INTERNATIONAL STANDARD

ISO 9635-4

Second edition
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Agricultural irrigation equipment — Irrigation valves —

Part 4: Air valves

Matériel agricole d'irrigation — Vannes d'irrigation —
Partie 4: Vannes de purge d'air

Reference number
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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 (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 (www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

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 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 18, *Irrigation and drainage equipment and systems*.

This second edition cancels and replaces the first edition (ISO 9635-4:2006) which has been technically revised.

ISO 9635 consists of the following parts, under the general title *Agricultural irrigation equipment — Irrigation valves*:

— *Part 1: General requirements*

— *Part 2: Isolating valves*

— *Part 3: Check valves*

— *Part 4: Air valves*

— *Part 5: Control valves*

Agricultural irrigation equipment — Irrigation valves —

Part 4:
Air valves

1 Scope

This part of ISO 9635 specifies construction and performance requirements and test methods for air valves, intended for operation in irrigation systems with water at temperatures not exceeding 60 °C, which can contain fertilizers and other chemicals of the types and concentrations used in agriculture.

It is applicable to hydraulically operated air irrigation valves of DN 15 diameter or greater, designed to be directly operated, i.e. the force is applied to the obturator by the float, either directly or via a mechanical linkage. The valves can be operated by a force applied through an adjustable pilot valve.

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.

ISO 9635-1:2014, *Agricultural irrigation equipment — Irrigation valves — Part 1: General requirements*

ISO 9635-2:2014, *Agricultural irrigation equipment — Irrigation valves — Part 2: Isolating valves*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9635-1:2014 and the following apply.

3.1
air valve
float-type purger
self-operating float-type valve for the evacuation of air from, or the ingress of air into water pipelines

Note 1 to entry: Such valves can be single-float or double-float and can fulfill one or more or the following functions: air release, air intake.

3.2
air release function
discharge of air from a water pipeline or appliance

3.3
air intake function
vacuum relief function
admittance of air to a water pipeline or appliance

3.4
air venting function
continuous acting air vent function
purging of entrapped air from a water pipeline in service under pressure

4 Design requirements

Air valves shall be designed in accordance with ISO 9635-1:2014, Clause 4. In addition, these valves may be fitted with an integrated isolating device which shall be in accordance with ISO 9635-2:2014.

5 Performance requirements

5.1 General

Perform all tests on the valve as delivered to the test facility.

5.2 Mechanical strength

5.2.1 Resistance of shell and all pressure-containing components to internal pressure

Carry out testing in accordance with ISO 9635-1:2014, 5.2.1. For double-float valves, the obturators may be tested simultaneously or separately.

Test results shall comply with the requirements of ISO 9635-1:2014, 5.2.1.

5.2.2 Resistance of obturator to differential pressure

Tested within 5.2.1.

5.2.3 Resistance of valves to bending

Not applicable. However, testing of bending resistance may be an optional requirement for air valves, if bending resistance is specified by the customer.

5.2.4 Resistance of valves to operating loads

Not applicable, except for any integrated isolating device, which shall be in accordance with ISO 9635-2:2014, 5.2.4.

5.3 Watertightness

5.3.1 Watertightness of shell and all pressure-containing components

5.3.1.1 Internal pressure

The requirement of watertightness to internal pressure is fulfilled by compliance with 5.2.1.

5.3.1.2 External pressure

Not applicable, except for any integrated isolating device, which shall be in accordance with ISO 9635-2:2014, 5.3.1.2.

5.3.2 Seat tightness

5.3.2.1 Seat tightness at high pressure

Carry out testing in accordance with ISO 9635-1:2014, 5.3.2.1, using water as the test fluid. The leakage rate shall be rate A. For a type test, continue the test for at least 10 min. For double-float valves, the obturators may be tested simultaneously or separately.

Test results shall comply with the requirements of ISO 9635-1:2014, 5.3.2.1.

5.3.2.2 Seat tightness at low pressure

Carry out testing in accordance with ISO 9635-1:2014, 5.3.2.2, using water as the test fluid. The leakage rate shall be rate A. For a type test, continue the test for at least 10 min. For double-float valves, the obturators may be tested simultaneously or separately.

Test results shall comply with the requirements of ISO 9635-1:2014, 5.3.2.2.

5.3.3 Maximum operating torque (MOT) for operation and tightness

Not applicable, except for air valves with an integrated isolating device which shall be in accordance with ISO 9635-2:2014, 5.3.3.

5.4 Airflow characteristics

Test results shall comply with the requirements of ISO 9635-1:2014, 5.4.

The characteristics given by the manufacturer in the form of a graph or table shall be the airflow as a function of inlet pressure. When this is measured according to the conditions defined hereafter in the relevant subclauses of this part of ISO 9635, the flow shall be not less than 90 % of the value indicated by the manufacturer at a minimum of three points on the curve, these points being indicative of the range and functions of the valve.

Show the performance data at standard conditions of temperature and barometric pressure.

5.4.1 Air release function

Conduct the type test as set out in Annex A. Compare the results with the values given in the manufacturer's catalogue and the difference shall be no greater than ±10 %.

5.4.2 Air intake function

Conduct the type test as set out in Annex B. Compare the results with the values given in the manufacturer's catalogue and the difference shall be no greater than ±10 %.

5.4.3 Air venting function

Verify the air venting function by measuring the section of the small orifice of the valve, calculating the flow through it at sonic conditions and comparing the result with the value given in the manufacturer's catalogue. The difference shall be no greater than ±10 %.

To calculate the flow, use the M51 AWWA formula, changing the units from US units to SI units.

For sonic flow, the most usual, it is possible to use Formula (1):

$$Q = 0{,}686 \times C \times A \times P / \left[\rho \times \left(R \times T \right)^2 \right] \quad (1)$$

where

Q is the flow in Nm^3/s (normal conditions);

C is the discharge coefficient;

A is the area of orifice;

P is the absolute pressure in the pipe (Pa);

ρ is the air density in normal conditions (kg/Nm^3);

R is the air constant (287,05 $m^2/s^2/°K$);

T is the temperature in the pipe (°K).

Measure the actual air venting capability in a manner similar to the air release function (see 5.4.1). Compare the results with the values given in the manufacturer's catalogue and the difference shall be no greater than ±10 %.

We should consider the influence of the air relative humidity (RH) which is a critical factor when measuring the maximum allowable pressure in the pipe to prevent the float closing without water, i.e. a higher RH will cause an earlier closure.

5.5 Resistance to chemicals and fertilizers

Conduct testing in accordance with ISO 9635-1:2014, 5.5.

Test results shall comply with the requirements of ISO 9635-1:2014, 5.5.

5.6 Endurance

5.6.1 Endurance of valves with air intake and/or air release functions

Evaluate the endurance of a valve with air intake and/or air release functions by subjecting the valve to 250 consecutive cycles of filling and draining in accordance with Annex C, with the pressure varying from atmospheric to the allowable operating pressure. The valve shall open and close fully during the test and shall pass the watertightness tests as set out in a 5.3.1 and 5.3.2 after the 250 cycles.

5.6.2 Endurance of valves with air venting function

Evaluate the endurance of a valve with air venting function by subjecting the valve to 2 500 consecutive cycles of air venting. This may be achieved by continuous injection of air into the system, allowing the valve to cycle automatically, or by cyclic injection of air, depending on the type of valve. The valve shall open and close fully at each cycle of the test and shall pass the watertightness tests as set out in 5.3.1 and 5.3.2 after the 2 500 cycles.

Perform the test at a pressure equal to the allowable operating pressure.

5.6.3 Long-term unseating test

This is an accelerated test to ensure that the obturator will release after being under pressure for a long duration.

Carry out the test on a valve, mounted vertically, at a temperature of 50 °C (+5 °C), kept under 1,2 × the hydraulic maximum allowable operating pressure +20 % to 0 % for five days.

Following this, release the pressure and check that the valve opens normally.

The valve shall then pass the watertightness tests as set out in 5.3.1 and 5.3.2.

Test valves with several functions (air release, air intake, and air venting) without isolating the parts ensuring the compliance of the different functions.

6 Conformity assessment

6.1 General

Test results shall comply with the requirements of ISO 9635-2:2014, 6.1.

6.2 Type tests

Test results shall comply with the requirements of ISO 9635-2:2014, 6.2. Perform the type tests as set out in Table 1.

6.3 Control of production process and quality system

Test results shall comply with the requirements of ISO 9635-2:2014, 6.3.

NOTE The production control tests given in Table 1 are for information only.

Table 1 — Requirements and testing

Subclause of ISO 9635-1:2014	Corresponding requirement	Type tests[a]	Production tests (informative)
4.1	Materials	See drawings and part lists	—
4.2	DN	See drawings	—
4.3	Pressures	See technical documentation	—
4.4	Temperatures	See materials	—
4.5	Design of shell and float	See test report or calculation report	—
4.6	End types and interchangeability	See drawings and marking	—
4.7	Operating direction	See drawings	—
4.8	Maximum air velocity	See Clause 4	—
4.10	Internal corrosion and ageing resistance	See drawings, part lists and technical documentation	Visual inspection of coatings
4.11	External corrosion and ageing resistance	See drawings, part lists and technical documentation	Visual inspection of coatings
5.2.1	Resistance of shell and all pressure-containing components to internal pressure	See 5.2.1	See 5.2.1
5.2.2	Resistance of float to differential pressure	See 5.2.2	—

[a] References to subclauses in this column are to this part of ISO 9635.

Table 1 *(continued)*

Subclause of ISO 9635-1:2014	Corresponding requirement	Type tests[a]	Production tests (informative)
5.2.4	Resistance of valves to operating loads	See 5.2.4	—
5.3.1.1	Leak-tightness to internal pressure	See 5.3.1.1	See 5.3.1.1
5.3.1.2	Leak-tightness to external pressure	See 5.3.1.2	—
5.3.2	Seat tightness	See 5.3.2	See 5.3.2
5.3.3	Maximum operating torque (MOT) for operation and leak-tightness	See 5.3.2 and 5.3.3	See 5.3.3
5.4.1	Air release function	See 5.4.1	—
5.4.2	Air intake function	See 5.4.2	—
5.5	Resistance to chemicals and fertilizers	See 5.5	—
5.6	Endurance	5.6	—

[a] References to subclauses in this column are to this part of ISO 9635.

7 Marking

Requirements shall be in accordance with ISO 9635-1:2014, Clause 7.

8 Packaging

Requirements shall be in accordance with ISO 9635-1:2014, Clause 8.

Annex A
(normative)

Test method for airflow characteristics of valves with air release function

A.1 General

See 5.4 and 5.4.1.

Use air as the test fluid. Ensure that air pressure testing complies with all related safety regulations. Take additional safety measures when necessary.

Carry out the test on a valve mounted vertically. Begin the test with the valve and the air at ambient temperature.

At the point where the air flow is measured, ensure that the air temperature remains between 5 °C and 45 °C throughout the test.

Test valves with several functions (air release, air intake, and air venting) without isolating the parts ensuring the compliance of the different functions.

A.2 Test installation

Figure A.1 is given as an example.

A.3 Test procedure

The test procedure is the following.

a) Open the isolating valve to reach the flow of the first point of measurement. Ensure that the flow is within the range of ±4 % for the test duration.

   The minimum recommended test duration is 30 s.

   Ensure that the pressure is within the range of ±5 % for the test duration.

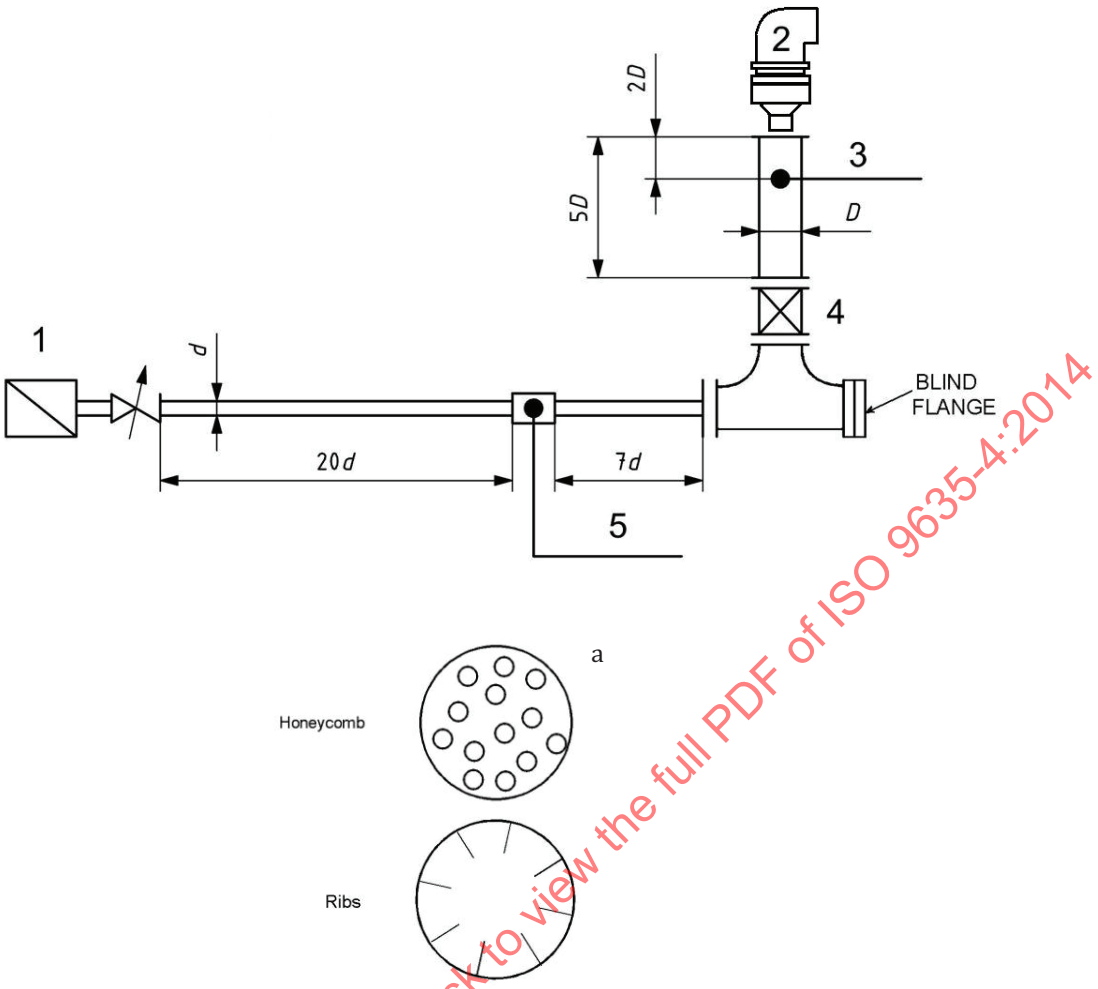
   Ensure that the temperature is within the range of ±2 °C for the test duration.

b) Calculate the average flow, expressed in cubic metres per hour (m^3/h) (at standard temperature and pressure).

c) Record the test conditions and test results (average pressure, average temperature, average flow).

d) Repeat the procedure by opening the isolating valve to reach the flow of the second and third measurement points.

   The three points of measurement shall be at 25 %, 50 %, and 75 % as declared on the graph in the manufacturer's catalogue.



Key

d nominal pipe diameter
D nominal riser and valve diameter
1 compressed air pressure source
2 air valve under test
3 pressure and temperature measurement devices
4 flow stabilizer
5 flow meter
a Cross-sections of typical flow stabilizers.

Figure A.1 — Test installation example

Annex B
(normative)

Test method for airflow characteristics of valves with air intake function

B.1 General

See 5.4 and 5.4.2.

Use air for the test fluid. Ensure that air pressure testing complies with all related safety regulations. Take additional safety measures when necessary.

Carry out the test on a valve mounted vertically. Begin the test with the valve and the air at ambient temperature.

At the point where the air flow is measured, ensure that the air temperature remains between 5 °C and 45 °C throughout the test.

Test valves with several functions (air release, air intake, and air venting) without isolating the parts ensuring the compliance of the different functions.

B.2 Test installation

Ensure that the test installation is capable of creating airflow in the air intake direction, either by negative pressure below the valve or by positive pressure around or into the valve. Figures B.1, B.2, and B.3 show examples.

Ensure that the test installation is equipped with devices allowing the measurement of air flow, pressure, and temperature.

B.3 Test procedure

The test procedure is the following.

a) Open the isolating valve to reach the flow of the first point of measurement.

   Ensure that the value of the flow is within the range of ±4 % for the test duration.

   Ensure that the value of the pressure is within the range of ±5 % for the test duration.

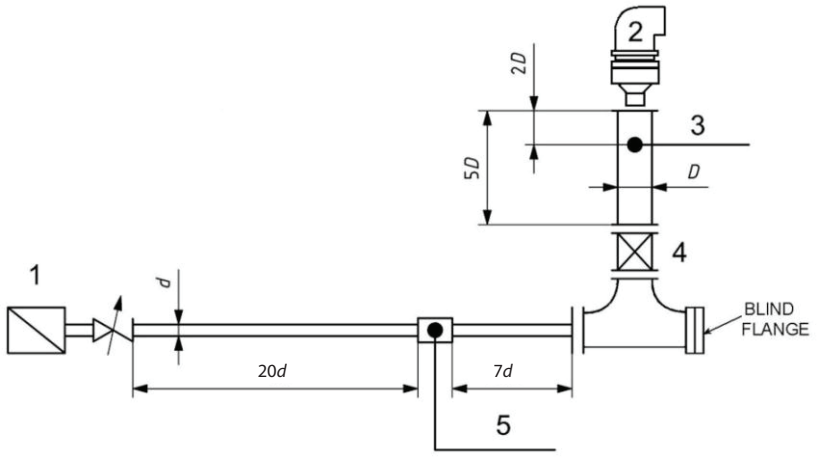
   Ensure that the value of the temperature is within the range of ±2 °C for the test duration.

b) Calculate the average flow, expressed in cubic metres per hour (m^3/h) (at standard temperature and pressure), converting it to normal outside atmospheric conditions.

c) Record the test method, e.g. ISO 9635-2 Figure B.1, test conditions and test results (average pressure, average temperature, average flow).

d) Repeat the procedure by opening the isolating valve to reach the flow of the second and third points of measurement.

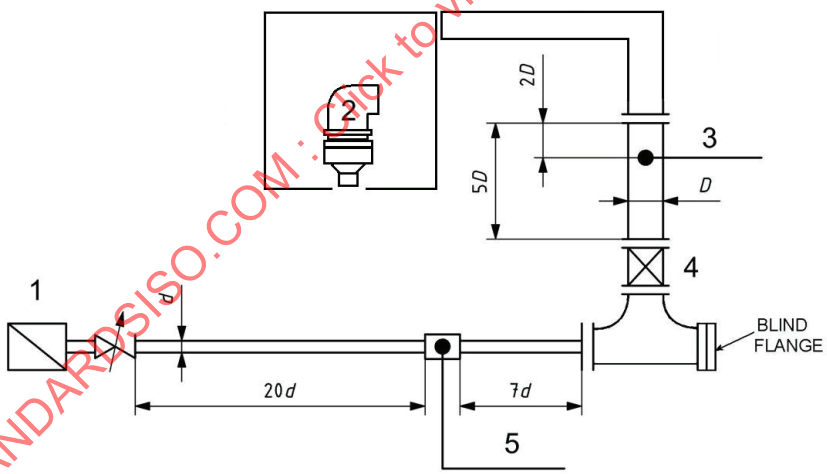
e) The three points of measurement shall be at 25 %, 50 %, and 75 % as declared on the graph in the manufacturer's catalogue.



Key

d nominal pipe diameter
D nominal riser and valve diameter
1 vacuum pump
2 air valve under test
3 pressure and temperature measurement devices
4 flow stabilizer
5 flow meter

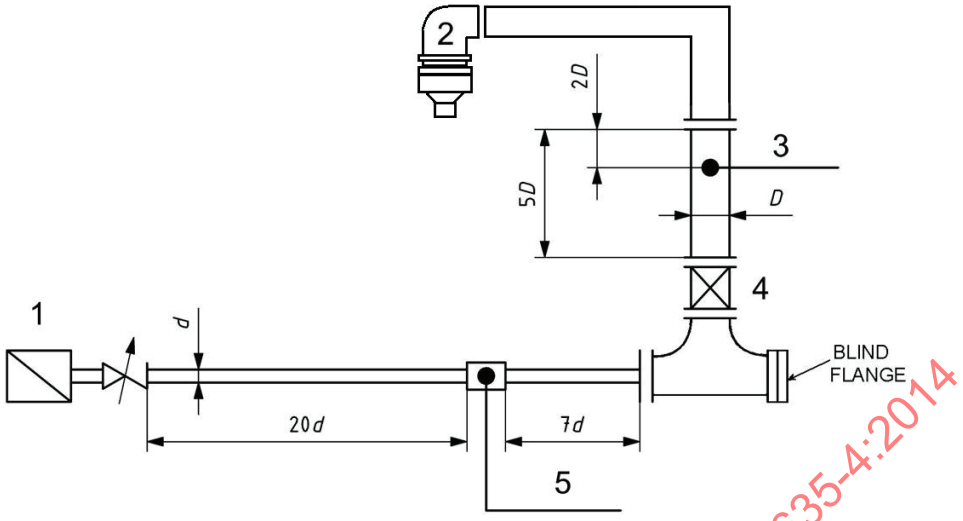
Figure B.1 — Air intake test (Example 1)



Key

d nominal pipe diameter
D nominal riser and valve diameter
1 compressed air pressure source
2 air valve under test
3 pressure and temperature measurement devices
4 flow stabilizer
5 flow meter

Figure B.2 — Air intake test (Example 2)



Key

d nominal pipe diameter
D nominal riser and valve diameter
1 compressed air pressure source
2 air valve under test
3 pressure and temperature measurement devices
4 flow stabilizer
5 flow meter

Figure B.3 — Air intake test (Example 3)

Annex C
(normative)

Test method for endurance of valves with air intake and/or air release functions

C.1 General

See 5.6.

Use water for the test medium. Ensure that air pressure testing complies with the related safety regulations.

Carry out the test on a valve at ambient temperature, mounted vertically.

Test valves with several functions (air release, air intake, and air venting) without isolating the parts ensuring the compliance of the different functions. Figure C.1 shows installation example.

C.2 Test procedure

The test procedure is the following.

a) Fill the test installation with water up to the lowest point of the valve to be tested.

b) Begin the first test cycle by filling the valve with water and purging the air over a period of between 5 s and 10 s.

c) Increase the water pressure inside the valve to a value between AOP and AOP +10 % and maintain it for at least 2 min.

d) Release the pressure to allow the full displacement of the float. Air will enter the valve through the orifice in the case of a valve with an air intake function. Repeat the same procedure for 250 cycles.

e) Proceed to the watertightness tests in accordance with 5.3.1 and 5.3.2.

f) Record the test conditions and test results.