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Ships and marine technology — Maritime safety — Gas inflation systems for inflatable life-saving appliances

Navires et technologie maritime — Sécurité maritime — Systèmes de gonflage au gaz pour dispositifs de sauvetage gonflables

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Foreword

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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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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 1, *Maritime safety*.

This second edition cancels and replaces the first edition (ISO 15738:2002), which has been technically revised.

The main changes compared to the previous edition are as follows:

— addition of the salt water exposure test for cylinders;

— modifications of the exposure period of the salt water exposure test according to ISO 9227:2017;

— restructuring of clauses of gas cylinder valves and operating heads;

— changes from the absolute values to the relative values in the test pressure of the pressure tests;

— modifications of the test pull loads of operating heads considering the friction in containers of liferafts; and

— additions of the torque test, the valve thread strength test, the plug test, and the valve pull test for necessary valves

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

A gas inflation system for inflatable life-saving appliances is a vital system to inflate life-saving appliances appropriately.

This document addresses the performance and testing of the gas inflation systems for inflatable life-saving appliances including those specified in the 1974 Safety of Life at Sea Convention (SOLAS 74), as amended, and the IMO International Life-Saving Appliance Code (LSA Code), adopted by IMO Resolution MSC.48(66), as amended. In this sense, it supplements the International Maritime Organization (IMO) requirements for inflatable lifesaving appliances.

Ships and marine technology — Maritime safety — Gas inflation systems for inflatable life-saving appliances

1 Scope

This document specifies performance and testing requirements for gas inflation systems for inflatable life-saving appliances.

NOTE It is suitable for inflatable life-saving appliances complying with the requirements of the 1974 Safety of Life at Sea Convention (SOLAS 74), as amended, and the IMO International Life-Saving Appliance Code (LSA Code) as amended, adopted by IMO Resolution MSC.48(66).

This document applies to gas inflation systems which consist of an inflation gas, a gas cylinder valve, a gas cylinder operating head, high-pressure hoses, and pressure-relief/transfer, inflate/deflate and non-return valves. This document addresses only systems in which compressed inflation gas in cylinders is used as the inflation medium.

National requirements for qualification, use, and testing of gas cylinders vary widely. Such requirements for gas cylinders are not addressed in this document, but it is presupposed that gas cylinders meet the requirements of the applicable regulatory bodies. The systems addressed in this document are of the type generally used in life-saving appliances, such as survival craft, marine evacuation systems, and means of rescue. Systems used in personal life-saving appliances, such as inflatable lifejackets, are addressed in ISO 12402-7.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9227:2017, *Corrosion tests in artificial atmospheres — Salt spray tests*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

3.1
approved gas cylinder
gas cylinder which has been approved by a competent authority as complying with an appropriate recognized national or international standard

3.2
gas cylinder valve
closure on a gas cylinder designed to control the transfer of the inflation gas from the cylinder to the inflatable compartments

3.3
siphon tube
device or means to effect the transfer of the liquid phase from the gas cylinder before the gas phase

4 Gas cylinder — Salt water exposure test

Two gas cylinders shall have their ends blanked off and then shall be subjected to a corrosion test in accordance with the neutral salt spray test in ISO 9227:2017, for a period of 168 h at 35 °C ± 2 °C. These cylinders shall then be hydraulically proof tested to their test pressure. No permanent distortion and no leakage are allowed after the test.

5 Inflation gas

5.1 Type and quantity

A non-toxic gas, such as carbon dioxide, shall be used for inflation. The type and quantity shall provide a sufficient rate of inflation to allow the complete system to meet the specified inflation performance requirements for the equipment in which it is installed.

5.2 Dryness

If the gas used is carbon dioxide, the moisture content of the gas used shall be no more than 150 parts of water per 1 million parts of gas by mass.

6 Gas cylinder valve and operating head

6.1 General

If a gas cylinder valve is originally integrated with an operating head, the gas cylinder valve shall meet the requirements of 6.2 and 6.3.

6.2 Gas cylinder valve

6.2.1 General

6.2.1.1 The gas cylinder valve shall be fitted with a safety relief device that vents gas prior to damage to the gas cylinder due to over-pressurization.

6.2.1.2 Means shall be provided to protect the threads on the gas cylinder valve for attachment of the high-pressure hoses and an operating head from damage during storage and transit. If the gas cylinder valve is originally integrated with the operating head, the means may be provided only for the high-pressure hoses.

6.2.1.3 A gas cylinder valve constructed from aluminum alloy shall be anodized and may only be used with an aluminum cylinder, unless it is galvanically isolated from the cylinder.

6.2.1.4 Each combination of a gas cylinder valve and a gas cylinder that differ in materials, or any aluminum alloy cylinder valve used with an aluminum gas cylinder, shall be subjected to the salt water exposure test as described in 6.2.2.9.

6.2.1.5 If the gas cylinder valve is used with an inflation gas producing a liquid phase within the certified value of pressure and temperature, the design of the gas cylinder valve shall prevent the transfer of the gas phase until the liquid phase is transferred. A siphon tube or similar arrangements may be used, in which it shall be ensured that, in all operational positions of the cylinder, the siphon tube's open end remains submerged in the liquid phase.

6.2.2 Testing

6.2.2.1 Safety relief test

It shall be demonstrated that the safety relief device on the gas cylinders valve, when fitted to an approved gas cylinder in accordance with the instructions of the cylinder valve manufacturer, operates at a pressure not greater than the highest cylinder test pressure for which it is rated.

6.2.2.2 Proof-load test

The bodies of six gas cylinder valves shall be subjected to an internal hydraulic pressure 1,5 times the test pressure for which the valve is rated. The pressure shall be held for a period of 2 min.

On completion of the test, there shall not be any signs of leakage or damage.

6.2.2.3 Temperature cycling test

Two gas cylinder valves fitted to approved gas cylinders, with a gas capacity of not less than 5 l, shall be charged with 3,17 kg of CO_2/N_2 gas in the ratio 96 %/4 % by mass, weighed and then alternately subjected to surrounding temperatures of −30 °C and +65 °C. These alternating exposures need not follow immediately after each other and the following procedure is acceptable.

a) Complete an 8 h half-cycle exposure at +65 °C in one day.

b) Remove the specimens from the hot chamber and leave them exposed to ordinary room temperature until the following day.

c) Complete an 8 h half-cycle exposure at −30 °C the next day.

d) Remove the specimens from the cold chamber and leave them exposed to ordinary room temperature until the following day.

e) Repeat the above procedure a further nine times.

f) On completion of the test, the gas cylinders shall be subjected to the leak test as per clause 6.2.2.6.

6.2.2.4 Cold inflation test

Gas cylinder valves fitted to two approved gas cylinders, with a gas capacity of not less than 5 l, one charged with 3,17 kg of CO_2 and the other charged with 3,17 kg of CO_2/N_2 in the ratio 96 %/4 % by mass, shall be placed in a cold chamber at a temperature of –30 °C for a period of 3 h.

On completion, the gas shall be capable of being completely and continuously discharged within 20 s through a nozzle containing four holes of diameter 3,3 mm. There shall be no interruptions of flow by ice formation.

Where a siphon tube is fitted, the cylinder shall be rotated through 180° at least every 5 s during the discharge to demonstrate the efficacy of the siphon tube.

6.2.2.5 Fatigue test

Two gas cylinder valve bodies shall be hydraulically pressure-cycled internally in a laboratory from 0 MPa to 20 MPa for 33 000 cycles.

On completion of the test, they shall be subjected to a hydraulic pressure 1,5 times the test pressure for which the valve is rated. The pressure shall be held for a period of 2 min. There shall be no damage to the valve bodies after this test.

6.2.2.6 Long-term leak test

Two gas cylinders assembled with the valves used in the temperature cycling test in 6.2.2.3 shall be tested to ensure that they shall not lose more than 2 % of the original mass of the gas over an 18 month period.

The procedure of measuring mass loss is as follows.

a) The gas cylinder valves shall be fitted to two approved gas cylinders, with a gas capacity of not less than 5 l, charged with not less than 3,17 kg of CO_2/N_2 gas in the ratio 96 %/4 % by mass.

b) The cylinders shall be weighed carefully and then stowed in a secure stowage place for a period of 18 months at an ambient temperature of 18 °C to 20° C.

c) On completion of the 18 month period, the cylinders shall be reweighed and the loss of gas charge on each cylinder shall not exceed 2 % of the original mass of the gas.

6.2.2.7 Impact test

One of the gas cylinders and gas cylinder valves used in the long-term leak test, after being fully discharged of gas, shall be dropped 9 times from a height of 300 mm at an angle of 45° onto a concrete floor covered with hardboard so that the valve receives the full force of the impact.

The test shall be repeated with the cylinder angled in a plane at 90° to the original test.

After the above test, the cylinder shall be stood vertically on its base, and pushed over so that, as it falls, the gas cylinder valve strikes a steel stop secured to the floor. The height of the steel stop shall be not less than half the diameter of the cylinder used for the test. The test shall be repeated 12 times.

On completion of the above test, the valve shall be carefully examined using appropriate means. There shall not be any signs of flaw or fracture other than superficial surface damage.

An approved gas cylinder, with a mass of at least 8,165 kg, fitted with the gas cylinder valve shall be dropped three times from a height of 1,5 m onto an aluminum sheet so that the valve takes the full force of the impact at an angle of 60° to the sheet.

The aluminum sheet shall be removed and the test shall be repeated with a single drop onto a concrete floor.

On completion of the tests, the valve shall be removed from the cylinder and carefully examined. There shall not be any signs of flaw or fracture other than superficial surface damage.

6.2.2.8 Torque test

An approved gas cylinder shall be valved and devalved in accordance with the instructions of the valve manufacturer. The test shall be repeated six cycles.

On completion of the test, carefully examine the valve threads. There shall not be any signs of damage.

6.2.2.9 Salt water exposure test

6.2.2.9.1 Application

This test is applicable to combinations of gas cylinder valve and approved gas cylinder that are of differing in materials, or any aluminum-alloy gas cylinder valve used with an approved aluminum gas cylinder.

6.2.2.9.2 Test procedure

Two gas cylinder valve operating head assemblies shall be assembled to approved gas cylinders filled with a typical gas charge. The assemblies shall be subjected to a corrosion test in accordance with the neutral salt spray test in ISO 9227:2017 for a period of 168 h at 35 °C ± 2 °C.

On completion of this test, the assemblies shall be checked to ensure that no more than 2% of the gas charge has been lost.

The system shall demonstrate that it functions correctly at an ambient temperature of 18 °C to 20 °C and the pull load does not exceed 125 N.

NOTE This test can be performed simultaneously with the test specified in 6.3.2.4.

6.3 Gas cylinder operating head

6.3.1 General

The operating head fitted to a charged gas cylinder shall be able to fully open the gas cylinder valve with a pull load less than 125 N and a pull distance of less than 200 mm at the temperature range of −30 °C to +65 °C.

The operating head shall be made from corrosion-resistant materials.

An operating head constructed from aluminum alloy shall be anodized and shall comply with 6.2.1.4.

Means shall be provided, as necessary, to prevent kinking of the cable and abrasive damage to the fabric of an inflatable survival craft.

The operating head shall be sealed against the ingress of water.

The operating head shall be of a design that prevents any chafing of the fabric of an inflatable survival craft.

NOTE The 125 N pull load is a component performance requirement, whereas the maximum activation force of 150 N in LSA Code and MSC.81(70) Part 2 is for fully assembled liferafts where some additional friction should be expected.

6.3.2 Testing

6.3.2.1 Hot actuation-force test

Two operating heads fitted to approved gas cylinders, with a gas capacity of not less than 5 l, charged with 3,17 kg of CO_2, shall be placed in a hot chamber at a temperature of +65 °C for a period of 2 h. On removal from the hot chamber, the force required to activate the heads shall be measured.

The force shall not exceed 125 N.

6.3.2.2 Cold actuation-force test

Two operating heads fitted to approved gas cylinders, with a gas capacity of not less than 5 l, charged with 3,17kg of CO_2, shall be placed in a cold chamber at a temperature of −30 °C for a period of 2 h. On removal from the chamber, the force required to activate the heads shall be measured.

The force shall not exceed 125 N.

