DRAFT INTERNATIONAL STANDARD

ISO/DIS 28921-2

ISO/TC **153**/SC **1**

Secretariat: **AFNOR**

Voting begins on:
2014-06-17

Voting terminates on:
2014-09-17

Industrial valves — Isolating valves for low-temperature applications —

Part 2:
Type testing

Robinetterie industrielle — Robinets d'isolement pour application à basses températures —

Partie 2: Essais de type

ICS: 23.060.01

Reference number
ISO/DIS 28921-2:2014(E)

Contents

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 28921-2 was prepared by Technical Committee ISO/TC 153, Valves, Subcommittee SC 1, Design, manufacture, marking and testing.

ISO 28921 consists of the following parts, under the general title *Industrial valves — Isolating valves for low-temperature applications*:

— *Part 1: Design, manufacturing and production testing*

— *Part 2: Type testing*

Industrial valves — Isolating valves for low-temperature applications — Part 2: Type testing

1 Scope

This International Standard specifies requirements for the type testing of isolating valves for low-temperature applications to verify the performance of valves at a low temperature from – 50 °C down to – 196 °C.

Concerning the coverage as far as the DN or NPS and PN or Class refer to ISO 28921-1.

This International Standard does not evaluate valve actuators unless they are integral part of the valve. Valves during testing may be operated manually or an actuator may be utilized during the testing. The effect of cold gas vapours during testing is taken into consideration in particular if the actuator is mounted directly over the test stand with the cold gases engulfing the actuator.

This International Standard does not apply to valves for cryogenic services, designed in accordance with ISO 21011, used with cryogenic vessels.

2 Normative references

The following referenced 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 5208, *Industrial valves — Pressure testing of metallic valves*

ISO 28921-1, *Industrial valves — Isolating valves for low-temperature applications — Part 1: Design, manufacturing and production testing*

ASME B31.3, *Process Piping*

EN 13480-2, *Metallic industrial piping — Part 2: Materials*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 28921-1 and the following apply.

3.1
symmetric seated valve
valve with an internal construction which has a plane of symmetry perpendicular to the axis of the body ends

Note to entry: This is a valve where both seat sealing elements are identical.

3.2
asymmetric seated valve
valve with an internal construction which has no plane of symmetry perpendicular to the axis of the body ends

Note 1 to entry: This is a valve with a single seat offset from the shaft centreline.

3.3
design family
all valves of the same type (e.g. gate, globe, ball valves etc) for which the basic design as far the outside pressure retaining envelope is concerned in particular the body construction, e.g. one piece, two piece or three piece body, bonnet extension, is the same design for all sizes of the valve range, same stem movement, such as e.g. raising and not rotating etc

Note 1 to entry: The criteria to consider if valves are of the same design family is, if all valves of a design family can be depicted on one, dimensionless cross-sectional drawing with all the external dimensions added in a table on the same drawing, than all those valves on that drawing are to be considered of the same design family.

4 Test conditions

4.1 Valve selection

Inspection and testing under this International Standard shall be carried out on a randomly selected production valve of a design family and of a particular material of construction. Size selection shall be at mid-range of the design range, the valve PN or Class shall be selected so that it qualifies all valves of the same PN or Class and all valves of the lower PN or Class as long as the valves are of an identical design. Valves of the same design family and the same materials of construction tested at lower temperature qualify valves for applications at higher temperatures.

NOTE The mid-range valve size selected for testing vary with the size range available from the valve manufacturer or the range of valves specified in the purchase order. For example if the valve offering of a particular valve design is DN 50, DN 65, DN 80, DN 100, DN 150 and DN 200 or NPS 2, NPS 2 ½, NPS 3, NPS 4, NPS 6 and NPS 8, the mid-range valve selected for testing is DN 80 or DN 100, for NPS valves it is NPS 3 or NPS 4. One or the other size from the two is acceptable.

4.2 Testing criteria and selection of valve design

4.2.1 General

The test valve submitted for this type test shall be subjected to 210 operational cycles.

4.2.2 Representative valve design selection

Valve selected for this type testing shall be representative for each design family of the valve type (e.g. gate, globe, ball valve etc.) and closure member (e.g. single seated, double seated, unidirectional, bi-directional etc.). The test valve shall be of the same design as the other valves covered by this type test as far as the body and bonnet configuration is concerned (e.g. one piece or multiple piece body construction, integral or bolted on bonnet and the same gaskets types between those valve parts).

4.2.3 Selection and qualification of sealing elements

The pressure retaining seals and packing in the test valve shall be of the same design and materials of construction as all other valves covered by extension by this type test.

4.3 Requirements for test valve, direction for installation and conditions

4.3.1 Valves designed as symmetric or asymmetric seated valves, intended for the installation in both directions shall be tested in both directions.

4.3.2 Valves designed for unidirectional sealing shall be marked outside the valve body accordingly and shall be tested in one direction only.

4.4 Preparation for low temperature test

4.4.1 General

Valves submitted for low temperature testing shall be inside clean and free of all lubricants, sealants and oils unless otherwise agreed upon between the user and the valve manufacturer.

4.4.2 Valve tests

Shell and seat testing shall be in accordance with ISO 5208. The shell test pressure shall be 1,1 x CWP if tested with gas and 1,5 x CWP if tested with alcohol or water. The seat closure test pressure shall be at (6 ± 1) bar[1]. After each test is complete, the valve shall be thoroughly dried.

4.4.3 Test equipment

4.4.3.1 The cooling medium shall be contained in an insulated stainless steel tank that is open on the top. Each test valve shall be blinded with blind flanges that are equipped with support brackets as necessary and small bore austenitic stainless steel tubing connected to the pressurizing media.

4.4.3.2 Thermocouples shall be attached to the valve body, bonnet and end flange, except that the number of thermocouples may be reduced where the size of the test valve makes the use of multiple thermocouples impracticable. However, in all cases, a minimum of one thermocouple, located in the valve bonnet area and one inside the valve are required. A minimum of one thermocouple shall be provided to monitor the temperature of the cooling medium.

5 Low temperature testing requirements

5.1 Safety provisions

Low temperature testing is potentially dangerous and test personal shall be aware of this danger and shall receive appropriate training.

All necessary safety measures shall be taken to protect people performing the low temperature testing as well as other personal attending those tests. It is highly recommended to have the test area shielded up by appropriate barriers or to perform the testing in an underground test area with a video camera for the purpose of a visual observation of the test.

5.2 Cooling of the valve

The tested valve shall be installed into the cooling tank and it shall be oriented such that the stem position is vertical. Check valves may be oriented in either the vertical or horizontal disc position.

Cooling begins as the valve is lowered into the test tank and submerged into the cooling medium. Alternatively, if the cooling medium is gas, the cooling begins with the introduction of the gas into the cooling tank.

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[1] 1 bar = 0,1 MPa = 105 Pa; 1 MPa = 1 N/mm2 (bar is a unit deprecated by ISO).

The valve temperature, as well as the cooling medium temperature and level (if the cooling medium is liquid) shall be continuously monitored and recorded. The test shall begin when the valve temperature is stabilized within the specified test temperature tolerances. See Table 1.

Table 1 — Test temperature

Cooling medium	Test valve temperature
Dry ice, mixed with a heat transfer fluid or cooled by nitrogen	Low temperature at – 50 °C
Nitrogen gas or other medium by agreement between the purchaser and manufacturer	Low temperature of between – 50 °C and – 196 °C
Liquid nitrogen	Low temperature at – 196 °C
NOTE Valves with a minimum design temperature of between – 50 °C and – 196 °C may be tested at – 196 °C by agreement between the purchaser and manufacturer, provided the valve materials are suitable.	

5.3 Test gas

Test gas, see Table 2, from a charged bottle is used to provide test pressure on the inlet side of the valve.

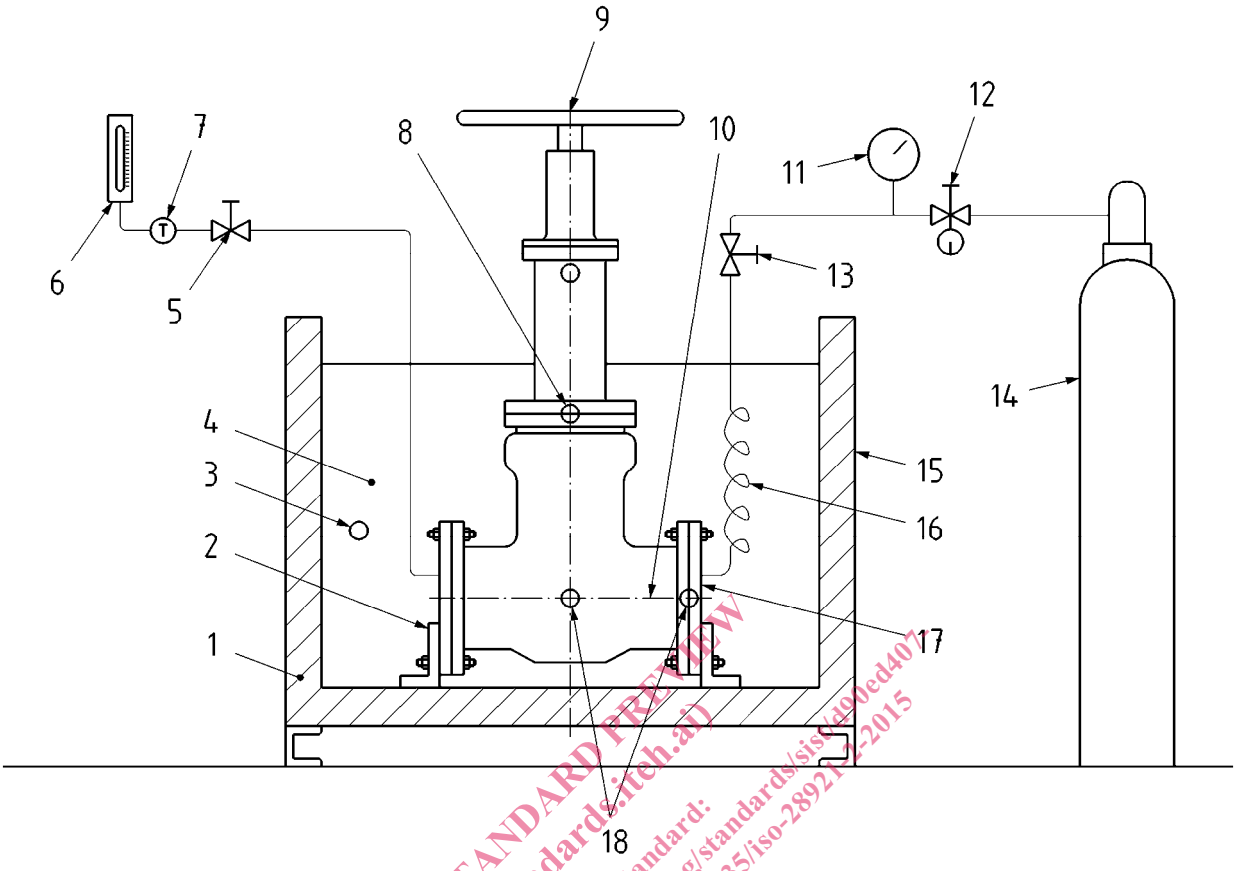
Table 2 — Test gas

Test gas	Test valve temperature
Nitrogen mixed with 10 % helium	Low temperature at – 110 °C and higher
Minimum 97 % pure helium	Any temperature down to – 196 °C

5.4 Equipment

5.4.1 General

A simplified schematic arrangement for immersion cold testing is shown in Figure 1. Its purpose is to facilitate understanding of the standard test. It is not a required arrangement.



Key

1	insulation	10	thermocouple inside valve
2	support bracket	11	pressure gauge
3	cooling medium thermocouple	12	pressure regulator
4	cooling medium	13	isolation valve upstream
5	isolation valve downstream	14	test gas bottle
6	flowmeter	15	tank
7	thermocouple (helium exit temperature)	16	pre-cooling coil
8	thermocouple on body/bonnet flange	17	blind flange
9	test valve	18	optional thermocouple on body and, optionally, on blind flange

Figure 1 — Test set-up

Before commencing the low temperature test, all connections to and from the tested valve shall be verified for tightness. A gas test shall be performed at the maximum valve cold working pressure or maximum seat test pressure, whichever is lower. For external leakage detection, a soap solution or helium leak detector shall be used. Any detected leakage shall be eliminated.

The tubing or piping between the test gas bottle and the tested valve as well as the tubing or piping downstream the test valve, shall be selected so the pressure loss of the flowing test gas is minimized.

5.4.2 Test equipment

5.4.2.1 Pressure gauges

Pressure gauges shall have indicating range between 1/3 and 2/3 of the maximum gas test pressure. Accuracy of the gauges shall be within 3 % of the total gauge scale.

5.4.2.2 Cooling tank

Cooling tank shall be adequately sized to accommodate the test valve, there shall be a minimum space of 100 mm between the test valve and the inside walls of the cooling tank. If the cooling media is liquid, there shall be enough space to completely submerge the test valve including part of the extended bonnet so the liquid level is minimum 25 mm above the bonnet to valve bolting.

5.4.2.3 Flowmeter

Test valve seat leakage shall be measured at the flowmeter, and shall be at standard atmospheric conditions.

Any type of flowmeter may be used, provided it can be calibrated, for example measuring cylinder, gas flowmeter soap film type or flow rotameter.

Some flowmeters (e.g. electronic mass flowmeters) are not affected by pressure or temperature changes. When such a flowmeter is used, test gas pressure and temperature measurements (as well as correction) at the flowmeter is not required.

5.4.2.4 Pressure regulator

The pressure regulator controls the pressure and the flow of test gas flowing to the test valve.

5.4.3 Instruments calibration

All instruments (flowmeter, pressure gauges, torque wrench, etc.) shall be calibrated. Calibration shall remain valid for a maximum duration of six months after the date of test.

6 Information to be supplied by the purchaser

See Annex B.

