INTERNATIONAL STANDARD

ISO 9635-2

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Agricultural irrigation equipment — Irrigation valves —

Part 2: Isolating valves

Matériel agricole d'irrigation — Vannes d'irrigation —

Partie 2: Vannes d'isolation

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.

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 9635-2 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 18, *Irrigation and drainage equipment and systems*.

This first edition of ISO 9635-2, together with ISO 9635-1, ISO 9635-3, ISO 9635-4 and ISO 9635-5, cancels and replaces ISO 9635:1990, of which it constitutes a technical revision.

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 hydraulically operated isolating irrigation valves of DN 8 (1/4 inch) 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 referenced documents are indispensable for the application 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 9635-1:2006, *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 and the following apply.

3.1
isolating valve
valve intended for use only in the fully closed or fully open position

[EN 736-1]

3.2
full bore valve
valve with a seat diameter of not less than 90 % of the internal diameter of the body end port

[EN 736-3]

3.3
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

[EN 736-3]

3.4
flow coefficient
K_V
coefficient equal to the flow rate, in cubic metres per hour, of water at a temperature between 5 °C and 50 °C, passing through the valve and causing a loss of static head of 1 bar

NOTE 1 $Q = K_V\sqrt{\Delta p}$, where Q is the flow rate in cubic metres per hour (m^3/h), and p is the pressure in kilopascals per square centimetre (kPa/cm^2).

NOTE 2 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2.

NOTE 3 Adapted from EN 736-3.

4 Design requirements

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

5 Performance requirements

All tests are to be performed on the valve as it was delivered to the test facility.

5.1 Mechanical strength

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

Requirements and testing shall be in accordance with ISO 9635-1:2006, 5.1.1.

5.1.2 Resistance of obturator to differential pressure

Requirements and testing shall be in accordance with ISO 9635-1:2006, 5.1.2.

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

5.1.3 Resistance of valve to bending

The requirement and testing shall be in accordance with ISO 9635-1:2006, 5.1.3.

The bending moment, M, to be applied during the test shall be in accordance with Table 1, as a function of DN.

Table 1 — Bending moments

DN	Bending moment M N · m
8	610
10	615
20	640
25	670
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

5.1.4 Resistance of valves to operating loads

Requirements shall be in accordance with ISO 9635-1:2006, 5.1.4.

In order to verify this requirement, the valve shall be tested 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 pass the operating tests in accordance with 5.2.3, and the seat tightness tests in accordance with 5.2.2.1 and 5.2.2.2.

The mST shall be equal to twice the maximum operating torque (MOT) given in 5.2.3. In the case of gate valves as specified in 5.2.3 c), the mST to be applied in the test in accordance with Annex A shall be equal to 5 × MOT. In the case of valves as specified in 5.2.3 d), the test is only applicable when there is an additional manual operating element.

5.2 Watertightness and air-tightness

5.2.1 Watertightness and air-tightness of shell and all pressure-containing components

5.2.1.1 Internal pressure

Requirements and testing shall be in accordance with ISO 9635-1:2006, 5.2.1.1.

5.2.1.2 External pressure

Requirements and testing shall be in accordance with ISO 9635-1:2006, 5.2.1.2.

5.2.2 Seat tightness

5.2.2.1 Seat tightness at high differential pressure

Requirements and testing shall be in accordance with ISO 9635-1:2006, 5.2.2.1.

After closing the valve by application of MOT (see 5.2.3), the leakage rate shall be rate A for resilient seated valves and shall not exceed rate B for metallic seated valves. For a type test, the test duration shall not be less than 10 min.

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

5.2.2.2 Seat tightness at low differential pressure

Requirements and testing shall be in accordance with ISO 9635-1:2006, 5.2.2.2

After closing the valve by application of MOT (see 5.2.3), the leakage rate shall be rate A for resilient seated valves and shall not exceed rate B for metallic seated valves. For a type test, the test duration shall not be less than 10 min.

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

5.2.3 MOT for operation and watertightness and air-tightness

In order to verify this requirement, an isolating valve shall be tested in accordance with Annex C. The measured torque shall not exceed the MOT as specified in a) to d) below.

a) Valves delivered with their operating element

— In the case of a hand wheel:

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

expressed in newton metres ($\text{N} \cdot \text{m}$),

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).

— In the case of a lever:

MOT = $F \times L$

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

— For butterfly valves:

MOT = 125 · m

— For gate valves:

MOT = 1 × DN, in N · m

— For other types of valve:

MOT = value given by the manufacturer.

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.

5.2.4 Watertightness and air-tightness of gearboxes to external pressure

Requirements and testing shall be in accordance with ISO 9635-1:2006, 5.2.1.2.

5.3 Hydraulic characteristics

Requirements shall be in accordance with ISO 9635-1:2006, 5.3. 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 greater than 0,9 times the value indicated by the manufacturer. Testing is not required for full bore gate valves or clear way valves.

5.4 Resistance to chemicals and fertilizers

Requirements and testing shall be in accordance with ISO 9635-1:2006, 5.4.

5.5 Endurance

The endurance of isolating valves is evaluated as follows:

a) the isolating valve shall be subjected to an endurance test in accordance with Annex D at a differential pressure equal to the PFA across the obturator;

b) the isolating valve shall be tested in accordance with 5.2.1, 5.2.2 and 5.2.3, with the application of a torque not exceeding either

   — 1,2 times MOT (with the same leakage rate), or

   — MOT (with leakage allowed to increase by one rate level)

See ISO 9635-1:2006, Table G.2, for leakage rates.

The number of opening/closing cycles to be applied during the endurance test shall be as follows:

— for manually operated valves, 250 cycles;

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

This test shall be applied to isolating valves of DN 8 up to and including DN 500.

6 Conformity assessment

6.1 General

Requirements shall be in accordance with ISO 9635-1:2006, 6.1.

6.2 Type tests

Requirements shall be in accordance ISO 9635-1:2006, 6.2. The type tests to be performed shall be those according to Table 2.

6.3 Control of production process and quality system

Requirements shall be in accordance with ISO 9635-1:2006, 6.3.

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

7 Marking

Requirements shall be in accordance with ISO 9635-1:2006, Clause 7.

8 Packaging

Requirements shall be in accordance with ISO 9635-1:2006, Clause 8.

Table 2 — Requirements and tests

Subclause of ISO 9635-1:2006	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 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 materials, including lubricants, in contact with water intended for human consumption	See test reports in accordance with national regulations	—
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
5.1.1	Resistance of shell and all pressure containing components to internal pressure	See 5.1.1	See 5.1.1
5.1.2	Resistance of obturator to differential pressure	See 5.1.2	—
5.1.3	Resistance of valves to bending	See 5.1.3	—
5.1.4	Resistance of valves to operating loads	See 5.1.4	—
5.2.1.1	Leak-tightness to internal pressure	See 5.2.1.1	See 5.2.1.1
5.2.1.2	Leak-tightness to external pressure	See 5.2.1.2	—
5.2.2.1	Seat tightness at high differential pressure	See 5.2.2.1 and 5.2.3	See 5.2.2.1 and 5.2.3
5.2.2.2	Seat tightness at low differential pressure	See 5.2.2.2 and 5.2.3	—
5.2.3	Maximum operating torque (MOT)	See 5.2.2.1, 5.2.2.2 and 5.2.3	See 5.2.2.1
5.2.1.2	Leak-tightness of gearboxes to external pressure	See 5.2.4	—
5.3	Hydraulic or airflow characteristics	See 5.3	—
5.4	Resistance to chemicals and fertilizers	See 5.4	—
5.5	Endurance	See 5.5	—

[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

The test shall be performed at ambient temperature.

The test shall begin 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) 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 mST.

d) Maintain the mST for at least 10 min.

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

f) Increase the opening torque until it reaches mST.

g) Maintain the mST for at least 10 min.

h) Check the performance in accordance with 5.2.3 and the seat tightness in accordance with 5.2.2.

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 therefore required to have higher minimum strength torques (mST), and shall be in accordance with Table B.1.

Table B.1 — Torque requirements

MOT N · m	mST N · m
DN + 60	5 × MOT[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

The test shall be performed at a water temperature of (23 ± 3)°C.

The test shall begin with the obturator in the fully open position.

C.2 Test procedure

The test procedure is the following.

a) Fit a blanking 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 MOT.

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 PFA 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 MOT.

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

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

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

The test shall be carried out 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 the following.

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 MOT at the maximum level specified by the manufacturer;

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

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 PFA and maintain the pressure for at least 5 s.

f) Open the obturator fully.

g) Repeat the cycle closing/pressurizing/opening for the specified number of cycles as specified in 5.5.

h) Check the watertightness and air-tightness of the shell and of all the pressure containing components in accordance with 5.2.1.

i) Check the seat tightness in accordance with 5.2.2. Apply a closing torque equal to MOT and check that the leakage rate does not exceed the value given in 5.2.2 increased by one rate level (see ISO 9635-1:2006, Table G.2). If it is exceeded, increase the applied torque to 1,2 times MOT and check that the leakage rate does not exceed the value given in 5.2.2.

j) Check that the operating torque does not exceed MOT according to 5.2.3.

k) Record the test conditions and test results, noting the calibration status of all measuring devices.

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,

— used for manual operation of power-actuated valves.

This annex is not applicable to

— impactor handwheels,

— T-keys, or

— chainwheels.

E.2 Symbols

D diameter of handwheel, 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 ($N \cdot m$);

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

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

The value of the operating manual force, F, and the maximum manual force, F_s, used to calculate the size of the operating element shall be in accordance with Table E.1.

Table E.1 — Manual forces

Force N	D or L[a] mm											
	100	125	160	200	250	315	400	500	630	720	800	1 000
F	250	300	300	350	400	400	400	400	400	400	400	400
F_s	500	600	600	700	800	800	1 000	1 000	1 000	1 000	1 000	100

[a] See Figures E.1 and E.2.

For intermediate values of D and L, the applicable values of F and F_s shall be calculated by linear interpolation of the tabulated values.

Force F is the assumed manual force which one person is capable of applying to the operating element under the following conditions:

— operator in standing position;

— operating element at approximately waist level;

— no space restrictions;

— firm footing;

— operating time no longer than 5 min.

Force F_s is the assumed manual force which one person is capable of applying under the same conditions as force F except that the time period is short.

If other conditions apply, the values of F and F_s to be used shall be subject to an agreement between the manufacturer and the test laboratory.

The size of the operating element (see Figures E.1 and E.2) shall be calculated so as to comply with conditions a) and b), below.

a) Handwheel

D shall be greater than or equal to

$$\frac{2\,000 \times T}{F} \text{ and } \frac{2\,000 \times T_s}{F_s}$$

b) Lever or crank

L shall be greater than or equal to

$$\frac{1\,000 \times T}{F} \text{ and } \frac{1\,000 \times T_s}{F_s}$$

Maximum torque T_s is a greater torque than T and is applied during a short time (10 s is recommended). When specified by the test laboratory, the manufacturer shall quantify this duration in terms of a percentage of the valve travel.

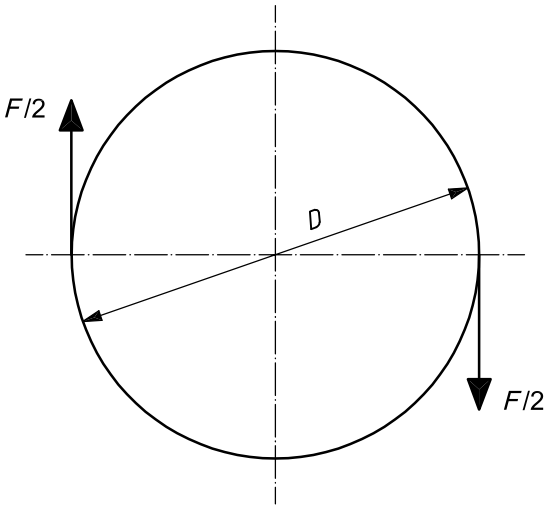

Figure E.1 — Hand wheel

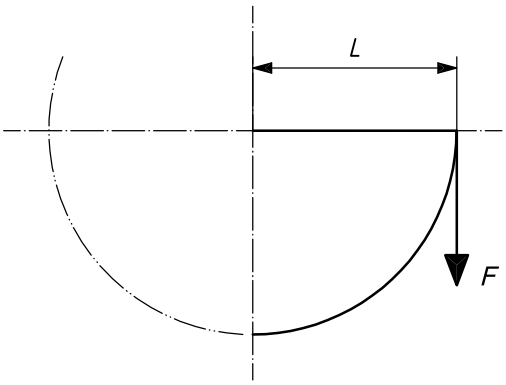

Figure E.2 — Lever or hand wheel with crank

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[3] EN 736-3, *Valves — Terminology — Part 3: Definition of terms*

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