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Ships and marine technology — Design and testing requirements of pneumatic quick-closing valves

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ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

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Foreword

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This document was prepared by Technical Committee ISO/TC 8, *Ships and marine technology*, Subcommittee SC 3, *Piping and machinery*.

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

Marine pneumatic quick-closing valves are extremely important for the prevention of fires caused by flammable liquids and the overall safety programme onboard ships. According to SOLAS Chapter II-2 Regulation 4,[16] in the event of a fire, the following must be fitted with a cock or valve directly on the tank, which can be closed from a safe position outside the space concerned:

a) oil fuel pipes, which, if damaged, would allow oil to escape from a storage;

b) settling or daily service tank having a capacity of 500 l and above, situated above the double bottom.

In older ships, the valve would normally be closed manually through a long mechanical connection from the valve to the position outside the machinery space. In modern ships, this valve is usually a pneumatic quick-closing valve (PQCV), which uses compressed air and spring tension to rapidly close off the fuel or oil flow in the event of a leak downstream of the tank. The PQCV is operated by a pneumatic quick-closing control devices, the specifications of which are defined by ISO 24225.

Proper operation of pneumatic quick-closing valves is one of the most important items to be checked during port state supervision ship inspections. If the quick-closing valve operation fails, the port state will likely require the problem to be corrected before the ship can proceed. This can result in detention of the ship, with adverse effects on the ship's schedule. Therefore, it is important to develop standards specifying the design and tests for pneumatic quick-closing valves to ensure quality and performance. In addition, since the PQCV is not used on an everyday basis, but is expected to perform as designed in an emergency, proper operation should be verified regularly and periodic maintenance completed.

Ships and marine technology — Design and testing requirements of pneumatic quick-closing valves

1 Scope

This document specifies requirements for the design and tests of pneumatic driven quick-closing valves, used in ship fuel and lubricating oil systems to stop the fluid flow in the event of a leak. This document is applicable to valves of nominal diameter (DN): 15, 20, 25, 32, 40, 50, 65, 80, 100, 125, 150, 200, 250, and 300, corresponding to nominal pipe sizes (NPS): 1/2, 3/4, 1, 1 1/4, 1 1/2, 2, 2 1/2, 3, 4, 5, 6, 8, 10, and 12.

NOTE This document is mainly intended for use by producers. Onboard ship inspection and maintenance after the delivery and installation of the valve can help ensure continued proper performance.

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 4987, *Steel and iron castings — Liquid penetrant testing*

ISO 5208, *Industrial valves — Pressure testing of metallic valves*

ISO 5752, *Metal valves for use in flanged pipe systems — Face-to-face and centre-to-face dimensions*

ISO 7005-1, *Pipe flanges — Part 1: Steel flanges for industrial and general service piping systems*

ISO 7005-3, *Metallic flanges — Part 3: Copper alloy and composite flanges*

ISO 17602, *Ships and marine technology — Metal valves for use in flanged pipe — Face-to-face and centre-to-face dimensions*

ASME B16.34-2020, *Valves — Flanged, Threaded, and Welding End*

3 Terms and definitions

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

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

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

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

3.1
pneumatic quick-closing valve
PQCV
pipe closing unit driven by compressed air for the emergency stoppage of the flow of flammable or combustible liquids such as fuel or lubricating oil

3.2
nominal size
DN
alphanumeric designation of size for components of a pipe-work system, used for reference purposes, comprising a dimensionless whole number indirectly related to the physical size, in millimetres, of the bore or outside diameter of the end connections

Note 1 to entry: The number following the letters DN does not represent a measurable value and shall not be used for calculation purposes, except where specified in the relevant standard.

Note 2 to entry: In standards which use the DN designation systems, any relationship between DN and component dimensions shall be given, e.g. DN/OD or DN/ID.

3.3
nominal pressure
PN
alphanumeric designation relating to the pressure rating of the valve, used for reference purposes

Note 1 to entry: It is intended that all equipment of the same *nominal size (DN)* (3.2) designated by the same PN number has the same mating dimensions appropriate to the type of end connections. The permissible working pressure depends upon materials, design and working temperature and shall be selected from the pressure/temperature rating in corresponding standards.

3.4
nominal pipe size
NPS
alphanumeric designation of size that is common for components used in a piping system, used for reference purposes, comprising the letters "NPS" followed by a dimensionless number having an indirect correspondence to the physical size of the bore or outside diameter of the component end connections

Note 1 to entry: The dimensionless number may be used as a size identifier without the prefix "NPS". The dimensionless number does not represent a measurable value and is not used for calculation purposes.

3.5
class
alphanumeric designation, used for reference purposes, related to a combination of mechanical and dimensional characteristics of a component of a pipe-work system, comprising the word "class" followed by a dimensionless whole number

3.6
design pressure
maximum pressure rating of the valve in normal operations which, together with the corresponding design temperature, is used as the basic design load condition of the valve and its value is not less than *working pressure* (3.7)

3.7
working pressure
pressure expected inside the valve under normal system operating conditions

3.8
maximum allowable working pressure
MAWP
maximum pressure on the valve at a given temperature, calculated according to the effective thickness and materials of each element of the valve, taking into account all the loads borne by the element

4 Pressure and temperature

4.1 The types of fluids for which the valve is used are shown in Table 1.

Table 1 — Typical valve fluids

Valve fluid	Temperature °C	Remarks
Fuel oil or lubricating oil	0 – 150	Flammable or combustible fluids

4.2 The valve and its cylinder shall be designed to operate without failure or leakage at the pressure ranges expected in service. The maximum allowable working pressure and design temperature are shown in Table 2. The maximum allowable working pressure (MAWP) shall be greater than the nominal pressure (PN) and the design pressure.

Table 2 — Maximum allowable working pressure

MAWP of valve MPa	Nominal diameter DN (NPS)[a]	Design temperature °C	Working pressure ranges of cylinder MPa
0,6 (Class 150)	15–300 (1/2 –12)	0 - 150	0,3 - 1,0
1,0 (Class 150)	15–300 (1/2 –12)		
1,6 (Class 150)	15–250 (1/2–10)		
NOTE The piping design conditions include working pressure and service temperature. [a] The parentheses correspond to the nominal pipe size (NPS) range.			

4.3 The manufacturer and purchasers may reach an agreement when the Class exceeds 150.

5 Structure and design

5.1 General

5.1.1 Structure

Pneumatic quick-closing valve (PQCVs) can be divided into two types: straight through valves and angle through valves. The end connection of the body is the flanged type. A cylinder is connected to the pneumatic quick-closing valve and serves to allow compressed air to close the PQCV in an emergency.

The PQCV can also be closed locally by a hand switch, which shall have a locking function to prevent accidental movements.

Generally, the PQCV is closed by applying its spring using pneumatic force to operate the piston and valve actuator. A handwheel is used to compress the spring to re-open the valve.

General examples of the structure of the valve are shown in Annex A. The PQCV should be metal-seated.

5.1.2 Materials

Throughout this document, materials are specified for the various parts of the valve. In lieu of the materials specified, other materials may be used provided they are manufactured by the same process as the materials specified, such as forging or casting.

In addition, the materials shall be suitable for the operating pressure of the valve and the metal materials shall have mechanical properties, including spring elastic impact resistance, and resistance to corrosion equal to or better than the material specified for the specific valve part.

5.2 Design and materials of the body

5.2.1 Design

The body should be casting or forged integrally and there should be no leakage under 1,5 times maximum working pressure of the hydraulic pressure.

5.2.2 Materials

Materials of the body should comply with relevant standards, including those relating to cast steel (see ISO 4990), forged steel, copper alloy and other materials (see ASME B16.34).

5.2.3 Manufacturing

The valve shall be manufactured in accordance with the following requirements, except when there are special orders specified by purchasers.

a) Face-to-face and end-to-end dimension of flange ends shall be in accordance with ISO 5752 or ISO 17602.

b) The minimum wall thickness shall be equal to or thicker than the values shown in ASME B16.34.

c) The flange end connection of the body shall be manufactured in accordance with ISO 7005-1 and ISO 7005-3.

NOTE The flange end connection can also be manufactured as per relevant international or national standards such as JIS B2220, JIS B2239 and JIS B2240.

5.3 Design and materials of the bonnet

5.3.1 Design

The bonnet shall meet the following requirements:

a) the minimum wall thickness shall conform to ASME B 16.34;

b) there shall be no leakage at the connection between the bonnet and body.

5.3.2 Materials

Materials should be consistent with the valve body.

5.4 Design and materials of the disc

5.4.1 Design

The disc shall meet the following requirements:

a) it shall withstand the maximum working pressure without deleterious deformation and damage;

b) the sealing of the valve shall be designed with metal-to-metal disc-to-seat interface.

5.4.2 Materials

The disc materials should comply with relevant standards, such as ISO 683-1 for steel, or other appropriate material standards for brass or bronze specified in ASME B16.34.