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Ships and marine technology — Methodology for ship launching utilizing air bags

Navires et technologie maritime — Méthodologie pour le lancement de bateau utilisant des coussins gonflables

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Foreword

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The committee responsible for this document is ISO/TC 8, *Ships and marine technology*, Subcommittee SC 8, *Ship design*.

Ships and marine technology — Methodology for ship launching utilizing air bags

1 Scope

This International Standard specifies general guidelines for ship launching utilizing air bags, including the specification of the ship and facilities such as air bags, slipway, towing arrangements, the launching procedure, and safeguards during the ship launching.

This International Standard is applicable to ships meeting the requirements of 4.1 and utilizing air bags for launching.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2408, *Steel wire ropes for general purposes — Minimum requirements*

ISO 14409:2011, *Ships and marine technology — Ship launching air bags*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
ship launching
conveying a ship from a site to water so that the ship becomes buoyant

3.2
ship shifting
moving a ship from one place to another, such as from the building berth to near the water

3.3
slipway
ramp which is used for launching ships, including the part that extends into the water

Note 1 to entry: The shore-side portion, including the berth, is called the main slipway, while the part that extends into the water is called the auxiliary slipway.

3.4
transferring from docking blocks
process that encompasses placing the air bags under the ship, filling the air bags to raise the ship off the building blocks, removing the blocks and letting the ship rest on the air bags

3.5
ground anchor
structure that is in front of the berth and is constructed in the berth, used for mooring the ship, the hemicycle part above the ground is used to fasten the steel wire ropes and tow the ship

3.6
ship length
L_{OA}
longitudinal distance, in metres, measured from the forward extreme to the aft-most part of the ship

4 Specification for launching ships

4.1 A ship shall have a flat bottom and be suitable for putting down, filling and rolling air bags. The bottom acreage of the ship shall be large enough to provide proper contact with the air bags in order to ensure adequate bearing capacity.

4.2 According to the weight and the length of the ship, the ship to be launched is to be classed as follows:

a) class I: ships of not more than 1 000 tons in weight or not more than 90 m in length (L_{OA});

b) class II: ships of more than 1 000 tons but less than or equal to 3 000 tons in weight, or more than 90 m but less than or equal to 120 m in length (L_{OA});

c) class III: ships of more than 3 000 tons but less than or equal to 5 000 tons in weight, or more than 120 m but less than or equal to 150 m in length (L_{OA});

d) class IV: ships of more than 5 000 tons in weight, or more than 150 m in length (L_{OA}).

4.3 The underwater valves and major equipments are to be installed in position, tested, inspected and approved by shipyard or shipowner.

4.4 All burrs and weld beads on the ship's bottom plates and all appendages shall be ground smooth and inspected.

4.5 In all underwater compartments, all the hot work on the shell plating, blasting and painting and compartment tightness tests shall have been completed and approved by shipowner or classification society. All loose items shall be secured. All mooring equipment and fittings are to be installed.

4.6 The draft marks and the load lines shall be verified and approved by inspection.

4.7 Outer-hull painting shall have been completed as per the approved paint scheme.

5 Requirements for arrangements and equipment

5.1 Slipway

5.1.1 Shipyard QC shall clear the area where each air bag is to be laid and inflated.

5.1.2 The gradient and the length of the slipway shall be determined according to the size of the ship and the hydrological condition of the area water.

5.1.3 The bearing capacity of the slipway shall be at least twice as strong as the working pressure of air bags.

5.1.4 For class III and class IV ships, the slipway shall be constructed with reinforced concrete and the height difference between the right and left sides shall be less than 20 mm. For class II ships, the slipway shall be constructed with cement concrete and the height difference between the right and left sides shall be less than 50 mm. For class I ships, the slipway may be an earthen slope and shall be compacted even by rollers. The height difference between the right and left sides shall be less than 80 mm.

5.1.5 The main slipway shall enable the ship to glide automatically when the ship is off the tow. The auxiliary slipway shall be determined according to the ship type, the water level at time of launching, the diameter of the air bags, and the safety requirements.

5.2 Air bags

5.2.1 Air bags shall meet the requirements of ISO 14409.

5.2.2 For class III and class IV ships, air bags with bearing capacity of at least 200 kN/m shall be used.

5.2.3 Prior to using any air bag for ship launching, all air bags shall be tested for any potential leakage. Without applying any external load, an air bag shall be filled to 1,25 times of the rated working pressure, as shown in Table 3 of ISO 14409:2011, and the pressure shall be maintained for at least one hour.

5.2.4 According to the weight of the ship being launched, the quantity of the air bags needed for this operation shall be calculated in accordance with Formula (1):

$$N = K_1 \frac{Qg}{C_b \cdot R \cdot L_d} \tag{1}$$

where

N is the quantity of air bags used for ship launching;

K_1 is a coefficient, in general, $K_1 \geq 1{,}2$;

Q is the weight of the ship (ton);

g is acceleration of gravity (m/s^2), $g = 9{,}8$;

C_b is the block coefficient of the ship being launched;

R is the allowable unit bearing capacity of the air bags (kN/m), see Table 3 of ISO 14409:2011;

L_d is the contact length between the bottom of the ship and the body of the air bag at the midship section (m).

5.2.5 For ship shifting, 2 to 4 additional air bags shall be made ready and available.

5.2.6 For class IV ships, prior to launching, calculations shall be made for transferring from docking blocks. The product of the bearing load of an air bag times the distance between the air bag and the ship's longitudinal centre of gravity shall be less than 1 % of the product of ship's launching weight times the distance between the perpendiculars.

5.2.7 The centre to centre distance between two neighbouring air bags shall be less than or equals to that found in Formula (2) and equals to or be greater than that found in Formula (3).

$$L/(N-1) \leq 6k \tag{2}$$

$$L/(N-1) \geq \pi D/2 + 0{,}3 \tag{3}$$

where

L is the actual length of the ship bottom that can make contact with the air bags (m);

N is the quantity of air bags used for ship launching;

k is a coefficient, k = 1 for steel ships, k = 0,8 for wooden, aluminium and glass-fibre-reinforced ships;

D is the nominal diameter of air bags (m).

5.2.8 In general, the long axes of the air bags shall be arranged perpendicular to the direction of ship's movement. When it is necessary to move a ship in a curved manner, the long axes of the air bags shall be arranged perpendicular to the direction of tangent line to the curve.

5.2.9 See Annex A for air bags arrangement.

5.3 Towing arrangement

5.3.1 A windlass shall be used to control the movement of the ship. Tow system that comprises windlass, steel wire rope and pulley set shall be securely fastened to the ground anchor in front of the berth.

5.3.2 In general, a slow windlass shall be selected for ship launching. The veering speed of the windlass shall be 9 m/min to 13 m/min.

5.3.3 The forces of the windlass and the steel wire rope are shown in Figure 1 when the ship is being launched and before gaining any floatation. The maximum tensile force of the steel wire rope shall be calculated in accordance with Formula (4). The hauling force of windlass's steel wire shall be checked in accordance with Formula (5).

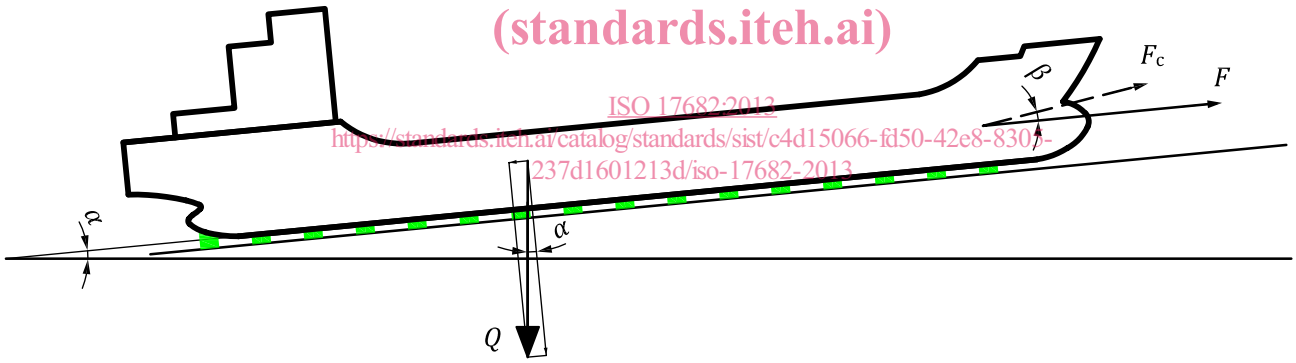

Figure 1 — Force components of a ship being launched

$$F = Qg \cdot \sin\alpha - \mu Qg \cdot \cos\alpha + Q\frac{v}{t} \tag{4}$$

$$F_c \geq \frac{KF}{N_c \cdot \cos\beta} \tag{5}$$

where

F is the maximum pulling force of the steel wire rope when the ship is being launched (kN);

α is the angle between the ship, which is borne by air bags, and the horizon (degree);

μ is a friction coefficient of the rolling air bags on the slipway. It shall be determined according to many factors such as gradient of the slipway, condition of the ground, configuration and internal pressure and arrangement of air bags (see Table B.1 of Annex B for an example);

v is the speed of the ship in motion (m/s);

t is the time for the windlass to brake the ship motion (s);

F_c is the tensile force of the steel wire rope of the windlass (N);

K is the safety coefficient, in general, K = 1,2~1,5;

N_c is the number of the hauling wire ropes on the moving tackle;

β is the angle between the direction of maximum pull force (F) and the steel wire rope (degree). In general, it is not to be greater than 6°.

5.3.4 Windlass shall be securely fixed to the ground anchor. The design load of ground anchor shall meet the requirement of the calculated pulling force (F).

5.3.5 The steel wire ropes shall meet the requirements of ISO 2408, with capacity of the calculated maximum pull force (F) or the calculated tensile force (F_c). The allowable load of pulley set, shackle, steel wire rope and rope clip shall meet the calculated pulling force.

5.3.6 Windlass shall be checked and maintained on a regular basis. Steel wire ropes shall be inspected and, according to the manufacturer's specification, be replaced on a regular basis.

6 Ship launching procedure

6.1 Document preparation

The following documents shall be prepared before ship launching:

a) general arrangement and the lines plan;

b) weight and centre of gravity of the ship;

c) light ship distribution curve including ballast if any;

d) hydrostatic curves or data and Bonjean curves or data ;

e) principal data of berth and the ship launching slipway;

f) docking block arrangement plan;

g) bearing force report of the slipway; and

h) hydrological data such as water depth, tide table and current speed.

6.2 Planning

6.2.1 Planning including the following items shall be prepared before ship launching.

a) ship's main dimension, weight and centre of gravity, slipway and hydrological conditions;

b) launching calculations, including specifications, quantities, bearing capacities and arrangements of air bags;

c) calculations of hauling force, arrangements of the hauling bat, arrangement of windlass and steel wire ropes; and

d) planning for transferring from docking blocks.