INTERNATIONAL STANDARD

ISO 9635-2

Second edition
2014-11-15

Agricultural irrigation equipment — Irrigation valves —

Part 2: Isolating valves

Matériel agricole d'irrigation — Vannes d'irrigation —
Partie 2: Vannes d'isolation

Reference number
ISO 9635-2:2014(E)

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Published in Switzerland

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Foreword

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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).

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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 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 9635-2:2006), 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 2: Isolating valves

1 Scope

This part of ISO 9635 specifies construction and performance requirements and test methods for isolating 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 isolating irrigation valves of DN 8 in diameter or greater, designed to operate in the fully open and fully closed positions, but which can also operate for extended time periods in any intermediate position.

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 9644, *Agricultural irrigation equipment — Pressure losses in irrigation valves — Test method*

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
clear way valve
valve designed to have an unobstructed flow path which allows the passage of a theoretical sphere with a diameter which is not less than the inside diameter of the body end port

[SOURCE: EN 736-3]

3.2
flow coefficient
K_V
proportionality factor equal to the flow rate, in cubic metres per hour, of water at a temperature between 5 °C to 50 °C, passing through the valve and causing a loss of static head of 1 bar

Note 1 to entry: $Q = K_V \sqrt{\Delta p}$, where Q is the flow rate in cubic metres per hour (m^3/h), and Δp is the pressure drop across the valve, in bar or kilopond/kilogram-force per square centimetre (kp/cm^2, kgf/cm^2).

Note 2 to entry: 1 bar = 0,1 MPa = 105 Pa; 1 MPa = 1 N/mm^2.

Note 3 to entry: Adapted from EN 736-3.

3.3
full bore valve
valve with a seat diameter of not less than 90 % of the internal diameter of the body end port

[SOURCE: EN 736-3]

3.4
isolating valve
valve intended for use only in the fully closed or fully open position

[SOURCE: EN 736-1]

4 Design requirements

Isolating valves shall be designed in accordance with the requirements given in Clause 4 of ISO 9635-1:2014.

5 Performance requirements

5.1 General

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

5.2 Mechanical strength

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

Carry out testing in accordance with ISO 9635-1:2014, 5.2.1. Test results shall comply with the requirements of ISO 9635-1:2014, 5.2.1.

5.2.2 Resistance of obturator to differential pressure

Carry out testing in accordance with ISO 9635-1:2014, 5.2.2. Test results shall comply with the requirements of ISO 9635-1:2014, 5.2.2.

Except for valves to be used for a single flow direction, perform the test successively in each flow direction.

5.2.3 Resistance of valve to bending

Carry out testing in accordance with ISO 9635-1:2014, 5.2.3, applying a bending moment, *M,* during the test appropriate to the DN value of the valve in accordance with Table 1. Test results shall comply with the requirements of ISO 9635-1:2014, 5.2.3.

Table 1 — Bending moments

DN	Bending moment *M* N · m
8	610
10	615
20	640
25	670
NOTE For plastic-bodied valves, the applied bending moment should be equal to the bending moment exerted by a 6 m long plastic tube of the same diameter (DN).	

Table 1 *(continued)*

DN	Bending moment *M* N · m
32	730
40	825
50	1 050
65	1 400
80	1 500
100	2 200
125	3 200
150	4 800
200	7 200
250	11 000
300	15 000
350	19 000
400	24 000
450	28 000
500	33 000
NOTE For plastic-bodied valves, the applied bending moment should be equal to the bending moment exerted by a 6 m long plastic tube of the same diameter (DN).	

5.2.4 Resistance of valves to operating loads

Test results shall comply with the requirements of ISO 9635-1:2014, 5.2.4.

In order to verify this requirement, test the valve in accordance with Annex A, with the application of a closing torque and an opening torque equal to the minimum strength torque (mST), following which it shall satisfy the requirements of the operating tests in accordance with 5.3.3, and the seat tightness tests in accordance with 5.3.2.1 and 5.3.2.2.

The minimum strength torque shall be equal to twice the maximum operating torque given in 5.3.3. In testing gate valves as specified in 5.3.3 c), apply a minimum strength torque (mST) as set out in Annex A equal to 5 × the maximum operating torque (MOT). In the case of valves as specified in 5.3.3 d), the test is applicable only when there is an additional manual operating element.

5.3 Watertightness and airtightness

5.3.1 Watertightness and airtightness of shell and all pressure-containing components

5.3.1.1 Internal pressure

Conduct testing in accordance with ISO 9635-1:2014, 5.3.1.1.

Test results shall comply with the requirements of ISO 9635-1:2014, 5.3.1.1.

5.3.1.2 External pressure

Conduct testing in accordance with ISO 9635-1:2014, 5.3.1.2.

Test results shall comply with the requirements of ISO 9635-1:2014, 5.3.1.2.

5.3.2 Seat tightness

5.3.2.1 Seat tightness at high differential pressure

Conduct testing in accordance with ISO 9635-1:2014, 5.3.2.1.

After closing the valve by application of the maximum operating torque (see 5.3.3), the leakage rate shall not exceed rate A for resilient seated valves and shall not exceed rate B for metallic-seated valves. Maintain the test pressure for 10 min.

Except for valves to be used in a single flow direction, perform the test successively in each flow direction.

5.3.2.2 Seat tightness at low differential pressure

Conduct testing in accordance with ISO 9635-1:2014, 5.3.2.2

After closing the valve by application of the maximum operating torque (see 5.3.3), the leakage rate shall not exceed rate A for resilient seated valves and shall not exceed rate B for metallic seated valves. Maintain the test pressure for 10 min.

Except for valves to be used in a single flow direction, perform the test successively in each flow direction.

5.3.3 Maximum operating torque (MOT) for operation and watertightness and airtightness

In order to verify this requirement, test the isolating valve as set out in Annex C. The measured torque shall not exceed the MOT as specified in a) to d) below.

a) **Valves delivered with their operating element**

1) In the case of a hand wheel, use Formula (1):

$$\text{MOT}=0{,}5\times F\times D \tag{1}$$

NOTE This is expressed in newton metres (N · m).

where

F is the maximum operating manual force (F refers to operating the valve, F_{max}, to seating and unseating the valve, see Annex E), expressed in newtons (N);

D is the diameter of the hand wheel, in metres (m).

2) In the case of a lever, use Formula (2):

$$\text{MOT}=F\times L \tag{2}$$

NOTE This is expressed in newton metres (N · m).

where

F is the maximum operating manual force (F refers to operating the valve, F_{max}, to seating and unseating the valve, see Annex E), expressed in newtons (N);

L is the length of the lever, in metres (m).

b) **Valves delivered without operating element and intended to be operated by T-shaped key**

1) For butterfly valves, use Formula (3):

$$MOT=125\ N\cdot m \tag{3}$$

2) For gate valves, use Formula (4):

$$MOT=1\times DN \tag{4}$$

NOTE This is expressed in newton metres (N · m).

3) For other types of valves, use Formula (5):

$$MOT=\text{value given by the manufacturer} \tag{5}$$

c) **Gate valves delivered without operating element and intended to be operated by ring key and bar**

See Annex B.

d) **Valves operated electrically, hydraulically, or pneumatically**

MOT=value given by the manufacturer

5.3.4 Watertightness and airtightness of gearboxes to external pressure

Conduct testing in accordance with ISO 9635-1:2014, 5.3.1.2.

Test results shall comply with the requirements of ISO 9635-1:2014, 5.3.1.2.

5.4 Hydraulic characteristics

Test results shall comply with ISO 9635-1:2014, 5.4. The characteristic given by the manufacturer shall be the flow coefficient, K_V.

It is recommended that the manufacturer show the head loss of valves in the form of a table or graph.

When measured in accordance with ISO 9644, K_V resulting from the head loss curve shall be within ±5 % of the value declared by the manufacturer.

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

The endurance of isolating valves is evaluated as follows:

a) Subject the isolating valve to an endurance test as set out in Annex D at a differential pressure equal to the allowable operating pressure across the obturator.

b) Test the isolating valve in accordance with 5.3.1, 5.3.2, and 5.3.3, with the application of a torque not exceeding either

— 1,2 × the maximum operating torque (with the same leakage rate), or

— the maximum operating torque (with leakage allowed to increase by one rate level).

See ISO 9635-1:2014, Table G.2, for leakage rates.

Complete the following number of opening/closing cycles during the endurance test:

— for manually-operated valves, 250 cycles;

— for electrically-operated, hydraulically-operated, or pneumatically-operated valves, 2 500 cycles.

Apply this test to isolating valves of DN 8 up to and including DN 500.

6 Conformity assessment

6.1 General

Test results shall comply with the requirements of ISO 9635-1:2014, 6.1.

6.2 Type tests

Perform the type tests set out in Table 2.

Test results shall comply with the requirements of ISO 9635-1:2014, 6.2.

6.3 Control of production process and quality system

Test results shall comply with the requirements of ISO 9635-1:2014, 6.3.

NOTE The production control tests given in Table 2 are for information only.

7 Marking

Requirements shall comply with ISO 9635-1:2014, Clause 7.

8 Packaging

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

Table 2 — Requirements and tests

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 obturator	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 water velocity	See Clause 4	—
4.9	All wetted valve part materials, including lubricants, in contact with water intended for human consumption	See test reports in accordance with national regulations	—

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

Table 2 *(continued)*

Subclause of ISO 9635-1:2014	**Corresponding requirement**	**Type tests**[a]	**Production tests (informative)**
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 obturator to differential pressure	See 5.2.2	—
5.2.3	Resistance of valves to bending	See 5.2.3	—
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	—
5.3.2.1	Seat tightness at high differential pressure	See 5.3.2.1 and 5.3.3	See 5.3.2.1 and 5.3.3
5.3.2.2	Seat tightness at low differential pressure	See 5.3.2.2 and 5.3.3	—
5.3.1.2	Leak-tightness of gearboxes to external pressure	See 5.3.4	—
5.4	Hydraulic or airflow characteristics	See 5.4	—
5.5	Resistance to chemicals and fertilizers	See 5.5	—
5.6	Endurance	See 5.6	—

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

Annex A
(normative)

Test method for resistance of valves to operating loads

A.1 General

Perform the test at ambient temperature.

Begin the test with the obturator fully or partially open.

A.2 Test procedure

The test procedure is the following.

a) Place the valve on the test bench.

b) Apply a torque at the shaft (see ISO 9635-1:2014) in order to close the obturator. In the specific case of valves to be operated by means of a ring key and bar (see Annex B), apply the torque and the bending moment simultaneously.

c) Increase the closing torque until it reaches the mST.

d) Maintain the minimum strength torque for at least 10 min.

e) Rotate the obturator until it reaches the fully open position.

f) Increase the opening torque until it reaches the mST.

g) Maintain the mST for at least 10 min.

h) Check the performance as set out in 5.3.3 and the seat tightness as set out in 5.3.2.

Annex B
(normative)

Torque requirements for gate valves to be operated by ring key and bar

Where gate valves are operated by means of a ring key and bar, they are required to have higher minimum strength torques as set out in Table B.1.

Table B.1 — Torque requirements

Maximum operating torque	Minimum strength torque
N · m	N · m
DN + 60	5 × maximum operating torque [a]
[a] Applied simultaneously with a bending moment of 1 500 N · m on the operating mechanism.	

Annex C
(normative)

Test method for operation of valves

C.1 General

Perform the test at a water temperature of (23 ±3) °C.

Begin the test with the obturator in the fully open position.

C.2 Test procedure

The test procedure is as follows.

a) Fit a solid plate containing a vent valve to the outlet flange, and the inlet to a hydrostatic pressure source.

b) Partially open the obturator and the vent valve.

c) Fully fill the body with water and vent all the air from the valve.

d) Close the obturator and apply a torque equal to the maximum operating torque.

e) The pressure should be raised progressively and smoothly by increasing it in approximately 15 s intervals for every bar from zero until it reaches the allowable operating pressure and maintain it for at least 1 min.

f) Check for seat tightness.

g) Open the valve. During opening, the running torque should not exceed the maximum operating torque.

NOTE A large volume of water is evacuated from the vent valve.

h) Close the valve. During closing, the running torque should not exceed the maximum operating torque.

i) Note the maximum torque required during the test and check that it does not exceed MOT.

j) Restart the test on the other side.

Annex D
(normative)

Test method for endurance of valves

D.1 General

Carry out the test at a water temperature of (23 ±3) °C.

The test assembly should be designed to minimize water consumption and cycle time.

D.2 Test procedure

The test procedure is as follows.

a) Fix the valve on a test bench, with the obturator fully open.

b) Blank off one end of the valve and provide means to

   1) vent air from the valve,

   2) pressurize the closed end with water, and

   3) measure the pressure.

c) Bring the obturator to the fully closed position as follows:

   — for a valve with an actuator, close the obturator by means of the actuator using the appropriate energy source and apply the maximum operating torque at the maximum level specified by the manufacturer;

   — for a manually operated valve, close the obturator and apply a torque equal to the maximum operating torque.

d) Fill the space between the obturator and the blank flange with water, and vent the air.

e) Increase the water pressure progressively and smoothly until it reaches a minimum of the allowable operating pressure and maintain the pressure for at least 60 s.

f) Open the obturator fully.

g) Repeat the cycle closing/pressurizing/opening for the specified number of cycles as specified in 5.6.

h) Check the watertightness and airtightness of the shell and of all the pressure containing components as set out in 5.3.1.

i) Check the seat tightness as set out in 5.3.2. Apply a closing torque equal to the maximum operating torque and check that the leakage rate does not exceed the value given in 5.3.2 by one rate level (see ISO 9635-1:2014, Table G.2). If it is exceeded, increase the applied torque to 1,2 × the maximum operating torque and check that the leakage rate does not exceed the value given in 5.3.2.

j) Check that the operating torque does not exceed the maximum operating torque as set out in 5.3.3.

k) Record the test conditions and test results, noting the calibration status of all measuring devices. All measuring instruments should be valid and calibrated by an ISO/IEC 17025 accredited laboratory.

Annex E
(normative)

Method for sizing operating element

E.1 General

The purpose of this Annex is to specify the requirements for establishing the minimum size of the operating element supplied with an irrigation valve, considering the force applied by one person to operate the valve under specified working conditions.

This Annex applies to manual operating elements of sizes 100 mm to 1 000 mm that are

— directly mounted on valves,

— mounted on valve reduction gearboxes, or

— used for manual operation of power-actuated valves.

This Annex is not applicable to

— impactor hand wheels,

— T-keys, or

— chainwheels.

E.2 Symbols

D diameter of hand wheel, in millimetres (mm);

L length of lever or radius of crank circle, in millimetres (mm);

T torque, under specified conditions, required to operate the valve, in newton metres (N · m);

T_S maximum torque, under specified conditions, required to seat or unseat the obturator or to overcome temporary intermediate dynamic conditions, in newton metres (N · m);

F operating manual force for sizing the manual operating element, in newtons (N);

F_S maximum manual force for sizing the manual operating element, in newtons (N).

E.3 Requirements

Determine the value of the operating manual force, F, and the maximum manual force, F_S, used to calculate the size of the operating element as specified in Table E.1.