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Ships and marine technology — Pressure/vacuum valves for cargo tanks

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National foreword

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Ships and marine technology — Pressure/vacuum valves for cargo tanks

*Navires et technologie maritime — Soupapes de pression/dépression
pour citernes à cargaison*



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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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

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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 3, *Piping and machinery*.

This third edition cancels and replaces the second edition (ISO 15364:2007), which has been technically revised.

Ships and marine technology — Pressure/vacuum valves for cargo tanks

1 Scope

This International Standard is applicable to pressure-vacuum relief valves protecting marine vessel systems, including cargo tanks, which may be subject to gas/vapour pressure or vacuum beyond the design parameters of the system/tank. This International Standard specifies the minimum requirements for performance and testing of pressure-vacuum relief valves, with emphasis on selection of materials, internal finish and surface requirements for pressure-vacuum valves installed on cargo tanks in tankers (see [Annex A](#)). This International Standard specifies design and in-service performance criteria, operational testing and maintenance requirements. Design or manufacturing in accordance with this International Standard does not imply suitability for any given installation, it indicates that certain minimum requirements have been considered and that information necessary for determination of suitability is provided to the buyer of the equipment.

This International Standard does not cover all test procedures for devices that prevent the passage of flame, such as flame arresters. Such devices can be used in conjunction with pressure/vacuum valves.

NOTE 1 Additional information for devices to prevent the passage of flame is found in the International Maritime Organization (IMO) “International Convention for the Safety of Life at Sea, 2009” (SOLAS), Chapter II-2, Regulation 4, and IMO Maritime Safety Committee (MSC) Circular No. 677 (MSC/Circ. 677), “Revised Standards for the Design, Testing and Locating of Devices to Prevent the Passage of Flame into Cargo Tanks in Tankers”, as amended.

NOTE 2 In addition to providing pressure relief, high velocity vent valves are devices that prevent the passage of flame. Where high velocity vent valves are installed on the pressure relief system and the vacuum relief valve is protected by a flame arrester, the standards of IMO MSC/Circ. 677, as amended, are applicable. ISO 16852 is also an acceptable test standard for devices to prevent the passage of flame.

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.

International Maritime Organization, Assembly Resolution A.746 (18), *Survey Guidelines under the Harmonized System of Survey and Certification*. International Maritime Organization, *International Convention for the Safety of Life at Sea (SOLAS)*, 2002, Chapter II-2, Regulation 4

International Maritime Organization (IMO), *International Convention for the Safety of Life at Sea (SOLAS)*, 2009

3 Terms and definitions

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

3.1

flame arrester

device to prevent the passage of flame, designed and tested in accordance with a specified performance standard

Note 1 to entry: Its flame-arresting unit is based on the principle of quenching.

3.2

dual nozzle valve

pressure relief valve that features two high velocity vents with different opening settings integrated into one valve, the flow characteristics of which may be one or more of the types defined below

3.3

full opening valve

design that opens fully at the set pressure

3.4

high velocity vent

device to prevent the passage of flame, consisting of a mechanical valve which adjusts the opening available for flow in accordance with the pressure at the inlet of the valve in such a way that the efflux velocity cannot be less than 30 m/s (98 ft/sec)

3.5

maximum experimental safe gap

MESG

maximum clearance of the joint between two parts of the interior chamber of a test apparatus which, when the internal gas mixture is ignited and under specified conditions, prevents ignition of the external gas mixture through a 25 mm (1 in) long joint, for all concentrations of the tested gas or vapour in air

Note 1 to entry: IEC 60079-20-1 standardizes the test apparatus and the test method.

3.6

maximum verified pressure drop

largest pressure drop generated over a valve for which the test laboratory verifies the corresponding flow capacity

3.7

modulating valve

design that opens proportionally with rise in pressure

3.8

pressure-vacuum valve

device designed to maintain pressure and/or vacuum in a closed container within preset limits

3.9

standard air

dry air at 21 °C (70 °F) and 1 013,25 hPa (29,92 in Hg) pressure

Note 1 to entry: This is substantially equivalent to a density of 1,2 kg/m³ (0,075 lb/ft³). Specific heat of dry air = 1 004,8 J/(kg.K) [0,24 Btu/(lb.°R)].

3.10

third party inspection body

organization which is independent from the manufacturer or user and which performs or witnesses the tests and inspections provided for by this International Standard

3.11

transition point valve

design where the valve characteristics change from modulating to full opening at a particular pressure

3.12

verified drawings and diagrams

drawings and diagrams certified to be authentic and complete by the test laboratory issuing the test report in accordance with this International Standard

3.13

verified flow chart

pressure versus flow volume presented in a chart certified by the test laboratory issuing the test report in accordance with this International Standard

4 Symbols and abbreviated terms

D	nominal pipe diameter at device connection
$D_{\min}$	minimum diameter of the piping between the device and the tank allowed for non-oscillating performance
$L_{\max}$	maximum length of the piping between the device and the tank allowed for non-oscillating performance
L_1	pipe length between test tank and the device for flow testing
L_2	pipe length between test tank and the device during non-oscillation testing
P_{closing}	pressure drop over the valve corresponding to the minimum flow required to keep the valve partially open with no contact between the disc and the seat
$P_{\max}$	maximum pressure drop corresponding to the maximum flow volume (Q_3)
P_{set}	set pressure, expressed as the calculated force applied to the disc versus the area on which tank pressure is applied
$P_{1\text{-tpv}}$	pressure at which a transition point valve changes from modulating to full opening
$Q_{1\text{-fov}}$	flow volume needed to open the valve
Q_2	flow volume needed for the valve to remain fully open
$Q_{2\text{-fov}}$	flow volume needed to maintain the valve fully open at P_{set}
$Q_{1\text{-mv}}$	flow volume needed to open the valve
$Q_{2\text{-mv}}$	flow volume needed to maintain the valve fully open
$Q_{1\text{-tpv}}$	flow volume at which a transition point valve changes from modulating to full opening
$Q_{2\text{-tpv}}$	flow volume needed to maintain a transition point valve fully open at $P_{1\text{-tpv}}$
Q_3	flow volume corresponding to the maximum intended pressure drop over the valve
Q_{close}	minimum flow required to keep the valve partially open with no contact between the disc and the seat
$V_{\min}$	minimum volume of the tank allowed for non-oscillating performance

5 Materials

5.1 The device housing, and other parts or bolting used for pressure retention, shall be constructed of materials suitable for the intended service and listed in a recognized National/International Standard. Housings, discs, spindles, seats, springs, gaskets, seals, flame arresters (when included in the design) and all other integral parts, including parts with coatings to prevent corrosion, shall be resistant to attack by sea water and the liquids and vapours contained in the tank being protected (see [Annex C](#)). Springs plated with corrosion resistant material are not acceptable.

5.2 Non-metallic materials, other than gaskets, seals and diaphragms as allowed by [6.11](#), shall not be used in the construction of pressure retaining components of the device. Resilient seals may be installed only if the device is still capable of effectively performing its flame arresting function when the seals are worn down, partially or completely damaged or burned. Non-metallic gaskets shall be made of non-combustible material and suitable for the service intended.

5.3 Materials for connecting pressure-vacuum valves to their respective piping systems should meet standards for physical characteristics similar to those of the piping systems to which they are connected.

5.4 The possibility of galvanic corrosion shall be considered in the selection of materials (see [Annex D](#) for additional considerations).

5.5 The verified drawings shall include a complete bill of materials showing conformity with this subclause and any other material requirements listed in [Clause 6](#).

6 Other requirements

6.1 The maximum gas leakage rate shall be provided and expressed as the volume in standard air that may leak from the valve at 75 % of the nominal setting as determined by the manufacturer. See Annex I for suggested leakage rates.

6.2 Housings, elements, and seal gasket materials shall be capable of withstanding the maximum and minimum pressures and temperatures to which the device may be exposed under normal operating conditions.

6.3 Where welded construction is used for pressure retaining components, welded joint design details, welding and non-destructive testing shall be in accordance with National or International Standards. Welding procedures should be in accordance with the ISO 15607 series. Welders should be qualified according to the ISO 9606 series. Non-destructive testing should comply with ISO 5817.

Alternative equivalent National/International Standards may be used.

6.4 End-of-line pressure-vacuum valves shall be designed, such that condensed vapour and water in the pressure-retaining zone drain from the device into the tank and do not impair the efficiency of the device. The design shall also prevent the accumulation of water inside the device and subsequent blockage due to freezing. The design shall prevent pockets of water or product from accumulating.

6.5 All fasteners essential to the operation of the device shall be protected against loosening.

6.6 Devices shall be designed and constructed to minimize the effect of fouling under normal operating conditions.

6.7 Devices shall be capable of operating over the full range of ambient air temperatures anticipated. Devices shall be capable of operating in freezing conditions (such as may cause blockage by freezing cargo vapours or by icing in bad weather). Devices shall also be capable of operating at whatever surface temperature is developed by heating arrangements.

Where a valve is intended to be fitted in a ship that will be operated in climate conditions that might hamper its operation, e.g. seawater icing, the instruction manual should contain appropriate information to ensure continued operation.

6.8 End-of-line devices are required to direct the efflux vertically upward (see SOLAS 2009, Ch. II-2 Regulation 4, 5.3.4.1.1.2) and the minimum average velocity of air through a cross section of the valve's outlet to atmosphere shall not be less than 30 m/s for all flow rates.

6.9 A manual means (e.g. check-lift) shall be provided to verify that any valve disc and other moving elements lift freely and fully and cannot remain in the open position. The design shall be such that the device is verified not to be inoperable due to corrosion, residue build-up or icing, when the aforementioned manual means is used in combination with the manufacturer's requirements for visual inspection.

6.10 Valve discs and other moving parts shall be guided by a suitable means to prevent binding and ensure proper self-closing (seating), taking into account the possible build-up of condensed vapours passing through the valve during loading, when maintenance is carried out in accordance with the manufacturer's requirements.

Valve discs and other moving parts shall close against the valve seat by metal to metal contact. Where the valve closes against a metal seat and a resilient seal is added to reduce gas leakage, the valve's performance in terms of flow shall not be affected if the seal is destroyed, damaged or is otherwise carried away.

Valve discs may be solid or made hollow so that weight material may be added to vary the lifting pressure. If hollow discs are employed, a watertight bolted cover shall be fitted to encase the weight material. A clear indication, visible from the outside of the valve, shall be employed to indicate the position of the valve disc(s). The indicator shall be visible from below and from the side of the valve at deck level.

6.11 Valves may be actuated by non-metallic diaphragms except where failure would result in unrestricted flow of tank vapours to the atmosphere or in an increase in the pressure or vacuum at which the valve normally releases.

6.12 Relief pressure adjusting mechanisms shall be permanently secured by lockwire, locknuts, or other suitable means to prevent devices from becoming misadjusted due to handling, installation, or vibration.

6.13 The design shall be such that the device can be examined for any build-up of residue due to vapour condensation. For certain cargoes that solidify, heating arrangements may be necessary.

7 Type tests

7.1 Type tests shall be conducted by a laboratory acceptable to a third party inspection body. The laboratory should be qualified to conduct the tests provided for by this International Standard, and that the laboratory has (or has access to) the apparatus, facilities, personnel and calibrated instruments necessary for the tests. Alternatively, the tests provided for by this International Standard may be conducted by the manufacturer when the tests are witnessed by a third party inspection body who can certify that the tests are conducted in accordance with this International Standard.

7.2 One of each model device and each size shall be tested in accordance with [Clauses 7, 8 and 9](#). A change of material or coating system that negatively affects the corrosion resistance shall be considered a change of model for the purpose of this paragraph. A change of design or construction shall be considered a change of model for the purpose of this paragraph. Each size of each model should be submitted for type testing. Devices should have the same dimensions and most unfavourable clearances expected in the production model. If a device is modified during the test programme, or at a later date, such that the functions of the valve or its performance characteristics are affected, the third party inspection body shall be informed. An appropriate test related to the modified part may be required by the third party inspection body.

7.2.1 A corrosion test shall be conducted. In this test, a complete device shall be exposed to a 5 % sodium chloride solution spray at a temperature of 25 °C (77 °F) for a period of 240 h, and allowed to dry for 48 h. Following this exposure, all movable parts shall operate properly and there shall be no corrosion deposits that cannot be washed off.