Polski Rejestr Statków

RULES
FOR CLASSIFICATION AND CONSTRUCTION OF FLOATING DOCKS

PART III
STABILITY AND FREEBOARD

2016
March

GDAŃSK

RULES FOR CLASSIFICATION AND CONSTRUCTION OF FLOATING DOCKS
developed and published by Polski Rejestr Statków S.A., hereinafter referred to as PRS, consist of the following parts:

Part I – Classification Regulations
Part II – Hull and Hull Equipment
Part III – Stability and Freeboard
Part IV – Fire Protection
Part V – Machinery Installations
Part VI – Electrical Equipment and Automatic Control
Part VII – Cranes.

With respect to materials and welding, the requirements specified in the *Rules for the Classification and Construction of Sea-Going Ships, Part IX – Materials and Welding, apply.*

Part III – Stability and Freeboard – Marcz 2016, was approved by the Executive Board of PRS on 8 March 2016 and comes into force on 15 March 2016.

From the entry into force, the requirements of *Part III – Stability and Freeboard* are applicable within the scope specified in *Part I – Classification Regulations.*

The requirements of *Part III – Stability and Freeboard,* are extended by the following PRS Publications:

Publication No. 6/P – Stability,
Publication No. 14/P – Principles of Approval of Computer Programs.

PRS/OP, 03/2016

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1 GENERAL

1.1 Scope of Application

1.1.1 The requirements of *Part III – Stability and Freeboard* apply to floating docks intended for service in sheltered waters.

1.1.2 Docks which have undergone an alteration or major repair shall have stability which fulfils the requirements specified in this *Part III* or the requirements which they fulfilled prior to the alteration or major repair.

1.1.3 For docks flying a foreign flag the requirements concerning stability and freeboard may be considered as fulfilled if those requirements have been considered by the Administration of the Flag State as fulfilling the requirements specified by that Administration.

1.2 Definitions

The definitions concerning the general glossary terminology applied in the *Rules for Classification and Construction of Floating Docks* (hereinafter referred to as *Rules*) are contained in *Part I – Classification Regulations*.

For the purposes of *Part III*, the following definitions are introduced:

Base plane – horizontal plane which crosses the keel top amidships.

Breadth of the dock, B [m] – the maximum breadth of the dock measured between the inner edges of frames.

Correction for free surfaces – a correction taking into account the decrease of the dock's stability due to the effect of the free surface of liquids (residual and ballast water).

Deadweight of the dock – difference, in tonnes, between the displacement of dock in water with mass density of 1.0 t/m^3 at the summer waterline, and the lightweight mass of the dock.

Displacement of the dock, D [t] – mass of water, in tonnes, of the volume equal to the volume of the submerged part of the dock's hull.

Flooding angle, θ_z [deg] – the minimum roll angle when the internal spaces of dock are flooded by sea-water through the openings which are considered to be open.

Heeling moment, M_w [kN m] – conventional design moment caused by static action of the wind.

Inclining test – test performed to determine the lightweight of the dock and the position of its centre.

Length of dock, L [m] – a distance between the pontoon aft and fore bulkheads measured in the symmetry plane.

Maximum draught of the dock, T_{max} [m] – vertical distance from the base plane to the deepest waterline measured amidships.

Moulded depth of the dock, H [m] – vertical distance, measured at side, from the base plane to the top of the uppermost deck beam of the side wall deck.

Openings considered to be open – openings in side walls or pontoons of the dock whose closing arrangements do not fulfil the watertightness, strength and reliability requirements specified in the *Rules*.

Residual water – residual ballast water remaining in the tanks which is impossible to be pumped out by the dock drainage system in service conditions.

Safe height of openings – distance between the deepest waterline of the dock and the point above which the dock is not watertight.

Safety deck – watertight deck in side walls situated below the upper deck at a distance ensuring fulfilment of the freeboard requirements for the upper deck when all ballast tanks are flooded and keel blocks are not subjected to any load.

Stability Booklet – document containing reliable information enabling the dock master to obtain – by rapid and simple processes – accurate guidance as to the stability of the dock at the particular phases of ship docking.

Towage beyond the specified operating area – towage of a dock beyond the specified operating area provided that particular requirements are fulfilled and PRS' permit has been obtained.

Wind pressure, q_w [Pa] – assumed design wind pressure.

Wind pressure arm, z [m] – height of windage area centre above the waterline.

Windage area, F_w [m^2] – projection, on the centre plane, of the above water dock-ship in the upright position.

1.3 Documentation

1.3.1 Depending on the phase of dock construction, documentation specified in paragraphs 1.3.1.1 and 1.3.1.2 shall be submitted to PRS Head Office for approval.

1.3.1.1 Prior to the commencement of the dock's construction or alteration, the following shall be submitted for information:

.1 General arrangement plan;
.2 Arrangement plan of openings in the plating of side walls including their sizes, locations and closing arrangements;
.3 Arrangement plan of openings in the pontoon decks and safety deck including their sizes, locations and closing arrangements;
.4 Body lines or the body lines table;
.5 Hydrostatic curves – print-outs of calculation results where computer programs, not approved by PRS, have been used;
.6 Calculations of: heeling levers due to the effect of wind (including the windage area diagram), flooding angles, and liquid free surface effect on the ship's stability;
.7 Plan of watertight compartments and tanks of dock, including sounding tables;
.8 Calculations of the dock lightweight mass and its centre;
.9 Arrangement plan of draught marks;
.10 Preliminary stability booklet.

1.3.1.2 Upon completion of the dock construction or alteration, the following shall be submitted to PRS for approval:

.1 *Stability Booklet* prepared on the basis of the inclining test data;

and for information:

.2 Inclining test report, accepted by PRS Surveyor.

1.4 Scope of Survey

1.4.1 General principles for classification, survey of the construction, classification surveys as well as documentation to be submitted for consideration and approval by PRS are specified in *Part I – Classification Regulations*.

1.4.2 With regard to each dock to which the requirements specified in this *Part* of the *Rules* apply, PRS activities include the following:

.1 prior to the commencement of the dock construction:
- consideration of the dock stability documentation;
- acceptance of preliminary stability booklet.

.2 during the dock construction and tests:
- acceptance of the hull measurement results and the survey of draught marks' location;
- supervision of the inclining test and the acceptance of inclining test report;
- consideration and approval of *Stability Booklet*;

.3 during the dock service: surveys aimed at determining the changes in the lightweight mass of dock which took place during the service, repair of modification of the dock in order to maintain validity of the *Stability Booklet*.

1.5 General Requirements

1.5.1 General Assumptions and Principles

1.5.1.1 Fulfilment of the stability criteria does not provide immunity against capsizing and does not absolve the dock master from his responsibility for the safety of both the dock and ship being docked. An additional requirement to ensure the safety are proper docking operations having regard to the prevailing circumstances.

1.5.1.2 It is recommended that calculations be made using programs approved by PRS in accordance with the requirements specified in *Publication No. 14/P – Principles of Approval of Computer Programs*.

1.5.2 Windage Area Calculations

1.5.2.1 Windage area F_w and its static moment shall be calculated for the dock draught T_{min} .

The windage area for other draughts may be calculated by linear interpolation taking, the second point of the draught corresponding to the summer load waterline.

1.5.2.2 The position of the windage area centre shall be determined by the method generally used in determining the coordinates of the geometric centre of a plane figure.

1.5.2.3 The side area of a crane with lattice construction shall be taken equal to half the area side outline of the crane.

1.5.2.4 The windage area includes the projections, on the ship's centre plane, of all continuous walls and surfaces of the dock, fans, deck machinery, jib cranes as well as surfaces protruding beyond the dock outline.

It is recommended that the windage area of discontinuous surfaces of rails and rigging, be taken into account by increasing the windage area calculated for draught T_{min} by 5% and the static moment of this area – by 10 %. These increased values of windage areas of discontinuous surfaces and small objects, as well as their static moments shall be assumed constant for all service draughts.

1.5.3 Effect of Free Surfaces of Liquids

1.5.3.1 The effect of free surfaces of liquids on the initial metacentric height shall be taken into account for all docking stages.

1.5.3.2 The effect of free surfaces of liquids on the values of the vertical coordinate of the centre of mass and the metacentric height at the docking stage under consideration shall be taken into account using correction G_0G calculated in accordance with the formula below:

$$G_0G = \frac{\sum(i_1 \cdot \rho_1 + i_2 \cdot \rho_2 + ... + i_n \cdot \rho_n)}{D} \qquad (1.5.3.2\text{-}1)$$

where:
G_0G – free surface correction, [m];
i – moment of inertia of the free surface in tank, at the angle of heel $\Theta = 0$, [m^4];
ρ – mass density of liquid in tank, [t/m^3];
D – displacement of dock, [t].

The corrected vertical coordinate of the dock centre of mass, KG, shall be determined in accordance with the formula below:

$$KG = KG_0 + G_0G \qquad (1.5.3.2\text{-}2)$$

The corrected dock metacentric height, GM, shall be determined in accordance with the formula below:

$$GM = KM - KG \qquad (1.5.3.2\text{-}3)$$

where:
KM – height of metacentre above base plane, [m];
KG_0 – vertical coordinate of the centre of mass, without free surface correction, [m].

The maximum correction value which may occur within the filling range of each tank in accordance with the service instructions shall be taken into account.

1.5.4 Stability Booklet

1.5.4.1 Docks shall be provided with reliable information and appropriate means to enable the dock master to obtain, by simple and rapid processes, data on the dock stability in varying operating conditions.

1.5.4.2 Docks shall be provided with *Stability Booklet* approved or noted by PRS in accordance with the provisions specified in this Chapter.

1.5.4.3 *Stability Booklet* shall be drawn on the basis of the light dock data in the valid inclining test report.

1.5.4.4 Inclining test shall be performed in PRS surveyor's presence in accordance with the requirements specified in *Publication No. 6/P – Stability.*

1.5.4.5 Upon the Owner's request, a dock may be exempted from the inclining test, provided the following conditions are fulfilled:
– dock deadweight test performed after completion of the dock construction proves that the mass of lightweight dock has not changed by more than 2 % against the design mass.
– the requirements specified in this Part of the *Rules* are fulfilled for the height of the centre of mass of a light dock greater than the design height by 20%.

1.5.5 Departures and Interpretations

1.5.5.1 Interpretation of the requirements and provisions, specified in this *Part*, shall be made exclusively by PRS.

1.5.5.2 At the request of the designer or Owner, PRS may, in justified cases, depart from a specified requirement or provision, provided that the dock safety is not thereby impaired.

1.5.5.3 Where deemed necessary, Polski Rejestr Statków may insert entries on operational limits in the approved documentation and the issued documents.

1.5.6 Towage beyond the Specified Operating Area

1.5.6.1 In the case of necessity to tow a dock beyond the specified operating area, a document including navigation conditions in the anticipated towage area as well as possible weather limitations shall be submitted to PRS for approval.

2 STABILITY CRITERIA

2.1 General

2.1.1 Dock stability with respect to the weather criterion is considered sufficient if the dock fulfils the following requirements at all phases of docking and undocking of a ship:

.1 corrected metacentric height of dock is not less than 1.4 m during the ship lifting.

It is recommended that the metacentric height of dock with the deadweight above 8000 t be not less than 3 m.

Metacentric height of dock shall be determined as regards stability in the most adverse moments of immersing the dock and lifting a ship with the mass equal to the lifting capacity of dock.

While determining the metacentric height of dock during lifting a ship with the mass equal to the lifting capacity of dock, the centre of gravity of a ship shall be taken in accordance with the approved *Stability Booklet* of the ship. Where no such data are available concerning the ship, its centre of gravity shall be taken at the height equal to $0.75 \cdot H_s$

where:

H_s – moulded depth of the ship, [m].

.2 The angle of static heel caused by wind pressure in the most adverse docking condition shall not exceed 1.5 degrees.

$$\text{tg}\ \phi = M_w / (9.81 \cdot GM \cdot D) \qquad (2.1.1\text{-}2)$$

where:

$M_w = 0.001 \cdot q \cdot F_w \cdot z$ [kNm];

Wind pressure $q = 490$ Pa.

F_w – area of side surface exposed to wind, [m^2];

z – vertical distance from the centre of windage to the waterline, [m];

GM – corrected metacentric height, [m];

D – dock displacement in particular docking conditions, [t].

.3 The angle of static heel of dock in the floating condition caused by the operations of dock cranes shall not exceed 0.5 degrees.

$$\text{tg}\ \phi = M_d / (GM \cdot D) \qquad (2.1.1\text{-}3)$$

where:

$M_d = \Sigma P_i \cdot l_i$, [tm];

P_i – maximum lifting capacity of individual cranes on one side, [t];

l_i – maximum angle of turn of individual cranes measured from the dock plane of symmetry, [m];

where:

GM, D – see .2 above.

3 FREEBOARD

3.1 Freeboard of Dock

3.1.1 After all ballast tanks below the safety deck have been flooded, assuming that no loads are imposed on keel blocks, the freeboard of dock shall not be less than 1000 mm and shall provide an adequate margin of displacement in case of incidental flooding of one compartment above the safety deck.

3.2 Freeboard of Pontoon

3.2.1 Freeboard of dock pontoon loaded with a ship with the mass equal to the dock deadweight shall not be less than:

– 75 mm, measured on the inside part of the side wall,

– 300 mm, measured in the plane of symmetry of pontoon,

and the measurement shall be taken with such a position of dock cranes which causes no trim.

At the trim caused by the dock cranes positioned on one end of dock and loaded with the mass equal to their maximum lifting capacity, the minimum distance between the pontoon deck (at the inner side wall) and waterline shall not be less than 50 mm.

3.2.2 In the case of dock operation outside a harbour, the freeboard is subject to PRS consideration in each particular case.

3.3 Safe Height of Openings

3.3.1 Safe height of bottom ballast tank air pipes terminating below the side wall upper deck shall be 400 mm or more, when measured from the waterline.

3.3.2 In the case of ballast tanks which are not filled in 100% at the dock immersion up to the minimum freeboard, air pipe shall terminate on the upper deck.

List of amendments effective on the 15 March 2016

Item	*Title/Subject*	*Source*
1.5.3.2-1	The formula has been corrected as suggested by the user	Remarks of rule users
3.1.1	Term „compartment" has been changed into „ballast tanks"	Remarks of rule users
3.2.1	Distance from pontoon deck to waterline	Remarks of rule users
3.3.1	Method of measuring the height of bottom ballast tank air pipes outlets	Remarks of rule users
3.3.2	Detailed amount of filling the ballast tank has been given	Remarks of rule users