



2020

Rules and Guidance for the Classification of
Floating Docks

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Rules for the Classification of
Floating Docks

Rules

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Guidance Relating to the Rules for the Classification of
Floating Docks

Guidance



2020

Rules for the Classification of
Floating Docks

**APPLICATION OF
"RULES FOR THE CLASSIFICATION OF FLOATING DOCKS"**

1. Unless expressly specified otherwise, the requirements in the Rules apply to Floating Docks for which contracts for construction are signed on or after 1 July 2020.
2. The amendments to the Guidance for 2018 edition and their effective date are as follows;

Effective Date 1 July 2020

CHAPTER 1 GENERAL

- 1102. has been amended.

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CHAPTER 1 GENERAL

1100. General

1101. Application

1. This Rules applies to survey and construction of floating docks which intend to be registered or which registered with classification.
2. The Rules are made for on the conditions that floating docks will be properly loaded and handled in sheltered waters; they do not provide for special distributions or concentrations of loading. The Society may also require additional strengthening to be fitted in any floating dock which in their opinion, may be subjected to severe stresses due to particular features in her design or when it is desired to make provision for exceptional loaded or ballasted conditions. In these cases particulars and relevant data are to be submitted for consideration.
3. The relevant parts of the **Rules for the Classification of Steel Ships** (hereinafter referred to as "the **Rules**") apply to essential constructions, machinery and equipment not specified in these Rules, as may be required.

1102. Equivalency

The equivalence of alternative and novel features which deviate from or are not directly applicable to the Rules is to be in accordance with **Pt 1, Ch 1** of the **Rules for the Classification of Steel Ships. (2020)**

1103. Other regulations

These Rules specify the requirements for the Classification of floating docks. Therefore, the attention of owners, builders, and designers is directed to the regulations of national or local governments, or other organizations which may contain safety, health, or other standards applicable to the floating dock.

1104. Towage certificate

Where the Society's towage certificate is requested by a builder/owner to enable a dock to be towed at sea special consideration may be required to be given to the strength, freeboard and stability, and other items as considered necessary.

1105. Cranes

When the assignment of safe working load of cranes is requested by the builders or the owners, the Society will assign the safe working load in accordance with **Pt 9, Ch 2** of the **Rules for the Classification of Steel Ships**.

1200. Classification Registry

1201. Character of classification

1. The class notations assigned to the floating dock classed with the Society are to be in accordance with the requirements specified in **Pt 1, Ch 1, 201.** of the **Rules**. However, the notation "Floating Structure" shall be assigned as a ship type notation.
2. For barge equipped with skid (launching) arrangements, the notation "Launching Skid Barge" shall be assigned as a ship type notation.

1300. Definition**1301. Length**

The length (L) is the distance, in meters, measured on water line when supporting a ship whose displacement is the lifting capacity between the aft end and the fore end of the bulkheads of the floating structures of the dock.

1302. Breadth

The breadth (B) is the moulded breadth in meters measured at the greatest horizontal distance between the inner surfaces of the outer side plating of wing walls.

1303. Depth

The Depth (D) is the vertical distance in meters measured at the centerline from the inner surface of the bottom plating to the inner surface of the top deck plating.

1304. Safety deck

The safety deck is a watertight deck extending over the length of the wing walls and located below the top deck.

1305. Top deck

The top deck is the deck extending over the length of the wing walls to form the top of the wing walls.

1306. Pontoon

The pontoon is the structure that extends between and under the wing walls to form the bottom of the dock.

1307. Rest ballast water

The rest ballast water is ballast water which can not be discharged by pumps from ballast compartments.

1308. Compensating ballast water

The compensating ballast water is ballast water for reduction of stresses and deflections in the dock structures and for adjustment of the trim and heel of the dock.

1309. Lifting capacity

The lifting capacity (Q) is the displacement of the heaviest ship it is intended that the dock shall lift in normal service.

1310. Light displacement

The light displacement of the dock is its complete weight including all machinery, cranes, equipment, full supply of consumables for operation of the dock (fuel oil, fresh water etc.), compensating ballast water (if necessary) and rest ballast water. ↓

CHAPTER 2 CLASSIFICATION SURVEYS

2100. Classification Surveys during Construction

2101. General

1. In the Classification Survey during Construction, the hull structures, hull equipment, machinery, fire protection and detection, fire extinction, electrical installation, stability and load lines are to be examined in order to ascertain that they meet the relevant requirements of the **Rules**.
2. New installation of materials which contain asbestos is to be prohibited.

2102. Plans and documents

When a floating dock is intended to be classed with the Society, plans and documents showing the scantlings, arrangements and details of the principal parts of the structure, and relevant data are to be submitted for review or approval. Plans for approval are generally to be submitted in triplicate. In general, these plans and documents are to include the following (1) and (2) where applicable.

- (1) Plans for approval
 - (a) General arrangement plan
 - (b) Transverse section scantlings at mid-length of dock
 - (c) Structural plans of the wing walls and pontoons
 - (d) Structural plans of the decks and bulkheads
 - (e) Pumping arrangements
 - (f) Machinery and electrical plans
 - (g) Piping systems (diagram)
 - (h) Fire extinguishing arrangements
 - (i) Particulars of indicator systems for tank water level and drafts
 - (j) Particulars of deflection indicating system
- (2) Information
 - (a) Specifications
 - (b) Stability calculations and hydrostatic curves
 - (c) Calculations and data for longitudinal, transverse and local strength
 - (d) Operating manual including ballasting manual
 - (e) Tank arrangements showing also maximum service heads and heights of overflows and air pipes and where used in design, data showing the maximum differential service head
 - (f) Data relating to overall load due to crane including hook load and arrangement if cranes are installed
 - (g) Coating specifications
 - (h) Testing schemes

2103. Survey of the work

From the commencement of the work until the completion of the dock, the Surveys during construction are to examine the materials, workmanship and arrangements.

2104. Testing

In the classification surveys during construction, the following tests are to be carried out.

- (1) Tank testing

All tanks including those used for void tanks and cofferdams are to be separately tested by a head of water to the highest point to which the liquid will rise in service. Where the scantlings of a tank boundary are based on the maximum differential head in service, care is to be taken to ensure test heads do not exceed the design differential head. On submission of all necessary detail, air testing or hose testing may be considered as an alternative to the foregoing.
- (2) Completion trials

On the completion of the dock, trials are to be carried out to ascertain following :

 - (a) The freeboard to top deck with the dock flooded.
 - (b) The light displacement and the lifting capacity of the dock corresponding to the minimum

- freeboard.
- (c) The position of the centre of gravity by an inclining test. Where it is difficult to calculate an accurate centre of gravity by inclining test, the lightweight displacement shall be obtained through lightweight survey and centre of gravity shall be determined by calculation.
 - (d) Any built-in permanent deflection in the initial condition. The initial condition is a condition that all tanks for consumables (fresh water, fuel oil etc.) are completely filled, but all other tanks are empty, only rest ballast water remaining in the ballast tanks. The travelling cranes may be parked in positions giving equal draughts forward and aft.
 - (e) Correct calibration of deflection meters by simulating the most severe intended loading condition as far as practicable.
- (3) General systems
The machinery pumps, piping remote control/automatic control, instrumentation and fire-extinguishing system are to be tested at the makers in accordance with the **Rules for the Classification of Steel Ships** as applicable. The Society may, however, omit the surveys or inspection in the presence of the Surveyor at the makers, subject to submission of the maker's certificate and satisfactory performance witnessed by the Surveyor after installation. All machinery and systems relating to the classification of the dock are to be functionally tested after installation in the presence of the Surveyor.
- (4) Electrical equipment
The following tests and inspections are to be carried out for electrical equipment after installation on the docks.
- (a) Insulation resistance test
 - (b) Operation test of the essential electrical equipment
 - (c) Other tests and inspections as considered necessary by the Society.

2200. Classification Survey after construction

2201. Submission of plans and documents

Plans showing the main scantlings and arrangements of the actual dock and documents specified in **2101.** are to be submitted for approval. Records and reports relating to the construction of the dock should be submitted as may be required by the Society.

2202. Survey

In all cases the full requirements of **2303.** are to be carried out. During the survey, the Surveyors are to satisfy themselves regarding the workmanship and verify the approved scantlings and arrangements. For this purpose, and in order to ascertain the amount of any deterioration, parts of the structure will be required to be drilled as necessary, or alternatively to be measured by using appropriate methods to determine the actual thickness. However, docks of recent construction will receive special consideration.

2300. Periodical Survey and Occasional Survey

2301. General

1. To retain its class with the Society, a dock in normal service is to be subjected to periodical surveys and survey of alternations, damages and repairs in accordance with the provisions in the following **2302.** to **2304.**
2. The requirements of the **Rules for the Classification of Steel Ships** also apply as may be relevant to docks, unless otherwise specified in **2300.** of this chapter.

2302. Intermediate surveys

1. Intermediate Surveys are to be carried out within 3 months before or after the second or the third anniversary date from the completion date of the initial classification Survey or of the previous Special Survey.

2. At each Intermediate Survey the following parts are to be examined and placed in good condition.
 - (1) Pontoon, safety and top decks, wing wall plating above the light waterline, keel and side blocks and their foundations.
 - (2) Vents and overflow pipes, air pipes extending below decks to form air cushions and overboard scuppers.
 - (3) Companionways, ladders, and handrails and other means of protection that might be provided for access to all spaces.
 - (4) Deflection indicating system
 - (5) Arrangement of fire protection and extinguishing.
 - (6) Machinery, pumps and other equipment.
3. The boilers(if any) are to be examined at each intermediate Survey in accordance with the relevant of the **Rules for the Classification of Steel Ships**.

2303. Special survey

1. The first Special Survey is to be completed within 5 years from the date of initial classification Survey and thereafter within 5 years from the credited date of the previous Special Survey.
2. At each Special Survey, the compliance with all Intermediate Survey requirements and the following requirements are to be examined.
 - (1) Condition of means of protection to openings.
 - (2) Pontoon and wing wall tanks are to be cleaned examined internally, and water tested to the satisfaction of the Surveyor. At the discretion of the Surveyor, fuel oil tanks forming part of the main structure need not be examined internally until the dock is more than 15 years old.
 - (3) Spaces above safety deck are to be examined internally, removing linings, etc. where necessary for inspection. Air pipes extending below deck to form air cushions are also to be examined.
 - (4) Where the surface of plating is covered with cement, composition, or wood sheathing, the covering is to be removed as may be required for examination of the plating.
 - (5) The thickness of any part of the structure where wastage is evident may be required by the Surveyor to be determined by an approved method. Where necessary the structure is to be renewed.
 - (6) The shell plating below the light waterline is to be examined.
3. At the Special Survey after the dock is 20 years old, and at 10 years intervals thereafter, in addition to the requirements of the preceding 2, the thicknesses of the structure are to be determined by an approved method to assess the general condition. Two belts of gauging are to be made within the 0.4 L mid-length of the dock.
4. Survey of the outer bottom below the light waterline is may be carried out by some combination of:
 - (1) Ultrasonic measurement of plate thickness.
 - (2) Heeling of the dock for partial examination of the bottom.
 - (3) Underwater photography.
 - (4) Underwater television.
 - (5) Examination by diver.
5. For the extension of intervals of the examination below the waterline, special consideration may be given by the Society taking into account the condition of the dock, painting method and corrosion protection.
6. Surveys of boilers are to be in accordance with the requirements of **Pt 1, Ch 2, Sec 8** of the **Rules for the Classification of Steel Ships**.

Surveys of machinery, piping systems and electrical equipment are to be in accordance with the relevant requirements of **Pt 1, Ch 2, Sec 5** of the **Rules for the Classification of Steel Ships** as far as applicable.

2304. Damage and Iteration

Damage or alteration to structure, machinery or equipment, which affects or may affect classification, is to be submitted by the owners or their representatives for examination by the Surveyor. This examination is to be requested by the owners or their representatives.

2400. Cooperation for the survey

All such preparations as required for the survey to be carried out as well as those which may be required by the Surveyor as necessary in accordance with the requirements in the **Rules** are to be made by the applicant of the survey.

The survey may be suspended where necessary preparations have not been made or any appropriate attendant is not present. ⚡

CHAPTER 3 GENERAL ARRANGEMENT

3100. Safety Deck

A safety deck is to be fitted at such a height below the top deck that when all tanks below the safety deck are flooded but with no load on the keel blocks, there is a reasonable freeboard from the top deck to the waterline. Alternative arrangements to fitting a safety deck, such as the provision of an air cushion, will be given special consideration. Special consideration will also be given to the need for a safety deck in relation to the depth of water in which the deck operates.

3200. Top Deck

The dock is to be provided with a weathertight top deck, weathertight in this case meaning the ability to exclude water other than that due to rainfall in way of necessary access openings.

3300. Ventilation and Access

All tanks are to have vent or overflow pipes that terminate well above the water line at the maximum draught when the dock is submerged. All compartments are to be provided with manholes for access and openings are to be arranged to provide adequate ventilation and access to all parts of the structure.

3400. Cofferdam

Compartments carrying oil are to be separated by cofferdams from those carrying fresh or feed water. ⚡

CHAPTER 4 FREEBOARD AND STABILITY

4100. Freeboard

4101. Freeboard to top deck

When the dock is submerged to its maximum draught, the freeboard to the top deck is generally not to be less than 1.0 m.

4102. Freeboard to pontoon deck

The freeboard to the pontoon deck with the dock in its final working condition with a ship corresponding to the lifting capacity of the dock on the blocks is not to be less than 300 mm at the centerline and not less than 75 mm at the inner wing walls. The dock cranes may be positioned so as to produce no trim.

4103. Freeboard in unsheltered waters

If the dock's port of operation is not sheltered against waves, greater freeboard than given by **4101.** and **4102.** may be required.

4200. Stability [See Guidance]

4201. General

The requirements for stability specified in **4202.**, **4203.** and **4204.** below apply to the docks operating in sheltered waters and special consideration will be given to the docks operating in areas other than sheltered waters.

4202. Metacentric height, GM

In general, the initial metacentric height GM is not to be less than 1.0 m in any condition of loading as referred to in (1), (2) and (3) below. For transient conditions of short duration, however, a smaller metacentric height GM may be accepted upon special consideration.

- (1) Dock fully submerged to the minimum freeboard to the top deck.
- (2) Dock with pontoon immersed to just below top of keel blocks, with the most unfavourable typical ship supported by the blocks, and restoring water-plane for the combination dock/ship provided only by the wing walls of the dock.
- (3) Dock in final working condition with typical ships on the blocks, including the most unfavourable ship.

4203. Statical stability diagram

The statical stability diagram including wind heeling moment curve is to be submitted for the design condition of **4202.** (3).

In general, the point of intersection between the statical stability curve and the wind heeling moment curve is under no circumstance to exceed the angle where any part of the pontoon deck submerges.

4204. Wind heeling moment

The wind heeling moment may be calculated from the following formula.

$$0.625 \times 10^{-4} \times V^2 AH \quad (\text{t-m})$$

where:

A : the longitudinal projected area of the exposed surface considered at every stage of

inclining exposed areas of docked ship (m^2).

$$H = \Delta H + 1/2d \text{ (m)}$$

ΔH : Vertical distance from the center of A to the water line of the dock (m).

d : draught of the dock (m).

V : wind velocity (m/sec), the wind velocity is not to be than 25 m/sec in general. However, the values of the wind velocity will depend on the service location and the mode of operation of the dock, and may be considered more precisely in each case. \downarrow

CHAPTER 5 HULL STRUCTURE

5100. General

5101. Material

1. The main structural members in this chapter are to be of the hull structural rolled steels specified in "Rules for the Classification of Steel Ships" or equivalent.
2. Grade A steels specified in "Rules for Classification of Steel Ships" may be used for the main the main structural members of the dock. Grade D steels will, however, be required for the main structural members such as the deck plates, shell plates and their girders within $0.4 L$ amid-length, where the thickness exceeds 30 mm.
3. If the dock is to be operated in a site with air temperatures regularly below 0°C in the winter season, the notch toughness of the steels will be given special consideration.

5102. Welding

Welding and weld connections are to comply with the requirements of "Rules for the Classification of Steel Ships", as far as applicable to the docks. Alternatively, welding may be in accordance with another recognized standard provided all related requirements of the standard are also complied with.

5103. Corrosion protection

All external and internal surfaces of the hull structures except in oil tanks are to be protected against corrosion by paint of suitable composition or other effective means. Where special protective coatings are applied to the external and internal surfaces, or other specially, effective methods of corrosion control are adopted, reductions in scantlings will be specially considered.

5104. General construction

1. The requirements in this chapter apply to the steel docks of the following types :
 - (1) Caisson type; dock in which the bottom pontoon and both dock wings are continuous and inseparable.
 - (2) Sectional pontoon type; dock in which the dock wings are continuous and the bottom consists of individual noncontinuous pontoons. The pontoons are permanently or detachably connected to the dock wings.
2. To avoid the excessive stress concentration, the structural members of the dock are to be continuous as far as possible.

5200. Longitudinal Strength

5201. Longitudinal strength

The longitudinal strength of the dock is to be calculated for the most severe expected docking and transient loading conditions during normal operations. Such condition may be generally assumed that a ship having a weight equal to the maximum lifting capacity of the dock and the shortest ship's length expected is supported on the keel blocks, the center of the ship's length being positioned at the mid-length of the dock, and the freeboard at the pontoon deck is as described in **4102**. The level of water ballast is to be constant over the length(L). The level of compensating ballast water may, however, be determined with the normal operation manual where it is intended that normal operation of the dock is to be by differential ballast conditions by special agreement with the Society.

5202. Towing condition

Special consideration will be given to the longitudinal strength where it is intended to tow the dock in unprotected waters, including particulars of the season and the duration and area of the towing operation.

5203. Ship weight curve

The weight curve of the ship is to be taken as a rectangle with a superimposed parabola of half the area of the rectangle, the length of each area being L_s .

5204. Allowable stresses

For the loading conditions defined in **5201.** the longitudinal bending stresses are not to exceed 142 N/mm² and the shear stresses are not to exceed 98 N/mm².

5205. Section modulus

When calculating the section modulus of the hull structure, the sectional area of all effective continuous longitudinal strength members are to be included. The section modulus of the hull structure at its mid-length is to be maintained within 0.4 L a mid-length of the dock, unless a larger extension or special strengthening is necessitated by the bending moment curve.

5206. Approximate formula of required section modulus

Notwithstanding the requirements of **5201.**, **5203.** and **5204.** the section modulus required for the hull structure may be generally determined from the formula where the lifting capacity of the dock is not exceeds 40,000 tons.

$$Z = 2.35QL \quad (\text{cm}^2)$$

Q : the maximum lifting capacity in tons

5207. Operation manual

Information on the loading conditions for the longitudinal strength is to be contained in the operation manual. Where governing bending moments and/or shear forces may occur at less than the maximum lifting capacity, such conditions are to be investigated, and contained in the operation manual.

5208. Deflection control

The maximum allowable deflection of the dock is to be submitted for approval. This deflection is not to exceed that corresponding to a stress of 142 N/mm² when lifting the ship defined in **5201.** As for deflection monitoring measures, see **6200.**

5300. Transverse Strength**5301. Loading condition**

The transverse strength of the dock is to be calculated for the most severe expected docking and transient conditions during normal operations, and is to be examined at least for the conditions as follows;

- (1) The docked ship conditions : as described in **5201.** It is assumed that the docked ship is supported by the keel blocks only.
- (2) The transient condition : the dock emerging out of water with a typical ship fully supported on the blocks and the pontoon deck subjected to a waterhead just below top of docking blocks, with corresponding ballast water in the tanks.

5302. Allowable stress

Under the loading conditions in **5301.** the compressive or tensile stresses in transverse members are not to exceed 170 N/mm^2 . The shear stresses in the transverse members are not to exceed 98 N/mm^2 .

5303. Approximate formula

Where the maximum lifting capacity of the dock does not exceed 40,000 tons, calculations of the transverse strength defined in **5301.** and **5302.** may be omitted if the thickness of the top and bottom plates of the pontoon is not less than that given below :

(1) Caisson type; obtained from the following formula.

$$0.0047 B^2 \quad (\text{mm})$$

(2) Sectional pontoon type; given by the above(1) or obtained from the following formula, whichever is greater ;

$$0.033 \times Q l_p / L d_p \quad (\text{mm})$$

where:

Q : the maximum lifting capacity in tons

l_p : length of the sectional pontoon measured alongside the center line of the dock in meters

d_p : depth of the pontoon at the center in meters

5400. Structural Detail and Local Strength**5401. Structural arrangement**

A centerline girder or longitudinal member is to provide adequate support for the keel blocks. Side girders or transverse members are to be arranged to support the side blocks.

5402. Buckling

The structural panels and members of the hull structures are to be adequately stiffened to vent buckling.

5403. Tank and shell plates

The thickness of the tank and shell plates is not to be less than obtained from the following formula. The minimum thickness is, however, to be 6.5 mm for the tank plates and 7 mm for the shell plates.

$$3.6 S\sqrt{h} + 1.5 \quad (\text{mm})$$

where:

S : spacing of stiffeners, frames etc., in meters

h : 2.5 m or the followings, whichever is greater ;

for tanks ;

vertical distance measured from the lower edge of plate to the mid-point of the distance between the top of tanks and the top of overflow pipes in meters. As an alternative the maximum differential head defined in **5407.** may be used for the ballast tanks.

for cofferdams and void spaces;

vertical distance measured from lower edge of plate to the maximum immersion water line in meters.

5404. Tank stiffener and frame

The section modulus of tank stiffeners and frames is not to be less than obtained from the following formula;

$$6.65 C S h l^2 \quad (\text{cm}^3)$$

where:

S : spacing of stiffeners, frames etc. in meters

l : span of stiffeners, frames etc. in meters

h : 2.5 m or the followings, which ever is greater;

for tanks;

vertical distance measured from the mid-point of l for vertical stiffeners of S for horizontal stiffeners to the midpoint of the distance between the top of tanks and the top of overflow pipes in meters. As an alternative, the maximum differential head defined in 5407. may be used for the ballast tanks.

for cofferdams and void spaces;

vertical distance measured from the midpoint of l for vertical frames etc. or S for longitudinal frames etc. to the maximum immersion water line in meters.

C : Coefficient given in Table 5.1, according to the type of end connections

Table 5.1 Values of C

One end of stiffeners The other end of stiffeners	Connection by brackets	Lug-connection or supported by girders	Snip
Connection by brackets	0.70	0.85	1.30
Lug-connection or supported by girders	0.85	1.00	1.50
Snip	1.30	1.50	1.50

5405. Girder, web frame etc.

1. The section modulus of the girders is not to be less than obtained from the following formula;

$$7.13 S h l^2 \quad (\text{cm}^3)$$

where:

S : breadth of the area supported by the girders in meters

l : span of the girders in meters

h : 2.5 m or the followings, which ever is greater

for tanks;

vertical distance measured from the mid-point of l for vertical girders etc. or S for

horizontal girders etc. to the mid-point of the distance between the top of tanks and the top of overflow pipes in meters. As an alternative, the maximum differential head defined, in **5407**, may be used for ballast tanks.

for void spaces, cofferdams;

vertical distance measured from the mid-point of l for vertical web frames etc. or s for horizontal web frames etc. to the maximum immersion water line in meters.

2. Thickness of girders is not to be less than obtained from the following formula.

$$10s_1 \quad (\text{mm})$$

where:

s_1 : stiffener space or depth of girders, whichever is less in meters.

5406. Cross tie

The sectional area of cross ties, where fitted between the stiffeners, frames, girders, web frames etc. is not to be less than obtained from the following formula.

$$2.2Sbh \quad (\text{cm}^3)$$

where:

S : space of the stiffeners etc. supported by the cross tie in meters:

b : distance between the mid-point of two adjacent spans of stiffeners etc. supported by the cross tie in meters.

h : the maximum head in meters to be determined in accordance with the requirements of **5404**, or **5405**, as applicable.

5407. Maximum differential head

Where the maximum differential head is used for the design basis of the ballast tanks, hydrostatic data is to be submitted for approval to show the differential head based on the highest levels to which water will rise on each side of the structure in service. The differential head on the design is to be determined with a suitable margin to an actual differential head in service. Necessary data on operating the dock within such design limits are to be included in the operating manual.

5408. Top deck

1. Thickness of the top deck plates is not to be less than obtained from the following formula or 7 mm; whichever is greater.

$$10S \quad (\text{mm})$$

where:

S : beam space (m)

2. Section modulus of the top deck beam is not to be less than obtained from the following formula.

$$CSl^2 \quad (\text{cm}^3)$$

where:

C : 14.5 for longitudinal beam within $0.4 L$ amid-length,
 5.4 for transverse beam and longitudinal beam at the fore and aft end.
 For longitudinal beam other than the aforesaid, C may be gradually from 14.5 to 5.4.

S : space of beam in meters

l : span of beam in meters

3. Section modulus of the transverse girder of the top deck is not to be less than obtained from the following formula.

$$6.1 b l^2 \quad (\text{cm}^3)$$

where:

b : breadth of the area supported by the girders in meters

l : span of girder in meters

5409. Safety deck

- Scantlings of the safety deck as constructed as the tanks are to be in accordance with the requirements defined in **5403.**, **5404.** and **5405.**
- Scantling of the safety deck as constructed as other than the tanks are to be as follows;
 - Thickness of the deck plates is not to be less than 6.5 mm or obtained from the following formula, whichever is greater.

$$3.9 S \sqrt{h} + 1.5 \quad (\text{mm})$$

where:

S : beam space in meters

h : deck loads in t/m^2

- Section modulus of the deck beam is not to be less than obtained from the following formula.

$$4.2 S h l^2 \quad (\text{cm}^3)$$

where:

S : beam space in meters

h : deck loads in t/m^2

l : span of beam in meters

- Section modulus of the deck girders is not to be less than obtained from the following formula.

$$4.75 b h l^2 \quad (\text{cm}^3)$$

where:

b : breadth of the area supported by the girders in meters

l : span of the girder in meters

h : deck load in t/m^2

5410. Non-water tight structures

The thickness of the web plates of the non-water tight structures such as the center girder, side girders and solid floors of the pontoon, and the non-water tight bulkheads, is not to be less than obtained from the following formula in general.

$$10 S_1 \quad (\text{mm})$$

where:

S_1 : space of stiffeners in meters

5411. Keel block and supporting structure

The keel blocks and their supporting structures are to be generally designed to the following loads:

$$P = 1.5 Q / L \quad (\text{t/m})$$

where:

P : loads to the keel blocks and supporting structures over the whole length of the dock.

Q : the maximum lifting capacity of the dock in tons.

5412. Platforms

The minimum load on the platforms of dock ends is to be 5.88 kN/mm^2 , the factor of safety being not less than 4.

5413. Swing bridge

The minimum load on the swing bridge at dock ends is to be 3.92 kN/mm^2 , the factor of safety being not less than 4. ⚡

CHAPTER 6 MACHINERY AND INSTRUMENTATION

6100. Machinery

6101. Machinery

The pressure vessels other than those belonging to Group 3 and essential machinery such as generator driving and auxiliary machinery which are necessary for operations of the docks, are generally to be in accordance with the relevant provisions of the **Rules for the Classification of Steel Ships**.

6102. Piping system

1. The piping systems are generally to be in accordance with **Pt. 6 of the Rules for the Classification of Steel Ships** as far as applicable.
2. The dock is to have at least two water ballast pumps driven by each independent power. The arrangements for de-ballasting are to be such that in case of failure to the one pump an alternative pumping is available for each ballast tank.

6103. Electrical equipment

1. Electrical equipment to be installed in the manner of minimizing the risks due to electrical cause such as electric shocks, fires etc. on reference to the requirements of the **Rules for the Classification of Steel Ships**.
2. Electrical machinery and cables are to be those conformed to an applicable standards accepted by the Society, and suitable to be used safely and effectively under the conditions of the environment where they are installed.
3. Electric circuits are to be protected against accidental over currents including short circuit. These protecting devices are to be capable of breaking a fault circuit, eliminating the expansion of the faults and the hazards of fire and securing to serve electric power to essential driving sources, lights, internal communications and alarm devices.

4. Supply voltage (2018)

In general, the voltage for the electric power supply to the dock is not to exceed 15 kV. Higher voltages will be subject to special consideration.

5. Switchboard (2018)

- (1) Switchboard for shore side power supply is to be of the metal enclosed and dead-front type. The following instruments are to be provided for each voltage level.
 - Voltmeter
 - Ammeter
 - Ground fault indication
- (2) Switchboard is to be braced for maximum available fault current, and circuit breakers and fuses are to be capable of interrupting maximum fault current at their point of application. Fault current studies are to be submitted for approval and are to include determination of available feeder source current at the service disconnect switch.

6200. Indicator system

Deflection meters or acceptable alternatives, tank level, draught, and trim indicators are to be provided to enable the operation of the dock to be properly controlled. ⚡

CHAPTER 7 FIRE PROTECTION AND EXTINGUISHING

7100. General

The requirements of this Chapter apply to the minimum fire protection and extinction for the docks and do not cover equipment fitted for fighting fires that may occur on ships in the dock. Attention should also be given to any relevant statutory requirements of the National Authority of the country in which the dock is to operate. Compliance with such statutory requirements may, at the discretion of the Society, be accepted as meeting the requirements of this Chapter.

7200. Fire Protection

7201. Accommodation

Accommodation, control station and service spaces are to be arranged so that the risk of fire will be reduced to a minimum. Deck houses are to be of steel or equivalent materials. Deck coverings on the decks forming the crown of machinery spaces are to be of a type which will not readily ignite.

7202. Machinery space

Boundary walls of the machinery spaces and interior stairways below the top deck to be of steel or equivalent materials.

7203. Paints

In accommodation, control station, service and machinery spaces, paints, varnished and similar preparations having a nitrocellulose or other highly inflammable bases are not to be used.

7300 Fire-Extinguishing

7301. Piping system for fire-extinguishing

The fire pumps, associated piping and fire main are to be so designed that a minimum pressure can be maintained sufficient to produce at least 12 m jet throw through adjacent nozzles of sizes required by **7302**. A fire main is to be provided on each dock wing. Two separate means of water supply are to be provided for the fire main. At least, one mean of water supply is to be of an adequate shoreside supply or an independent driven emergency pump is to be provided with the dock.

7302. Hydrant, hose and nozzle

1. The number and position of the hydrants are to be such that at least two jets of water not emanating from the same hydrant, one of which is to be from a single length of hose, may reach any part of the dock except the water ballast tanks under any operating conditions.
2. In spaces containing machinery with a total power of 1,000 PS and over, two hydrants are to be provided, and in spaces where the total power of the machinery is less than 1,000 PS, one hydrant will be accepted. Where, in either of the above cases, fire fighting from within a small compartment is impracticable due to limitations in space, the hydrants required may be situated outside and adjacent to the compartment entrance.
3. The fire hoses are to be sufficient in length to protect a jet of water to any of the spaces in which they may be required to be used. The hoses are not to exceed 18 meters in length with a nozzle in size of 12 mm or over.

7303. International shore connection

It is recommended that the top deck of the dock is provided with the international shore connection specified in **Ch. II-2/Reg.19 of '74 SOLAS 1988** amend to supply water to the docking ship's extinguisher from the dock's pump.

7304. Portable extinguisher

1. Portable extinguishers are to be placed onboard in places with risk of fire. Within the accommodation portable extinguishers are to be so placed that at least one extinguisher will be accessible from any part of the accommodation. The total number of extinguishers required within the accommodation area will depend on its size and arrangement.
2. Portable extinguishers are to be provided in machinery spaces as well as spaces with electric motors and switchboards etc. for pumps, warping capstans etc. Number and location will depend on the size and arrangement of the spaces.

7305. Fire smothering gas system

Where provision is made for the injection of gas into machinery spaces for fire-extinguishing purposes, the necessary pipes for conveying the gas are to be provided with control valves or cocks which are to be so placed that they will be easily accessible and not readily cut off from use by an outbreak of fire. Suitable provision is to be made to prevent inadvertent admission of the gas to any compartment. ↓



2020

Guidance Relating to
the Rules for the Classification of
Floating Docks

APPLICATION OF THE GUIDANCE

This "Guidances relating to the Rules for the Classification of Floating Docks" (hereafter called as the Guidance) is prepared with the intent of giving guidelines as to the treatment of the various provisions for items required the unified interpretations and items not specified in details in the Rules, and the requirements specified in the Guidance are to be applied, in principle, in addition to the various provisions in the Rules.

As to any technical modifications which can be regarded as equivalent to any requirements in the Guidance, their flexible application will be properly considered.

**APPLICATION OF
"GUIDANCES RELATING TO THE RULES FOR THE CLASSIFICATION OF
FLOATING DOCKS"**

1. Unless expressly specified otherwise, the requirements in the Guidance apply to Floating Docks for which contracts for construction are signed on or after 1 July 2015.
2. The amendments to the Guidance for 2015 edition and their effective date are as follows:

Effective Date 1 July 2015

Chapter 4 FREEBOARD AND STABILITY

4200. Stability

– 4200. has been revised.

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CHAPTER 1 GENERAL

1100. General

1101. Application

Dock gates not specified in **1101.** of the Rules for Floating Docks are to be in accordance with the relevant requirements in Annex of the Guidance for Dock Gates. ↓

CHAPTER 4 FREEBOARD AND STABILITY

4200. Stability

Semi-submersible heavy lift carriers engaged in international voyage may be in accordance with the followings.

1. Stability requirements in transit condition

- (1) 2008 IS Code Part A, Ch.2.2 and 2.3 apply. The windage area in loading conditions shall include deck cargo.
- (2) If the vessel's characteristics render compliance with 2008 IS Code Part A, Ch. 2.2 impracticable, then the criteria of Part B, Ch.2.4.5 may be used.
- (3) For intact stability the buoyancy provided by a part of large deck cargo such as semi-submersible units, jack-up units, barges or ships may be taken into account, provided that the securing arrangement is separately approved. The watertight integrity of the cargo is to be defined and taken into account in the calculations. And the application of this requirement shall be authorized by Administration.
- (4) The damage stability standard shall be in accordance with SOLAS Ch.II-1 or ICLL 1966 Reg.27, including IACS UI LL65, as applicable.
- (5) Ships with B reduced freeboard:
B-60 freeboard requires one-compartment damage, while B-100 requires two-compartment damage in accordance with Reg.27 of the ICLL 1966. The calculations are to be carried out assuming the damaged tanks empty and for representative loads, such as a semi-submersible unit and a jack-up unit, as far as applicable. Damage extent is to be taken according to ICLL Reg. 27. The buoyancy of the deck cargo not located within the damage extent for each damage case may be taken into account if authorized by Administration. In all cases, transverse extent of damage shall be taken from the ship's side. And the SOLAS limit curve is considered in addition as ships intended for the carriage of the deck cargo.
- (6) Ships with B freeboard:
If, in addition to the SOLAS limit curves, it is desired to take the buoyancy of the deck cargo into account, calculations as for ICLL Reg. 27 corresponding to B-60 damage may be considered equivalent. And the application of this requirement shall be authorized by Administration.

2. Intact stability criteria in temporarily semi-submerged conditions

- (1) The loading and unloading sequences are so planned that the stability is sufficient during all phases of the sequence. The buoyancy provided by a part of large deck cargo such as semi-submersible units, jack-up units, barges or ships may be taken into account.
- (2) The GM at equilibrium shall not be less than 0.3 m. The positive range of the GZ curve shall be minimum 15° in conjunction with a height of not less than 0.1 m within this range. The maximum righting arm shall occur at an angle of heel not less than 7°. Unprotected openings shall not be immersed within this range. It may be required to calculate the stability about additional axis to determine the most onerous result.
- (3) Whenever free liquid surface exists in a tank, the effect shall be considered. The calculations shall account for the real filling of the tanks, i.e., in particular the location of air pipes needs to be carefully considered. If the complete filling of the tanks is dependent on certain trim or heel during the submerging sequence this needs to be clearly stated in the stability manual.

3. Damage stability in temporarily semi-submerged conditions

- (1) The risks of accidental flooding of any one compartment on the ship shall be considered. Damage to be considered is that which might occur following an uncontrolled movement of the deck cargo during loading or offloading leading to puncture of exposed surfaces
- (2) Accidental flooding of watertight compartment with watertight openings shall be considered in addition if this would result in a more severe condition.
- (3) The permeability of a damaged compartment shall be assumed to be 0.95. For machinery spaces, a permeability = 0.85.
- (4) In the final stage of flooding after damage, the positive range of the GZ curve shall be minimum 7° in conjunction with a height of not less than 0.05 m within this range. Unprotected openings shall not be immersed within this range unless the space concerned is assumed to be flooded. The angle of heel after flooding shall not exceed 15°. The final waterline after flooding is to be below the lower edge of any weathertight opening through which progressive flooding may take

place unless the space concerned is assumed to be flooded. It may be required to calculate the stability about additional axis to determine the most onerous result.

- (5) The stability at intermediate stages of flooding after damage shall not be significantly less than in the final stage.
- (6) The flooding of any damaged compartment shall not render vital safety functions inoperative.
- (7) For the purpose of damage stability calculations, a damage extent of 5 m horizontally along the surface shall be assumed for all exposed surfaces except the cargo deck. Watertight bulkheads may be considered to remain intact provided that the distance between adjacent bulkheads exceeds 5 m. The damage penetration into the structure shall be assumed to be equal to 0.76 m and the vertical extent of damage is assumed to be from the cargo deck or its horizontal extension upwards without limit. For the cargo deck a damage extent of 5 × 5 m shall be assumed. Watertight bulkheads may be considered to remain intact provided that the distance between adjacent bulkheads exceeds 5 m. The damage penetration into the cargo deck shall be assumed to be equal to 0.76 m. ↓

ANNEX GUIDANCE FOR DOCK GATES

1. General

1.1 Application

- (1) This Guidance applies to the dock gates which are intended to be classed with the Society.
- (2) Items not specified in this Guidance are to be in accordance with the relevant parts of the **Rules for the Classification of Steel Ships** and the Rules for Floating Docks, as far as applicable.

1.2 Character of Classification

The class notations assigned to the dock gate classed with the Society are to be in accordance with the requirements specified in **Pt 1, Ch 1, 201.** of the **Rules**. However, the notation "Dock Gate" shall be assigned as a ship type notation.

1.3 Plans and Documents to be submitted

- (1) Plans for approval
 - (A) Transverse section scantlings at mid-length of dock
 - (B) Structural plans of the wing walls, decks and bulkheads
 - (C) Structural plans of the transverse section
 - (D) Piping diagram
 - (E) Details of sea chest and ship-side distance pieces
- (2) Plans and Documents for Information
 - (A) Specifications
 - (B) General arrangement plan
 - (C) Tank arrangements
 - (D) Calculation sheets and data for overall strength and local strength
 - (E) Operating manual including stability information
 - (F) Coating specifications
 - (G) Arrangements and details of seals

2. Classification Surveys

2.1 Classification Surveys during Construction

- (1) Survey

For classification survey of a dock gate, the materials, workmanship and arrangements are to be surveyed in the presence of the Surveyor from the commencement of the work until the completion of the dock, and until the completion of the final test for machinery under the working condition. Any item found not to be in accordance with the **Rules** or the approved plans, or any material, workmanship or arrangement found to be unsatisfactory are to be rectified.
- (2) Hydraulic test

Hydraulic test and leak test are to be carried out in accordance with **Pt 3, Ch 1, 209.** of the **Rules** in the presence of the Surveyor.
- (3) Inclining test
 - (A) The inclining test is to be carried out under the work completion state as far as practicable in order to obtain correct light displacement and the position of the center of gravity of the dock gate.
 - (B) Prior to the inclining test, inclining testing schemes are to be submitted to the Society, and inclining test is to be carried out in the presence of the Surveyor.
- (4) Opening and closing test of dock gate

After the completion of dock gate, opening and closing test of dock gate is to be carried out in accordance with operation manual and the condition is to be confirmed and leakage of water is to be checked. In this case, quantity of leakage is not to exceed a half of the capacity of drain-

age system of the shipbuilding dock.

2.2 Periodical Survey

(1) Intermediate Surveys

- (A) Intermediate Survey is to be carried out within 3 months before or after the second or the third anniversary date from the completion date of the initial classification survey or of the previous Special Survey.
- (B) Intermediate Survey is to be carried out under the condition that dock gate is lifted to minimum draft.
- (C) At each Intermediate Survey, the following parts are to be examined.
 - (i) The shell plating above the waterline.
 - (ii) Internal examination of representative compartment.
 - (iii) Condition of air pipes, overflow pipes and overboard scuppers.
 - (iv) Companionways, ladders, and handrails and other means of protection that might be provided for access to all spaces.
 - (v) Condition of machinery, pumps and emergency lifting equipment.
 - (vi) Condition of seals above water line.

(2) Special Survey

- (A) The first Special Survey is to be completed within 5 years from the date of initial classification survey and thereafter within 5 years from the credited date of the previous Special Survey.
- (B) Special Survey of dock gate is to be carried out under the condition of dry docking or on slipway. However, the Survey of the outer bottom below the light waterline, at the Special Survey, may be carried out by some combination of the following methods.
 - (i) Ultrasonic measurement of plate thickness.
 - (ii) Heeling of the dock for partial examination of the bottom.
 - (iii) Underwater photography.
 - (iv) Underwater television.
 - (v) Examination by diver.
- (C) For each Special Survey, following requirements are to be examined in addition to the Intermediate Survey requirements.
 - (i) Condition of means of protection to openings
 - (ii) Internal examination of all compartments. However, internal examination of fresh water tank may be omitted where the result of outer inspection is good.
 - (iii) From the third Special Survey, the thicknesses measurement for the structural members is to be carried out. Two transverse sections within the 0.4 L mid-length of the dock gate are to be measured.
 - (iv) Wear-down condition of seals

3. Stability

3.1 Criteria of Stability Calculation

- (1) Stability calculation is to be in accordance with following conditions.
 - (A) The position of center of gravity of dock gate is to be obtained from the results of inclining test.
 - (B) The free surface effect of liquid tanks is to be considered.
- (2) Further details other than above, **Pt 1, Annex 1-2** of Guidance relating to the **Rules** is to be applied to stability calculation.

3.2 Metacentric Height, GM

The initial metacentric height GM is not to be less than 1.0 m for the each following condition.

- (1) Lifted condition with minimum draft
- (2) Each lifted condition taking into account the tidal difference

3.3 Stability Information

Stability Information is to include following.

- (1) Capacity and the location of center of compartments and tanks, and the moment of inertia of free surface to be presented in numerical tables or curves
- (2) Hydrostatic curves or numerical tables
- (3) Other data deemed necessary by the Society.

4. Structure and Strength

4.1 General

The dock gate is to have adequate strength and stiffness fit for the environmental condition and operational condition of water area in service.

4.2 Overall Strength

- (1) Overall Strength of the dock gate is to be assessed by direct strength calculation method in accordance with the following.
- (2) Analysis method
 - (A) The Analysis methods and programs are to be capable of taking the effects of bending deformation, shear deformation, axial deformation, and warping deformation into account.
 - (B) The analysis methods and programs are to be such that the behaviors of plane or space structures can be effectively expressed and displayed under the reasonable boundary condition.
 - (C) The analysis program is to have a sufficient analysis accuracy. And if deemed necessary by the Society, the Society may require the submission of the data on the details of analysis method, verification of accuracy, etc.
 - (D) Where direct strength calculation is performed, documents describing the conditions of calculation and the data summarizing their results are to be submitted to the Society.
- (3) Load
 - (A) The design loads for the dock gate are to be such that the most severe load conditions taking into account of the environment of water area in service are considered.
 - (B) The design loads are to be presented by the builder and to be specified in the drawings and documents for approval.
 - (C) Where vehicles pass over the dock gate, the vehicle loads are to be considered and not to be less than 17.2 kN/m².
- (4) Structural model
 - (A) Structural modelling for analysis is to be in accordance with **Pt 3, Annex 3-2** of Guidance Relating to the **Rules**.
 - (B) However, structural modelling is to be carried out based on the net thickness excluding thicknesses for corrosion margin.
- (5) Allowable stress
 - (A) When structure analysis is carried out by overall model of steel-made dock gate, allowable stress is to be in accordance with the following:
 - (i) Allowable stress when plate elements are used.

$$\text{Normal stress : } \sigma_N = 145 / K \quad (\text{N/mm}^2)$$

$$\text{Shear stress : } \tau = 100 / K \quad (\text{N/mm}^2)$$

$$\text{Equivalent stress : } \sigma_e = 175 / K \quad (\text{N/mm}^2)$$

σ_e : in accordance with the following formula:

$$\sigma_e = \sqrt{\sigma_x^2 - \sigma_x \cdot \sigma_y + \sigma_y^2 + 3\tau^2} \quad (\text{N/mm}^2)$$

K : material factor of used material as follows:

A, B, D and E : 1.0

AH 32, DH 32 and EH 32 : 0.78

AH 36, DH 36 and EH 36 : 0.72

AH 40, DH 40 and EH 40 : 0.68

(ii) Allowable stress when beam elements are used;

Web of beam elements :

$$\text{equivalent stress } \sigma_e = 175 / K \quad (\text{N/mm}^2)$$

$$\text{shear stress } \tau = 100 / K \quad (\text{N/mm}^2)$$

Flange of beam elements :

$$\text{longitudinal stress of dock gate } \sigma_l = 100 / K \quad (\text{N/mm}^2)$$

$$\text{transverse stress of dock gate } \sigma_t = 145 / K \quad (\text{N/mm}^2)$$

Equivalent stress is to be in accordance with the following:

$$\sigma_e = \sqrt{\sigma^2 + 3\tau^2} \quad (\text{N/mm}^2)$$

σ : in-plane normal stress, to be in accordance with the following:

$$\sigma = \sigma_a + \sigma_b$$

σ_a : axial stress

σ_b : bending stress

τ : mean shear stress

(iii) Where deemed necessary by the Society, fine mesh analysis may be required. In this case, the allowable stress is to be deemed appropriate by the Society.

(B) Allowable stress of dock gate made of special material other than steel is to be deemed appropriate by the Society.

4.3 Local Strength

Structural members used for deep tank are to comply with the following, in addition to the requirements of 4.2. as above.

(1) Bulkhead plate of deep tank

The thickness(t) of the bulkhead plate of deep tank is not to be less than that obtained from the following formula;

$$t = 3.6S\sqrt{h} + 2.5 \quad (\text{mm})$$

where,

S : spacing of bulkhead stiffeners (mm)

h : the greater of the following

(A) vertical distance measured from the lower edge of each bulkhead plate to the mid-point of the distance between the top of tanks and the top of overflow pipes.(m)

(B) 0.7 times the distance measured from the lower edge of each bulkhead plate to the point of 2.0 m above the top of overflow pipes(m)

(2) Bulkhead stiffeners of deep tank

The section modulus (Z) of bulkhead stiffeners of deep tank is not to be less than that obtained from the following formula;

$$Z = C S h l^2 \quad (\text{cm}^3)$$

where,

S : as specified in (1).

l : span of the bulkhead stiffeners in meters

h : vertical distance given below, whichever is the greater, the lower end being regarded as the midpoint of l for vertical stiffeners and as the midpoint of distance between the adjacent stiffeners for horizontal stiffeners.

(A) vertical distance measured from the lower end to the midpoint of the distance between the top of tanks and the top of overflow pipes(m)

(B) 0.7 times the vertical distance measured from the lower end to the point of 2.0 m above the top of overflow pipes

C : Coefficient given in following Table, according to the type of end connections

Values of C

One end of stiffeners The other end of stiffeners	Rigid connection by brackets	Flexible connection by brackets	Lug-connection or supported by girders	Snip
Rigid connection by brackets	4.90	8.05	5.95	9.10
Flexible connection by brackets	8.05	5.95	9.10	8.05
Lug-connection or supported by girders	5.95	9.10	7.00	10.50
Snip	9.10	8.05	10.50	10.50

(3) Strengthening girder

(A) The section modulus (Z) of the strengthening girders(hereinafter referred to as girder) supporting stiffeners is not to be less than that obtained from the following formula;

$$Z = 7.13 S h l^2 \quad (\text{cm}^3)$$

where :

S : breadth of the area supported by the girders in meters

h : vertical distance measured from the mid-point of S for horizontal girders, and from the midpoint of l for vertical girders, to the top of h specified in (2) in meters

l : span of the girders in meters

(B) The moment of inertia (I) of girders is not to be less than that obtained from the following formula. However, the dept of girders is not to be less than 2.5 times the dept of slots for stiffeners.

$$I = 30 h l^4 \quad (\text{cm}^4)$$

where,

h and l : as specified in the preceding paragraph (A)

- (C) Thickness of the girder web is not to be less than that obtained from the following three formulas, whichever is the greatest.

$$t_1 = 41.7 \frac{C S h l}{d_1} + 2.5 \quad (\text{mm})$$

$$t_2 = 0.174 \sqrt[3]{\frac{C S h l S_1^2}{d_1}} + 2.5 \quad (\text{mm})$$

$$t_3 = 0.01 S_1 + 2.5 \quad (\text{mm})$$

where,

S , h and l : as specified in the preceding paragraph (A)

S_1 : spacing of web stiffeners or the depth of girders, whichever is the smaller (mm)

d_1 : depth of the girder at the location considered, reduced by the depth of slots for stiffeners (mm)

C : Coefficient obtained from the following three formulas. However, it is not to be less than 0.5.

$$\text{For horizontal girders : } C = \left| 1 - 2 \frac{x}{l} \right|$$

$$\text{For vertical girders : } C = \left| 1 + \frac{1}{5} \cdot \frac{1}{h} - \left(2 + \frac{1}{h} \right) \frac{x}{l} + \frac{l}{x} \left(\frac{x}{l} \right)^2 \right|$$

x : Distance measured from the end of l for horizontal girders, and from the lower end of l for vertical girders, to the location considered (m)

- (D) The actual section modulus and moment of inertia of girders are to be calculated in accordance with **Pt 3, Ch 1, 602.** of the **Rules.**

(4) Cross Ties

(A) Where efficient cross ties are provided across deep tanks connecting girders on each side of the tanks, the span(l) of girders specified in (3) may be measured between the end of girder and the center line of cross tie or between the centerlines of adjacent cross ties.

(B) The sectional area(A) of cross ties is not to be less than that obtained from the following formula.

$$A = 1.3 S b_s h \quad (\text{cm}^2)$$

where :

S and h : As specified in (3)

b_s : Breadth of the area supported by cross ties(m)

(C) The ends of cross ties are to be bracketed to girders.

(5) Top and bottom construction

The scantlings of the members forming the top or the bottom of deep tanks are to be in accordance with the requirements of **4.** of this Annex, regarding the members as the members forming the deep tank bulkheads at the location. For top plating of deep tanks, the thickness of plates is to be at least 1 mm greater than that specified in (1) above.

- (6) Scantlings of members not in contact with sea water
The thickness of bulkhead plates and girders which are not in contact with sea water in service conditions may be reduced from the requirements in (1), (3) and (4) by the values given below:

For the plates of which only one side is in contact with sea water ----- 0.5 mm
For the plates of which neither side is in contact with sea water ----- 1.0 mm

However, bulkhead plate in way of the location such as bilge wells are to be regarded as plates in contact with sea water.

- (7) All structural members are to be sufficiently considered in respect of buckling.

4.4 Consideration for Deflection and Leakage

- (1) The structural scantlings of the dock gate are to be determined taking into account negative(-) deflection(in the reverse direction against that of loading) due to reaction forces at longitudinal ends of the dock gate. the calculation results of negative(-) deflection at longitudinal ends are to be submitted to the Society.
- (2) Seals are to be provided along the longitudinal ends and bottom of dock gate to prevent leakage. Details for the seal structure and its material property including compressive strength are to be submitted to the Society.
- (3) Pump and drainage system are to be provided in dock gate to discharge sea water leaking from the dock gate into the dock.

5. Opening and Closing Equipment of Dock Gate

5.1 Opening and Closing Equipment of Dock Gate

- (1) Appropriate equipment is to be provided for opening and closing the dock gate.
- (2) The type of lifting and immersion for opening and closing the dock gate may be of pumping or valve operation using gravity.
- (3) Where equipment such as pneumatic pressure is used as emergency drainage system and it may affect the design of dock gate, documents for verification of safe operation of this system are to be submitted to the Society by maker. If necessary, the Society may require additional safety devices.

5.2 Piping Systems

Auxiliaries and piping systems of the dock gate are to be designed, manufactured and installed in accordance with **Pt 5** of the **Rules** as par as applicable.

5.3 Electric Equipment

Electric equipment of the dock gate is to be designed, manufactured and installed so that electrical impact, fire and other electrical hazard are to be avoided, in accordance with **Pt 6** of the **Rules** as par as applicable. ↓

**RULES AND GUIDANCES RELATING TO
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FLOATING DOCKS**

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