INTERNATIONAL STANDARD

ISO 5208

Third edition
2008-08-01

Industrial valves — Pressure testing of metallic valves

Robinetterie industrielle — Essais sous pression des appareils de robinetterie métalliques

Reference number
ISO 5208:2008(E)

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Published in Switzerland

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 5208 was prepared by Technical Committee ISO/TC 153, *Valves*, Subcommittee SC 1, *Design, manufacture, marking and testing*.

This third edition cancels and replaces the second edition (ISO 5208:1993) which has been technically revised.

Introduction

The purpose of this International Standard is the establishment of basic requirements and practices for pressure testing valves of various configurations that are used in general purpose, power generation, petroleum, and petrochemical or allied industry applications. The intent is to provide a consistent set of procedural requirements and acceptance criteria that can be considered in conjunction with valve specific standards appropriate for specific applications. Account has been taken of the valve testing requirement needs of EN 12266 and API 598 with requirements referenced for PN designated valves for the former and Class designated valves for the latter.

Industrial valves — Pressure testing of metallic valves

1 Scope

This International Standard specifies examinations and tests that a valve manufacturer needs to act upon in order to establish the integrity of the pressure boundary of an industrial metallic valve and to verify the degree of valve closure tightness and the structural adequacy of its closure mechanism. This International Standard is to be applied in conjunction with the specific requirements of a valve product standard to the extent cited by the product standard as a normative reference. Where requirements of a product standard differ from those given in this International Standard, the requirements of the product standard apply.

This International Standard does not cover safety aspects of pressure testing.

2 Terms and definitions

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

2.1
shell test
test at a pressure in excess of the **cold working pressure** (2.9) rating of a valve for the purpose of validating the soundness and strength of the valve pressure containing and retaining structures

NOTE These structures include valve-actuating mechanisms that have a direct connection to the valve internals subject to fluid test pressure within the valve proper.

2.2
closure test
pressure test for the purpose of validating leakage through a valve's closure mechanism

2.3
test pressure
internal pressure (gauge), expressed in bar [1] to which the valve under test is subjected

NOTE Unless otherwise noted, gauge pressure is used throughout this International Standard.

2.4
test fluid
pressurized liquid or gas used to test a valve

2.5
test fluid temperature
temperature of the test fluid, $\geqslant$ 5 °C and $\leqslant$ 40 °C

2.6
resilient seats
broad category of seating surface materials that make up a pliable seat sealing combination, including elastomeric, polymeric, solid and semi-solid grease seals, either used in combination or used in conjunction with a mating metallic or ceramic component

1) 1 bar = 10^5 Pa.

2.7
DN, NPS, A
alphanumeric designation of size that is common for components used in a piping system, used for reference purposes, comprising the letters DN or NPS followed by, or the letter A preceded by, a dimensionless number indirectly related to the physical size of the bore or outside diameter of the end connections

NOTE The number following DN or NPS or preceding A does not represent a measurable value and is not used for calculation purposes except where specified in a product standard.

2.8
PN or Class
alphanumeric designation for pressure-temperature rating that is common for components used in a piping system, used for reference purposes, comprising the letters “PN or Class” followed by a dimensionless number indirectly related to the pressure retaining capability as a function of temperature of the component

NOTE The number following “PN or Class” does not represent a measurable value and is not used for calculation purposes except where specified in a product standard. There is no definitive correlation that links PN designations to Class designations.

2.9
cold working pressure
CWP
maximum fluid pressure assigned to a valve for operation at a fluid temperature of −20 °C to 38 °C

NOTE Valve pressure-temperature ratings are specified in product standards by reference to PN or Class designations.

2.10
design differential pressure
limiting pressure difference across the upstream and downstream sides of the closure element seals when the valve is in the closed position

NOTE While the standard is for this to be equal to the CWP there may be circumstances that dictate a lesser pressure difference.

2.11
double block-and-bleed valve
valve with two separate closure seating surfaces that, when in the closed position, block flow from both ends where the cavity between the two seating surfaces is fitted with a bleed connection to which either temporary or permanent piping or piping components may be installed

3 Conditions relevant to pressure testing

3.1 Purchaser examination options

3.1.1 A purchaser may specify, in a valve procurement purchase order, examination and pressure testing requirements along with the opportunity to be witness to specific in-process examinations and tests as regards valves that are the subject of the purchase order. In this event, a representative of the purchaser shall be allowed access to those areas of the manufacturer's site that are involved with related examination and pressure testing of the purchase order valves.

3.1.2 When a purchaser specifies examinations or testing to be witnessed as described in 3.1.1, the valve manufacturer shall give notice to the purchaser at least five working days prior to the purchase order specified activity.

3.2 Witnessing

If pressure testing in the presence of a representative of the purchaser is specified for valves that are in stock, painted or coated valves from stock may be retested without removal of painting or coating.

3.3 Closure pressure testing options

A purchaser may specify, in a valve procurement purchase order, optional closure testing. See Table 1.

4 Requirements for pressure testing

4.1 Forewarning

A user of this International Standard needs to properly take into account the hazard involved with working with pressurized gases and liquids.

4.2 Location

Pressure tests shall take place either at the site of the valve manufacture or at a test facility under the supervision of the valve manufacturer.

4.3 Test equipment

4.3.1 The test equipment shall be of such a design, that it does not subject the valve to externally applied loads that may affect the results of the test. When end-clamping devices are used, the valve manufacturer shall be able to demonstrate that, during the valve closure test, they do not serve to reduce the resultant leakage. Valves designed for installation between flanges, e.g. wafer style check or butterfly valves, shall not have test equipment clamping forces applied that are so great as to bear upon the pressure test results.

4.3.2 When equipment such as volume loss detection devices are used, the manufacturer shall be capable of demonstrating equivalence of the system with the requirements of this International Standard.

4.4 Pressure measuring equipment

The equipment used for measuring test fluid pressure shall measure the fluid pressure with an accuracy of ± 5 % of the required test pressure.

4.5 Shell surfaces

Before the shell test, valves shall not be externally painted or otherwise coated with materials capable of sealing against leakage from external surfaces of the shell. However, valves with internal liners, internal linings or internal coatings that form a design feature of the valve may be tested with the liner, lining or coating in place. In the event a purchaser specifies a retest of the shell test of valves that have been painted, retesting may be without removal of external paint or coatings.

4.6 Test fluid

The test fluid to be used, as specified in the relevant tests detailed in this International Standard, shall be:

— water, that may contain a corrosion inhibitor, kerosene or other appropriate liquid having a viscosity not greater than that of water, or

— air or other suitable gas.

The temperature of the test fluid shall be between 5 °C and 40 °C. Pressure testing valves with shell components of austenitic stainless steel, using water as the test fluid, requires that the chloride content of the water shall not exceed 100×10^{-6} (100 ppm).

NOTE A purchaser may specify, in a valve procurement purchase order, that a wetting agent be added to water used as a test fluid.

4.7 Test pressure

Except for low-pressure closure testing, test pressures are related to the valve CWP which in turn is related to the shell material of the valve under test.

NOTE Piping systems in which valves are installed are subjected to pre-operational pressure testing. Therefore, valve standards, by and large, include requirements for CWP-related marking to be on an attached valve identification label or valve body.

4.8 Pressure tests

4.8.1 Compliance with this International Standard for pressure testing requires:

— satisfactory execution of the required tests listed in Table 1, taking into account the exceptions and clarifications of 4.8.3;

— satisfactory execution of the tests that may be required by the referencing valve product standard, which are listed as optional in Table 1;

— pressure testing is conducted following written procedures prepared by the valve manufacture, which are in accordance with this International Standard.

4.8.2 In the event that a purchaser specifies optional tests as shown in Table 1, the optional tests shall be performed in addition to Table 1 required tests.

4.8.3 The following clarifications and exceptions to Table 1 are applicable:

— for plug valves that rely on a sealing compound to effect a closure seal, a high-pressure closure test is required and the low-pressure test is an option;

— for valves having bellows stem sealing, a backseat test is not required;

— for valves specified as double block and bleed, a high-pressure closure test is required and the low-pressure test is an option.

4.8.4 For the purpose of identifying required tests, test duration times and calculating closure leakage rates, it is necessary to establish the equivalent DN number for those valves that have size designations other than DN. The equivalent DN numbers of valves having flanged ends, threaded ends, weld ends, capillary or compression ends shall be as given in Table A.1.

4.8.5 A shell test option using gas as a test fluid may be specified in a valve procurement purchase order. In this event precautions are vital to safe conduct of this test, see 4.1.

4.9 Closure test compliance

Valve types listed in Table 1, for which a high-pressure closure test is an option, are nevertheless required to be able to pass the test (as a test of the valve closure structure). Results of tests confirming the ability of the valve design to pass the high-pressure closure test shall be supplied when specified in a valve purchase order.

Table 1 — Prescribed pressure tests

Test	DN	PN or Class	Gate valve	Globe valve	Plug valve [a]	Check valve	Floating ball or diaphragm valve	Butterfly or trunnion mounted ball valve
Shell test Liquid test	All	All	Required	Required	Required	Required	Required	Required
Shell test Gas test	All	All	Optional	Optional	Optional	Optional	Optional	Optional
Backseat test [b, c] Liquid test	All	All	Optional	Optional	Not required	Not required	Not required	Not required
Closure test Gas Low-pressure	DN ⩽ 100	Class ⩽ 1 500 and PN ⩽ 250	Required	Optional	Required	Optional	Required	Required
		Class > 1 500 and PN > 250	Optional	Optional	Optional	Optional	Required	Optional
	DN > 100	Class ⩽ 600 and PN ⩽ 100	Required	Optional	Optional	Optional	Required	Required
		Class > 600 and PN > 100	Optional	Optional	Optional	Optional	Required	Optional
Closure test Liquid High-pressure	DN ⩽ 100	Class ⩽ 1 500 and PN ⩽ 250	Optional	Required	Optional	Required	Optional	Optional
		Class > 1 500 and PN > 250	Required	Required	Required	Required	Optional	Required
	DN > 100	Class ⩽ 600 and PN ⩽ 100	Optional	Required	Optional	Required	Optional	Optional
		Class > 600 and PN > 100	Required	Required	Required	Required	Optional	Required

NOTE 1 Successful completion of an optional test does not relieve the manufacturer from also successfully completing the required test.

NOTE 2 In the case of resilient seated valves, a high-pressure closure test may degrade subsequent closure sealing performance in low-pressure applications.

[a] Plug valves that rely on a sealing compound to effect a closure seal may be closure tested with the compound installed.

[b] Successful completion of a backseat test should not be interpreted as a recommendation by the valve manufacturer that, while an installed valve is pressurized, the stem seal may be altered, repaired or replaced when backseated.

[c] In the case of bellows stem sealed valves, a backseat test is not required.