FLOATING DOCK

Rule Note
NR 475 DTM R00 E
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MARINE DIVISION GENERAL CONDITIONS

ARTICLE 1

1.1. - BUREAU VERITAS is a Society the purpose of whose Marine Division (the "Society") is the classification (« Classification ») of any ship or vessel or structure of any type or part of it or system therein collectively hereinafter referred to as a "Unit" whether linked to shore, river bed or sea bed or not, whether operated or located at sea or in inland waters or partly on land, including submarines, hovercrafts, drilling rigs, offshore installations of any type and of any purpose, their related and ancillary equipment, subsea or not, such as well head and pipelines, mooring legs and mooring points or otherwise as decided by the Society.
The Society:

- prepares and publishes Rules for classification, Guidance Notes and other documents (« Rules »);
- issues Certificates, Attestations and Reports following its interventions (« Certificates »);
- publishes Registers.

1.2. - The Society also participates in the application of National and International Regulations or Standards, in particular by delegation from different Governments. Those activities are hereafter collectively referred to as « Certification ».

1.3. - The Society can also provide services related to Classification and Certification such as ship and company safety management certification; training activities; all activities and duties incidental thereto such as documentation on any supporting means, software, instrumentation, measurements, tests and trials on board.

1.4. - The interventions mentioned in 1.1., 1.2. and 1.3. are referred to as « Services ». The party and/or its representative requesting the services is hereinafter referred to as the « Client ».

The Services are prepared and carried out on the assumption that the Clients are aware of the International Maritime and/or Offshore Industry (the "Industry") practices.

1.5. - The Society is neither and may not be considered as an Underwriter, Broker in ship's sale or chartering, Expert in Unit's valuation, Consulting Engineer, Controller, Naval Architect, Manufacturer, Shipbuilder, Repair yard, Charterer or Shipowner who are not relieved of any of their expressed or implied obligations by the interventions of the Society.

ARTICLE 2

2.1. - Classification is the appraisement given by the Society for its Client, at a certain date, following surveys by its Surveyors along the lines specified in Articles 3 and 4 hereafter on the level of compliance of a Unit to its Rules or part of them. This appraisement is represented by a class entered on the Certificates and periodically transcribed in the Society's Register.

2.2. - Certification is carried out by the Society along the same lines as set out in Articles 3 and 4 hereafter and with reference to the applicable National and International Regulations or Standards.

2.3. - It is incumbent upon the Client to maintain the condition of the Unit after surveys, to present the Unit for surveys and to inform the Society without delay of circumstances which may affect the given appraisement or cause to modify its scope.

2.4. - The Client is to give to the Society all access and information necessary for the performance of the requested Services.

ARTICLE 3

3.1. - The Rules, procedures and instructions of the Society take into account at the date of their preparation the state of currently available and proven technical knowledge of the Industry. They are not a code of construction neither a guide for maintenance or a safety handbook.

Committees consisting of personalities from the Industry contribute to the development of those documents.

3.2. - The Society only is qualified to apply its Rules and to interpret them. Any reference to them is void unless it involves the Society's intervention.

3.3. - The Services of the Society are carried out by professional Surveyors according to the Code of Ethics of the Members of the International Association of Classification Societies (IACS).

3.4. - The operations of the Society in providing its Services make use of random inspections and are absolutely exclusive of any monitoring and thorough verification.

ARTICLE 4

4.1. - The Society, acting by reference to its Rules:

- reviews the construction arrangements of the Units as shown on the documents presented by the Client;
- conducts surveys at the place of their construction;
- classes Units and enters their name in its Register;
- surveys periodically the Units in service to note that the requirements for the maintenance of class are met.

The Client is to inform the Society without delay of circumstances which may cause the date or the extent of the surveys to be changed.

ARTICLE 5

5.1. - The Society acts as a provider of services. This cannot be construed as an obligation bearing on the Society to obtain a result or in a warranty.

5.2. - The certificates issued by the Society pursuant to 5.1. here above are a statement on the level of compliance of the Unit to its Rules or to the documents of reference for the Services provided for.

In particular, the Society does not engage in any work relating to the design, building, production or repair checks, neither in the operation of the Units or in their trade, neither in any advisory services, and cannot be held liable on those accounts. Its certificates cannot be construed as an implied or express warranty of safety, fitness for the purpose, seaworthiness of the Unit or of its value for sale, insurance or chartering.

5.3. - The Society does not declare the acceptance or commissioning of a Unit, that being the exclusive responsibility of its owner.

5.4. - The Services of the Society cannot create any obligation bearing on the Society or constitute any warranty of proper operation, beyond any representation set forth in the Rules, of any Unit, equipment or machinery, computer software of any sort or other comparable concepts that has been subject to any survey by the Society.

ARTICLE 6

6.1. - The Society accepts no responsibility for the use of information related to its Services which was not provided for the purpose by the Society or with its assistance.

6.2. - If the Services of the Society cause to the Client a damage which is proved to be the direct and reasonably foreseeable consequence of an error or omission of the Society, its liability towards the Client is limited to ten times the amount of fee paid for the Service having caused the damage. This limit is subject to a minimum of fifty thousand (50.000) French francs, and to a maximum which is the greater of five millions (5.000.000) French francs and one and a half times the above mentioned fee.

The Society bears no liability for indirect or consequential loss such as e.g. loss of revenue, loss of profit, loss of production, loss relative to other contracts and indemnities for termination of other agreements.

6.3. - All claims are to be presented to the Society in writing and on pain of debarment by right, within three months of the date the Services were supplied or of the date the events which are taken advantage of were first known.

ARTICLE 7

7.1. - Requests for Services are to be in writing.

7.2. - Either the Client or the Society can terminate as of right the requested Services by prior written notice according to paragraph 7.3., for convenience, and without prejudice to the provisions in Article 8 hereunder.

7.3. - The notice due by the Society to the Client to exercise the possibility under 7.2. is of three calendar months and conversely, of ten banking days.

7.4. - The class granted to the concerned Units and the previously issued certificates remain valid until the date of effect of the notice issued according to 7.2. hereabove subject to compliance with 2.3. hereabove and Article 8 hereunder.

ARTICLE 8

8.1. - The Services of the Society, whether completed or not, involve the payment of fee upon receipt of the invoice and the reimbursement of the expenses incurred.

8.2. - The class of a Unit may be suspended in the event of non-payment of fee after a first unfruitful notification to pay.

ARTICLE 9

9.1. - The documents and data provided to or prepared by the Society for its Services, and the information available to the Society, are treated as confidential. However:

- Clients have access to the data they have provided to the Society and to the reports and certificates which have been prepared for them;
- copy of the documents made available for the classification of the Unit can be handed over to another Classification Society Member of the International Association of Classification Societies (IACS) in case of the Unit's transfer of class;
- the data relative to the evolution of the Register, to the class suspension and to the survey status of the Units are passed on to IACS according to the association working rules;
- technical records and history related to specific class notations may be transferred to the new owner in case of change of ownership;
- the certificates, documents and information relative to the Units classed with the Society are passed on upon order of the flag authorities of the Unit or of a Court having jurisdiction.

The documents and data are subject to a file management plan.

ARTICLE 10

10.1. - Any delay or shortcoming in the performance of its Services by the Society arising from an event not reasonably foreseeable by or beyond the control of the Society shall be deemed not to be a breach of contract.

ARTICLE 11

11.1. - The Society may designate another Surveyor at the request of the Client in case of diverging opinions during surveys.

11.2. - Disagreements of a technical nature between the Client and the Society can be submitted by the Society to the advice of its Classification Committee.

ARTICLE 12

12.1. - Disputes over the Services carried out by delegation of Governments are assessed within the framework of the applicable agreements with the States, international Conventions and national rules.

12.2. - Disputes arising out of the payment of the Society's invoices by the Client are submitted to the Court of Nanterre, France.

12.3. - Other disputes over the present General Conditions or over the Services of the Society are exclusively submitted to arbitration in London according to the London arbitration procedural rules in force. English law applies.

ARTICLE 13

13.1. - These General Conditions constitute the sole contractual obligations binding together the Society and the Client, to the exclusion of all other representation, statements, terms, conditions whether express or implied. They may be varied in writing by mutual agreement.

13.2. - The invalidity of one or more stipulations of the present General Conditions does not affect the validity of the remaining provisions.

13.3. - The definitions herein take precedence over any definitions serving the same purpose which may appear in other documents issued by the Society.

RULE NOTE NR 475

FLOATING DOCK

October 2001

NR 475 FLOATING DOCK

Section 1 General

Section 2 Hull Structure

Section 3 Machinery and Systems, Electrical Installations, fire Fighting

SECTION 1 GENERAL

1 General

1.1 Application

1.1.1 Requirements in this Rule Note apply to all floating docks having a lifting capacity not exceeding 40000 t, and to floating docks with controllable ballast arrangement having a lifting capacity greater than 40 000t.

1.1.2 However, the case of floating docks with controllable ballast arrangement having a lifting capacity greater than 40000 t, and able to receive two ships side by side, or one ship the displacement of which is greater than twice its light mass, is to be specially examined by the Society.

1.1.3 A distinct examination of longitudinal and transverse strength of the dock structure is to be carried out when deep sea towing is provided.

A complementary examination of towing conditions may be carried out by the Society, if requested by the Designer or by the Owner. This examination includes the verification of towing lines, the verification of the tug power and its connection arrangement with the dock, the verification, by mean of a dynamic calculation, of the securing of cranes and loads eventually carried, etc.

1.1.4 The mooring equipment of the dock (moorings, chain cables, anchors, attachment devices of the dock, etc.) are not included in the scope of Classification.

A distinct examination of mooring may be carried out by the Society, if requested by the Designer or by the Owner. If this examination is carried out, the mention «mooring reviewed» is mentioned on the Certificate of Classification.

1.2 Navigation notation

1.2.1 The navigation notation **sheltered area** is assigned to floating docks.

1.2.2 When the dock is towed, the navigation notation **temporary unrestricted navigation** is assigned in addition to the navigation notation **sheltered area**, within the scope of Classification and the corresponding particular conditions are mentioned in the annex to the Certificate of Classification (see Pt A, Ch 1, Sec 2, [5.2.7] of Rules for the Classification of Ships).

1.3 Measurement of deflections

1.3.1 Docks are to be fitted with devices for measuring deflections.

2 Definitions

2.1 Dock with uniform ballast

2.1.1 A dock with uniform ballast is such that the tanks are loaded with ballast simultaneously at the same level. The adjustment of the deflection and still water bending moment of the loaded dock is not possible with this system of ballast.

2.2 Dock with controllable ballast

2.2.1 A dock with controllable ballast is such that the tanks can be ballasted independently. This arrangement gives the possibility of adjusting the trim, the deflection and the still water bending moment of the loaded dock.

2.3 Self-docking dock

2.3.1 A self-docking dock has, in general, two continuous wing walls and a pontoon deck composed of longitudinally independent transverse detachable members connected to the lower flange of the wing walls by bolting or any other similar device.

SECTION 2 HULL STRUCTURE

Symbols

L : Length of the dock, in m, as defined in [2.1]

B : Moulded breadth, in m, as defined in [2.3]

D : Depth, in m, as defined in [2.4]

T : Moulded draught, in m, as defined in [2.5]

Δ : Moulded displacement, in tonnes, at draught T, in sea water (density $\rho = 1,025$ t/m^3)

C_B : Total block coefficient

$$C_B = \frac{\Delta}{1,025LBT}$$

P : Lifting capacity of the dock, in t

k : Material factor, as defined in [3.1]

R_{eH} : Minimum guaranteed yield stress of the material, in N/mm^2

Z_{AB},Z_{AD} : Section moduli, in cm^3, at bottom and upper deck, respectively, to be calculated according to [5.3.3]

σ_c : Combined stress, in N/mm^2, calculated according to the Von Mises criterion, and taken equal to:

$$\sigma_C = \sqrt{\sigma^2 + 3\tau^2}$$

σ : Normal stress, in N/mm^2

τ : Shear stress, in N/mm^2

σ_B,σ_D : Hull girder bending stresses at bottom and upper deck calculated as indicated in [5.4.1] for the hogging and sagging conditions.

h : Design pressure, in t/m^2

ℓ : Span of stiffeners, in m

s : Spacing of stiffeners, in m

t : Thickness of plating, in mm

μ : Aspect ratio of the plate panel, equal to:

$$\mu = 1 \quad \text{for } \ell \geq 3s$$

$$\mu = 1 - 0,675\left(1 - \frac{\ell}{3s}\right)^2 \quad \text{for } \ell < 3s$$

to be taken not less than 0,7

w : Section modulus, in cm^3, of stiffener with attached plating

1 General

1.1 Application

1.1.1 The scantlings of floating docks of less than 65 m in length are to be specially examined.

1.1.2 When the dock is towed, scantlings are to comply with [5.5.5]and [7].

1.2 Documentation to be submitted

1.2.1 The plans and documents to be submitted to the Society for approval are listed in Tab 1.

Structural plans are to show details of connections of the various parts and, in general, are to specify the materials used, including their manufacturing processes, welded procedures and heat treatments.

1.2.2 In addition to those in [1.2.1], the following plans and documents are to be submitted to the Society for information:

- general arrangement
- justificative calculation of forces induced by mooring equipment and cranes, if any

Table 1 : Plans and documents to be submitted for approval

Plan or document	Containing also information on
Transverse sections Shell expansion Decks and profiles Pontoon deck Bulkheads	Main dimensions Frame spacing Design loads on decks and pontoon deck Steel grades Openings in decks and shell and relevant compensations Details of structural reinforcements and/or discontinuities Forces and moments induced by mooring equipment and cranes,if any Connections of mooring equipment and cranes, if any, to the dock structures
Plan of tank testing	Testing procedures for the various compartments Height of pipes for testing

1.2.3 If the complementary examination mentioned in Sec1, [1.1.3] is required, the following information are also to be provided:

- preparation for towage (disposition of cranes and other equipment, etc.)
- installation of a break water, if any, at fore end
- dismounting of working platforms, if applicable, at ends.

2 Definitions

2.1 Length

2.1.1 The length L of the dock, in m, is measured between the aft bulkhead of the aftermost pontoon and the fore bulkhead of the foremost pontoon, disregarding the platforms outside the end pontoons.

2.2 Fore and aft perpendiculars

2.2.1 The fore perpendicular is the perpendicular to the load waterline at the fore bulkhead of the foremost pontoon, disregarding the platforms outside the fore end pontoons.

2.2.2 The aft perpendicular is the perpendicular to the load waterline at the aft bulkhead of the aftermost pontoon, disregarding the platforms outside the aft end pontoons.

2.3 Moulded breadth

2.3.1 The moulded breadth B is the greatest moulded breadth, in m, measured amidships below the upper deck.

2.4 Depth

2.4.1 The depth D, in m, is measured at the upper deck. However, in the case of a self-docking dock, D is taken equal to the distance between the upper and lower flange of the side walls.

2.5 Moulded draught

2.5.1 The moulded draught T is the distance, in m, measured vertically on the midship transverse section, from the moulded base line to the load waterline.

2.6 Safety deck

2.6.1 The safety deck is the continuous deck situated below the upper deck and bouding the minimum volume of buoyancy.

3 Material

3.1 Material factor k

3.1.1 Unless otherwise specified, the material factor k has the values defined in Tab 2, as a function of the minimum guaranteed yield stress R_{eH}.

For intermediate values of R_{eH}, k may be obtained by linear interpolation.

Steels with a yield stress lower than 235 N/mm^2 or greater than 390 N/mm^2 are considered by the Society on a case by case basis.

Table 2 : Material factor k

R_{eH}, in N/mm^2	k
235	1
315	0,78
355	0,72
390	0,70

4 Design loads

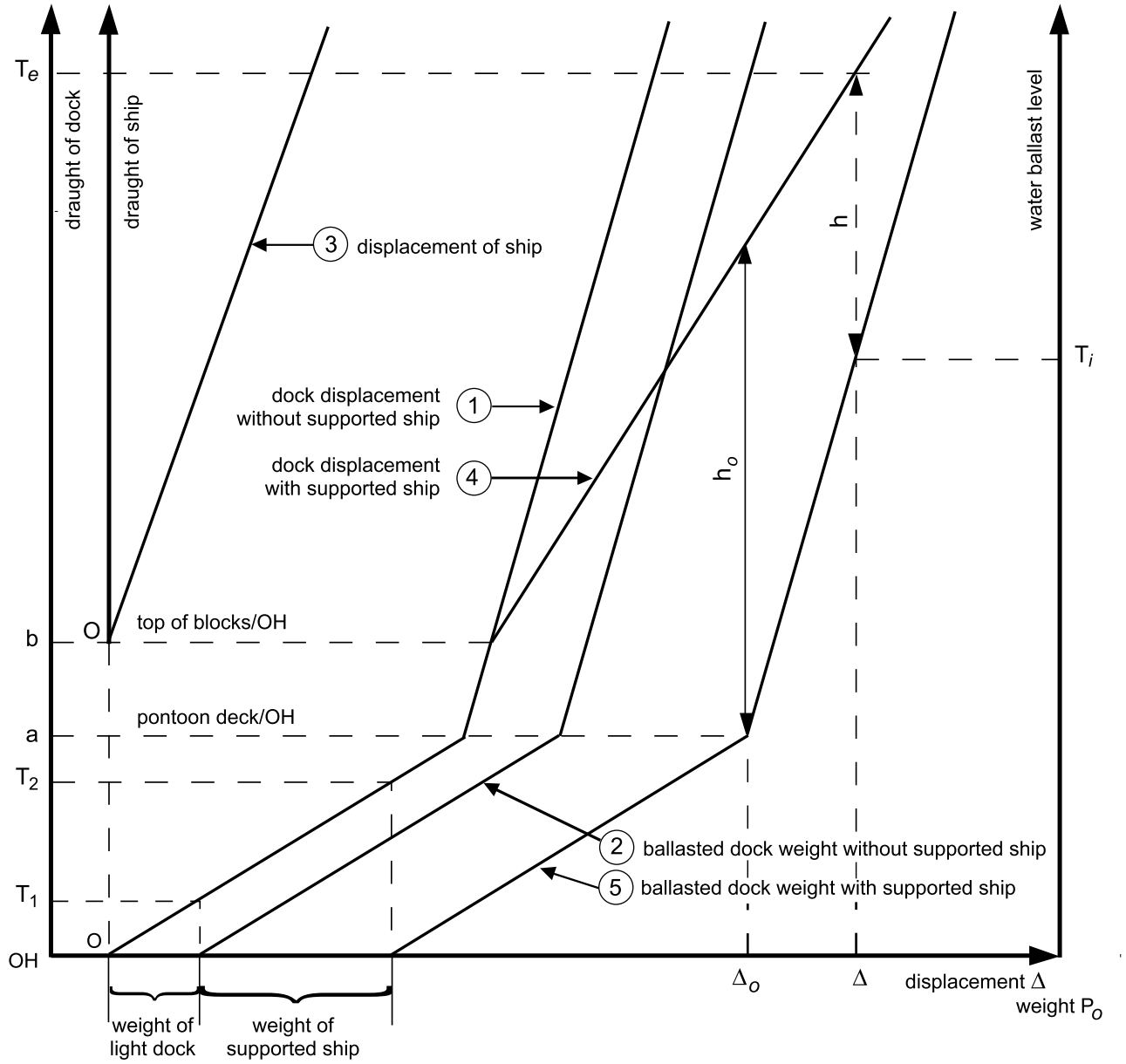
4.1 General

4.1.1 Design pressure h_o is the maximum vertical distance, in m, between the inner and outer levels. In the case of docks with controllable ballast, h_o is to be determined for each compartment. If values obtained from hydrostatic curves, according to [4.1.2], are missing, h_o is to be taken as the distance between the dock bottom and the highest waterline.

4.1.2 For a dock with uniform ballast, design pressure h_o may be obtained from hydrostatic curves defined in Fig 1, where:

- a is the distance between the pontoon deck and the dock keel line
- b is the distance between the top of blocks and the dock keel line
- the curve 1 shows the dock displacement Δ without supported ship, in terms of its draught T_e
- the curve 2 shows the total weight P_o of the dock without supported ship, in terms of inner water ballast height T_i. This curve is obtained from curve 1 by a horizontal translation equal to the light dock weight
- the curve 3 shows the displacement Δ of the only ship, in terms of its own draught, which is measured from the top of blocks
- the curve 4 shows the dock displacement Δ with the supported ship, in terms of draught T_e. This curve is obtained by adding up the displacements given in curves 1 and 3,
- the curve 5 shows the total weight P_o of the dock with supported ship, in terms of inner water ballast height T_i. This curve is obtained from curve 2 by a horizontal translation equal to the ship weight
- T_1 is the light dock draught
- T_2 is the draught of the dock without ballast and undrained ballast, and with the supported ship.

Figure 1 : Hydrostatic curves



For a displacement Δ, the values of T_e and T_i are obtained from curves 1 and 2 in the case of dock without supported ship and from curves 4 and 5 in the case of dock with supported ship. The resulting pressure acting on the outside walls of the dock is given by Fig2.

The value h_o used for the scantlings is the greatest of h values, that is the one obtained for the displacement equal to Δ_o (see Fig 1).

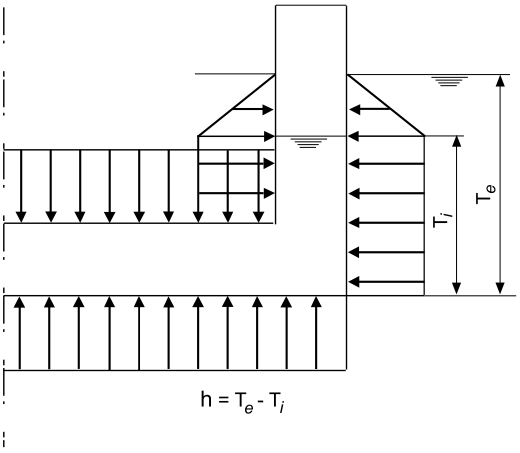
4.1.3 The design pressure h, in t/m^2, to be considered for scantlings is the maximum difference between hydrostatic heights simultaneously applied on the two faces of the plate considered. For all the outside vertical or horizontal walls, this value h is not to be greater than h_o.

Moreover, the design pressure is not to be taken less than 0,9 times the tank testing pressure h_e.

4.1.4 However, if the Designer can arrange a sequence of tests afloat which limit the maximum pressure of any point to a value less than 0,9 h_e, this maximum pressure can be taken into account for the scantling calculation instead of 0,9 h_e.

The sequence of tests afloat and a calculation note justifying the maximum pressure at any location are to be submitted by the Designer for review. Moreover, this note is to justify that design pressures arising in service conditions are less than the maximum testing pressures. Means to avoid overpressure in any compartment are also to be described.

Figure 2 : Resulting pressure acting on outside walls



5 Longitudinal strength

5.1 Rule loading conditions

5.1.1 The following loading conditions are to be considered:

- light dock
- fully-loaded dock, with ballast unevenly distributed where ballast is controllable
- dock in towing condition.

5.1.2 Moreover, the following conditions are also to be considered, according to the lifting capacity of the docks:

- $P \leq 40000$ t
  - fully-loaded dock, with undrained ballast water evenly distributed
- $P > 40000$ t
  - dock loaded with one short ship aft
  - dock loaded with two ships one behing the other
  - any other special case.

5.2 Calculation of bending moments and shear forces

5.2.1 For this calculation, unless otherwise specified by the Owner for restricting the use of the dock to ships of particular types, the mass P_1, in t, of the supported ship is assumed to be evenly distributed over a docking length L_1, in m, equal to:

$L_1 = 0,7L$ if $P \leq 40000$t

$L_1 = 5,87\sqrt[3]{P_1}$ if $P > 40000$t

5.2.2 When the dock is loaded with two ships placed one behind the other in the absence of accurate data, the overall length of each is to be taken as $1,25\ L_1$.

5.3 Calculation of the section modulus

5.3.1 In the calculation of the section modulus, all the continuous longitudinal members are to be considered.

5.3.2 In the case of a self-docking dock, some members of the transverse pontoons may also be taken into account, either partly or fully, according to the type and scantlings of the assembly (bolted, riveted or welded assembly).

5.3.3 The section moduli at bottom and at upper deck are obtained, in m^3, from the following formulae:

- at bottom:

$$Z_{AB} = \frac{I_Y}{N}$$

- at upper deck:

$$Z_{AD} = \frac{I_Y}{z_D - N}$$

where:

I_Y : Moment of inertia, in m^4, of the dock transverse section about its horizontal neutral axis

N : Vertical distance, in m, from the base line to the centre of gravity of the dock transverse section

z_D : Vertical distance, in m, from the base line to the upper deck.

5.4 Longitudinal strength criteria where $P \leq 40000$ t

5.4.1 Hull girder bending stresses at bottom and upper deck, in hogging or sagging condition, are given, in N/mm^2 by the formulae:

$$\sigma_B = \frac{M_{SW} + 0,1M_{WV}}{Z_{AB}}10^{-3}$$

$$\sigma_D = \frac{M_{SW} + 0,1M_{WV}}{Z_{AD}}10^{-3}$$

with:

M_{SW} : Maximum still water bending moment, in kN.m, in hogging or sagging condition, derived from loading cases of dock in service, for which longitudinal structure is calculated

M_{WV} : Rule vertical wave bending moment, in kN.m, given by:

$$M_{WV} = C_v\ F\ L^2\ B\ (C_B + 0,7)\ 10^{-3}$$

where:

$C_v = 58,5$ in hogging condition

$C_v = 65,0$ in sagging condition

$$F = \left(109,5 - \frac{L}{3}\right)\frac{L}{1000} \quad \text{if } L \leq 120$$

$$F = 10,75 - \left(\frac{300 - L}{100}\right)^{3/2} \quad \text{if } 120 < L \leq 300$$

$$F = 10,75 \quad \text{if } 300 < L \leq 350$$

$$F = 10,75 - \left(\frac{L - 350}{150}\right)^{3/2} \quad \text{if } 350 < L \leq 500$$

5.4.2 Under normal loading conditions, the combined stress in the dock beam is not to exceed:

$\sigma_c = 175 / k$ N/mm²

For docks without controllable ballast arrangement, the full load condition with evenly distributed undrained ballast water is considered as the normal loading conditions; the same condition is considered as exceptional for docks with controllable ballast arrangement.

5.4.3 Moreover, the combined stress is not to exceed:

- under exceptional loading condition:

  $\sigma_c = 210 / k$ N/mm²
- under towing conditions:

  $\sigma_c = 190 / k$ N/mm²

5.4.4 Where high tensile steel is used for the upper deck, for the bottom or for the lower flange of the side walls, members contributing to longitudinal strength and located at a distance greater than kV from the neutral axis are to be made from high tensile steel, V being the distance between the neutral axis and the most heavily loaded fibre.

5.5 Longitudinal strength criteria where P > 40000 t

5.5.1 The combined stresses are to be in accordance with [5.4.2] and [5.4.3].

5.5.2 The minimum midship section modulus, in m³, is to be equal to the greatest of the following values:

$$Z_{R,MIN} = P(0,0058L - 0,034\sqrt[3]{P})10^{-3}$$
$$Z_{R,MIN} = P|0,0058L - 0,043\sqrt[3]{P}|10^{-3}$$
$$Z_{R,MIN} = P(0,0043L - 0,023\sqrt[3]{P})10^{-3}$$
$$Z_{R,MIN} = P(0,0029L - 0,013\sqrt[3]{P})10^{-3}$$

5.5.3 The requested section modulus:

- at upper deck and bottom of non self-docking docks
- at upper deck and continuous lower sole piece of self-docking docks

is not to be less than $Z_{R,MIN}$, nor than:

$$Z_R = \frac{M_{SW} + 0,1M_{WV}}{150}10^{-3}$$

where:

M_{SW} : Maximum still water bending moment, in kN.m, in hogging or sagging condition, derived from loading cases of dock in service, for which longitudinal structure is calculated.

5.5.4 If M_{SW} value is not available, the still water bending moment to be considered, in kN.m, to calculate the longitudinal structure is to be taken as:

$M_{SW0} = 150\ Z_{R,MIN}\ 10^3 - 0,1\ M_{WV}$

Moreover, the calculation of M_{SW} is to be subsequently submitted. When this calculation shows a higher value of Z_R, the scantlings of dock structure are to be increased accordingly.

5.5.5 Furthermore, if the dock is towed, the midship section modulus, in m³, is not to be less than:

$$Z_R = \frac{M_{SWT} + \beta M_{WV}}{190}10^{-3}$$

where:

M_{SWT} : Maximum value, in kN.m, of still water bending moment of the dock in towing condition

β : Coefficient usually equal to 1.

β may be taken less than 1 considering the limitative conditions of towing (route, season, meteo covering, etc.).

5.5.6 Where high tensile steel is used, the section moduli at deck and bottom are to be not less than the value Z_R defined in [5.5.5], multiplied by the material factor k.

5.5.7 High tensile steel is to be used at least to a distance of:

$$z_B = \frac{\sigma_B - 150}{\sigma_B + \sigma_D}D \text{ from bottom}$$
$$z_D = \frac{\sigma_D - 150}{\sigma_B + \sigma_D}D \text{ from deckline at side}$$

5.5.8 The total permissible shear force, in kN, is given by the following formulae:

$Q_A = 167\ D\ (t_1 + t_2)$

where:

t_1 : Smallest thickness, in mm, of the inner wall strakes in the cross-section considered

t_2 : Smallest thickness, in mm, of the outer wall strakes in the cross-section considered.

6 Transverse strength

6.1 Calculation of bending moments and shear forces

6.1.1 Bending moments and shear forces due to the load distribution across the dock are calculated as follows:

a) $P \leq 40000$ t

The load P is distributed over a line of centre blocks.

The linear load p, in t/m, (see Fig 3) is to be taken equal to:

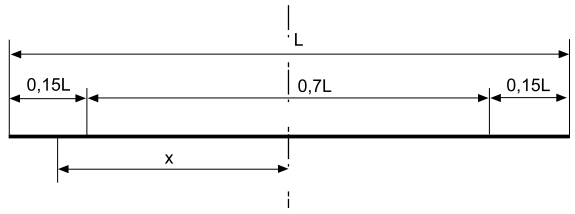
- over 0,7 L amidships:

  $$p = \frac{P}{0,7L}$$
- elsewhere:

  $$p = \frac{P}{2x}$$

  x being measured, in m, from the midship perpendicular.

Figure 3 : P ≤ 40000 t - Linear load distribution



b) P > 40000 t

The load P is distributed over a line of centre blocks extending along the full length of the dock, and over the two lines of side blocks closest to the centreline, from 0,2 L forward of the aft perpendicular to 0,1 L abaft the forward perpendicular.

The linear load p, in t/m, (see Fig 4) is to be taken equal to:

- amidships, centre blocks:

$$p = \frac{0,8P}{L}$$

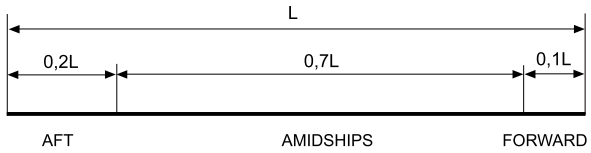
- amidships, side blocks:

$$p = \frac{0,4P}{L}$$

- at ends:

$$p = \frac{1,4P}{L}$$

Figure 4 : P > 40000 t - Linear load distribution



6.2 Transverse strength criteria

6.2.1 The combined stress is not to exceed 175/k N/mm², with:

$$\sigma = \frac{M_T}{Z_T}10^3 \quad \text{and} \quad \sigma \leq \frac{150}{k} \text{N/mm}^2$$

$$\tau = \frac{Q_T}{\sum t(d-d')}10^3 \quad \text{and} \quad \tau \leq \frac{100}{k} \text{N/mm}^2$$

the summation being extended to all the floors in the portion.

In these formulae:

M_T, Q_T : Transverse bending moment and transverse shear force, respectively in kN.m and kN, for a dock portion, calculated as specified in [6.1]

Z_T : Transverse section modulus, in m³, of the dock portion

t : Floor thickness, in mm

d : Floor depth, in mm

d' : Depth of lightening hole in floor, in mm.

7 Scantlings

7.1 General

7.1.1 The scantlings of the midship section are to be maintained throughout the region extending over 0,4 L amidships. Outside such region, the scantlings may decrease gradually, to reach their minimum values at 0,1 L from the fore and aft perpendiculars.

7.1.2 At the lower part of the side walls on a self-docking dock, a thick horizontal plating is to be provided over the full width of the side wall, on a level with the pontoon deck, in order to ensure continuity of the pontoon deck at the joints of the pontoons.

7.2 Platings

7.2.1 The thicknesses of the shell plating, in mm, are to be neither less than 7,5 nor than 0,6 $L^{1/2}$.

7.2.2 Furthermore, plating thickness of the following members, in mm, are not to be less than the he values defined in Tab 3.

Table 3 : Plating thicknesses

Element	Plating thickness, in mm
keel plate	$t = 4,4\mu s\sqrt{kh} + 3$
bottom	$t = 4,4\mu s\sqrt{kh} + 1$
side shell	$t = 4,4\mu s\sqrt{kh}$
upper deck: • longitudinal framing • transverse framing	 $t = 1,14s\sqrt{\sigma_e}$ $t = 1,32s\sqrt{\sigma_e}$
pontoon deck: • centre strake • other strakes	 $t = 4,4\mu s\sqrt{kh} + 2$ $t = 4,4\mu s\sqrt{kh}$
safety deck	$t = 4,4\mu s\sqrt{kh} + 1$
bulkheads	$t = 4,4\mu s\sqrt{kh}$
Note 1: σ_e : Greatest compressive stress due to longitudinal bending, in N/mm², for the different loading conditions considered, including the towage condition, if any.	

7.2.3 In regions where the total shear force is greater than the total permisible shear force, defined in [5.5.8], the thickness of the shell plating is to be increased accordingly.

7.3 Stiffeners of walls, bottom, pontoon deck and bulkheads

7.3.1 On docks of significant length, the framing of the walls and the deck is preferably to be longitudinal.

7.3.2 The framing of the pontoon deck is preferably to be transversal to reduce buckling risks in transverse bending.

7.3.3 In the case of longitudinal stiffeners, it is to be checked that the stress due to the combination of local bending of the stiffener and to the longitudinal bending of the dock remains less than 190/k N/mm^2 under all loading and flooding conditions.

7.3.4 In the case of transverse stiffeners, it is to be checked that the stress due to the combination of local bending of the stiffener and to the transverse bending of the dock remains less than 190/k N/mm^2 under all loading and flooding conditions.

7.4 Deck beams

7.4.1 The section modulus of the upper deck beams is to be not less than:

$w = 5,6\ k\ p\ s\ \ell^2$

where:

p : Deck load, in t/m^2, the value of which is to be not taken less than 1.

7.4.2 The section modulus of the safety deck beams is not to be less than:

$w = 5,6\ k\ (d + 1)\ s\ \ell^2$

where:

d : Distance, in m, from the safety deck to the load waterline.

7.5 Floors

7.5.1 The web thickness of non-watertight floors, in mm, is not to be less than 7 mm.

7.5.2 The web thickness of watertight floors, in mm, is neither to be less than 7,5 nor than:

$t = 4,4\mu s\sqrt{kh}$

7.5.3 The spacing and thickness of watertight floors, the thickness of non-watertight floors and size of the holes may be modified to comply with transverse strength criteria.

7.5.4 For all docks, the combined stress at each point of the floor does not exceed 175/k N/mm^2. The calculation is to take into account the following loads applied to a portion having a breadth equal to a floor spacing:

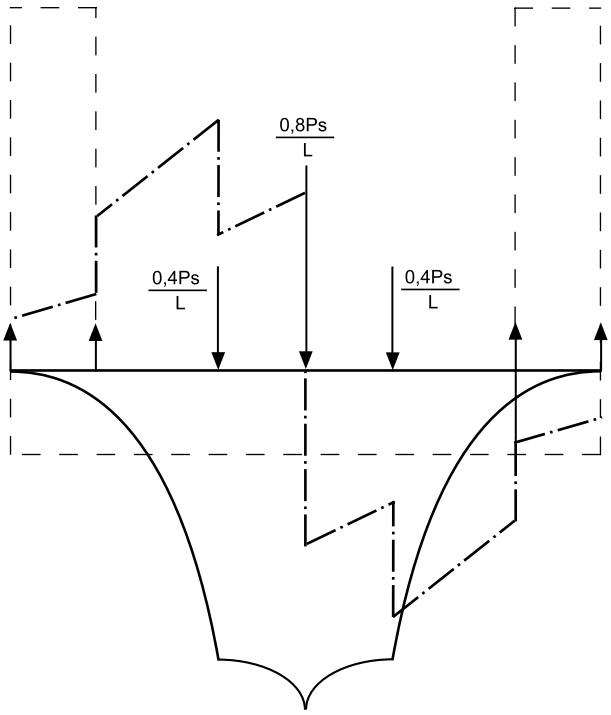
- hydrostatic pressure
- weight of the portion of structure under the pontoon deck, side walls weight being included in support reactions values
- ballast weight corresponding to the most unfavourable ballast loading case for the portion considered
- reactions of the side walls in way of the inner and outer walls; the reactions are assumed to be the same at the four wall locations
- weight of supported ship, distributed as indicated in [6.1].

This calculation is to be carried out either for the middle part of the dock, where weight exceed hydrostatic pressure, or in extreme parts, where hydrostatic pressure exceeds weight.

Furthermore, it is to be checked that actual stresses in deck, bottom and floors do not exceed the critical buckling stress value under transverse compression.

For a floating dock with three lines of blocks, the bending moment and shear force curves are given in Fig 5, where s is the floor spacing.

Figure 5 : Dock with three lines of blocks - Bending moment and shear force



7.5.5 Where open floor struts are provided, the sectional area A_{SR}, in cm^2, and the moment of inertia I_{SR} about the main axes, in cm^4, of struts are to be not less than the values obtained from the following formulae:

$$A_{SR} = \frac{h_{SR} s \ell}{2}$$

$$I_{SR} = \frac{0,75 s \ell (h_{SR1} + h_{SR2}) A_{ASR} \ell_{SR}^2}{4,72 A_{ASR} - s \ell (h_{SR1} + h_{SR2})}$$

where:

h_{SR} : Pressure to be taken equal to the greater of the values obtained, in t/m^2, from the following formulae:

$h_{SR} = 0,5 (h_{SR1} + h_{SR2})$

$h_{SR} = h_{SR3}$

h_{SR1} : External pressure acting on bottom, in way of the strut, in t/m^2

h_{SR2} : External pressure acting on the pontoon deck in way of the strut, in t/m^2

h_{SR3} : Internal pressure at mid-span of the strut, in t/m^2, in the compartment in which the strut is located

ℓ : Span, in m, of stiffeners connected by the strut

ℓ_{SR} : Length, in m, of the strut

A_{ASR} : Actual sectional area, in cm^2, of the strut.

7.6 Members in compartments not intended for filling

7.6.1 The Designer is to indicate to the Society the compartments not intended for filling .

7.6.2 Scantlings are determined as indicated in [7.3] where h, in m, is to be taken as being the distance from the considered member to the highest load waterline.

SECTION 3 MACHINERY AND SYSTEMS, ELECTRICAL INSTALLATIONS, FIRE FIGHTING

1 Auxiliary machinery and relevant equipment

1.1 General

1.1.1 The auxiliary machinery, boilers, pressure vessels and other units required for operating the dock, as well as their fluid systems, are to comply with the applicable requirements of Part C, Chapter 1 of Rules for the Classification of Ships .

1.1.2 At least, two pumps are to be fitted for any essential ballasting requirements.

2 Electrical installations

2.1 General

2.1.1 As a general rule, the electrical installations are to comply with the applicable provisions of Part C, Chapter 2 of Rules for the Classification of Ships. However, units complying with the standards of industrial equipment may be accepted insofar as their satisfactory operation can be established under special temperature, moisture and corrosion conditions.

3 Fire fighting

3.1 General

3.1.1 The fire fighting installations are to comply with the applicable requirements of Part C, Chapter 4 of Rules for the Classification of Ships .