BIRO KLASIFIKASI INDONESIA

RULES
FOR THE CLASSIFICATION
AND CONSTRUCTION OF
SEAGOING STEEL SHIPS

RULES FOR FLOATING DOCKS

EDITION 2002

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Section 1

General

A. Scope

1. The following requirements apply to floating docks of the caisson type, in which the bottom caisson and the wing walls are continuous from the fore to the aft end and are inseparable, as well as to floating docks of the pontoon type, in which the wing walls are continuous from the fore to the aft end and the bottom is formed of non-continuous pontoons, which are bolted to the wing walls.

These requirements apply accordingly also to L-type docks and to floating pontoons.

2. The data given by the manufacturer's "Working Instructions" in respect of weight distribution and loads are to be used as a basis for design of structural elements unless the following requirements are more severe than these instructions.

B. Character of Classification

Floating docks which comply with the requirements of this Rules will have the notation "FLOATING DOCK", indicating also the nominal lifting capacity in [t], affixed to the character of classification.

C. Documents for Approval

1. Three copies[1)] of each of the following plans and documents are to be submitted for approval:

– general arrangement plan, showing the arrangement of compartments and tanks,

– drawings of longitudinal and transverse sections, showing all scantlings and the position of longitudinal and transverse girders, and of watertight bulkheads,

– drawings of the wing walls with top deck and safety deck, bottom caisson or non-continuous pontoons,

– drawings of the structural elements of pontoon decks which transfer the forces pontoon - wing wall-pontoon in way of the pontoon gaps,

– admissible loads and deflections according to the Working Instructions,

– pumping diagram showing the differences in pressure between the inside water and the outside water over the total docking procedure,

– verifiable strength calculations for the various longitudinal and transverse load conditions as well as proof of local strength,

– plans of machinery and electrical installations,

– plans of piping systems and of fire protection and extinguishing appliances,

– calculations showing the stability of the dock when supporting a ship.

2. Further documents may be required if deemed necessary.

1) For Indonesian flag Floating Docks four copies (one for Indonesia Goverment)

D. Materials

1. Unless otherwise stated, the material used for the main structural members of the dock shall be hull structural steel in accordance with the requirements of the Rules for Materials, Volume V.

Other types of steel of lower strength may be used if the weldability of the steel under shipyard conditions can be guaranteed. In such cases the permissible stresses specified for the design of structural members are to be modified by the ratio of the ultimate tensile strength of the steel used to that of the hull structural steel (R_m = 410 N/mm^2).

2. The material used for structural parts of minor importance, such as platforms, swing bridges, gangways etc., may be other steel with good welding properties, if a manufacturer's certificate is submitted proving the good quality of the steel.

E. Principal Dimensions and Definitions

1. Length of dock

The length of the dock is to be measured on waterline when supporting a ship whose displacement is the nominal lifting capacity between the aft end - and the fore end bulkheads of the floating structures of the dock.

2. Breadth

2.1 The breadth is the moulded breadth measured from the outside edges of the frames.

2.2 The "Clear Breadth" is the clear inside breadth between the cantilever gangways of the wing walls.

3. Depth

The depth is the vertical distance from the base line to the top of beam of the uppermost deck.

4. Sinkage depth

The distance between the waterline when the dock is immersed and the top of the keel blocks will be defined as "Sinkage Depth above Keel Blocks".

5. Pontoon bottom

The bottom of the caisson dock or of the noncontinuous pontoons of the pontoon dock will be defined as pontoon bottom.

6. Pontoon deck

The deck of the bottom caisson or of the noncontinuous pontoons will be defined as pontoon deck. The keel blocks and bilge blocks are fitted on the pontoon deck.

7. Depth of pontoon

The depth of pontoon is the vertical distance between the pontoon bottom and the pontoon deck.

8. Top deck

The top deck is the uppermost continuous watertight deck extending over the entire wing wall.

9. Safety deck

The safety deck extends over the entire length of the wing wall. It provides a watertight and airtight boundary between the compartments above and the ballast compartments. It is arranged at such a height below the top deck that when all compartments below the safety deck are flooded, with no load on the keel blocks, the buoyancy of the space above the safety deck and of the air cushions is sufficient to keep the dock afloat and give it a reasonable freeboard from the top deck (see also Section 3, B.1).

10. Rest water, compensating ballast water

10.1 The ballast water remaining in the tanks which the pumps cannot discharge, will be defined as "Rest Water".

10.2 The ballast water remaining in excess of this rest water when the nominal lifting capacity is utilized will be defined as "Compensating Ballast Water" (see also Section 2, B.3).

11. Nominal Lifting Capacity

The nominal Lifting Capacity (LC) is the displacement of the heaviest ship that the dock is able to lift in normal service condition.

Section 2

Structural Strength

A. Transverse Strength

1. The strength of the transverse structure of the dock is to be investigated for three conditions of loading:

1.1 First condition

Dock supports a ship of the nominal lifting capacity, and the dock is emerged to the freeboard at the pontoon deck. The transverse strength is to be investigated for the load caused by water pressure and load on the keel blocks.

1.2 Second condition

Dock loaded as under 1.1, but with no load on the keel blocks at the ends of the dock. The transverse structure is to be investigated when loaded only by buoyancy assuming uniformly distributed compensating ballast water.

1.3 Third condition

Dock with a ship emerged to such a height that the maximum pressure difference between the inside and outside water is reached. The transverse structure is to be investigated for the load caused by water pressure and load on keel blocks.

2. In these calculations, the load on keel blocks is to be the maximum admissible load per metre of length of dock specified in the Building or Working Instructions; this load is to be determined from the data given for the shortest ship having a displacement equal to the nominal lifting capacity of the dock.

3. The load on keel blocks to be used in the calculations, is however, not to be less than:

$$q = 1{,}5 \, \frac{LC \cdot 9{,}81}{\text{length of dock}} \quad [\text{kN/m}]$$

LC = nominal lifting capacity in [t].

4. The load on the bilge blocks to be used is derived from the force resulting from a list of the ship of 3° ; i. e. the total load on the bilge blocks on each side is to be taken as approximately 5 % of the nominal lifting capacity.

5. The stresses in the transverse girders, in plating and frames are not to exceed the following values:

Table 2.1

Type of loading	Material	
	Ordinary hull structural steel	**St 37-2**
Compressive, tensile and bending stresses	σ_{perm} = 160 N/mm²	σ_{perm} = 140 N/mm²
Shear stress	τ_{perm} = 100 N/mm²	τ_{perm} = 95 N/mm²
Equivalent stress	σ_v = 200 N/mm²	σ_v = 180 N/mm²

The equivalent stress is to be derived from the formula:

$$\sigma_v = \sqrt{\sigma^2 + 3\tau^2} \quad [\text{N/mm}^2]$$

6. Proof of sufficient buckling strength of all structural parts is to be submitted. This proof can be provided on the basis of the relevant requirements for the ship's hull. See Rules for Hull, Volume II, Section 3, F.

B. Longitudinal Strength

1. The longitudinal strength of the dock is to be investigated for the condition when the dock supports the shortest ship the weight of which equals the nominal lifting capacity of the dock. The rigidity of the docked ship is not to be considered in this calculation.

2. At no point of the dock, the stress resulting from the smallest bending moment which can be achieved with the pumping system of the dock, is to exceed the following values:

.1 for ordinary hull structural steel:

σ = 120 N/mm²

.2 for St 37-2:

σ = 110 N/mm²

3. Where, however, this smallest bending moment is achieved by the "compensating ballast water" available, and thus by unequal water levels in the bottom compartments, the condition with the ballast water evenly distributed over the entire length of the dock is also to be investigated. The stress related to the bending moment thus computed is not to exceed $\sigma = 160$ N/mm^2 (for ordinary hull structural steel) or $\sigma = 140$ N/mm^2 (for St 37-2).

4. The analysis required under 3. may be omitted if at least two different types of deflection meters, operating independently of each other, are fitted and the maximum admissible deflection is indicated in such a way that the corresponding stresses can in no case exceed the values specified under 3.

5. Where the longitudinal strength due to the dock being towed in open waters has to be considered, the calculations are to be based on wave lengths and heights, depending on the voyage route and season of the year.

6. In general, the length of wave is to be assumed as being equal to the length of dock. Deviating assumptions have to be authenticated.

7. The following permissible stress values may be used in the analysis:

– $\sigma_{perm} = 180 \text{ N/mm}^2$
(for ordinary hull structural steel)

– $\sigma_{perm} = 160 \text{ N/mm}^2$
(St 37-2).

8. The buckling strength of longitudinal members is to be proved. See also A.6.

C. Local Strength of Structural Parts

1. Loads

1.1 Structural elements which are not included in the transverse or longitudinal strength calculations, are to be designed according to the local loads. The values given in A.5. are to be assumed as permissible stresses. Adequate safety against buckling is to be proved.

1.2 The loads on the safety deck and the wing walls are to be obtained from the pumping diagram.

1.3 Unless other requirements have to be considered, such as the provision of capstans, the loads are not to be taken less than:

– 3,5 kN/m^2
for swing bridges at the end of the dock

– 5 kN/m^2
for the upper deck

– 10 kN/m^2
for the platforms at the end of the dock.

2. Bulkheads

2.1 The plate thickness of the bulkheads between the ballast compartments is not to be less than:

$$t = 3{,}8 \cdot a \sqrt{h \cdot k} + 1{,}5 \qquad \text{[mm]}$$

2.2 The section modulus of stiffeners constrained at both ends is not to be less than:

$$W = 7 \cdot a \cdot \ell^2 \cdot h \cdot k \qquad \text{[mm]}$$

k = material factor according to the Rules for Hull, Volume II, Section 2.B.2

a = spacing of stiffeners in [m]

ℓ = unsupported span in [m]

h = pressure head in [m]

h being the head of water to be expected due to unequal filling of the tanks, but is not to be less than the vertical distance between the waterline in the immerged condition and the lower edge of the air pipe in the wing tanks.

2.3 Where one or both ends are simply supported, the section moduli are to be increased by 50 %.

3. Storage tanks

For storage tanks arranged above the safety deck (fuel oil tanks, fresh water tanks, potable water tanks, lubricating oil and waste oil tanks etc.) are governed by the requirements of the Rules for Hull, Volume II, Section 12.

4. Centreline bulkhead

The centreline bulkhead supported at the transverse girders or the watertight transverse bulkheads is to be analysed as a continuous girder loaded by the load on keel blocks and the buoyancy. However, concentrated loads due to removal of keel blocks between two transverse girders in case of bottom repair are to be taken into account.

5. Dock cranes

5.1 The scantlings of dock cranes are to be determined according to the principles established by BKI Regulations for the Construction and Survey of Lifting Appliances, as far as applicable[1)].

Where cranes are tested, a corresponding notation will be entered into the certificate.

5.2 The total weight of cranes, maximum wheel loads and wheel bases of dock cranes fitted on the wing walls are to be taken into account for designing foundations and are to be indicated on the plans submitted for examination.

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1) Additional national requirements are to be observed.

Section 3

Stability and Freeboard

A. Stability[1)]

Calculations for proof of adequate stability in the most unfavourable condition are to be submitted. In general, this condition will be reached when the bottom of the ship is emerged, with the pontoon deck remaining below the waterline.

1. Metacentric Height, GM

The stability will be considered as being sufficient if the metacentric height GM is not to be less than 1,0 m in any condition of loading as referred belows :

1.1 Dock fully submerged to the minimum freeboard to the top deck.

1.2 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.

1.3 Dock in final working condition with typical ships on the blocks, including the most unfavourable ship.

Data on resultant acceptable heights of the centre of gravity of the ship, depending on the ship’s weight, are to be included in the Operating Instructions (if possible, in the form of a diagram).

2. Statical Stability Diagram

The statical stability diagram including wind heeling moment curve is to be submitted for the design condition of A.1.1.3.

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.

3. Wind Heeling Moment

The wind heeling moment may be calculated from the following formulae :

$$M_H = 6{,}131 \cdot 10^{-4} \cdot V^2 \cdot A \cdot H \quad [\text{kN-m}]$$

where :

A = the longitudinal projected area of the exposed surface considered at every stage of inclining exposed areas of docked ship [m^2]

$$H = \Delta H + \frac{1}{2}\,\mathbf{d} \quad [m]$$

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.

B. Freeboard[1)]

1. Freeboard to Top Deck

The safety freeboard of the completely immerged dock is at no point to be less than 1,0 m. Openings for cables etc. in way of the safety freeboard are to be so designed that they can be made watertight, or they are to be arranged and designed such as to prevent outside water from penetrating into the wing compartments.

2. Freeboard to Pontoon Deck

The pontoon freeboard of the emerged dock when supporting a ship of the nominal lifting capacity will be measured from the top of the pontoon deck at the centreline of the dock is not to be less than 300 mm and at the inner wing walls is not to be less than 75 mm. The freeboard at side is to be such that the side of the pontoon deck at the ends of the dock will not submerge when the cranes are moved to the forward or aft end of the dock.

3. Freeboard in Unsheltered Waters

If the dock's port of operation is not sheltered against waves, greater freeboards than given by B.1 and B.2 may be required.

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1) Additional national requirements are to be observed.

Section 4

Machinery and Electrical Plant

A. Machinery Plant

Machinery equipment, such as boilers, pressure vessels, auxiliary engines, pump etc., essential for the operation of a floating dock, are to be constructed and installed in accordance with the relevant requirements of the Rules for Machinery Installations, Volume III. They are to be tested at the manufacturers' works.

B. Electrical Plant

The electrical plant is to be constructed in accordance with the requirements of the Rules for Electrical Installations, Volume IV. Motors and transformers with an output of 100 kW or 100 kVA or more are to be tested at the manufacturers' works.

Section 5

Piping Systems, Fire Protection and Fire Extinction

A. Piping Systems

The piping systems are to comply with the requirements of the Rules for Machinery Installations, Volume III, Section 11, as far as applicable. When designing piping systems of ballast compartments consideration shall be given to the special service conditions during dock operations. It must be ensured that each ballast compartment can be pumped out by at least two pumps.

All pumps, inlet, outlet and distributing valves are to be arranged for direct control and checking, and also for control and checking from the control room.

B. Fire Protection and Fire Extinction

The fire protection and fire extinguishing appliances shall be in accordance with the Rules for Machinery Installations, Volume III, Section 12, as far as applicable.