



CCS Rule Change Notice For:
RULES FOR CLASSIFICATION OF SEA-GOING STEEL
SHIPS

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Effective date: 1 January, 2020

Beijing

CCS Rule Change Notice For:
RULES FOR CLASSIFICATION OF SEA-GOING STEEL
SHIPS

PART ONE

Brief Introduction

1. Incorporation of URZ3 (Rev.8 Apr., 2019), will be implemented from July 1, 2020.
2. The certification requirements for exhaust cleaning system has been revised, and only the exhaust cleaning system for scheme A is required to be approved and certificated.
3. The relevant class notations are added in the “list of class notations for sea-going ships” according to the CCS Guidelines for Survey of Hybrid Ships and CCS Guidelines for Survey of Pure Battery-Powered Ships.
4. The endorsement requirement for the executive hull summary has been revised.

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Special Equipment and System Notations

Table G

Class notation	Description		Technical requirements
Hybrid	Hybrid system	Ships with various sources of energy (excluding sails) which can serve as main propulsion power simultaneously, this notation may be assigned.	Guidelines for Survey of Hybrid Ships
Battery (Power)	Pure Battery-Powered Propulsion	When only batteries are used as propulsion power in ship's normal operation and relevant requirements in the Guidelines are met, with shipowner's application, this notation may be assigned.	Guidelines for Survey of Pure Battery-Powered Ships

CHAPTER 3 INSPECTIONS OF PRODUCTS

Appendix 1B

LIST OF CERTIFICATION REQUIREMENTS FOR STATUTORY MARINE PRODUCTS

No.	Product name	Document		Approval mode				Plan approval	Remark
		C/E	W	DA	TA-B	TA-A	WA	PA	
2	Pollution prevention at sea								
2.8	Exhaust cleaning system	X	-	-	X	O	-	X	Exhaust cleaning system for scheme A

CHAPTER 5 SURVEYS AFTER CONSTRUCTION

Section 1 GENERAL PROVISIONS

5.1.8 Reporting and evaluation of survey

5.1.8.4 An executive hull summary of the survey and results (~~Forms CER or EHS of CCS~~) is to be issued to the owner and placed on board the ship for reference at future surveys. The executive hull summary is to be endorsed by ~~the Headquarters of CCS~~.

Section 2 TYPES AND PERIODS OF SURVEYS

5.2.3 Periodical surveys of the outside of the ship's bottom and related items^①

5.2.3.7 For oil tankers, combination carriers, bulk carriers, chemical tankers, double hull oil tankers, double skin bulk carriers ~~and~~, general dry cargo ships [and liquefied gas carriers](#), reference is also be made to the relevant requirements of Sections 5, 6, 7 ~~and~~, 8 ~~and~~ 16 of this Chapter.

^① [This revision is to be implemented on or after 1 July 2020.](#)

CCS Rule Change Notice For:
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STEEL SHIPS
PART TWO

Explanation

1. Incorporating revisions of IACS UR S10 Rev.6, to be implemented from 1 January 2021.

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CHAPTER 3 EQUIPMENT AND OUTFITS

Section 1 RUDDERS

3.1.1.3 Materials

- (1) Welded parts of rudders are to be made of materials complying with relevant requirements for hull structural steel in CCS Rules for Materials and Welding.
- (2) Material factor k for normal and high tensile steel plating may be taken into account when specified in each individual rule requirement. The material factor k is to be taken as defined in Section 3, Chapter 1 of this PART, unless otherwise specified.
- (3) Steel grade of plating materials for rudders and rudder horns are to be in accordance with Section 3, Chapter 1 of this PART.
- (4) Rudder stocks, pintles, coupling bolts, keys and cast parts of rudders are to be made of rolled, forged or cast carbon manganese steel in accordance with CCS Rules for Materials and Welding.
- (5) For rudder stocks, pintles, keys and bolts the minimum yield stress is not to be less than 200 N/mm². The requirements of this Section are based on a material's yield stress of 235 N/mm². If material is used having a yield stress differing from 235 N/mm² the material factor K is to be determined as follows:

$$K = \left(\frac{235}{R_{eH}} \right)^e$$

where: $e = 0.75$ for $R_{eH} > 235$ N/mm²;

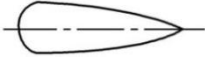
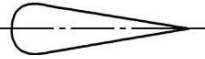
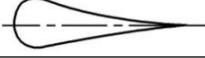

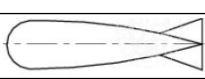

$e = 1.00$ for $R_{eH} \leq 235$ N/mm²;

R_{eH} — [specified minimum](#) yield stress (N/mm²) of material used, and is not to be taken greater than $0.7R_m$ or 450 N/mm², whichever is the smaller value;

R_m — tensile strength (N/mm²) of material used.

3.1.1.4 Welding and design details

- (1) Slot-welding is to be limited as far as possible. Slot welding is not to be used in areas with large in-plane stresses transversely to the slots or in way of cut-out areas of semi-spade rudders. When slot welding is applied, the length of slots is to be minimum 75 mm with breadth of $2t$, where t is the rudder plate thickness, in mm. The distance between ends of slots is not to be more than 125 mm. The slots are to be fillet welded around the edges and filled with a suitable compound, e.g. epoxy putty. Slots are not to be filled with weld. Continuous slot welds are to be used in lieu of slot welds. When continuous slot welding is applied, the root gap is to be between 6-10 mm. The bevel angle is to be at least 15°.
- (2) In way of the rudder horn recess of semi-spade rudders, the radii in the rudder plating [except in way of solid part in cast steel](#) are not to be less than 5 times the plate thickness, but in no case less than 100 mm. Welding in side plate is to be avoided in or at the end of the radii. Edges of side plate and weld adjacent to radii are to be ground smooth.
- (3) Welds between plates and heavy pieces (solid parts in forged or cast steel or very thick plating) are to be made as full penetration welds. In way of highly stressed areas e.g. cut-out of semi-spade rudder and upper part of spade rudder, cast or welding on ribs is to be arranged. Two sided full penetration welding is normally to be arranged. Where back welding is impossible welding is to be performed against ceramic backing bars or equivalent. Steel backing bars may be used and are to be continuously welded on one side to the heavy piece.
- (4) Requirements for welding and design details of rudder trunks are described in 3.1.9.2 of this Section.
- (5) Requirements for welding and design details when the rudder stock is connected to the rudder by horizontal flange coupling are described in 3.1.6.1(4) of this Section.
- (6) Requirements for welding and design details of rudder horns are described in 3.1.9.1(3).

Profile Type		Factor K_2	
		Ahead condition	Astern condition
NACA-00 series Göttingen		1.1	0.80
Flat side		1.1	0.90
Hollow		1.35	0.90
Lift rudders		1.7	to be specially considered; if not known: 1.30
Fish tail		1.4	0.8
Single plate		1.0	1.0
Mixed profiles (e.g. HSVA)		1.21	0.9

3.1.2.2 Rudder blades with cut-outs (semi-spade rudders)

The total rudder force C_R is to be calculated according to 3.1.2.1(1) of this Section. The pressure distribution over the rudder area, upon which the determination of rudder torque and rudder blade strength is to be based, is to be derived as follows:

The rudder area may be divided into two rectangular or trapezoidal parts with areas A_1 and A_2 , so that $A = A_1 + A_2$ (see Figure 3.1.2.2).

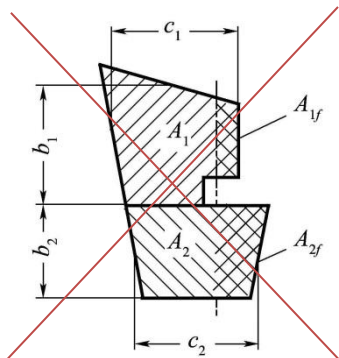


Figure 3.1.2.2 Areas A_1 and A_2

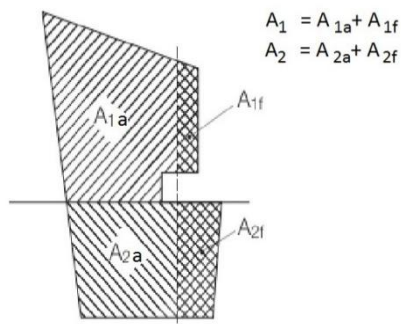


Figure 3.1.2.2

The levers r_1 and r_2 are to be determined as follows:

$$r_1 = c_1 (\alpha - k_1), \text{ m};$$

$$r_2 = c_2 (\alpha - k_2), \text{ m};$$

where: c_1, c_2 — mean breadth of partial areas A_1, A_2 determined, where applicable, in accordance with Figure 3.1.2.1;

$$k_1 = \frac{A_{1f}}{A_1};$$

$$k_2 = \frac{A_{2f}}{A_2};$$

A_{1a} — portion of A_1 situated aft of the centre line of the rudder stock, in m^2 ;

A_{1f} — portion of A_1 situated ahead of the centre line of the rudder stock, in m^2 ;

A_{2a} — portion of A_2 situated aft of the centre line of the rudder stock, in m^2 ;

A_{2f} — portion of A_2 situated ahead of the centre line of the rudder stock, in m^2 ;

$\alpha = 0.33$ for ahead condition;

$\alpha = 0.66$ for astern condition;

For parts of a rudder behind a fixed structure such as the rudder horn:

$\alpha = 0.25$ for ahead condition;

$\alpha = 0.55$ for astern condition;

3.1.4.3 Before significant reductions in rudder stock diameter due to the application of steels with specified minimum yield stresses exceeding 235 N/mm^2 are granted, CCS may require the evaluation of the rudder stock deformations. Large deformations of the rudder stock are to be avoided in order to avoid excessive edge pressures in way of bearings.

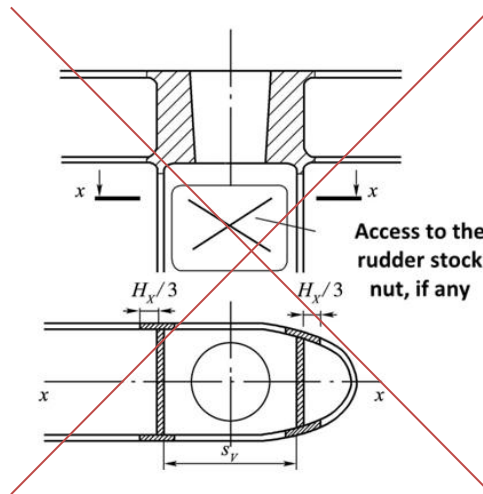


Figure 3.1.5.3 ~~Cross section of the connection between rudder blade structure and rudder stock housing~~

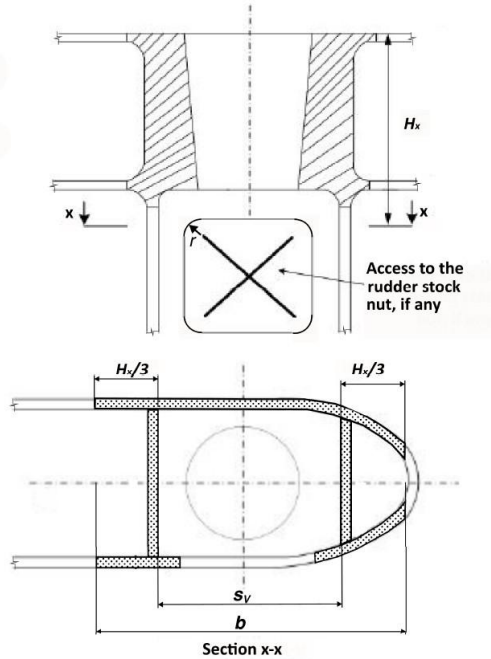


Figure 3.1.5.3 Cross-section of the connection between rudder blade structure and rudder stock housing, example with opening in only one side shown

3.1.6.3 Cone couplings with key

(1) Tapering and coupling length

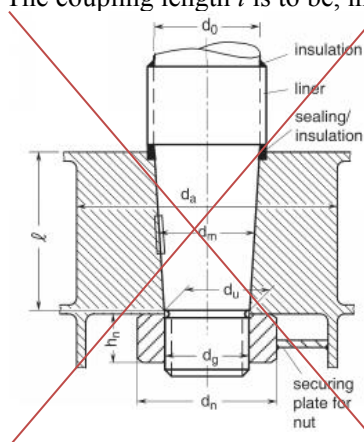
Cone couplings without hydraulic arrangements for mounting and dismounting the coupling are to have a taper c on diameter of 1:8 – 1:12.

where: $e = (d_0 - d_u) / l_c = (d_0 - d_u) / l_c$, see Figure 3.1.6.3(a) and Figure 3.1.6.3(c).

The diameters d_0 and d_u are shown in Figure 3.1.6.3(a) and the cone length, l_c , is defined in Figure 3.1.6.3(c).

The cone coupling is to be secured by a slugging nut. The nut is to be secured, e.g. by a securing plate as shown in Figure 3.1.6.3(a).

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



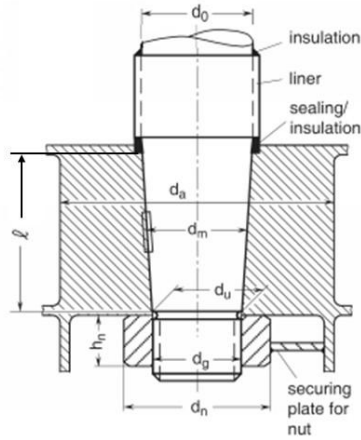


Figure 3.1.6.3(a) Cone coupling with key

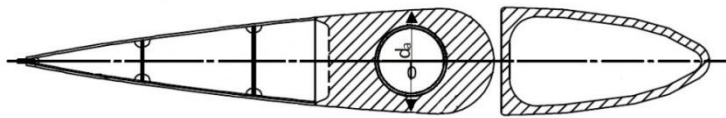


Figure 3.1.6.3(b) Gudgeon outer diameter d_0

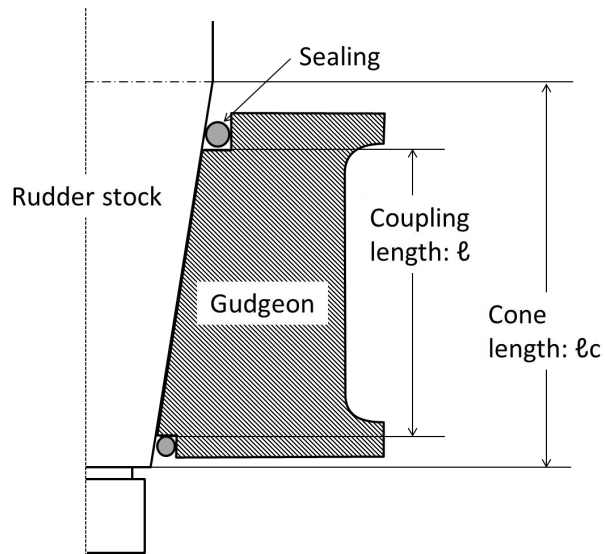


Figure 3.1.6.3(c) Cone length and coupling length

(2) Dimensions of key

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

$$a_s = \frac{17.55 Q_F}{d_k R_{eH1}} \text{ cm}^2$$

where:

Q_F — design yield moment of rudder stock, in N·m;

$$Q_F = 0.02664d_t^3/K \text{ N}\cdot\text{m}$$

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

d_t — stock diameter, in mm, according to 3.1.4.1 of this Section;

K — material factor for stock as given in 3.1.1.3(5) of this Section;

d_k — mean diameter of the conical part of the rudder stock, in mm, at the key;

R_{eH1} — specified minimum yield stress of the key material, in N/mm².

The effective surface area a_k , in cm², of the key (without rounded edges) between key and rudder stock or cone coupling is not to be less than:

$$a_k = \frac{5Q_F}{d_k R_{eH2}}$$

where: R_{eH2} — specified minimum yield stress of the key, stock or coupling material, in N/mm².

(3) The dimensions of the slugging nut are to be as follows (see Figure 3.1.6.3(± a)):

external thread diameter: $d_g \geq 0.65 d_o$,

height: $h_n \geq 0.6 d_g$,

outer diameter: $d_n \geq 1.2 d_u$ or $1.5 d_g$, whichever is the greater.

(4) It is to be proved that 50% of the design yield moment is solely transmitted by friction in the cone couplings. This can be done by calculating the required push-up pressure and push-up length according to 3.1.6.4(2) for a torsional moment $Q'_F = 0.5Q_F$.

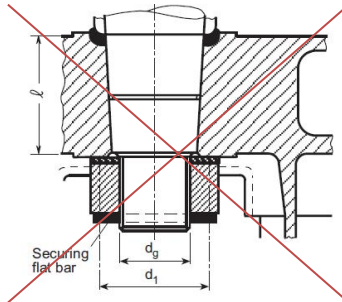
(5) Notwithstanding the requirements of 3.1.6.3(2) and 3.1.6.3(4), where a key is fitted to the coupling between stock and rudder and it is considered that the entire rudder torque is transmitted by the key at the couplings, the scantlings of the key as well as the push-up force and push-up length are to be subject to special consideration.

3.1.6.4 Cone couplings with special arrangements for mounting and dismounting the couplings

(1) Where the stock diameter exceeds 200 mm, the press fit is recommended to be effected by a hydraulic pressure connection. In such cases the cone is to be more slender, $c \approx 1:12$ to $\approx 1:20$.

In case of hydraulic pressure connections the nut is to be effectively secured against the rudder stock or the pintle.

For the safe transmission of the torsional moment by the coupling between rudder stock and rudder body the push-up pressure and the push-up length are to be determined according to 3.1.6.4(2) and 3.1.6.4(3) respectively.



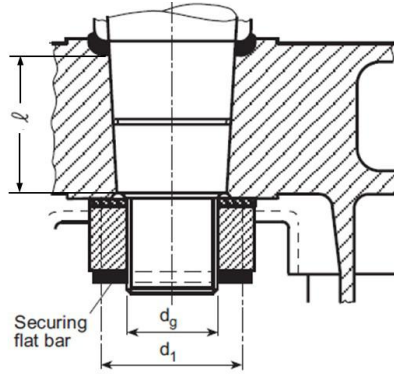


Figure 3.1.6.4 Cone couplings without key with special arrangements for mounting and dismantling the couplings

(2) Push-up pressure

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

$$p_{req1} = \frac{2Q_F \times 10^3}{d_m^2 l \pi \mu_0} \text{ N/mm}^2$$

$$p_{req2} = \frac{6M_b \times 10^3}{l^2 d_m} \text{ N/mm}^2$$

where: Q_F — design yield moment of rudder stock, as defined in 3.6.3.2 of this Section, in N·m;

d_m — mean cone diameter, in mm, see Figure 3.1.6.3(a);

l — ~~cone~~ coupling length, in mm;

μ_0 — frictional coefficient, equal to 0.15;

M_b — bending moment in the cone coupling (e.g. in case of spade rudders), in N·m.

It has to be proved by the designer that the push-up pressure does not exceed the permissible surface pressure in the cone. The permissible surface pressure, in N/mm², is to be determined by the following formula:

$$p_{perm} = \frac{0.95R_{eH}(1-\alpha^2)}{\sqrt{3+\alpha^4}} - p_b \text{ N/mm}^2 \text{ N/mm}^2$$

where: $p_b = \frac{3.5M_b \times 10^3}{d_m l^2} \text{ N/mm}^2$;

R_{eH} — specified minimum yield stress of the material of the gudgeon, in N/mm²;

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

d_m — diameter, in mm, see Figure 3.1.6.3(a);

d_a — outer diameter of the gudgeon to be not less than 1.25 d_0 , in mm, see Figure 3.1.6.3 (a) and 3.1.6.3(b). (The least diameter is to be considered).

3.1.7.2 Couplings

(1) Tapering

Pintles are to have a conical attachment to the gudgeons with a taper on diameter not greater than:

1:8 to 1:12 for keyed and other manually assembled pintles applying locking by slugging nut,

1:12 to 1:20 on diameter for pintles mounted with oil injection and hydraulic nut.

(2) Push-up pressure for pintle

The required push-up pressure for pintle p_{req} , in N/mm², is to be determined by the following formula:

$$p_{req} = 0.4 \frac{B_1 d_0}{d_m^2 l} \text{ N/mm}^2$$

where: B_1 — Supporting force in the pintle, in N;
 d_0 — Pintle diameter, in mm, see Figure 3.1.6.3(a).

The push up length is to be calculated similarly as in 3.1.6.4(3) of this Section, using required push-up pressure and properties for the pintle.

3.1.8 Rudder stock bearing, rudder shaft bearing and pintle bearing

3.1.8.1 Liners and bushes

(1) Rudder stock bearing

Liners and bushes are to be fitted in way of bearings. The minimum thickness of liners and bushes t_{min} is to be equal to:

- $t_{min} = 8$ mm for metallic materials and synthetic material;
- $t_{min} = 22$ mm for lignum material.

(2) Pintle bearing

The thickness of any liner or bush t , in mm, is not to be less than the minimum thickness defined in 3.1.8.1(1) and the following value:

$$t = 0.01\sqrt{P}$$

$$t = 0.01\sqrt{B}$$

where: P — relevant bearing force, in N.

3.1.8.2 Minimum bearing surface

An adequate lubrication is to be provided.

The bearing surface A_b (defined as the projected area: length \times outer diameter of liner) is not to be less than:

$$A_b = \frac{P}{q_a} \text{ mm}^2$$

where: P — reaction force, in N, in bearing as determined in 3.1.3.2 of this Section;

q_a — allowable surface pressure according to Table 3.1.8.2.

The ~~maximum~~ allowable surface pressure q_a for the various combinations is to be taken as reported in the table below. Higher values than given in Table 3.1.8.2 may be taken in accordance with makers' specifications if they are verified by tests:

Maximum Allowable surface pressure q_a

Table 3.1.8.2

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

Notes:

- ① Indentation hardness test at 23°C and with 50% moisture, are to be carried out according to a recognized standard. Synthetic bearing materials are to be of an approved type.
- ② Surface pressures exceeding 5.5 N/mm² may be accepted in accordance with bearing manufacturer's specification and tests, but in no case more than 10 N/mm².
- ③ Stainless and wear-resistant steel in an approved combination with stock liner.

3.1.9.2 Rudder trunk

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

(1) Materials, welding and connection to hull

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

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

Plating materials for rudder trunks are in general not to be of lower grades than corresponding to class

II as defined in Section 3, Chapter 1 of this PART.

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

The fillet shoulder radius r , in mm (see Figure 3.1.9.2) is to be as large as practicable and to comply with the following formulae:

$r = 0.1d_c$, without being less than:

$r = 60$ mm when $\sigma \geq 40/K$ N/mm²

$r = 0.1d_c$, ~~and not less than~~ 30 mm when $\sigma < 40/K$ N/mm²

where: d_c — rudder stock diameter axis as defined in 3.1.4.2;

σ — bending stress in the rudder trunk, in N/mm²;

K — material factor as given in 3.1.1.3(2) or 3.1.1.3(5) of this Section.

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

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

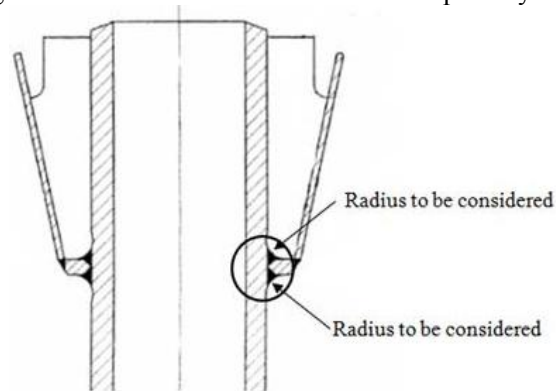


Figure 3.1.9.2

(2) Scantlings

~~Where the rudder stock is arranged in a trunk in such a way that the trunk is stressed by forces due to rudder action, t~~ The scantlings of the trunk are to be such that: the equivalent stress due to bending and shear does not exceed $0.35 R_{eH}$.

The bending stress on welded rudder trunk σ is to be in compliance with the following formula:

$$\sigma \leq 80/K \text{ N/mm}^2$$

where: σ — bending stress in the rudder trunk, as defined in 3.1.9.2(1);

K — material factor for the rudder trunk as given in 3.1.1.3(2) or 3.1.1.3(5) of this Section, not to be taken as less than 0.7;

R_{eH} — specified minimum yield stress, in N/mm², of the material used.

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

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PART THREE

Brief Introduction

- 1、 The revised requirements of M53 Rev.4 were introduced. This revision is to be uniformly implemented on or after 1 January 2021.
- 2、 The revised requirements of IACS UR A3 Rev.1(Jun 2019) were introduced.. This revision is to be uniformly implemented on or after 1st July 2020.
- 3、 IACS UI SC123 Rev.4 (Nov 2018) Withdrawn and Rev.3 reinstated. This revision is to be uniformly implemented on or after 1st June 2020.

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CHAPTER 4 MACHINERY PIPING SYSTEMS

4.2.1 General requirements^①

4.2.1.8 Two fuel oil service tanks or equivalent arrangements, for each type of fuel^② used on board, necessary for propulsion and essential systems are to be provided. Each tank is to have a capacity for at least 8 h operation at sea, at maximum continuous rating of the propulsion plant and normal operating load of the generating plant associated with that tank.

The arrangement of oil fuel service tanks is to be such that one tank can continue to supply oil fuel when the other is being cleaned or opened up for repair.

4.2.1.9 A service tank is a fuel oil tank which contains only fuel of a quality ready for use, i.e. fuel of a grade and quality that meet the specification required by the equipment manufacturer. A service tank is to be declared as such and not to be used for any other purpose. Use of a settling tank with or without purifiers, or purifiers alone, and one service tank is not acceptable as an “equivalent arrangement” to two service tanks.

Examples of application for the most common systems are shown below:

(1) Example 1

- ① Requirement normally to be followed – main and auxiliary engines and boiler(s) operating with heavy fuel oil (HFO) ~~Residual Marine Fuels (RMF and LSRMF)~~ (one fuel ship)

<p><u>HFO service tank</u> RMF/LSRMF Serv. TK 1 Capacity for at least 8 h Main engine + Auxiliary engine + Auxiliary boiler</p>	<p><u>HFO service tank</u> RMF/LSRMF Serv. TK 2 Capacity for at least 8 h Main engine + Auxiliary engine + Auxiliary boiler</p>	<p><u>MDO tank</u> DMF/LSDMF TK For initial cold starting or repair work of engines/boiler or ECA operation</p>
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- ② ~~Potential equivalent~~ Equivalent arrangement

<p>HFORMF/LSRMF service tank Capacity for at least 8 h Main engine + Auxiliary engine + Auxiliary boiler</p>	<p>MDODMF/LSDMF service tank Capacity for at least 8 h Main engine + Auxiliary engine + Auxiliary boiler or ECA operation</p>
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This arrangement only applies where main and auxiliary engines can operate with heavy fuel oil ~~RMF/LSRMF~~ under all load conditions and, in the case of main engines, during manoeuvring.

For pilot burners of auxiliary boilers if provided, an additional marine diesel oil ~~DMF~~ tank for 8 h may be necessary.

(2) Example 2

- ① Requirement normally to be followed – main engine(s) and auxiliary boiler(s) operating with HFO ~~can operate on both Residual Marine Fuels (RMF and LSRMF) and Distillate Marine fuels (DMF and LSDMF).~~ and auxiliary engine operating with marine diesel oil (MDO) ~~Auxiliary Engines can only operate on Distillate Marine fuels (DMF and LSDMF) (multiple fuel ship)~~

<p><u>HFO service tank</u> RMF/LSRMF Serv. TK 1 Capacity for at least 8 h Main engine + Auxiliary boiler</p>	<p><u>HFO service tank</u> RMF/LSRMF Serv. TK 2 Capacity for at least 8 h Main engine + Auxiliary boiler</p>	<p><u>MDO service tank</u> DMF/LSDMF Serv. TK 1 Capacity for at least 8 h Auxiliary engine</p>	<p><u>MDO service tank</u> DMF/LSDMF Serv. TK 2 Capacity for at least 8 h Auxiliary engine</p>
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^① This revision is applicable to service tank arrangements on ships contracted for construction on or after 1 January 2020.

^② ‘Type of fuel’ is strictly interpreted as the exact grade of fuel. “Equivalent arrangements” to this are described in the examples below where grades of fuel may be grouped according to their sulphur content and viscosity as follows:

- ① ~~Residual Marine Fuel (RMF) refers to fuel oils with a sulphur content above 0.1% that require some form of heating to achieve required injection viscosity for combustion.~~
- ② ~~Distillate Marine Fuel (DMF) refers to fuel oils with a sulphur content above 0.1 % that do not require heating to achieve injection viscosity.~~
- ③ ~~Low Sulphur Residual Marine Fuel (LSRMF) refers to fuel oils with a sulphur content not exceeding 0.1% that require some form of heating to achieve required injection viscosity for combustion.~~
- ④ ~~Low Sulphur Distillate Marine Fuel (LSDMF) refers to fuel oils with a sulphur content not exceeding 0.1% having a minimum viscosity of 1.4 cSt at 40°C.~~

② ~~Potential equivalent~~ Equivalent arrangement

<p><u>HFO</u>/RMF/LSRMF service tank Capacity for at least 8 h Main engine + Auxiliary boiler</p>

<p><u>MDO service tank</u> DMF/LSDMF Serv. TK 1 Capacity for at least <u>the highest of</u>: • 4 h Main engine + <u>Auxiliary engine</u> + Auxiliary boiler, <u>or</u> and • 8 h Auxiliary engine + <u>Auxiliary boiler</u></p>
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<p><u>MDO service tank</u> DMF/LSDMF Serv. TK 2 Capacity for at least <u>the highest of</u>: • 4 h Main engine + <u>Auxiliary engine</u> + Auxiliary boiler, <u>or</u> and • 8 h Auxiliary engine + <u>Auxiliary boiler</u></p>
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The arrangements in (1)② and (2)② are acceptable, provided the propulsion and vital systems which use the two types of fuel support rapid an emergency fuel changeover and are capable of operating in all normal operating conditions at sea with both types of fuel (MDO and HFO). ~~The emergency fuel changeover, including the following, should be able to be carried out within the time not exceeding 1 hour:~~

- (1) ~~Open and shut relevant changeover valves (to/from RMF/LSRMF and DMF/LSDMF service tanks or mixing valves, valves in fuel return pipes to RMF/LSRMF and DMF/LSDMF service tanks)~~
- (2) ~~Open and shut off heat tracing of fuel pipes~~
- (3) ~~Open and shut valves to fuel heaters and coolers~~
- (4) ~~Starting/stopping of pumps (if separate DMF/LSDMF and RMF/LSRMF pumps are provided)~~
- (5) ~~Taking into consideration the machinery manufacturers recommendations for safe changeover (e.g. prevention of temperature shock)~~

The emergency changeover procedure is to be kept available on board the ship.

CHAPTER 9 DIESEL ENGINES

Appendix 3 APPRAISAL OF CRANKSHAFT STRENGTH OF DIESEL ENGINES

Annex I Guidance for Evaluation of Fatigue Tests of Crankshafts

4.3 Use of results and crankshaft acceptability

In order to combine tested bending and torsion fatigue strength results in calculation of crankshaft acceptability, see 2.7 of this Appendix, the Gough-Pollard approach and the maximum principal equivalent stress formulation can be applied for the following cases:

Related to the crankpin diameter:

$$Q = \left(\sqrt{\left(\frac{\sigma_{BH}}{\sigma_{DWCT}} \right)^2 + \left(\frac{\tau_{BH}}{\tau_{DWCT}} \right)^2} \right)^{-1}$$

where:

σ_{DWCT} --- fatigue strength by bending testing;

τ_{DWCT} --- fatigue strength by torsion testing.

Related to crankpin oil bore:

$$Q = \left(\sqrt{\left(\frac{\sigma_{BO}}{\sigma_{DWOT}} \right)^2 + \left(\frac{\tau_{TO}}{\tau_{DWOT}} \right)^2} \right)^{-1}$$

$$Q = \frac{\sigma_{DWOT}}{\sigma_v}$$

where:

σ_{DWOT} — fatigue strength by means of largest principal stress from torsion testing. ~~fatigue strength by bending testing;~~

~~τ_{DWOT} — fatigue strength by torsion testing.~~

$$\sigma_v = \pm \frac{1}{3} \sigma_{BO} \left[1 + 2 \sqrt{1 + \frac{9}{4} \left(\frac{\sigma_{TO}}{\sigma_{BO}} \right)^2} \right] \text{MPa.}$$

Related to the journal diameter:

$$Q = \left(\sqrt{\left(\frac{\sigma_{BG}}{\sigma_{DWJT}} \right)^2} + \left(\frac{\tau_G}{\tau_{DWJT}} \right)^2 \right)^{-1}$$

where:

σ_{DWJT} — fatigue strength by bending testing;

τ_{DWJT} — fatigue strength by torsion testing.

In case increase in fatigue strength due to the surface treatment is considered to be similar between the above cases, it is sufficient to test only the most critical location according to the calculation where the surface treatment had not been taken into account.

CHAPTER 13 STEERING GEAR AND WINDLASSES

Section 2 WINDLASSES^①

13.2.1 General requirements

13.2.1.3 The design, construction and testing of windlasses are to conform to a standard or code of practice accepted by CCS. To be considered acceptable, the standard or code of practice is to specify criteria for stresses, performance and testing. The following are examples of standards recognized:

SNAME T & R Bulletin 3-15:	2018	Guide to the Design and Testing of Anchor Windlasses for Merchant Ships
ISO 7825:	2017	Deck machinery general requirements
ISO 4568:	2006	Shipbuilding - Sea-going vessels - Windlasses and anchor capstans
JIS F6714:	1995	Windlasses
BS MA35		Specifications for Ship Deck Machinery Windlass

13.2.4 Material and welding

13.2.4.3 Weld joint designs are to be shown in the construction plans and are to be approved in association with the approval of the windlass design. Welding procedures and welders are to be qualified in accordance with the requirements of CCS Rules for Materials and Welding. Welding consumables are to be ~~type~~-approved by CCS in the case their type and grade fall within the scope of CCS Rules for Materials and Welding; when their type and grade fall outside the scope of CCS Rules for Materials and Welding, the welding consumables are to comply with national or international standards. The degree of non-destructive examination of welds and post-weld heat treatment, if any, are to be specified and submitted to CCS for consideration.

13.2.5 Design and requirements

13.2.5.11 Marking

Windlass is to be permanently marked with the following information:

(1) nominal size of ~~chain~~the windlass (e.g. 100/3/45 ~~means chain dia./grade/breaking load~~is the size designation of a windlass for 100 mm diameter stud link chain cable of Class 3, with a holding load of 45 % of the breaking load)

^① These revised requirements are to be uniformly implemented:

- 1) when an application for certification of an anchor windlass is dated on or after 1st July 2020; or
- 2) to anchor windlasses installed in new ships for which the date of contract for construction is on or after 1st July 2020.

[of the chain cable](#));

(2) maximum anchorage depth, in metres.

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RULES FOR CLASSIFICATION OF SEA-GOING STEEL
SHIPS

PART FIVE

Brief Introduction

1、The requirements related refrigerant R22 were deleted.

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CHAPTER 1 GENERAL

Section 1 GENERAL PROVISIONS

1.1.2 Refrigerants

1.1.2.1 The provisions of this PART are applicable to the following refrigerants:

R717 Ammonia (NH₃);

~~R22 Monochlorodifluoromethane (CHClF₂);~~

R134a Tetra fluoro ethane (CH₂F-CF₃).

1.1.2.2 Where other refrigerants are to be used, relevant information is to be submitted for approval.

1.1.2.3 In addition, consideration is to be given to the relevant provisions for the application scope of refrigerants specified by the flag State Administration.

CHAPTER 2 REFRIGERATING PLANT

Section 1 GENERAL PROVISIONS

2.1.4 Design pressure of refrigerating plant

2.1.4.1 The design pressure of the high pressure side and the low pressure side of the refrigerating plant is to be not less than the values given in Table 2.1.4.1 respectively.

Refrigerant	Design pressure of high pressure side ^① (MPa)	Design pressure of low pressure side ^② (MPa)
R717	2.2	1.7
R22	2.2	1.7
R134a	1.4	1.1

Notes: ① High pressure side means the pressed parts of the compressor between its exhausting side and expansion valve.

② Low pressure side means the pressed parts from behind the expansion valve to suction valve of the compressor. Where the change-over of the plant (e.g. for defrosting) will put these parts under high pressure, they are to be designed and tested to the specified pressure of high pressure side.

Section 3 PIPING AND ACCESSORIES

2.3.1 Pressure vessels

2.3.1.1 Welded steel cylindrical pressure vessels for refrigerants R717 ~~and R22~~ are to be constructed in accordance with the relevant provisions for Class II pressure vessels specified in Chapter 6, PART THREE of the Rules, and in CCS Rules for Materials and Welding. The design pressure is to comply with the requirements of Table 2.1.4.1 of this Chapter.

2.3.2 Pressure piping

2.3.2.1 The wall thickness of all steel pressure pipes for the refrigerating plant is to be determined in accordance with the relevant provisions specified in Chapter 2, PART THREE of the Rules.

2.3.2.2 Pipes for the condensers are to be made of corrosion-resistant material. Pipes for condensers suitable for refrigerants ~~R22 and~~ R134a are to be made of corrosion-resistant copper.

Condenser tube plates are to be made of corrosion-resistant material on the seawater side, or alternatively, means capable of efficiently protecting against corrosion may be used.

2.3.2.6 The stop valves in the refrigerant piping are to be so constructed and arranged as to ensure safe renewal of the packings in the valve stuffing boxes without removing the refrigerant. The stop valves in the ~~R22 and~~ R134a refrigerant piping are to be constructed without stuffing boxes. If safety valves with soft stuffing boxes are adopted, they are to be provided with sealing glands.

2.3.5 Driers

2.3.5.1 Driers are to be fitted in ~~R22 and~~ R134a refrigerant systems and the arrangement is to be such that a drier can be by-passed, isolated and opened up without interrupting plant operations.

Section 5 LOCATION OF REFRIGERATING MACHINERY SPACE OR UNIT

2.5.1 Refrigerating machinery spaces

2.5.1.1 Where R717 is used as the refrigerant, the machinery compartment is to be isolated by gastight bulkheads and decks from any adjacent accommodation or working spaces. The compartment is to have doors capable of being opened outwards and self-closed.

2.5.1.2 Machinery using ~~R22~~ and R134a refrigerants will not, in general, be subject to restriction on location. Where relatively large plants are adopted, they are to be installed in a separate compartment.

2.5.2 Ventilation

2.5.2.1 Any refrigerating machinery space is to be provided with an efficient mechanical ventilation system. The ventilation is to provide at least 30 air changes per hour in the refrigerating machinery space.

The R717 refrigerating machinery space is to be provided with a ventilation system separated from other ventilation systems.

2.5.2.2 The suction ducts of the ventilation systems are to be constructed of steel or other equivalent material, and the exhaust ports of the ventilation systems are to be located in positions where no danger will arise. In the case of ~~R22~~ or R134a refrigerating machinery spaces, power exhaust ventilation systems are to be fitted with the suction inlets located at the lowest part of such spaces.

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PART EIGHT

Explanation

This Chapter is intended to provide classification survey guidance to oil tankers fitted with bow loading systems and provide implementation standards to shipowners, shipyards, designers and parties concerned.

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CHAPTER 27 BOW LOADING SYSTEMS

Section 1 GENERAL PROVISIONS

27.1.1 Application

27.1.1.1 This Chapter applies to oil tankers provided with bow loading systems.

27.1.1.2 Oil tankers provided with bow loading systems are, in addition to the provisions of this Chapter, to comply with the relevant requirements of other PARTs and Chapters of the Rules

27.1.2 Notation

27.1.2.1 Oil tankers complying with the provisions of this Chapter may be assigned the notation: Bow Loading System.

27.1.3 Definition

27.1.3.1 For the purpose of this Chapter:

(1) Bow loading control station means a control station performing all operations concerning positioning of the ship, operation and monitoring of bow loading safety systems, and monitoring of mooring and loading parameters.

27.1.4 Plans and documents

27.1.4.1 The following plans and documents are to be submitted for approval. If they have been included in plans and documents required for ship's classification, re-submission may be omitted:

- (1) general arrangement of bow loading systems, including bow loading control stations;
- (2) mooring arrangement of bow loading system areas;
- (3) lower hull supporting structure of mooring equipment of bow loading systems;
- (4) cargo lines of bow loading systems;
- (5) bow loading hydraulic oil systems;
- (6) foam fire-extinguishing piping and equipment capacity calculations of bow loading system areas;
- (7) water-spraying fire-extinguishing piping and equipment capacity calculations of bow loading system areas;
- (8) ventilation piping arrangement of bow loading system areas;
- (9) arrangement of the ship showing dangerous zones and spaces of bow loading system areas;
- (10) arrangement of electrical equipment in hazardous areas of bow loading system areas;
- (11) fire-resisting divisions of bow loading system areas;
- (12) fire control plans of bow loading system areas;
- (13) schematic diagram of control and monitoring systems of bow loading systems;
- (14) schematic diagram of communication systems related to the bow loading control station.

27.1.4.2 The following plans and documents are to be submitted for information:

(1) operation manual of bow loading systems.

27.1.4.3 For special structures and arrangement, expansion of the submission scope of plans and documents may be required if deemed necessary by CCS.

Section 2 ARRANGEMENT

27.2.1 Arrangement of bow loading systems

27.2.1.1 Cargo lines used for bow loading are to be arranged outside accommodation spaces, service spaces, machinery spaces and control stations, and they are to be clearly identified.

27.2.1.2 The bow loading system is to be so arranged as not to interfere with the operation and use of life-saving appliances and embarkation stations at bow. The stowage position of life-saving appliances and embarkation stations are to have a distance of not less than 10 m from the coupling.

27.2.1.3 Enclosed spaces containing the working area of bow loading coupler are to be provided

with mechanical ventilation system capable of giving at least 30 air changes per hour.

27.2.1.4 For oil tankers provided with emergency towing arrangements at bow, the bow loading system is to be so designed as not to interfere with the operation and use of emergency towing arrangements.

27.2.1.5 The working area of bow loading coupler is to be provided with sufficient lighting that ensures good working environment.

27.2.2 Bow loading control station

27.2.2.1 For ships provided with bow loading systems, a control station for bow loading is to be arranged within the bow area or on the navigation bridge.

27.2.2.2 Where the bow loading control station is arranged within the bow area, positive pressure mechanical ventilation is to be provided.

27.2.2.3 Where the bow loading control station is arranged within the bow area, at least one lifejacket and one immersion suit are to be provided for each person on watch.

27.2.3 Classification of hazardous areas and electrical equipment in hazardous areas

27.2.3.1 For oil tankers provided with bow loading systems, classification of hazardous areas and electrical equipment in hazardous areas are, in addition to additional requirements for oil tankers in Section 16, Chapter 2, PART FOUR of the Rules, to comply with the provisions of this Section.

27.2.3.2 Where the cargo hose joint is arranged outside the cargo tank area, for the purpose of electrical equipment or ignition devices, areas within 3 m from the manifold are to be considered as hazardous area zone 1, with corresponding requirements to electrical equipment and wiring.

27.2.3.3 Spaces housing the loading pipe (fitted with detachable joint) and bow loading coupling are to be considered as hazardous area zone 1, with corresponding requirements to electrical equipment and wiring.

27.2.3.4 Entrances, air inlets and openings to service and machinery spaces and control stations are not to face the bow loading coupling, and are to be located at least 10 m from the bow loading coupling. Direct access from the hazardous bow loading coupler room to non-hazardous spaces in the forecastle area is acceptable provided protected from gas ingress as follows:

An air lock in accordance with IEC60092-502 is provided between the bow loading coupler room and an intermediate space. The air lock will be considered as a hazardous zone 2. The intermediate space complies with the requirements to an air lock in IEC60092-502. The intermediate space will be considered as a non-hazardous space.

27.2.3.5 Spaces considered as non-hazardous are not to have any connections with hazardous spaces or areas, and are to be ventilated in accordance with IEC60092-502.

Section 3 EQUIPMENT AND OUTFITS

27.3.1 Mooring equipment and its supporting structures

27.3.1.1 The ship is to be provided with suitable mooring equipment that can be used in conjunction with the ship's manoeuvring system to ensure that the ship is moored during bow loading. The mooring equipment is to be arranged to prevent the mooring load from being transferred to the oil pipeline used for loading.

27.3.1.2 Mooring equipment and its arrangement are to meet Oil Companies International Marine Forum (OCIMF) mooring equipment guidelines

27.3.1.3 The arrangement plan of mooring equipment is to indicate the safe working load of equipment.

27.3.1.4 The design load of the hull supporting structure of the mooring equipment is to be 2 times the safe working load of the equipment, and the calculated stress is not to exceed the minimum yield limit of the material used.

Section 4 PIPING SYSTEMS

27.4.1 General provisions

27.4.1.1 Materials, design and manufacture and testing of piping systems, valves and fittings of bow loading systems are to comply with applicable requirements of Chapter 2 of PART THREE of the Rules.

27.4.1.2 For ships to which this Chapter is applicable, requirements for bow loading in Chapter 5 of PART THREE of the Rules are replaced by requirements of this Chapter.

27.4.2 Cargo lines

27.4.2.1 Cargo lines used for the bow loading system which are outside the cargo area are to have welded connections. Flanged connections may be used in way of the coupler. If necessary, expansion joints of flanged connection may be permitted when compensation is needed for lines subject to expansion and contraction.

27.4.2.2 Lines of the bow loading system and lines within the cargo area are to be effectively segregated in the cargo area by the following methods or equivalent means:

- (1) a spool piece and blanking the line ends; or
- (2) a valve and blanking the line ends; or
- (3) two valves which can be secured in the closed position and provided that the efficiency of the segregation can be checked.

27.4.2.3 The bow loading coupling is to be fitted with a shut-off valve and a blank flange. The blank flange may be omitted when a patent hose coupling is fitted. A spill tray or coaming arrangement is to be provided in way of the bow loading coupling. Means for draining the spill tray to the cargo tank or sloptank are to be provided.

27.4.2.4 The cargo line is to be arranged to drain cargoes in the line to the cargo tank or slop tank by itself or by means of a draining device, where necessary by connection to a stripping device.

27.4.2.5 Spray shields are to be provided in way of valves or joints with potential leakage of the loading manifold of bow loading system except where the loading manifold is located outboard.

27.4.2.6 Means of inerting, purging and gas freeing for relevant lines of bow loading piping system are to be arranged, and the connected vent pipes are to be located in the cargo area. The relevant joints to the lines are to be fitted with shut-off valves and blank flanges.

Section 5 CONTROL AND MONITORING

27.5.1 General requirements

27.5.1.1 The control and monitoring of electrical installations are, in addition to the applicable requirements of the Rules, to comply with the provisions of this Section.

27.5.1.2 For instrumentation, equipment and automation, including computer based control and monitoring, the requirements of Chapter 2, PART SEVEN of the Rules are to be complied with.

27.5.1.3 From the control station for bow loading, all operations concerning positioning of the ship, operation and monitoring of bow loading safety systems, and monitoring of mooring and loading parameters are to be performed. The station is in general arranged on the navigation bridge and may also be arranged within the bow area

Where the bow loading control station is arranged on the navigation bridge, it is to have concentrated arrangement and control and monitoring functions above. The bow area may also be provided with local operation which a necessary operation function of the bow loading system. Where the bow loading control station is only arranged within the bow area, all functions of the station are to be met.

27.5.1.4 Oil tankers applying for the notation DP are to satisfy the applicable requirements of Chapter 11 of this PART.

27.5.2 Instrumentation, equipment and automation

27.5.2.1 Ship manoeuvring instrumentation or equipment is to cover:

- (1) thruster(s) control;
- (2) main engine(s) emergency stop, or disengagement of clutch, if fitted;
- (3) steering gear control, if fitted;
- (4) radar;
- (5) log.

27.5.2.2 Bow mooring instrumentation or equipment is to cover:

- (1) mooring line traction control;
- (2) chain stopper control;
- (3) data logger system for recording of mooring and load parameters.

The mooring system is to be provided with a tension meter continuously indicating the tension during the bow loading operation. This requirement may be waived if the vessel has in operation an approved dynamic positioning system.

27.5.2.3 The bow loading system is to cover:

- (1) indicator for loading connector coupling position;
- (2) cargo valve position indicators;
- (3) cargo tank level indicators and high level alarm (which may be omitted if the bow loading control station is located on the navigation bridge and such indicators are provided in other areas of the bridge);
- (4) a system for automatic transfer of signals from the control and safety system, to enable automatic termination of cargo supply from the offshore terminal;
- (5) cargo pressure monitoring in the bow loading line in way of the bow loading coupling with high and low pressure alarms.

27.5.2.4 An emergency disconnection system is to be provided, which is to be activated from the control station.

- tripping the main crude oil transfer pumps;
- closing the connector and loading hose end coupler valves;
- start of the water sprinkler system;
- opening of the bow loading coupling claws;
- opening of the chain stopper.

In addition to the above automatic disconnection systems, a manually-operated backup emergency disconnection system is to be provided. Such a system may be based on accumulators providing hydraulic pressure.

27.5.3 Communication

27.5.3.1 Means of communication between the ship's cargo oil control station and bow loading control station and the offshore loading terminal are to be provided and certified safe for hazardous areas, if necessary.

27.5.3.2 Means of emergency communication between the bow loading control station and the offshore terminal are to be arranged.

27.5.3.3 Both primary and secondary methods are to be provided to ensure that continuous communication can be maintained between the bow loading control station and the offshore terminal in the event of any equipment failure or other problems arising during the operations.

Section 6 FIRE SAFETY

27.6.1 Fire protection, fire detection and fire extinction

27.6.1.1 Where the bow loading control station is arranged within the bow compartment, a protected escape route is to be provided and protected by a self-closing A-class door with the control station. The exit of the escape route is to be 10 m away from the coupling and not to face the joint of coupling.

27.6.1.2 Where the bow loading control station is arranged within the bow compartment, A-60 insulation protection is to be provided for boundaries adjacent to the space containing the coupling, including doors, windows and side scuttles.

27.6.1.3 At least one fire hydrant with associated fire hose and nozzle is to be provided in the working area of bow loading coupler.

27.6.1.4 The compartment containing the working area of bow loading coupler is to be provided with fixed combustible gas system and fire detection and alarm system. The alarm of the above systems is to be provided locally and in the bow loading control station.

27.6.1.5 The bow area is to be additionally provided with at least one additional foam monitor and one additional foam applicator complying with 2.2.2, Chapter 14 of the FSS Code, which are to be capable of effectively protecting the cargo lines and loading areas at bow.

27.6.1.6 Where the coupling and cargo lines are arranged in the compartment, a fixed foam fire-extinguishing system complying with the following requirements or other equivalent fire-extinguishing system is to be provided:

(1) foam sprinkler system. The system is to be capable of operating continuously for at least 30 minutes at a rate of not less than 6 L/m^2 to protect the compartment; or

(2) fixed high-expansion foam system. The system is to be arranged to meet the requirements of the foam fire extinguishing system for the cargo pump room in Chapter 6 of the FSS Code.

The control of the fixed foam fire-extinguishing system required by this paragraph is to be located in an easily operable position outside the protected space.

27.6.1.7 The bow area is to be provided with a water spraying system with a spraying intensity not less than 5 L/m^2 per minute. The system is to cover potential spark generating equipment and location, e.g. mooring related equipment and coupling etc. The water spraying system is to be capable of being started within and outside the working area of bow loading coupler, and in addition, its control is to meet starting requirements in case of emergency disconnection.

Section 7 OPERATION MANUAL

27.7.1 Operation manual

27.7.1.1 An operation manual is to be provided on board, generally containing the bow loading operation procedure and safety measures that need to be taken during operation.

27.7.1.2 The operation manual is in general to give information regarding the following:

(1) Arrangement and equipment

- ① tank arrangement;
- ② arrangement and explanation of mooring equipment;
- ③ cargo loading and transfer system;
- ④ control station;
- ⑤ communication equipment;
- ⑥ other relevant equipment.

(2) Operation procedures

- ① communication procedure;
- ② mooring procedure;
- ③ connection and disconnection of cargo hose coupling;
- ④ transfer/distribution/storage of oil cargo;
- ⑤ oil spillage alarm of tanks.

(3) Safety measures

- ① emergency disconnection system;
- ② emergency communication system;
- ③ ventilation system;
- ④ fire safety system;
- ⑤ emergency escape routes.

(4) Cleaning and gas-freeing.

Section 8 TESTING AND SURVEY

27.8.1 Inspection and testing of products

27.8.1.1 Equipment forming the bow loading system is to be furnished with CCS certificates in accordance with the requirements of Chapter 3, PART ONE of the Rules.

27.8.1.2 Equipment forming the bow loading system is to be inspected and tested in accordance with approved plans and relevant standards.

27.8.2 Ship survey

27.8.2.1 For newbuildings and ships in service, the first survey after onboard installation is to comply with the provisions of 27.8.2.2 of this Chapter. The survey after construction is to comply with the provisions of 27.8.2.3 and 27.8.2.4 of this Chapter.

27.8.2.2 Initial classification survey

- (1) checking the product certificate of equipment forming the bow loading system;
- (2) checking the arrangement and installation of equipment forming the bow loading system comply with approved plans;
- (3) After completion of installation, related equipment and systems of the bow loading system are subject to the following examination and testing:

- ① visual examination;
- ② examining and testing the function of instrument, automation and communication equipment in the bow loading control station (including the bow area and navigation bridge);
- ③ examining and testing the function of emergency disconnection system;
- ④ examining and testing the function of water spraying system;
- ⑤ interlock functional testing of mooring equipment and the bow loading system;
- ⑥ calibration testing of mooring line tension sensor;
- ⑦ functional test of the interconnection effect between the bow loading coupling and the connecting hose joint or equivalent device.

27.8.2.3 Annual survey

- (1) The bow loading system is subject to the following examination:

- ① visual examination;
- ② examining and testing the function of instrument, automation and communication equipment in the bow loading control station (including the bow area and navigation bridge);
- ③ examining and testing the function of emergency disconnection system;
- ④ examining and testing the function of water spraying system.

27.8.2.4 The requirements for intermediate and special surveys are the same as those for annual survey.