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Ships and marine technology — Floating pneumatic rubber fenders —

Part 1: High pressure

Navires et technologie maritime — Éperons pneumatiques flottants —

Partie 1: Haute pression

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT) see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 8, *Ships and marine technology*, Subcommittee SC 4, *Outfitting and deck machinery*.

ISO 17357-1 together with ISO 17357-2 cancels and replaces ISO 17357:2002.

ISO 17357 consists of the following parts, under the general title *Ships and marine technology — Floating pneumatic rubber fenders*:

— *Part 1: High pressure*

— *Part 2: Low pressure*

Introduction

This International Standards has been developed to provide guidelines on the quality and performance of all floating pneumatic rubber fenders. Floating pneumatic rubber fenders can play an important role in a ships safe berthing operation and this International Standard is seen as a technical reference to ensure necessary product standards.

Essentially there are two main types of floating pneumatic rubber fender, defined as either high or low pressure fenders. Although manufactured using different techniques, both high and low pressure fenders work by the same principle. The resistance to berthing vessel momentum is provided by a reaction pressure due to compression of the air inside the fender when deformed by the vessels hull. The kinetic energy of the berthing vessel is absorbed during the work done to compress the air inside the fender. Fenders are sized according to the expected duty of the fender in terms of the energy absorption (EA) requirements which will be at the most basic level, a function of the vessel mass and velocity.

Throughout this International Standard, the minimum essential criteria are identified by the use of the keyword “shall”. Recommended criteria are identified by the use of the keyword “should”, and while not mandatory are considered to be of primary importance in providing serviceable, economical, and practical connectors. Deviation from the recommended criteria should occur only after careful consideration, extensive testing, and thorough service evaluation have shown alternative methods to be satisfactory.

The documents in the Bibliography provide information on the usage of the fenders.

Ships and marine technology — Floating pneumatic rubber fenders —

Part 1: High pressure

1 Scope

This part of ISO 17357 specifies the material, performance, and dimensions of high-pressure floating pneumatic rubber fenders, which are intended to be used for the berthing and mooring of a ship to another ship or berthing structure. It also specifies the test and inspection procedures for high-pressure floating pneumatic rubber fenders.

This part of ISO 17357 does not address any safety hazards associated with its use. It is the user's responsibility to establish appropriate safety and health practices and determine the applicability of regulatory limitations before using this part of ISO 17357.

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 34-1:2010, *Rubber, vulcanized or thermoplastic — Determination of tear strength — Part 1: Trouser, angle and crescent test pieces*

ISO 37:2011, *Rubber, vulcanized or thermoplastic — Determination of tensile stress-strain properties*

ISO 188:2011, *Rubber, vulcanized or thermoplastic — Determination of compression set*

ISO 815-1:2008*Rubber, vulcanized or thermoplastic — Determination of compression set — Part 1: At ambient or elevated temperatures*

ISO 1382:2012, *Rubber — Vocabulary*

ISO 1431-1:2012, *Rubber, vulcanized or thermoplastic — Resistance to ozone cracking — Part 1: Static strain test*

ISO 7619-1:2010, *Rubber, vulcanized or thermoplastic — Determination of indentation hardness — Part 1: Durometer method (Shore hardness)*

ISO 12236:2006, *Geosynthetics — Static puncture test (CBR test)*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 1382:2012 and the following apply.

3.1
high pressure floating pneumatic rubber fender
fender which is made of synthetic-cord-reinforced rubber sheet with compressed air inside, at initial pressure of 50 kPa or 80 kPa, to enable it to float on the water and work as a shock absorber between two ships, or between ships and berthing structures when they come alongside each other on the water

3.2
outer rubber
rubber layer that covers the outside of the fender to protect the cord layers and the inner liner rubber from abrasion and other external forces

3.3
inner rubber
liner of a rubber membrane that seals the pressurized air inside the fender

3.4
synthetic-tyre-cord layer for reinforcement
layer made of synthetic-tyre-cord fabric, which maintains the internal air pressure of the fender

Note 1 to entry: As the main fibres of the synthetic-tyre-cord fabric are not braided like synthetic canvas fabric or synthetic belt fabric, there are advantages for its fatigue-resistance performance and pressure-holding performance. See Annex A.

3.5
bead ring
steel ring which is placed at one end (or both ends) of the fender and holds the end of cord layers

Note 1 to entry: See Annex B.

3.6
flange opening
steel flange which is mounted on the fender, to which an air valve or safety valve can be adapted

Note 1 to entry: See Annex B.

3.7
guaranteed energy absorption
energy that the fender can absorb without permanent deformation or failure

3.8
reaction force
force produced by a fender reacting to a compressive force

Note 1 to entry: It is equal to the force of the air pressure of the fender multiplied by the contact area of the fender to the ship or berthing structure.

3.9
initial internal pressure
air pressure at which an uncompressed fender operates

3.10
endurable pressure
inner pressure at which a fender bursts

3.11
net-type fender
fender which is covered by a protection net consisting of either chain, wire, or fibre and usually with tyres or rubber sleeves

3.12
sling-type fender
fender which is designed to be used without a protection net

4 Classification

4.1 High-pressure fender types

High-pressure fender types are defined as follows:

a) Type I — Net-type;

b) Type I Single — Net-type and one end with no flange opening and no metal parts. See Annex B;

c) Type II — Sling-type.

4.2 Initial internal pressure

Initial internal pressures are defined as follows:

a) pneumatic 50 (initial internal pressure 50 kPa);

b) pneumatic 80 (initial internal pressure 80 kPa).

5 Ordering or inquiring information

5.1 Information to the manufacturer

The fender purchase order or inquiry should state the following.

a) The International Standard number and applicable year, i.e. ISO 17357-1:2014.

b) Fender size: nominal fender diameter and length; see Table 1 or Table 2.

NOTE If the purchaser requests other sizes, they shall satisfy the requirements of paragraph of 6.3.3.

c) Fender type: see 4.1.

d) Initial internal pressure: see 4.2.

e) Fender colour. If not specified, the colour shall be black.

f) If a safety valve is required for fenders smaller than 2 500 mm in diameter, see 6.1.7.

g) If an identification system is required, see Clause 10.

h) If inspection/evaluation by a major classification society is required, see Clause 12.

5.2 Information from the manufacturer

In order to confirm that the products meet the requirements of this part of ISO 17357, the purchaser can request the manufacturer to provide following information prior to order placement.

a) Prototype fender test certificate

The certificate which confirms successful results of the tests in Clause 8, which are evaluated by a major classification society and are conducted no more than ten years prior to inquiry date.

b) Commercial fender inspection and test certificate

The certificate which confirms successful results of the inspections and the tests in Clause 9, which must be performed on fender which has a diameter equal to or larger than the inquired fender with the same or higher internal pressure, and are evaluated by a major classification society and are conducted no more than ten years prior to inquiry date.

6 Requirements

6.1 General high pressure fender requirements

6.1.1 High pressure floating pneumatic rubber fenders shall consist of a cylindrical air bag with hemispherical heads at both ends, which shall be filled with compressed air. The basic body construction of this fender shall consist of an outer rubber, synthetic-tyre-cord layer (see Annex A) for reinforcement, and an inner rubber. All of these shall be vulcanized firmly.

6.1.2 The outer rubber shall protect the cord layers and inner rubber from abrasion and other external forces. This rubber compound shall have sufficient tensile and tear resistance strength to withstand anticipated weather conditions and severe usage. This rubber shall satisfy the values specified in Table 3.

6.1.3 The inner rubber layer shall seal the air inside. This rubber shall satisfy the requirements specified in Table 3.

6.1.4 The reinforcement synthetic-tyre-cord layers shall be strong enough to hold the internal pressure. In both compressed and non-compressed situations, the fender's endurable pressure shall be as in Table 4 or Table 5.

6.1.5 The flange opening shall be at either end, or both ends, for convenience of air charge and water filling for Type I and Type II. The flange opening shall be at only one end for Type I Single and no metal parts shall be at the other end to make that end safe from permanent deformation when it gets over compression.

6.1.6 The end of the reinforcement-cord layers shall enter the bead ring and be turned up outside the bead ring, which is built-in at the flange opening. Diameter of the bead ring or other steel material around the flange opening shall be less than 0,20 D (D: fender diameter) to make metal parts safe from permanent deformation when it gets over compression near to 80 %. See Annex B. For Type I (Net-type) fenders, the bead ring, and turning up on construction can be excluded.

6.1.7 Fenders of diameter 2 500 mm and larger shall be equipped with a safety valve for releasing excess internal pressure when the fenders are over-compressed accidentally. Fenders which are smaller than 2 500 mm in diameter, can be equipped with a safety valve if required.

6.1.8 The fender shall be equipped with an air valve for inflation and checking air pressure.

6.2 Type requirements

6.2.1 Type I and Type I Single (Net-type) fenders shall be covered by a chain net, wire net, or fibre net. Each end of longitudinal chains, wires, or fibres shall be linked together with one or two ring(s), which shall be connected with a guy-chain or guy-rope. Usually, these nets will be fitted with used tyres or rubber sleeves to provide additional protection to the fender body.

6.2.2 Type II (Sling-type) fenders shall have a lifting device on each end, which shall be connected with a guy-chain or guy-rope.

6.3 Pressure requirements

6.3.1 Pneumatic 50: the internal pressure, endurable pressure, safety-valve setting pressure, and hydraulic test pressure shall be as specified in Table 4.

6.3.2 Pneumatic 80: the internal pressure, endurable pressure, safety-valve setting pressure, and hydraulic test pressure shall be as specified in Table 5.

6.3.3 Sizes not listed in Tables 4 and 5 shall satisfy all the requirements in this sub-clause, using the pressure requirements of the next-larger-diameter size.

EXAMPLE A 2 200 mm diameter fender shall satisfy the pressure requirements of a 2 500 mm diameter fender.

7 Performance

7.1 Specification of performance

The performance of high pressure floating pneumatic rubber fenders shall be specified in terms of guaranteed energy absorption (GEA), reaction force at GEA deflection, and hull pressure at GEA deflection.

7.2 Performance curves

The relationship between the deflection percentage, reaction force, inner pressure (which is equal to the hull pressure), and energy absorption is shown in Figure 1. The reaction force, the inner pressure, and the energy absorption of the fender increase as the deflection percentage increases. From the GEA value, point A is determined on the energy absorption curve and the corresponding deflection percentage is read as the GEA deflection. The reaction force and the hull pressure are then obtained at that deflection percentage value.

7.3 Fender performance

7.3.1 Pneumatic 50: the fenders shall comply with the values specified in Table 1.

7.3.2 Pneumatic 80: The fenders shall comply with the values specified in Table 2.

7.3.3 GEA values shown in Table 1 or Table 2 shall be obtained at (60 ± 5) % deflection.

7.3.4 The tolerance of reaction force at the GEA deflection shall be ±10 %.

7.3.5 Fender performance can be calculated by the formula, which shall be established using the performance test described in 8.1.

8 Performance confirmation of prototype fender test

8.1 General

Each fender, involving different methods of basic construction and/or design, shall require a prototype test.

Fenders of lesser diameter than a prototype confirmed fender, incorporating the same basic design, construction, and fabrication methods but having fewer plies due to the smaller diameter, but satisfying all requirements of this part of ISO 17357, do not require a prototype test.

Manufacturer shall provide the certificate which confirms successful results of the tests which are evaluated by a major classification society and the performance confirmation of prototype fender test shall be done every ten years.