboard fittings.

3 Shipboard fittings are to comply with the requirements of **27.2.2** and **27.2.3** respectively.

4 When the shipboard fittings are not selected from industry standards deemed appropriate by the Society, the corrosion additions specified in **27.2.4** are to be applied to shipboard fittings and their supporting structures such as foundations.

5 When the shipboard fittings are not selected from industry standards deemed appropriate by the Society, the wear down allowances specified in **27.2.5** are to be applied to shipboard fittings.

~~**3**~~**6** The scantlings of supporting hull structures are to be built at least with the gross scantlings obtained by adding the corrosion additions specified in ~~**27.2.2.-5 and 27.2.3.-5**~~**27.2.4** to the net scantlings obtained by applying the criteria specified in this section.

~~**4**~~**7** The scantlings of supporting hull structures are to be in accordance with the relevant chapters or sections in addition to this section.

27.2.2 Towing Fittings*

1 Arrangement ~~of Towing Fittings~~

(1) Towing fittings are to be located on ~~longitudinals, beams~~stiffeners, ~~or~~ girders, or both which are part~~s~~ of the deck construction so as to facilitate efficient distribution of the towing load.

(2) When towing fittings can not be located as specified in **(1)**, appropriate reinforced members are to be provided directly underneath the towing fittings. ~~are to be arranged on reinforced members.~~

2 Selection

(1) Towing fittings are to be selected from industry standards deemed appropriate by the Society, and are to be at least based on the following loads.

(a) For normal towing operations, the intended maximum towing load (e.g. static bollard pull) as indicated on the towing and mooring arrangements plan specified in **27.2.6**

(b) For other towing services, the minimum breaking strength of the tow line specified in **Table C27.1** according to the equipment number determined in **27.1.2**

(c) For fittings intended to be used for both normal and other towing operations, the greater of the loads specified in **(a)** and **(b)**

(2) When towing fittings are not selected from industry standards deemed appropriate by the Society, the strength of the fitting and of its attachment to the ship are to be in accordance with **-3** and **-4**. For strength assessments, beam theory or finite element analysis using net scantlings is to be applied as appropriate. At the discretion of the Society, load tests may be accepted as alternatives to strength assessments by calculations.

(3) Towing bitts (double bollards) are to be of sufficient strength to withstand the loads caused by the tow line attached with eye splice.

~~**2**~~**3** Design Load

Design load for ~~towing fittings and their~~ the supporting hull structures of towing fittings ~~(hereinafter referred to as "design load on fittings" (see **Fig.C27.1**) in this paragraph)~~ are to be as specified in **(1)** to **(~~6~~7)** below:

(1) For the normal towing operations specified in **27.2.1-1(1)**~~(e.g. harbour/manoeuvring)~~, the minimum design load ~~on the line (see **Fig.C27.1**)~~ is to be 1.25 times the intended maximum towing load.

(2) For the other ~~types of~~ towing services ~~(e.g. escort)~~ specified in **27.2.1-1(2)**, the minimum design load ~~on the line (see **Fig.C27.1**)~~ is to be the breaking strength of the tow~~ing~~ line specified in **Table C27.1** according to the equipment number determined in **27.1.2**.

(3) For fittings intended to be used for both normal and other towing operations, the minimum design load is to be the greater of the design loads specifies in **(1)** and **(2)**.

(~~3~~4) The design load ~~on fittings~~ is ~~to take into account all acting loads~~ to be applied to fittings in

all directions that may occur by taking into account the arrangements shown in the towing and mooring arrangements plan specified in **27.2.6**.

(~~4~~5) The point where the towing force acts on towing fittings is to be taken as the attachment point of the tow~~ing~~ line. For bollards and bitts, the attachment points of tow line is to be taken as not less than 4/5 of the tube height above the base (see **Fig.C27.1**).

(~~5~~6) Where the tow line takes a turn at a fitting, the design load ~~on fittings~~ is to be equal to ~~take into account~~ the resultant force of the ~~total~~ design loads acting on the line, but needs not exceed twice the design load on the line. ~~specified in **(1)** and **(2)** (see **Fig.C27.1**)~~ The design load acting on the line is to be the minimum design load specified in **(1)** and **(2)** (see **Fig.C27.2**)~~, but need not exceed twice the design load on the line~~.

(~~6~~7) ~~If the design load on fittings specified in **(2)** to **(5)** is less than the intended towing load stipulated in the construction specifications for the towing fittings and their supporting structures used for towing operations specified in **(2)**, the design load on fittings is to be not less than the intended towing load.~~Notwithstanding the requirements in **(1)** to **(6)**, when a safe towing load (*TOW*) greater than that determined according to **-5** is requested by the applicant, the design load is to be increased in accordance with the appropriate *TOW*/design load relationship given by **-3** and **-5**.

~~**3 Selection of Towing Fittings**~~

~~Towing fittings are generally to be specified according to standards approved by the Society.~~

4 Allowable Stresses ~~of Supporting Structures~~

Allowable stresses of supporting hull structures are not to be more than ~~below~~the following:

(1) For strength assessments using beam theory or grillage analysis:

(a) Normal stress: 100% of the specified minimum yield point of the material

(b) Shearing stress: 60% of the specified minimum yield point of the material

(2) For strength assessments using finite element analysis:

(a) Equivalent stress: 100% of the specified minimum yield point of the material

~~(1) Normal stress: 100% of the specified yield point for the material used~~

~~(2) Shearing stress: 60% of the specified yield point for the material used~~

~~**5 Corrosion Addition of Supporting Structures**~~

~~The corrosion addition of supporting structures is not to be less than the following values:~~

~~(1) For bulk carriers and double hull oil tankers specified in **1.1.2-4, Part A**, the corrosion addition specified in **Section 3**, **Chapter 3**, **Part 1** of **Part CSR-B&T**~~

~~(2) For other ships, the value will be considered by the Society, but is not to be less than 2*mm*~~

6~~5~~ Safe ~~Working~~Towing Load (~~*SWL*~~*TOW*)

(1) For towing fittings ~~and their supporting structures~~ used for the normal towing operations specified in **27.2.1-1(1)**, ~~the *SWL*~~*TOW* is not to exceed 80% of the minimum design load ~~on fittings~~ specified in ~~-2~~**3(1)**~~, (3), (4),~~ and ~~(5)~~.

(2) For towing fittings ~~and their supporting structures~~ used for the other towing operations specified in ~~**-2(2)**~~**27.2.1-1(2)**, ~~the *SWL*~~*TOW* is not to exceed the minimum design load ~~on fittings~~ specified in ~~-2~~**3(2)** ~~to **(6)**~~.

(3) For towing fittings ~~and their supporting structures~~ used for both normal and other towing operations ~~specified in both **-2(1)** and **-2(2)**~~, ~~the *SWL*~~*TOW* is ~~not~~ to ~~exceed~~ be the greater of the minimum design loads.

(4) For fittings intended to be used for both towing and mooring, *SWL* according to **27.2.3-5** is to be marked in addition to *TOW*.

(~~4~~5) The ~~*SWL*~~*TOW* (in tonnes) of each fitting is to be marked by weld beads and paint, or the equivalent, on the fitting.

Fig.C27.1 Acting point of the towing force

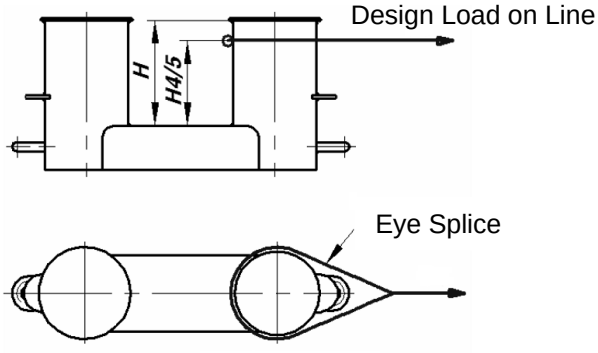
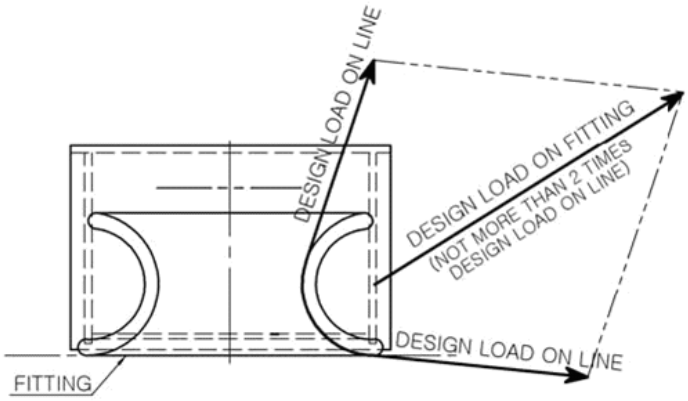


Fig.C27.~~1~~2 Design Load



27.2.3 Mooring Fittings*

1 Arrangement ~~of Mooring Fittings~~

(1) Mooring fittings, winches and capstans are to be located on ~~longitudinals~~stiffeners, ~~beams or~~ girders, or both which are part~~s~~ of the deck construction so as to facilitate efficient distribution of the mooring load.

(2) When mooring fittings, winches and capstans can not be located as specified in **(1)**, ~~the mooring fittings~~ appropriate reinforced members are to be provided ~~arranged on reinforced members~~ directly underneath them.

2 Selection

(1) Mooring fittings are to be selected from industry standards deemed appropriate by the Society, and are to be at least based on the minimum breaking strength of mooring line according to **27.1.5**.

(2) When mooring fittings are not selected from industry standards deemed appropriate by the Society, the strength of the fitting and of its attachment to the ship are to be in accordance with **-3** and **-4**. For strength assessments, beam theory or finite element analysis using net scantlings is to be applied as appropriate. At the discretion of the Society, load tests may be accepted as alternatives to strength assessments by calculations.

(3) Mooring bitts (double bollards) are to be chosen for the mooring line attached in a figure-of-eight fashion if the industry standard distinguishes between different methods to attach the line, i.e. figure-of-eight or eye splice.

~~2~~**3** Design Load

Design load for ~~mooring fittings and their~~ supporting hull structures of mooring fittings ~~(hereinafter referred to as "design load on fittings" (see **Fig.C27.1**) in this paragraph)~~ are to be as

specified in **(1)** to **(7)** below:

(1) The minimum design load ~~on the line (see **Fig.C27.1**)~~ is to be 1.~~2~~15 times the breaking strength of the mooring line ~~specified in **Table C27.1** according to the equipment number determined in **27.1.2**.~~according to **27.1.5**.

(2) The design load ~~on fittings~~ is to ~~take into account all acting loads~~ be applied to fittings in all directions that may occur by taking into account the arrangements shown in the towing and mooring arrangements plan specified in **27.2.6**.

(3) The point where the mooring force acts on mooring fittings is to be taken as the attachment point of the mooring line. For bollards and bitts, the attachment point of the mooring line is to be taken not less than 4/5 of the tube height above the base (See **Fig.C27.3(a)**). If fins are fitted to the bollard tubes to keep mooring lines as low as possible, the attachment point of the mooring line may be taken as the location of the fins. (See **Fig.C27.3(b)**)

(4) Where the mooring line takes a turn at a fitting, ~~T~~the design load ~~on fittings~~ is to be equal to the resultant force of ~~take into account the total~~ design load acting on the line ~~specified in **(1)** (see **Fig.C27.1**)~~, but needs not exceed twice the design load on the line. The design load acting on the line is to be the minimum design load specified in **(1)**.

(5) ~~If the design load on fittings specified in **(1)** to **(4)** is less than 1.25 times the intended mooring load stipulated in the construction specifications for the mooring fittings and their supporting structures used for mooring operations specified in **(1)**, the design load on the fittings is to be at least 1.25 times the intended mooring load.~~Notwithstanding the requirements in **(1)** to **(4)**, when a safe working load (*SWL*), greater than that determined according to **-5** is requested by the applicant, the design load is to be increased in accordance with the appropriate *SWL*/design load relationship given by **-3** and **-5**.

(6) The minimum design load applied to supporting hull structures for mooring winches is to be 1.25 times the intended maximum brake holding load~~.~~, where the maximum brake holding load is to be assumed not less than 80% of the minimum breaking strength of the mooring line according to **27.1.5**.

(7) The minimum design load applied to supporting hull structures for capstans is to be 1.25 times the intended maximum hauling-in force.

~~**3 Mooring Fittings**~~

~~Mooring fittings are generally to be specified according to standards approved by the Society.~~

4 Allowable Stresses ~~of Supporting Structures~~

Allowable stresses of supporting hull structures are not to be more than ~~below~~the following:

(1) For strength assessments using beam theory or grillage analysis:

(a) Normal stress: 100% of the specified minimum yield point ~~for~~ of the material ~~used~~

(b) Shearing stress: 60% of the specified minimum yield point of the material

(2) ~~Shearing stress: 60% of the specified yield point for the material used~~For strength assessments using finite element analysis:

(a) Equivalent stress: 100% of the specified minimum yield point of the material

~~**5 Corrosion Addition of Supporting Structures**~~

~~The corrosion addition of supporting structures is not to be less than the following values:~~

~~(1) For bulk carriers and double hull oil tankers specified in **1.1.2-4, Part A**, the corrosion addition specified in **Section 3**, **Chapter 3**, **Part 1** of **Part CSR-B&T**~~

~~(2) For other ships, the value will be considered by the Society, but is not to be less than 2*mm*~~

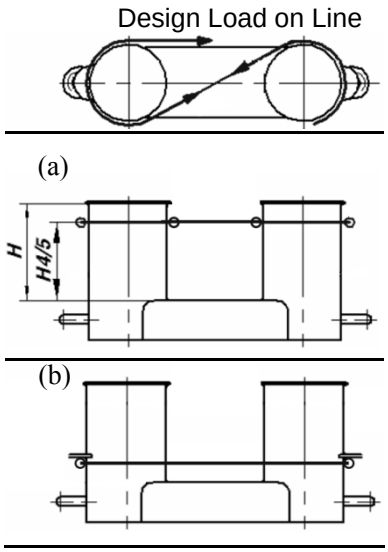
~~6~~5 Safe Working Load (*SWL*)

(1) Unless a greater *SWL* is requested by the applicant according to -**3(5)**, ~~The~~ *SWL* is not to exceed ~~80% of the design load on fittings specified in **-2(1) to (5)** or the design load specified in **-2(6)** or **(7)**~~ the minimum breaking strength of the mooring line according to **27.1.5**.

(2) The *SWL* (in tonnes) of each fitting, excluding mooring winches and capstan, is to be marked

by weld beads and paint, or the equivalent, on the fitting. For fittings intended to be used for both towing and mooring, *TOW* according to **27.2.2-5** is to be marked in addition to *SWL*.

Fig. C27.3 Acting Point of Mooring Force



27.2.4 Corrosion Additions

Corrosion additions are to be added to the scantlings of the supporting hull structures specified in **27.2.1-6** and shipboard fittings specified in **27.2.1-4** as follows:

(1) Supporting hull structures: According to other rules for the surrounding structures

(2) Pedestals and foundations on deck which are not a part of a fitting according to an industry standard deemed appropriate by the Society: 2.0 *mm*

(3) Shipboard fittings not selected from industry standards deemed appropriate by the Society: 2.0 *mm*

27.2.5 Wear Allowances

In addition to the corrosion additions referred to in **27.2.4**, the wear allowances for shipboard fittings not selected from industry standards deemed appropriate by the Society are not to be less than 1.0 *mm*, added to surfaces which are intended to regularly contact the line.

27.2.4~~6~~6 Towing and Mooring Fitting Arrangements Plan*

~~Ships are to have a Towing and Mooring Fitting Arrangement Plan which includes the notes below:~~

1 The *SWL* and *TOW* for the intended use for each shipboard fitting is to be noted in the towing and mooring arrangements plan available on board for the Master. If not otherwise chosen, *TOW* is to be the load limit for a tow line attached with eye-splice.

2 Information provided on the plan is to include:

(1) ~~Approved~~Industry standard and referenced ~~No.~~number of each towing and mooring fittings

(2) For each towing and mooring fitting, the location on the ship, the purpose (mooring, ~~harbour~~normal towing, ~~escort~~other towing etc.), the *SWL/TOW* and the manner of applying towing or mooring line loads including limiting fleet angles

(3) An arrangement of mooring lines showing the number of lines

(4) The minimum breaking load of each mooring line

(5) The acceptable environmental conditions as given in **27.1.5**, for the minimum breaking strength of mooring lines for ships with equipment numbers > 2,000;

(a) Maximum wind speed or acceptable wind speed
(b) Maximum current speed

(6) Other information or notes related to the design of shipboard fittings or lines.

Table C27.1 Anchors, Chain Cables and Ropes

Equipment Letter	Equipment number		Anchor		Chain cable for anchor (Stud anchor for chain)				Tow line		~~Mooring line~~		
			number	Mass per anchor (stock-less anchor)	Total length	Diameter			Length	Breaking load	~~number~~	~~Length of each line~~	~~Breaking load~~
						Grade 1	Grade 2	Grade 3					
	Over	Up to		*kg*	*m*	*mm*	*mm*	*mm*	*m*	*kN*		~~*m*~~	~~*kN*~~
A1	50	70	2	180	220	14	12.5		180	98	~~3~~	~~80~~	~~34~~
A2	70	90	2	240	220	16	14		180	98	~~3~~	~~100~~	~~37~~
A3	90	110	2	300	247.5	17.5	16		180	98	~~3~~	~~110~~	~~39~~
A4	110	130	2	360	247.5	19	17.5		180	98	~~3~~	~~110~~	~~44~~
A5	130	150	2	420	275	20.5	17.5		180	98	~~3~~	~~120~~	~~49~~
B1	150	175	2	480	275	22	19		180	98	~~3~~	~~120~~	~~54~~
B2	175	205	2	570	302.5	24	20.5		180	112	~~3~~	~~120~~	~~59~~
B3	205	240	2	660	302.5	26	22	20.5	180	129	~~4~~	~~120~~	~~64~~
B4	240	280	2	780	330	28	24	22	180	150	~~4~~	~~120~~	~~69~~
B5	280	320	2	900	357.5	30	26	24	180	174	~~4~~	~~140~~	~~74~~
C1	320	360	2	1020	357.5	32	28	24	180	207	~~4~~	~~140~~	~~78~~
C2	360	400	2	1140	385	34	30	26	180	224	~~4~~	~~140~~	~~88~~
C3	400	450	2	1290	385	36	32	28	180	250	~~4~~	~~140~~	~~98~~
C4	450	500	2	1440	412.5	38	34	30	180	277	~~4~~	~~140~~	~~108~~
C5	500	550	2	1590	412.5	40	34	30	190	306	~~4~~	~~160~~	~~123~~
D1	550	600	2	1740	440	42	36	32	190	338	~~4~~	~~160~~	~~132~~
D2	600	660	2	1920	440	44	38	34	190	37~~1~~0	~~4~~	~~160~~	~~147~~
D3	660	720	2	2100	440	46	40	36	190	406	~~4~~	~~160~~	~~157~~
D4	720	780	2	2280	467.5	48	42	36	190	441	~~4~~	~~170~~	~~172~~
D5	780	840	2	2460	467.5	50	44	38	190	4~~80~~79	~~4~~	~~170~~	~~186~~
E1	840	910	2	2640	467.5	52	46	40	190	518	~~4~~	~~170~~	~~201~~
E2	910	980	2	2850	495	54	48	42	190	559	~~4~~	~~170~~	~~216~~
E3	980	1060	2	3060	495	56	50	44	200	603	~~4~~	~~180~~	~~230~~
E4	1060	1140	2	3300	495	58	50	46	200	647	~~4~~	~~180~~	~~250~~
E5	1140	1220	2	3540	522.5	60	52	46	200	691	~~4~~	~~180~~	~~270~~
F1	1220	1300	2	3780	522.5	62	54	48	200	738	~~4~~	~~180~~	~~284~~
F2	1300	1390	2	4050	522.5	64	56	50	200	786	~~4~~	~~180~~	~~309~~
F3	1390	1480	2	4320	550	66	58	50	200	836	~~4~~	~~180~~	~~324~~
F4	1480	1570	2	4590	550	68	60	52	220	888	~~5~~	~~190~~	~~324~~
F5	1570	1670	2	4890	550	70	62	54	220	941	~~5~~	~~190~~	~~333~~
G1	1670	1790	2	5250	577.5	73	64	56	220	1024	~~5~~	~~190~~	~~353~~
G2	1790	1930	2	5610	577.5	76	66	58	220	1109	~~5~~	~~190~~	~~378~~
G3	1930	2080	2	6000	577.5	78	68	60	220	1168	~~5~~	~~190~~	~~402~~
G4	2080	2230	2	6450	605	81	70	62	240	1259	~~5~~	~~200~~	~~402~~
G5	2230	2380	2	6900	605	84	73	64	240	1356	~~5~~	~~200~~	~~422~~
H1	2380	2530	2	7350	605	87	76	66	240	1453	~~5~~	~~200~~	~~451~~
H2	2530	2700	2	7800	632.5	90	78	68	260	1471	~~6~~	~~200~~	~~480~~
H3	2700	2870	2	8300	632.5	92	81	70	260	1471	~~6~~	~~200~~	~~490~~
H4	2870	3040	2	8700	632.5	95	84	73	260	1471	~~6~~	~~200~~	~~500~~
H5	3040	3210	2	9300	660	97	84	76	280	1471	~~6~~	~~200~~	~~520~~
J1	3210	3400	2	9900	660	100	87	78	280	1471	~~6~~	~~200~~	~~554~~
J2	3400	3600	2	10500	660	102	90	78	280	1471	~~6~~	~~200~~	~~588~~
J3	3600	3800	2	11100	687.5	105	92	81	300	1471	~~6~~	~~200~~	~~618~~
J4	3800	4000	2	11700	687.5	107	95	84	300	1471	~~6~~	~~200~~	~~647~~

*J*5	4000	4200	2	12300	687.5	111	97	87	300	~~÷~~	1471	~~7~~	~~200~~	~~÷~~	~~647~~
*K*1	4200	4400	2	12900	715	114	100	87	300	~~÷~~	1471	~~7~~	~~200~~	~~÷~~	~~657~~
*K*2	4400	4600	2	13500	715	117	102	90	300	~~÷~~	1471	~~7~~	~~200~~	~~÷~~	~~667~~
*K*3	4600	4800	2	14100	715	120	105	92	300	~~÷~~	1471	~~7~~	~~200~~	~~÷~~	~~677~~
*K*4	4800	5000	2	14700	742.5	122	107	95	300	~~÷~~	1471	~~7~~	~~200~~	~~◎~~	~~686~~
*K*5	5000	5200	2	15400	742.5	124	111	97	300	~~÷~~	1471	~~8~~	~~200~~	~~÷~~	~~686~~
*L*1	5200	5500	2	16100	742.5	127	111	97	300	~~÷~~	1471	~~8~~	~~200~~	~~÷~~	~~696~~
*L*2	5500	5800	2	16900	742.5	130	114	100	300	~~÷~~	1471	~~8~~	~~200~~	~~÷~~	~~706~~
*L*3	5800	6100	2	17800	742.5	132	117	102	300	~~÷~~	1471	~~9~~	~~200~~	~~÷~~	~~706~~
*L*4	6100	6500	2	18800	742.5		120	107	300		1471	~~9~~	~~200~~	~~÷~~	~~716~~
*L*5	6500	6900	2	20000	770		124	111	300		1471	~~9~~	~~200~~	~~÷~~	~~726~~
*M*1	6900	7400	2	21500	770		127	114	300		1471	~~10~~	~~200~~	~~÷~~	~~726~~
*M*2	7400	7900	2	23000	770		132	117	300		1471	~~11~~	~~200~~	~~÷~~	~~726~~
*M*3	7900	8400	2	24500	770		137	122	300		1471	~~11~~	~~200~~	~~÷~~	~~735~~
*M*4	8400	8900	2	26000	770		142	127	300		1471	~~12~~	~~200~~	~~÷~~	~~735~~
*M*5	8900	9400	2	27500	770		147	132	300		1471	~~13~~	~~200~~	~~÷~~	~~735~~
*N*1	9400	10000	2	29000	770		152	132	300		1471	~~14~~	~~200~~	~~÷~~	~~735~~
*N*2	10000	10700	2	31000	770			137	300		1471	~~15~~	~~200~~	~~÷~~	~~735~~
*N*3	10700	11500	2	33000	770			142	300		1471	~~16~~	~~200~~	~~÷~~	~~735~~
*N*4	11500	12400	2	35500	770			147	300		1471	~~17~~	~~200~~	~~÷~~	~~735~~
*N*5	12400	13400	2	38500	770			152	300		1471	~~18~~	~~200~~	~~÷~~	~~735~~
*O*1	13400	14600	2	42000	770			157	300		1471	~~19~~	~~200~~	~~÷~~	~~735~~
*O*2	14600	16000	2	46000	770			162	300		1471	~~21~~	~~200~~	~~÷~~	~~735~~

Notes:

~~1 Where steel wire ropes are used, the following wire ropes corresponding to the marks shown in the Table are to be provided: ●(6×12), ○(6×24), and ◎(6×37).~~

~~2~~1 Length of chain cables may include shackles for connection.

~~3~~2 Tow line is not a condition of Classification, but is listed in this table only for guidance. (ref. **27.1.6**)

3 Values given for anchoring equipment in this table are based on an assumed maximum current speed of 2.5 *m*/*s*, a maximum wind speed of 25 *m*/*s* and a minimum scope of chain cable of 6, the scope being the ratio between the paid-out length of the chain and water depth.

Table C27.2 Mooring Lines for Ships with Equipment Number ≦ 2,000

Equipment Letter	Equipment number		Mooring line		
			Number	Length of each line	Breaking load
	Over	Up to		*m*	*kN*
*A*1	50	70	3	80	37
*A*2	70	90	3	100	40
*A*3	90	110	3	110	42
*A*4	110	130	3	110	48
*A*5	130	150	3	120	53
*B*1	150	175	3	120	59
*B*2	175	205	3	120	64
*B*3	205	240	4	120	69
*B*4	240	280	4	120	75
*B*5	280	320	4	140	80
*C*1	320	360	4	140	85
*C*2	360	400	4	140	96
*C*3	400	450	4	140	107
*C*4	450	500	4	140	117
*C*5	500	550	4	160	134
*D*1	550	600	4	160	143
*D*2	600	660	4	160	160
*D*3	660	720	4	160	171
*D*4	720	780	4	170	187
*D*5	780	840	4	170	202
*E*1	840	910	4	170	218
*E*2	910	980	4	170	235
*E*3	980	1060	4	180	250
*E*4	1060	1140	4	180	272
*E*5	1140	1220	4	180	293
*F*1	1220	1300	4	180	309
*F*2	1300	1390	4	180	336
*F*3	1390	1480	4	180	352
*F*4	1480	1570	5	190	352
*F*5	1570	1670	5	190	362
*G*1	1670	1790	5	190	384
*G*2	1790	1930	5	190	411
*G*3	1930	2000	5	190	437

EFFECTIVE DATE AND APPLICATION (Amendment 1-2)

1. The effective date of the amendments is 1 July 2018.

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.

Amendment 1-3

Chapter 1 GENERAL

1.1 General

Paragraph 1.1.7 has been amended as follows.

1.1.7 Materials*

1 The requirements in this Part are based upon the use of materials which comply with the requirements in **Part K**, unless otherwise specified.

2 Where high tensile steel specified in **Chapter 3, Part K of the Rules** is used, the construction and scantlings of the ship are to comply with the following requirements in **(1)** to **(3)**:

(1) The section modulus of the transverse section of the hull is not to be less than the value obtained by multiplying the following coefficient with the value specified in **32.2.4** for ships subject to the requirements in **Chapter 32** and **15.2** for other ships. However, where special consideration is given to the type of high tensile steel used, this value may be different, subject to the approval of the Society, from the following coefficients. Moreover, the extent of high tensile steel use is to be at the discretion of the Society.
0.78: where high tensile steels *KA*32, *KD*32, *KE*32 or *KF*32 are used
0.72: where high tensile steels *KA*36, *KD*36, *KE*36 or *KF*36 are used
0.68: where high tensile steels *KA*40, *KD*40, *KE*40 or *KF*40 are used.
0.62: where high tensile steel *KE*47 is used (However, only applies to ships subject to **Chapter 32**).

(2) With the exception of the requirements in **(1)**, details such as the thickness of decks and shell plating, and the section modulus of stiffeners and other scantlings are to be at the discretion of the Society.

(3) With the exception of the requirements in **(1)**, the construction and scantlings where high tensile steels are used are to be at the discretion of the Society.

3 (Omitted)

4 Where steels for low temperature service specified in **Chapter 3, Part K of the Rules** which have minimum specified yield stress greater than 235 N/mm^2 are used, the construction and scantlings of the ship are to comply with the following requirements in **(1)** to **(3)**:

(1) The section modulus of the transverse section of the hull is not to be less than the value obtained by multiplying the following coefficient with the value specified in **15.2**. Moreover, the extent of use of steels for low temperature service is to be at the discretion of the Society.
0.90: where *KL*27 are used
0.76: where *KL*33 are used
0.71: where *KL*37 are used.

(2) Details such as the thickness of plates and the section modulus of stiffeners of each structural member are to be at the discretion of the Society.

(3) The construction and scantlings where steels for low temperature service other than those mentioned in **(1)** above are used are to be at the discretion of the Society.

~~4~~5 Where materials other than steels complying with **Part K of the Rules** are used for the main hull structure, the use of such materials and corresponding scantlings are to be at the discretion of the Society.

~~5~~6 Where materials other than those specified in the Rules are used, the use of such materials and corresponding scantlings are to be specially approved by the Society.

~~6~~**7** Materials used for the hull construction of ships classed for *Smooth Water Service* are to be at the Society's discretion.

EFFECTIVE DATE AND APPLICATION (Amendment 1-3)

1. The effective date of the amendments is 29 December 2018.

2. Notwithstanding the amendments to the Rules, the current requirements apply to ships other than ships that fall under the following:

(1) for which the date of contract for construction is on or after the effective date; or

(2) the keels of which are laid or which are at *a similar stage of construction* on or after 1 July 2016.

(Note) The term "*a similar stage of construction*" means the stage at which the construction identifiable with a specific ship begins and the assembly of that ship has commenced comprising at least 50 *tonnes* or 1% of the estimated mass of all structural material, whichever is the less.

GUIDANCE FOR THE SURVEY AND CONSTRUCTION OF STEEL SHIPS

GUIDANCE

Part C Hull Construction and Equipment

2018 AMENDMENT NO.1

Notice No.52 29 June 2018

Resolved by Technical Committee on 31 January 2018

Notice No.52 29 June 2018
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 C HULL CONSTRUCTION AND EQUIPMENT

Amendment 1-1

C1 GENERAL

C1.1 General

Paragraph C1.1.22 has been amended as follows.

C1.1.22 Direct Calculations

Where the yield~~ing~~ strength assessment and buckling strength assessment are made by direct strength calculations carried out under the requirements in **1.1.22**, **Part C of the Rules**, the ~~method of~~ assessment is to comply with either of the following.

(1) The ~~method of~~ strength assessment ~~stipulated in~~ is to be carried out in accordance with **Annex C1.1.22-1** "**GUIDANCE FOR DIRECT CALCULATIONS**", and **Annex C1.1.22-2** "**GUIDANCE FOR BUCKLING STRENGTH CALCULATIONS**"

(2) Where the class notation "PS-DA" is affixed to classification characters, ~~T~~the strength assessment ~~method stipulated in~~ is to be carried out in accordance with the "Guideline for Direct Strength Calculation". ~~where class notation "PS-DA" is affixed to classification characters~~

(3) Where the class notation "PS-DA-DLA" is affixed to classification characters, the strength assessment of primary members in all cargo spaces is to be carried out in accordance with the "Guidelines for Direct Load Analysis and Strength Assessment".

C1.1.23 Structural Details

Sub-paragraph -3 has been renumbered to Sub-paragraph -4, and Sub-paragraph -3 has been added as follows.

3 Where the class notation "PS-FA-DLA" is affixed to classification characters, the fatigue strength assessment of primary members in all cargo spaces is to be carried out in accordance with the "Guidelines for Direct Load Analysis and Strength Assessment."

~~**3**~~**4** For ships with hatches which fall under the following **(1)** through **(4)**, the fatigue strength of strength deck plating at hatch corners and end parts of hatch side members is to be taken into consideration by avoiding abrupt changes of the cross section, or increasing scantling of strength deck plating and hatch side members suitably.

(1) Ships with hatches in the midship part, where the breadth of the hatch exceeds 0.7*B*

(2) Ships which use high tensile steel for strength deck plating and which comply with the requirements in **1.1.7-2(1)**, **Part C of the Rules**

(3) Ships with hatches of especially high coaming height

(4) Ships which are provided with hatches of special shapes or structures

EFFECTIVE DATE AND APPLICATION (Amendment 1-1)

1. The effective date of the amendments is 29 June 2018.

Amendment 1-2

C6 DOUBLE BOTTOMS

C6.1 General

C6.1.1 Application

Sub-paragraph -6(3) has been amended as follows.

6 Scantlings of structural members of the double bottom for ships intended to carry steel coils are recommended to comply not only with **Chapter 6, Part C** of the Rules but also with the following requirements.

(1) The calculations specified here are based on the steel coils being stacked as shown in **Fig. C6.1.1-4** in a way that their cores point athwartships.

(2) Thickness of inner bottom plates for ships with a longitudinal framing system is to be not less than the value obtained from the following formula.

$$\sqrt{kQ\left\{\left(1.65\beta-2.3\right)\alpha-6\beta+12.2\right\}}+1.5 \quad (mm)$$

Where,

k : Coefficient for mild steel in general, 1.65.

Q : Mass of steel coils loaded per panel of inner bottom plating, as obtained from the following formula:

$$\frac{Wn_1n_2}{1000n_3} \quad (ton)$$

Where steel coils are lined up in one tier with a key coil, Q is to be of 1.4 *times* the value obtained from the formula.

W : Mass of one steel coil (*kg*)

n_1 : Number of tiers of steel coils

n_2 : Number of load points per panel of inner bottom plates, as given in **Table C6.1.1-3** according to the value of n_3 and a/l_s

n_3 : Number of dunnages supporting one steel coil

α : Aspect ratio of panel of inner bottom plating (taken as 3.0 when α exceeds 3.0)

β : As obtained from the following formula: *c/a*

a : Spacing of floors (*mm*)

c : Distance (*mm*) between load points per panel of inner bottom plating measured in the direction of the ship length, which is obtained in **Table C6.1.1-2** according to the value of n_2 and n_3

l_s : Length of a steel coil (*mm*)

(3) Where inner bottom plating is of high tensile steel, the formula specified in **(2)** above is to be applied as follows.

For *KA*32, *KD*32, *KE*32 or *KF*32: 0.78*k* to be used instead of *k*
For *KA*36, *KD*36, *KE*36 or *KF*36: 0.72*k* to be used instead of *k*
For *KA*40, *KD*40, *KE*40 or *KF*40: 0.68*k* to be used instead of *k* (However, 0.66 *k* may be

taken where a fatigue assessment of the structure is performed to verify compliance with the requirements of the Society.)

(4) The scantlings of longitudinals of inner bottom plating are to be determined by the simple beam theory in the following conditions.

(a) Model:
Simple beam fixed at solid floor and/or simply supported at vertical strut

(b) Allowable stress:
$8.2\left(24-12\,f_B\right)$ *N/mm*^{2}, where f_B is specified in **6.4.3, Part C** of the Rules

(c) Load condition:
Concentrated load at the position of dunnages where the steel coils are loaded just on longitudinals

((5) is omitted.)

Annex C1.1.7-1 GUIDANCE FOR HULL CONSTRUCTION CONTAINING HIGH TENSILE STEEL MEMBERS

1.2 Structural Members

1.2.1 General

Sub-paragraph -2(2) has been amended as follows.

2 Expressions

Unless specified otherwise, the expressions employed in this Guidance are to be as stipulated in **(1)** to **(4)** below.

(1) f_{DH} and f_{BH} are to be as follows:

$$f_{DH} = \frac{Z_{Mreq}}{Z_{DH\ ship}}$$

$$f_{BH} = \frac{Z_{Mreq}}{Z_{BH\ ship}}$$

Z_{Mreq} : Section modulus of hull determined according to the requirements in **Chapter 15, Part C** of the Rules when mild steel is used.

$Z_{DH\ ship}$ and $Z_{BH\ ship}$: Actual hull section moduli at strength deck and bottom respectively.

(2) K is the coefficient corresponding to the kind of steel. ~~However, where special consideration is given to the type of high tensile steel used, this value may be different, subject to the approval of the Society, from the following coefficients:~~

0.78 (for *HT*32)

0.72 (for *HT*36)

0.68 (for *HT*40, however, 0.66 may be taken where a fatigue assessment of the structure is performed to verify compliance with the requirements of the Society.)

The values specified in **1.1.7-3, Part C** of the Rules (for stainless steel and stainless clad steel)

(3) Plate thickness t_M , section modulus Z_M and moment of inertia I_M are those required by the Rules for members and structures of mild steel, and t_H , Z_H and I_H are those for high tensile steel.

(4) Expressions not stipulated here are to be as defined in relevant provisions in **Part C** of the Rules.

EFFECTIVE DATE AND APPLICATION (Amendment 1-2)

1. The effective date of the amendments is 1 July 2018.

Amendment 1-3

C27 EQUIPMENT

Title of Section C27.1 has been amended as follows.

C27.1 Anchors, Chain Cables and Mooring Ropes

Paragraph 27.1.1 has been added as follows.

C27.1.1 General

1 "Special consideration" referred to in **27.1.1-1**, **Part C of the Rules** means the evaluation of the design effectiveness of anchors, chain cables and windlasses. For ships for which the L_1 specified in **15.2.1-1**, **Part C of the Rules** is not less than 135 *m*, the provisions of following **(1)** to **(4)** may be used for the design or to assess the adequacy of the anchoring equipment. However, the application of these provisions is limited to anchoring operations in water of depths up to 120 *m*, currents up to 1.54 *m/s*, winds up to 14 *m/s* and waves with significant heights up to 3 *m*. Furthermore, the scope of chain cables, being the ratio between the paid-out length of the chain and water depth, is limited to between 3 and 4.

(1) Anchors and chain cables are to be in accordance with **Table C27.1.1-1** and based on the Equipment number EN_1 obtained from the following formula:

$$EN_1 = 0.628\left[a\left(\frac{EN}{0.628} \right)^{1/2.3} + b(1-a) \right]^{2.3}$$

a: As obtained from the following formula:

$$a = 1.83\times10^{-9} L_1^3 + 2.09\times10^{-6} L_1^2 - 6.21\times10^{-4} L_1 + 0.0866$$

b: As obtained from the following formula:

$$b = 0.156 L_1 + 8.372$$

L_1: Ship length specified in **15.2.1-1**, **Part C of the Rules**

EN: Equipment number specified in **27.1.2**, **Part C of the Rules**

(2) Anchors are to be in accordance with the following **(a)** to **(d)**.

(a) Bow anchors are to be connected to their chain cables and positioned on board ready for use.

(b) Anchors are to be of a stockless high holding power (HHP) type. The mass of the head of a stockless anchor, including pins and fittings, is not to be less than 60 % of the total mass of the anchor.

(c) The mass, per anchor, of bower anchors given in **Table C27.1.1-1** is for anchors of equal mass. The mass of individual anchors may vary up to 7% of the tabular mass, but the total mass of anchors is not to be less than that required for anchors of equal mass.

(d) To hold the anchor tight in against the hull or the anchor pocket, respectively, it is recommended to fit anchor lashings appropriately (e.g., by using a "devils claw", etc.).

(3) Bower anchors are to be in accordance with the following **(a)** to **(b)**.

(a) Bower anchors are to be associated with stud link chain cables of special (Grade 2) or extra special (Grade 3) quality. The total length of chain cables, as given in **Table C27.1.1-1,** is to be reasonably divided between the two bower anchors. For the proof and breaking loads of stud link chain cables, reference is made to **Table L3.5, Part L of the**

Rules.

(b) For the installation of the chain cables on board, **Chapter 27, Part C of the Rules** is to be observed.

(4) Windlasses and chain stoppers are to be in accordance with the following **(a)** to **(c)**.

(a) The windlass unit prime mover is to be able to supply for at least 30 minutes a continuous duty pull Z_{cont} (in N) as given by:

$$Z_{cont} = 35d^2 + 13.4m_A$$

d: chain diameter (mm) as per **Table C27.1.1-1**

m_A: HHP anchor mass (kg) as per **Table C27.1.1-1**

(b) As far as practicable for testing purposes, the test speed of the chain cable during hoisting of the anchor and cable is to be measured over 37.5 m of the chain cable and initially with at least 120 m of chain and the anchor submerged and hanging free. The mean speed of the chain cable during hoisting of the anchor from the depth of 120 m to the depth of 82.5 m is to be at least 4.5 m/min.

(c) For the supporting hull structures of anchor windlasses and chain stoppers, reference is made to the provisions of **27.1.8**, **Part C of the Rules**.

Table C27.1.1-1 has been added as follows.

Table C27.1.1-1 Anchoring Equipment for Ships in Unsheltered Water of Depths up to 120 *m*

Equipment letter	Equipment number EN_1		High holding power stockless bower anchors		Stud link chain cable for bower anchors		
			Number	Mass per anchor	Length	Diameter	
						Grade 2	Grade 3
	Over	Up to		*kg*	*m*	*mm*	*mm*
-	-	1790	2	14150	1017.5	105	84
*DG*2	1790	1930	2	14400	990	105	84
*DG*3	1930	2080	2	14800	990	105	84
*DG*4	2080	2230	2	15200	990	105	84
*DG*5	2230	2380	2	15600	990	105	84
*DH*1	2380	2530	2	16000	990	105	84
*DH*2	2530	2700	2	16300	990	105	84
*DH*3	2700	2870	2	16700	990	105	84
*DH*4	2870	3040	2	17000	990	105	84
*DH*5	3040	3210	2	17600	990	105	84
*DJ*1	3210	3400	2	18000	990	105	84
*DJ*2	3400	3600	2	18300	990	105	84
*DJ*3	3600	3800	2	19000	990	107	87
*DJ*4	3800	4000	2	19700	962.5	107	87
*DJ*5	4000	4200	2	20300	962.5	111	90
*DK*1	4200	4400	2	21100	962.5	114	92
*DK*2	4400	4600	2	22000	962.5	117	95
*DK*3	4600	4800	2	22900	962.5	120	97
*DK*4	4800	5000	2	23500	962.5	124	99
*DK*5	5000	5200	2	24000	935	127	102
*DL*1	5200	5500	2	24500	907.5	132	107
*DL*2	5500	5800	2	25000	907.5	132	107
*DL*3	5800	6100	2	25500	880	137	111
*DL*4	6100	6500	2	25700	880	142	114

*DL*5	6500	6900	2	26000	852.5	142	117
*DM*1	6900	7400	2	26500	852.5	147	117
*DM*2	7400	7900	2	27000	825	152	122
*DM*3	7900	8400	2	27500	825		127
*DM*4	8400	8900	2	28000	797.5		127
*DM*5	8900	9400	2	28900	770		132
*DN*1	9400	10000	2	29400	770		137
*DN*2	10000	10700	2	29900	770		142
*DN*3	10700	11500	2	30600	770		142
*DN*4	11500	12400	2	31500	770		147
*DN*5	12400	13400	2	33200	770		152
*DO*1	13400	14600	2	35000	770		157
-	14600	-	2	38000	770		162

C27.1.2 Equipment Numbers

Sub-paragraph -5 has been amended as follows.

5 Structures to be included in the third term (0.1 A) of the formula in **27.1.2, Part C** of the Rules

(1) The following items are to be included in $\sum h''l$.

(a) Superstructures

(b) Deckhouses and trunks having breadths exceeding *B*/4 and heights exceeding 1.5 *m* (*See* **-4** above as to measurement of breadth)

(c) Screens and bulwarks higher than 1.5 *m* in continuation with superstructures or deckhouses having a breadth exceeding *B*/4 (*See* **C27.1.2-7** as to measurement of length)

Notes:

The following items may be excluded from the calculation of $\sum h''l$:

- portions outside the fore and aft ends of *L*
- derrick posts, ventilators, etc. in continuation with superstructures or deckhouses
- hatch coamings and hatch covers
- funnels
- cargoes on decks (In the case of calculating equipment numbers for the selection of tow lines and mooring lines, deck cargo as given by the Loading Manual is to be included in the calculation of $\sum h''l$)

(2) The structures specified in **(1)** above are to be divided at each deck into upper and lower structures, and the values of $\sum h''l$ are to be calculated for individual tiers.

Paragraph C27.1.4 has been added as follows.

C27.1.4 Chain Cables

Wire ropes may be used in place of chain cables on ships with less than 40 *m* in length as long as the following **(1)** to **(3)** are satisfied.

(1) The length of the wire rope is to be equal to 1.5 times the corresponding tabular length of chain cable specified in **Table C27.1**, **Part C of the Rules** and its strength is to be equal to that of a Grade 1 chain cable as specified in **Table L3.5**, **Part L of the Rules**.

(2) A short length of chain cable is to be fitted between the wire rope and anchor having a length of 12.5 *m* or the distance between anchor in its stowed position and the winch, whichever is less.

(3) All surfaces coming into contact with the wire rope need to be rounded with a radius of not less than 10 times the wire rope diameter (including stem).

Paragraph C27.1.5 has been amended as follows, and Table C27.1.5-1 to -3 have been deleted.

C27.1.5 Mooring Lines

~~**1 Table C27.1.5-1** indicates the equivalencies of Manila ropes and synthetic fibre ropes expressed in diameters. Special considerations will be given to a double braided rope.~~

~~Table C27.1.5-1 Comparison of Diameters of Manila Ropes and Synthetic Fibre Ropes (Unit: *mm*)~~

~~Manila rope~~	~~Vinylon rope~~		~~Polyethylene rope~~		~~Polyester rope~~	~~Polypropylene rope~~		~~Nylon rope~~
	~~Grade 1~~	~~Grade 2~~	~~Grade 1~~	~~Grade 2~~		~~Grade 1~~	~~Grade 2~~	
	~~Span, Monofilament~~	~~Multifilament~~	~~Ordinary yarn~~	~~Strong yarn~~		~~Span, Monofilament~~	~~Multi, Special multi, Special monosplit~~	
~~20~~	~~18~~	~~16~~	~~18~~	~~15~~	~~14~~	~~16~~	~~15~~	~~14~~
~~22~~	~~19~~	~~18~~	~~19~~	~~17~~	~~16~~	~~18~~	~~17~~	~~16~~
~~24~~	~~21~~	~~19~~	~~21~~	~~18~~	~~17~~	~~19~~	~~18~~	~~18~~
~~26~~	~~23~~	~~21~~	~~23~~	~~20~~	~~19~~	~~21~~	~~20~~	~~19~~
~~28~~	~~24~~	~~23~~	~~24~~	~~21~~	~~20~~	~~23~~	~~21~~	~~20~~
~~30~~	~~26~~	~~24~~	~~26~~	~~23~~	~~22~~	~~24~~	~~23~~	~~22~~
~~32~~	~~28~~	~~26~~	~~28~~	~~24~~	~~23~~	~~26~~	~~24~~	~~24~~
~~35~~	~~30~~	~~28~~	~~30~~	~~26~~	~~25~~	~~28~~	~~26~~	~~26~~
~~40~~	~~35~~	~~32~~	~~35~~	~~30~~	~~29~~	~~33~~	~~30~~	~~29~~
~~45~~	~~40~~	~~36~~	~~40~~	~~34~~	~~32~~	~~37~~	~~34~~	~~32~~
~~50~~	~~44~~	~~40~~	~~44~~	~~38~~	~~36~~	~~41~~	~~38~~	~~35~~
~~55~~	~~48~~	~~45~~	~~48~~	~~41~~	~~39~~	~~45~~	~~41~~	~~39~~
~~60~~	~~53~~	~~50~~	~~53~~	~~45~~	~~42~~	~~49~~	~~45~~	~~42~~
~~65~~	~~58~~	~~55~~	~~58~~	~~49~~	~~46~~	~~53~~	~~49~~	~~45~~
~~70~~	~~62~~	~~60~~	~~62~~	~~53~~	~~49~~	~~57~~	~~53~~	~~49~~
~~75~~	~~67~~	~~65~~	~~67~~	~~56~~	~~53~~	~~61~~	~~57~~	~~53~~
~~80~~	~~71~~	~~70~~	~~71~~	~~60~~	~~57~~	~~65~~	~~60~~	~~56~~
~~85~~	~~75~~	~~74~~	~~75~~	~~64~~	~~61~~	~~69~~	~~64~~	~~60~~
~~90~~	~~80~~	~~78~~	~~80~~	~~68~~	~~65~~	~~73~~	~~68~~	~~64~~
~~95~~	~~84~~	~~82~~	~~84~~	~~72~~	~~70~~	~~78~~	~~72~~	~~67~~
~~100~~	~~89~~	~~87~~	~~89~~	~~75~~	~~75~~	~~82~~	~~75~~	~~70~~

~~**2** The manner of determining the diameter of synthetic fibre rope corresponding to the equipment number is as indicated in the following example.~~

~~Example~~

~~Breaking strength of mooring line for equipment number 600 – 660 (D_2): 147*kN*~~

~~Diameter of Manila rope corresponding to the breaking strength~~

~~50ϕ : 144 *kN*~~

~~55ϕ : 173 *kN*~~

~~As per **Table L5.1, Part L** of the Rules~~

~~$50 + (55 - 50) \times \frac{147 - 144}{173 - 144} = 50.6$~~

~~(Rounded up to 1*st* decimal place)~~

~~1) Where Manila ropes are used, 50.6 → 51ϕ (Rounded up to a whole number)~~

~~2) Where synthetic fibre ropes are used:~~

~~To determine the diameter of Polyester rope corresponding to 50.6ϕ of Manila rope~~

~~50ϕ : 36~~

~~55ϕ : 39~~

~~As per **Table C27.1.5-1**~~

~~$36 + (39 - 36) \times \frac{50.6 - 50}{55 - 50} = 37\phi$~~

~~(Rounded up to a whole number)~~

~~**3** The correspondence of diameters determined as described above to the equipment numbers is indicated in **Table C27.1.5-2**.~~

~~Table C27.1.5-2 Comparison of Diameters of Mooring Ropes~~

~~*: (6×12), ⊕: (6×24), ◎: (6×37)~~

Equipment Number		Breaking strength of Manila rope (*kN*)	Length (*m*)	Number	Dia. of steelwire rope (*mm*)	Dia. of Manila rope (*mm*)	Dia. of synthetic fibre ropes (*mm*)							
							Vinylon		Polyethylene		Polyester	Polypropylene		Nylon (*mm*)
Over	Up to						1	2	1	2		1	2	
50	70	34	80	3	11	24	21	19	21	18	17	19	18	18
70	90	37	100	3	11	25	22	20	22	19	18	20	19	19
90	110	39	110	3	11	26	23	21	23	20	19	21	20	19
110	130	44	110	3	12	27	24	22	24	21	20	22	21	20
130	150	49	120	3	13	29	25	24	25	22	21	23	22	21
150	175	54	120	3	13	30	26	24	26	23	22	24	23	22
175	205	59	120	3	14	32	28	26	28	24	23	26	24	24
205	240	64	120	4	14	33	29	27	29	25	24	27	25	25
240	280	69	120	4	15	35	30	28	30	26	25	28	26	26
280	320	74	140	4	16	36	31	29	31	27	26	29	27	27
320	360	78	140	4	16	37	32	30	32	28	27	30	28	27
360	400	88	140	4	17	39	34	31	34	29	28	32	29	28
400	450	98	140	4	* 18	41	36	33	36	31	30	34	31	30
450	500	108	140	4	18	43	38	34	38	32	31	35	32	31
500	550	123	160	4	20	46	41	37	41	35	33	38	35	33
550	600	132	160	4	20	48	42	38	42	36	34	39	36	34
600	660	147	160	4	22	51	45	41	45	39	37	42	39	36
660	720	157	160	4	23	53	46	43	46	40	38	43	40	37
720	780	172	170	4	24	55	48	45	48	41	39	45	41	39
780	840	186	170	4	25	58	51	48	51	43	41	47	43	41
840	910	201	170	4	25	60	53	50	53	45	42	49	45	42
910	980	216	170	4	26	62	55	52	55	47	44	51	47	43
980	1060	230	180	4	23	65	58	55	58	49	46	53	49	45
1060	1140	250	180	4	24	68	60	58	60	51	48	55	51	47
1140	1220	270	180	4	25	70	62	60	62	53	49	57	53	49
1220	1300	284	180	4	26	72	64	62	64	54	51	59	54	51
1300	1390	309	180	4	27	76	68	66	68	57	54	62	57	54
1390	1480	324	180	4	27	78	69	68	69	58	55	63	58	55
1480	1570	324	190	5	27	78	69	68	69	58	55	63	58	55
1570	1670	333	190	5	⊕ 28	79	70	69	70	59	56	64	59	55
1670	1790	353	190	5	28	81	72	71	72	61	58	66	61	57
1790	1930	378	190	5	29	84	74	73	74	63	60	68	63	59
1930	2080	402	190	5	30	87	77	76	77	66	63	71	65	62
2080	2230	422	200	5	31	89	79	77	79	67	64	72	67	63
2230	2380	451	200	5	32	93	82	80	82	70	68	76	70	66
2380	2530	480	200	5	33	96	85	83	85	73	71	79	73	68
2530	2700	480	200	6	33	96	85	83	85	73	71	79	73	68
2700	2870	490	200	6	32	97	86	84	86	73	72	80	73	68
2870	3040	500	200	6	32	98	87	85	87	74	73	80	74	69
3040	3210	520	200	6	33	100	89	87	89	75	75	82	75	70
3210	3400	554	200	6	34		92	90	92	77	76	84	77	72
3400	3600	588	200	6	35		94	92	94	80	78	87	80	74
3600	3800	618	200	6	36		97	95	97	82	81	89	82	76
3800	4000	647	200	6	37		100	97	100	84	83	92	84	78
4000	4200	647	200	7	37		100	97	100	84	83	92	84	78
4200	4400	657	200	7	37			98		85	84	93	85	79
4400	4600	667	200	7	37			99		86	84	93	86	80
4600	4800	677	200	7	38			100		86	85	94	86	81
4800	5000	686	200	7	38					87	86	95	87	81
5000	5200	686	200	8	38					87	86	95	87	81
5200	5500	696	200	8	◎ 38					88	87	96	88	82
5500	5800	706	200	8	38					88	87	96	88	82
5800	6100	706	200	9	38					88	87	96	88	82
6100	6500	716	200	9	39					89	87	97	89	83
6500	6900	726	200	9	39					89	88	98	89	83
6900	7400	726	200	10	39					89	88	98	89	83
7400	7900	726	200	11	39					89	88	98	89	83
7900	8400	735	200	11	39					90	89	98	90	84
8400	8900	735	200	12	39					90	89	98	90	84
8900	9400	735	200	13	39					90	89	98	90	84
9400	10000	735	200	14	39					90	89	98	90	84
10000	10700	735	200	15	39					90	89	98	90	84
10700	11500	735	200	16	39					90	89	98	90	84
11500	12400	735	200	17	39					90	89	98	90	84
12400	13400	735	200	18	39					90	89	98	90	84
13400	14600	735	200	19	39					90	89	98	90	84
14600	16000	735	200	21	39					90	89	98	90	84

~~Table C27.1.5-3 Comparison of Diameters of Tow Lines~~

~~＊: (6×12), ⊕: (6×24), ◎: (6×37)~~

~~Equipment Number~~		~~Length (m)~~	~~Dia of Steelwire rope (mm)~~	~~Dia of Manila rope (mm)~~	~~Dia of synthetic fibre ropes (mm)~~							
					~~Vinylon~~		~~Polyethylene~~		~~Polyester~~	~~Polypropylene~~		~~Nylon~~
					~~1~~	~~2~~	~~1~~	~~2~~		~~1~~	~~2~~	
~~Over~~	~~Up to~~											
~~50~~	~~70~~	~~180~~	~~18~~	~~41~~	~~33~~	~~33~~	~~36~~	~~31~~	~~30~~	~~34~~	~~31~~	~~30~~
~~70~~	~~90~~	~~180~~	~~18~~	~~41~~	~~36~~	~~33~~	~~36~~	~~31~~	~~30~~	~~34~~	~~31~~	~~30~~
~~90~~	~~110~~	~~180~~	~~18~~	~~41~~	~~36~~	~~33~~	~~36~~	~~31~~	~~30~~	~~34~~	~~31~~	~~30~~
~~110~~	~~130~~	~~180~~	~~18~~	~~41~~	~~36~~	~~33~~	~~36~~	~~31~~	~~30~~	~~34~~	~~31~~	~~30~~
~~130~~	~~150~~	~~180~~	~~＊ 18~~	~~41~~	~~36~~	~~33~~	~~36~~	~~31~~	~~30~~	~~34~~	~~31~~	~~30~~
~~150~~	~~175~~	~~180~~	~~18~~	~~41~~	~~36~~	~~33~~	~~36~~	~~31~~	~~30~~	~~34~~	~~31~~	~~30~~
~~175~~	~~205~~	~~180~~	~~19~~	~~44~~	~~39~~	~~35~~	~~39~~	~~33~~	~~31~~	~~36~~	~~33~~	~~32~~
~~205~~	~~240~~	~~180~~	~~20~~	~~48~~	~~42~~	~~38~~	~~42~~	~~36~~	~~34~~	~~39~~	~~36~~	~~34~~
~~240~~	~~280~~	~~180~~	~~22~~	~~52~~	~~45~~	~~42~~	~~45~~	~~39~~	~~37~~	~~42~~	~~39~~	~~36~~
~~280~~	~~320~~	~~180~~	~~24~~	~~56~~	~~49~~	~~46~~	~~49~~	~~42~~	~~40~~	~~46~~	~~42~~	~~40~~
~~320~~	~~360~~	~~180~~	~~26~~	~~61~~	~~54~~	~~51~~	~~54~~	~~46~~	~~43~~	~~50~~	~~46~~	~~43~~
~~360~~	~~400~~	~~180~~	~~23~~	~~64~~	~~57~~	~~54~~	~~57~~	~~48~~	~~45~~	~~52~~	~~48~~	~~44~~
~~400~~	~~450~~	~~180~~	~~24~~	~~68~~	~~60~~	~~58~~	~~60~~	~~51~~	~~48~~	~~55~~	~~51~~	~~47~~
~~450~~	~~500~~	~~180~~	~~25~~	~~71~~	~~63~~	~~61~~	~~63~~	~~54~~	~~50~~	~~58~~	~~54~~	~~50~~
~~500~~	~~550~~	~~190~~	~~⊕ 27~~	~~75~~	~~67~~	~~65~~	~~67~~	~~56~~	~~53~~	~~61~~	~~56~~	~~53~~
~~550~~	~~600~~	~~190~~	~~28~~	~~79~~	~~71~~	~~69~~	~~71~~	~~59~~	~~56~~	~~65~~	~~59~~	~~56~~
~~600~~	~~660~~	~~190~~	~~29~~	~~83~~	~~74~~	~~73~~	~~74~~	~~62~~	~~59~~	~~68~~	~~62~~	~~59~~
~~660~~	~~720~~	~~190~~	~~30~~	~~88~~	~~78~~	~~76~~	~~78~~	~~66~~	~~63~~	~~71~~	~~66~~	~~62~~
~~720~~	~~780~~	~~190~~	~~32~~	~~92~~	~~81~~	~~80~~	~~81~~	~~70~~	~~67~~	~~75~~	~~70~~	~~65~~
~~780~~	~~840~~	~~190~~	~~33~~	~~96~~	~~85~~	~~83~~	~~85~~	~~73~~	~~71~~	~~79~~	~~73~~	~~68~~
~~840~~	~~910~~	~~190~~	~~33~~	~~100~~	~~89~~	~~87~~	~~89~~	~~75~~	~~75~~	~~82~~	~~75~~	~~70~~
~~910~~	~~980~~	~~190~~	~~34~~		~~93~~	~~90~~	~~93~~	~~78~~	~~77~~	~~85~~	~~78~~	~~73~~
~~980~~	~~1060~~	~~200~~	~~36~~		~~96~~	~~94~~	~~96~~	~~81~~	~~80~~	~~89~~	~~81~~	~~76~~
~~1060~~	~~1140~~	~~200~~	~~37~~		~~100~~	~~97~~	~~100~~	~~84~~	~~83~~	~~92~~	~~84~~	~~78~~
~~1140~~	~~1220~~	~~200~~	~~38~~					~~87~~	~~86~~	~~95~~	~~87~~	~~81~~
~~1220~~	~~1300~~	~~200~~	~~39~~					~~90~~	~~89~~	~~98~~	~~90~~	~~84~~
~~1300~~	~~1390~~	~~200~~	~~41~~					~~94~~	~~93~~		~~94~~	~~88~~
~~1390~~	~~1480~~	~~200~~	~~42~~					~~97~~	~~95~~		~~97~~	~~90~~
~~1480~~	~~1570~~	~~220~~	~~43~~					~~100~~	~~98~~		~~100~~	~~93~~
~~1570~~	~~1670~~	~~220~~	~~44~~									~~96~~
~~1670~~	~~1790~~	~~220~~	~~46~~									
~~1790~~	~~1930~~	~~220~~	~~48~~									
~~1930~~	~~2080~~	~~220~~	~~49~~									
~~2080~~	~~2230~~	~~240~~	~~51~~									
~~2230~~	~~2380~~	~~240~~	~~53~~									
~~2380~~	~~2530~~	~~240~~	~~55~~									
~~2530~~	~~2700~~	~~260~~	~~◎ 56~~									
~~2700~~	~~2870~~	~~260~~	~~as~~									
~~2870~~	~~3040~~	~~260~~	~~above~~									
~~3040~~	~~3210~~	~~280~~										
~~3210~~	~~3400~~	~~280~~										
~~3400~~	~~3600~~	~~280~~										
~~3600~~	~~3800~~	~~300~~										
~~3800~~	~~4000~~	~~300~~										
~~4000~~	~~4200~~	~~300~~										
~~4200~~	~~4400~~	~~300~~										
~~4400~~	~~4600~~	~~300~~										
~~4600~~	~~4800~~	~~300~~										
~~4800~~	~~5000~~	~~300~~										
~~5000~~	~~5200~~	~~300~~										
~~5200~~	~~5500~~	~~300~~										
~~5500~~	~~5800~~	~~300~~										
~~5800~~	~~6100~~	~~300~~										
~~6100~~	~~6500~~											
~~6500~~	~~6900~~											
~~6900~~	~~7400~~											
~~7400~~	~~7900~~											
~~7900~~	~~8400~~											
~~8400~~	~~8900~~											
~~8900~~	~~9400~~											
~~9400~~	~~10000~~											
~~10000~~	~~10700~~											
~~10700~~	~~11500~~											
~~11500~~	~~12400~~											
~~12400~~	~~13400~~											
~~13400~~	~~14600~~											
~~14600~~	~~16000~~											

~~**4** The modifications of diameters and numbers of mooring lines as prescribed in **27.1.5-2** and **-3, Part C** of the Rules are to be as indicated in the following examples.~~

~~Example 1~~

~~When the Equipment Number is greater than 3600 and not greater than 3800 (*J*3), and *A*/Equipment Number is not greater than 0.9~~

~~Number of mooring lines required by Rules:~~

~~6 lines~~

~~1) Where Hizex ropes with a breaking strength of 618 *kN* are to be provided:~~

~~Rope diameter:~~

~~Polyethylene rope, Grade 1, in column of breaking strength of 618 *kN* in **Table C27.1.5-2**: 97φ~~

~~Accordingly, 97φ × 200 *m* × 6 lines are required.~~

~~2) Where Pyren ropes with a breaking strength of 490 *kN* are to be provided:~~

~~Rope diameter:~~

~~Polypropylene rope, Grade 2, in column of breaking strength of 490 *kN* in **Table C27.1.5-2**: 73φ~~

~~Number of ropes: 618 *kN* × 6÷490 *kN* = 7.6: 8 lines~~

~~Accordingly, 73φ × 200 *m* × 8 lines are required.~~

~~Example 2~~

~~When the Equipment Number is greater than 5000 and not greater than 5200 (*K*5), and *A*/Equipment Number is greater than 1.1 and not greater than 1.2~~

~~Number of mooring lines required by Rules:~~

~~8 + 2 = 10 lines~~

~~1) Where Polyester ropes with a breaking strength of 686 *kN* are to be provided:~~

~~Rope diameter:~~

~~Polyester rope in column of breaking strength of 686 *kN* in **Table C27.1.5-2**: 86φ~~

~~Accordingly, 86φ × 200 *m* × 10 lines are required.~~

~~2) Where Amilan ropes with a breaking strength of 588 *kN* are to be provided:~~

~~Rope diameter:~~

~~Nylon ropes in column of breaking strength of 588 *kN* in **Table C27.1.5-2**: 74φ~~

~~Number of ropes: 686 *kN* × 10÷588 *kN* = 11.7: 12 lines~~

~~Accordingly, 74φ × 200 *m* × 12 lines are required.~~

1 With respect to the provisions of **27.1.5-2, Part C of the Rules**, deck cargo as given by the Loading Manual is to be included for the determination of side-projected area A_1.

2 Fibre ropes used for tow lines or mooring lines are to be not less than 20 *mm* in diameter. The minimum breaking strength specified in **27.1.5, Part C of the Rules** is to be increased by 20% for polyamide ropes and by 10% for other synthetic ropes to account for any strength loss due to aging and wear, etc.

3 For synthetic fibre ropes, it is recommended to use lines which have a reduced risk of recoil (snap-back) to mitigate the risk of injuries or fatalities in the cases where the lines may break.

4 "Breast line", "head line", "stern line" and "spring line" referred to in **27.1.5, Part C of the Rules** are defined as follows.

(1) Breast line: A mooring line that is deployed perpendicular to the ship, restraining the ship in the off-berth direction.

(2) Spring line: A mooring line that is deployed almost parallel to the ship, restraining the ship in fore or aft direction.

(3) Head/Stern line: A mooring line that is oriented between the longitudinal and transverse directions, restraining the ship in the off-berth and in the fore or aft directions. The amount of

restraint in the fore or aft and off-berth directions depends on the line angle relative to these directions.

5 "The ship is intended to be regularly moored to jetty-type piers" referred to in **27.1.5-5(2), Part C of the Rules** means oil tankers, chemical tankers or gas carriers which are assumed to be moored to jetty-type piers.

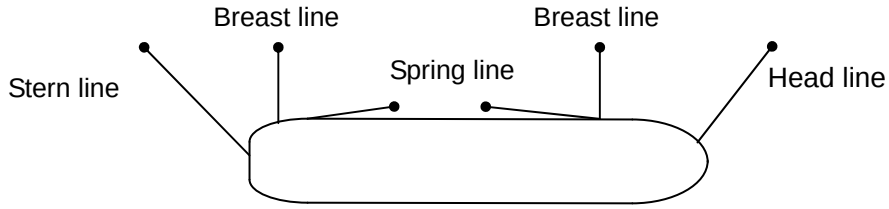
6 Maximum wind speed, acceptable wind speed and maximum current speed referred to in **27.1.5, Part C of the Rules** are based on the following **(1)** to **(2)**.

(1) The wind speed is considered representative of a 30 second mean speed from any direction and at a height of 10 *m* above the ground.

(2) The current speed is considered representative of the maximum current speed acting on bow or stern (±10°) and at a depth of one-half of the mean draft. Furthermore, it is considered that ships are moored to solid piers that provide shielding against cross currents.

Fig. C27.1.5-1 has been added as follows.

Fig. C27.1.5-1 Sample Arrangement of Mooring Lines



Paragraph C27.1.6 has been deleted.

~~**C27.1.6 Tow Lines (Tow line is not a condition of Classification)**~~

~~**1** It is advised that the manner of determining the diameters of tow lines of synthetic fibre ropes is in accordance with **C27.1.5-1** and **-2**.~~

~~**2** The correspondence of diameters of synthetic fibre ropes determined as described in **-1** above to the equipment numbers are indicated in **Table C27.1.5-3**.~~

Paragraph C27.1.7 has been amended as follows.

C27.1.7 Chain Lockers

The wording "the access cover and its securing arrangements to the satisfaction of the Society" in **27.1.7-45, Part C** of the Rules means those which are in accordance with *JIS* F 2304, *JIS* F 2329, or *ISO* 5894:1999 or their equivalent.

Section C27.2 has been amended as follows.

C27.2 Towing and Mooring Fittings

C27.2.1 General

~~**1** "Towing fittings" and "mooring fittings" as preseribed in **27.2, Part C** of the Rules, mean bollards, bitts, fairleads, stand rollers, chocks, etc. and are not intended for running capstans, winches, etc.~~

~~**2** Beds, seats and other equivalent facilities beneath towing and mooring fittings are included in towing and mooring fittings specified in **27.2, Part C** of the Rules.~~

1 "Shipboard fittings" referred to in **27.2.1-1, Part C of the Rules** mean bollards, bitts, fairleads, stand rollers, chocks used for normal mooring of the ship and other similar components used for normal or other towing of the ship. Other components such as capstans, winches, etc. are not included. Any weld, bolt or equivalent device connecting a shipboard fitting to its supporting structure is to be considered to be part of the shipboard fitting if selected in accordance with an industry standard deemed appropriate by the Society.

2 "Supporting hull structures" referred to in **27.2.1-1, Part C of the Rules** means the parts of the ship structure on/in which the shipboard fitting is placed and which is directly subjected to the forces exerted on the shipboard fitting. The supporting hull structures of capstans, winches, etc. used for normal or other towing and mooring operations mentioned above is included.

3 **27.2.1-1, Part C of the Rules** is not applicable to the design and construction of shipboard fittings and supporting hull structures used for the following types of special towing service:

(1) Escort towing: Towing service, in particular, for laden oil tankers or LNG carriers, required in specific estuaries. Its main purpose is to control the ship in case of failures of propulsion or steering systems.

(2) Canal transit towing: Towing service for ships transiting canals

(3) Emergency towing for tankers: Towing service to assist tankers in the cases of emergency referred to in **27.3, Part C of the Rules**.

4 "Sheltered waters" referred to in **27.2.1-1, Part C of the Rules** means water area specified in **3.5.2**, **Section 4, Chapter 1, Part 1 of Part CSR-B&T**.

C27.2.2 Towing Fittings

1 ~~For the requirements of "the ship's corresponding equipment number" as prescribed in **27.2.2-2(2), Part C** of the Rules, the side projected area is to include the maximum amount of deck cargoes when selecting tow lines.~~With respect to the provisions of **27.2.2, Part C of the Rules**, the increase of the minimum breaking strengths of fibre ropes according to **C27.1.5-2** need not to be taken into account for loads applied to shipboard fittings and supporting hull structures.

2 ~~The requirements in **27.2.3-2(5), Part C** of the Rules are based on the assumption that the load is that of one turn of cable around a single post. When it is assumed that the load is greater, appropriate adjustments are to be made for each case.~~With respect to the provisions of **27.2.2-1, Part C of the Rules**, the arrangements of towing fittings and their supporting hull structures refer to **Fig C27.2.2-1**

3 "Industry ~~S~~standards ~~approved~~ deemed appropriate by the Society" as prescribed in **27.2.2-~~3~~2(1), Part C of the Rules**, means international standards~~,~~ or national standards such as *ISO*, *JIS F*, etc. ~~or equivalent standards issued by shipyards or manufacturers~~. ~~When towing fittings that are not of the above standards are to be used, the design of the towing fitting is to be examined in based on the structural strength assessment of the supporting structures.~~

4 With respect to the provisions of **27.2.2-2(1)(b), Part C of the Rules**, side projected area including that of deck cargoes as given by the Loading Manual is to be taken into account for the calculation of equipment numbers.

5 With respect to the provisions of **27.2.2-2(2), Part C of the Rules**, strength assessments using finite element analysis are to be in accordance with **C27.2.2-8**.

~~4~~6 "Normal stress" ~~as prescribed~~ referred to in **27.2.2-4(1), Part C of the Rules** ~~means bending stress unless specified otherwise. However, axial stress due to the direction of the towing force may occur, in which case this stress is to be taken into account as well.~~ is the sum of bending stress and axial stress with the corresponding shearing stress acting perpendicular to the normal stress.

7 With respect to the provisions of **27.2.2-4(1), Part C of the Rules**, stress concentration factors need not be taken into account for strength assessments using beam theory or grillage analysis.

8 With respect to the provisions of **27.2.2-4(2), Part C of the Rules**, strength assessments using

finite element analysis are to be in accordance with the following **(1)** to **(10)**.

(1) The geometry is to be idealized as realistically as possible.

(2) The ratio of element length to width is not to exceed 3.

(3) Girders are to be modelled using shell or plane stress elements.

(4) Symmetric girder flanges may be modelled by beam or truss elements.

(5) The element height of girder webs is not to exceed one-third of the web height.

(6) In way of small openings in girder webs the web thickness is to be reduced to a mean thickness over the web height.

(7) Large openings are to be modelled.

(8) Stiffeners may be modelled by using shell, plane stress, or beam elements.

(9) Stresses are to be read from the centre of the individual element.

(10) For shell elements the stresses are to be evaluated at the mid-plane of the element.

9 The provisions for the *TOW* specified in **27.2.2-5, Part C of the Rules** are applied for the use with no more than one line. If not otherwise chosen, for towing bitts (double bollards), *TOW* is the load limit for a tow line attached with eye-splice.

10 Towing arrangements are recommended as follows.

(1) Tow lines are to be led through a closed chock. The use of open fairleads with rollers or closed roller fairleads is to be avoided.

(2) It is recommended to provide at least one chock close to centreline of the ship forward and aft. It is beneficial to provide additional chocks on port and starboard side at the transom and at the bow.

(3) Tow lines are to have a straight lead from the towing bitt or bollard to the chock. Bitts or bollards serving, chocks are to be located slightly offset and at a distance of at least 2 *m* away from the chock. (Refer to **Fig. C27.2.2-2**)

(4) Warping drums are to be positioned not more than 20 *m* away from chocks as far as practicable, measured along the path of the line.

(5) Attention is to be given to the arrangement of the equipment for towing and mooring operations in order to prevent interference of mooring and tow lines as far as practicable.

Fig. C27.2.2-1 Sample Arrangement of Shipboard Fittings and Supporting Hull Structures

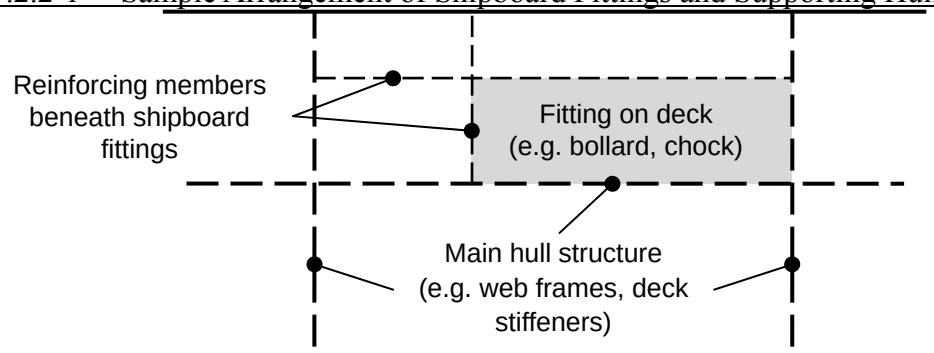
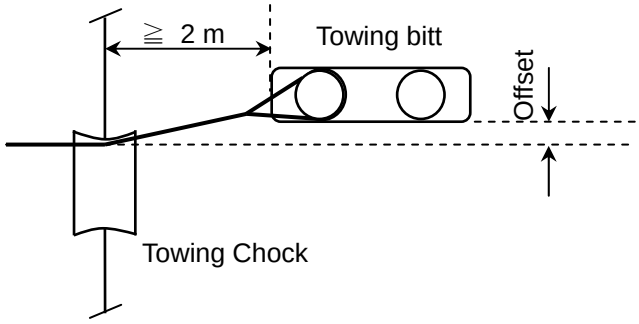


Fig. C27.2.2-2 Sample Arrangement of Towing Fittings



C27.2.3 Mooring Fittings

1 ~~For the requirements of "the ship's corresponding equipment number" as prescribed in **27.2.3-2(1), Part C** of the Rules, the side projected area is to include the maximum amount of deck cargoes when selecting mooring lines.~~ With respect to the provisions of **27.2.3, Part C of the Rules**, the increase of minimum breaking strength for fibre ropes according to **C27.1.5-2** needs not to be taken into account for the loads applied to shipboard fittings and supporting hull structures.

2 ~~The breaking strength of mooring lines specified in **27.2.3-2(1), Part C** of the Rules, may take into account the requirements in **27.1.5-3, Part C** of the Rules. In this case, the number of mooring lines and their breaking load are to be incorporated into the Towing and Mooring Fitting Arrangement Plan specified in **27.2.4, Part C** of the Rules.~~With respect to the provisions of **27.2.3-1, Part C of the Rules**, the arrangements of mooring fittings, capstans, winches and their supporting structures refers to **Fig C27.2.2-1**.

3 The requirements in **27.2, Part C of the Rules** are to apply to additional mooring fittings and their hull supporting structures. However, the design load of these fittings and their supporting hull structures may be 1.~~2~~15 times the intended maximum mooring load instead of the requirements in **27.2.3-~~2~~3(1) to (4), Part C of the Rules**. This information is to be incorporated into the Towing and Mooring Fitting Arrangement Plan specified in **27.2.~~4~~6, Part C** of the Rules.

4 ~~The requirements in **27.2.3-2(4), Part C** of the Rules are based on the assumption that the load is that of one turn of cable around a single post. When it is assumed that the load is greater, appropriate adjustments are to be made for each case.~~ "~~Standards approved by the Society~~Industry standards deemed appropriate by the Society" ~~as prescribed~~ referred to in **27.2.~~2~~3-~~3~~2(1)**, **Part C of the Rules** means international standards or national standards such as *ISO*, *JIS F*, etc. ~~or equivalent standards issued by shipyards or manufacturers. When mooring fittings that are not of the above standards are to be used, the design of the mooring fitting is to be examined in based on the structural strength assessment of the supporting structures.~~

5 With respect to the provisions of **27.2.3-2(2), Part C of the Rules**, strength assessments using finite element analysis are to be in accordance with **C27.2.2-8**.

~~5~~6 "The intended maximum brake holding load" as prescribed in **27.2.3-~~2~~3(6), Part C of the Rules** means the rated brake holding load or the rated hauling load specified in the mooring winch manufacturers' standards.

~~**6** "Standards approved by the Society" as prescribed in **27.2.2-3, Part C** of the Rules means international standards, national standards or equivalent standards issued by shipyards or manufacturers. When mooring fittings that are not of the above standards are to be used, the design of the mooring fitting is to be examined in based on the structural strength assessment of the supporting structures.~~

7 "Normal stress" ~~as prescribed~~ referred to in **27.2.3-4(1), Part C of the Rules** ~~means bending stress unless specified otherwise. However, axial stress due to the direction of the mooring force may occur, in which case this stress is to be taken into account as well.~~ is the sum of bending stress and axial stress with the corresponding shearing stress acting perpendicular to the normal stress.

8 With respect to the provisions of **27.2.3-4(1), Part C of the Rules**, stress concentration factors need not be taken into account for strength assessments using beam theory or grillage analysis.

9 The provisions for *SWL* specified in **27.2.3-5, Part C of the Rules** are to be applied in cases where no more than one line.

10 Mooring arrangements are recommended as follows.

(1) As far as possible, a sufficient number of mooring winches is to be fitted to allow for all mooring lines to be belayed on winches. If the mooring arrangement is designed such that mooring lines are partly belayed on bitts or bollards, it is to be considered that these lines may not be as effective as the mooring lines belayed on winches. Mooring lines are to have as straight a lead as is practicable from the mooring drum to the fairlead.

(2) At points of changes in direction, sufficiently large radii of the contact surface of a rope on a fitting is to be provided to minimize the wear experienced by mooring lines and as recommended by the rope manufacturer for the rope type intended to be used.

(3) Attention is to be given to the arrangement of the equipment for mooring operations in order to prevent interference of the mooring lines as far as practicable.

C27.2.~~4~~6 Towing and Mooring Fitting Arrangements Plan

1 It is recommended that the information related to safe towing and mooring operation in the Towing and Mooring Fitting Arrangements Plan specified in **27.2.~~4~~6, Part C of the Rules** is incorporated into the pilot card in order to provide the pilot proper information on harbour/escorting operations.

2 With respect to the provisions of **27.2.6-2(6), Part C of the Rules**, the design condition related to **27.1.5-5(2), Part C of the Rules** is to be described in this plan as a note.

EFFECTIVE DATE AND APPLICATION (Amendment 1-3)

1. The effective date of the amendments is 1 July 2018.

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.

Amendment 1-4

C1 GENERAL

C1.1 General

C1.1.23 Structural Details

Sub-paragraph -1 has been amended as follows.

1 In applying the requirements in **1.1.23-4**, **Part C of the Rules**, fatigue strength assessment of longitudinals in the midship part for tankers, ore carriers, bulk carriers ~~and~~, container carriers, ships carrying liquefied gases in bulk and ships carrying dangerous chemicals in bulk is to be in accordance with the following items **(1)** to **(3)**.

(1) For ships not less than 150 *m* in length L_1, the fatigue strength assessment of longitudinals that do not penetrate structural members which constrain athwartship or vertical displacements of longitudinals (such as transverse bulkheads, swash bulkheads or floors) is to be carried out in accordance with ~~the~~ **Annex C1.1.23-1** "**GUIDANCE FOR THE FATIGUE STRENGTH ASSESSMENT OF LONGITUDINALS**~~:~~". L_1 is the ship length specified in **15.2.1-1 Part C of the Rules**.

(2) Fatigue strength assessment of longitudinals that penetrate structural members which constrain athwartship or vertical displacements of longitudinals (such as transverse bulkheads, swash bulkheads or floors) is to be in accordance with the following **(a)** and **(b)**.

(a) For ships not less than 150 *m* in length L_1, the fatigue assessment may be dispensed with where the scantlings of the longitudinals comply with the requirements in **(1)** above and soft brackets with sufficient fatigue strength are arranged on both sides of the structural members (bulkheads, etc.).

(b) ~~For ships that have or are intended to have~~Where the class notation "PS-FA" ~~appended~~is affixed to ~~the~~ classification characters, the fatigue assessment is to be carried out on the structural members penetrated by the longitudinals in accordance with **Annex C1.1.23-1** "**GUIDANCE FOR THE FATIGUE STRENGTH ASSESSMENT OF LONGITUDINALS**~~:~~".

(3) A fatigue strength assessment of longitudinals other than those at the midship part is to be carried out where deemed necessary by the Society.

EFFECTIVE DATE AND APPLICATION (Amendment 1-4)

1. The effective date of the amendments is 29 December 2018.

2. Notwithstanding the amendments to the Guidance, the current requirements apply to ships other than ships that fall under the following:

(1) for which the date of contract for construction is on or after the effective date; or

(2) the keels of which are laid or which are at *a similar stage of construction* on or after 1 July 2016.

(Note) The term "*a similar stage of construction*" means the stage at which the construction identifiable with a specific ship begins and the assembly of that ship has commenced comprising at least 50 *tonnes* or 1% of the estimated mass of all structural material, whichever is the less.