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Agricultural irrigation equipment — Irrigation valves —

Part 1: General requirements

Matériel agricole d'irrigation — Vannes d'irrigation —

Partie 1: Exigences générales

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ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.org
Web www.iso.org

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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).

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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 9635-1:2006), 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 1: General requirements

1 Scope

This part of ISO 9635 specifies construction and performance requirements and test methods for 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 irrigation valves of 8 mm 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 4633, *Rubber seals — Joint rings for water supply, drainage and sewerage pipelines — Specification for materials*

ISO 5209, *General purpose industrial valves — Marking*

ISO 5752, *Metal valves for use in flanged pipe systems — Face-to-face and centre-to-face dimensions*

ISO 6708:1995, *Pipework components — Definition and selection of DN (nominal size)*

ISO 7005-1, *Pipe flanges — Part 1: Steel flanges for industrial and general service piping systems*

ISO 7005-2, *Metallic flanges — Part 2: Cast iron flanges*

ISO 7005-3, *Metallic flanges — Part 3: Copper alloy and composite flanges*

ISO 9227, *Corrosion tests in artificial atmospheres — Salt spray tests*

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

ISO 9635-5:2014, *Agricultural irrigation equipment — Irrigation valves — Part 5: Control valves*

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

ISO 9911:2006, *Agricultural irrigation equipment — Manually operated small plastics valves*

ISO 9080, *Plastics piping and ducting systems — Determination of the long-term hydrostatic strength of thermoplastics materials in pipe form by extrapolation*

EN 681-1, *Elastomeric seals — Materials requirements for pipe joint seals used in water and drainage applications — Part 1: Vulcanized rubber*

EN 12627, *Industrial valves — Butt welding ends for steel valves*

EN 12982, *Industrial valves — End-to-end and centre-to-end dimensions for butt welding end valves*

3 Terms and definitions

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

3.1
maximum operating torque
MOT
fixed upper limit for the torque which, when applied at the shaft, operates the valve and ensures compliance with the required leakage rate

3.2
minimum strength torque
mST
fixed lower limit for the torque which, when applied at the shaft, with the obturator either totally open or totally closed, causes no alteration to the functional capability of the valve

3.3
shaft
component of an obturator on which the actuating thread is formed and by which control of the closing component is effected

3.4
type test
test to prove that the design of a valve meets the general and specific performance requirements of the valve

3.5
operating mechanism
mechanism which translates the motion of the operating device to the motion of the obturator

[SOURCE: EN 736-2]

3.6
operating device
manual or power-operated device used to operate the non-pressurized valve

[SOURCE: EN 736-2]

3.7
operating element
component of the operating device by which the mechanical power is introduced

[SOURCE: EN 736-2]

3.8
nominal diameter
DN
parameter used for reference purposes to indicate the size of a valve abbreviated to DN and usually followed by a dimensionless round number which is loosely related to the effective dimensions of the bore or external diameter of the end connections of the valve

Note 1 to entry: It is expressed in millimetres.

Note 2 to entry: Adapted from ISO 6708:1995, definition 2.1.

3.9
nominal pressure
PN
parameter, used for reference purposes in describing a valve, abbreviated to PN and usually followed by a dimensionless round number which is loosely related to the maximum allowable working pressure of the valve

Note 1 to entry: PN is expressed in bars.

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

Note 3 to entry: Adapted from ISO 7268:1983/Amd, 1:1984.

3.10
allowable operating pressure
AOP
maximum hydrostatic pressure that a valve is capable of withstanding in continuous service

[SOURCE: EN 805]

3.11
maximum allowable pressure
MAP
maximum pressure occurring from time to time, including average surge pressures, that a valve is capable of withstanding in service

[SOURCE: EN 805]

3.12
allowable site test pressure
ASTP
maximum hydrostatic pressure that a newly-installed valve is capable of withstanding for a relatively short duration, in order to ensure integrity and tightness of the pipeline

[SOURCE: EN 805]

3.13
obturator
moving member in a valve that operates to close the valve and, where applicable, contains a washer or similar sealing device

4 Design requirements

4.1 Materials

4.1.1 Components and coating materials

Select components and coating materials from those conforming to the relevant standards, where standards exist. Ensure that they meet the requirements of 4.9, 4.10, and 4.11, either alone or in combination with coating materials.

4.1.2 Elastomers

Ensure that elastomers comply with ISO 4633 or EN 681-1 and 4.10 of this part of ISO 9635.

4.2 DN

Select DN values from the preferred values given in ISO 6708, with an upper limit of DN 2 000. Confirm with the manufacturer whether a DN value is from the DN/ID series or from the DN/OD series.

4.3 Pressures

Valves intended for irrigation systems come under the nominal pressure (PN) designation and shall be designed in such a way that their characteristic pressures, allowable operating pressure, maximum allowable pressure, and allowable site test pressure are as set out in Table 1 for the corresponding PN (see also 4.4).

Table 1 — Valve pressures

PN	Pressure bar		
	AOP[a]	MAP[a]	ASTP[b]
6	6	8	12
10	10	12	17
16	16	20	25
25	25	30	35

[a] Applicable to valves in all positions, from fully closed to fully open.

[b] Applicable only to valves not in the closed position.

Table 1 gives minimum values of allowable site test pressure. The manufacturer's catalogue can indicate higher values on the condition that the requirements of this part of ISO 9635 have been verified with these higher values. In this case, allowable site test pressure shall not be less than 1,5 maximum allowable pressure or (maximum allowable pressure +5 bar).

4.4 Temperatures

It is considered that, with the exception of the test where work is done with small volumes of water, it is possible to control the water temperature; the hydraulic characteristics tests and the endurance tests shall be carried out at a water temperature of 4 °C to 35 °C.

4.5 Design of shell and obturator

Valves shall be designed to ensure a safety factor against short-term and long-term shell and obturator rupture, taking account of allowable operating pressure, maximum allowable pressure, and allowable site test pressure according to 4.3. This requirement shall not preclude any of the performance requirements given in Clause 5.

The design shall be carried out using one of the following methods.

— A calculation method using the tensile strength of the material (as defined in the relevant material standards) divided by a safety factor. For materials with time-dependent mechanical behaviour (such as plastic materials), the tensile strength shall be the 20 °C 50-year extrapolated minimum strength obtained from pressure tests on injection moulded or extruded pipes subjected to constant hydrostatic pressure at various temperatures and for different lengths of time to comply with ISO 9080.

— An experimental method, relying on pressure tests on valve shells subjected to a constant hydrostatic pressure equal to maximum allowable pressure times a safety factor. For materials with time-dependent mechanical behaviour (such as plastic materials), the test pressure shall be further multiplied by a coefficient specific to each material in order to take into account its 50-year extrapolated minimum strength and the slope of its strength regression line.

4.6 End types and interchangeability

Valves can be designed with various types of end connections adapted to specific pipe systems. The connections shall fulfil the standardized requirements of the relevant pipe systems.

In order to ensure interchangeability of flanged valves, their face-to-face or centre-to-face dimensions shall comply with ISO 5752 and their flanges with ISO 7005-1, ISO 7005-2, or ISO 7005-3 (depending on the flange material). In the case of steel valves with welded ends, the end-to-end and centre-to-end dimensions shall comply with EN 12982 or EN 12627.

4.7 Operating direction

For valves with an operating mechanism, the preferred direction of closure is clockwise.

Valves, designed for anti-clockwise closure, shall be marked to indicate the closing direction.

4.8 Maximum water velocity

Valves shall be designed for water flow velocities that can reach at least the values given in Table 2 in steady flow conditions.

Table 2 — Maximum water flow velocity

Allowable operating pressure bar	**Flow velocity** m/s
6	2,5
10	3
16	4
25	5

4.9 Valve parts

Valve parts that are in contact with water shall be of non-toxic materials. All parts belonging to valves of the same size, type and model, and produced by the same manufacturer, shall be interchangeable.

Plastic valves shall comply with ISO 9911:2006.

Plastic parts of the valve that are exposed to ultraviolet (UV) radiation under normal field conditions in which the valve operates shall include additives to improve their resistance to UV radiation. Plastic parts that enclose waterways shall be opaque or they shall be provided with an opaque cover, designed to block all light from reaching clear waterway enclosures.

4.10 Internal corrosion and ageing resistance

Valve parts that are in contact with water shall be resistant to, or protected against, corrosion under the working conditions for which the valve is intended. The valve body shall meet the salt spray test requirements in accordance with ISO 9227.

4.11 External corrosion and ageing resistance

Under the usage conditions defined in this part of ISO 9635, all external surfaces of the valve (including bolts) which are in continuous contact with the surrounding soil, water, or atmosphere shall be resistant to corrosion and ageing by the selection of materials, or shall be protected by appropriate means. The valve body shall meet the salt spray test requirements in accordance with ISO 9227.

4.12 Repairs and maintenance

The valve, excluding butterfly valves, should be designed to permit internal repair and maintenance without removing the valve body from the line.

5 Performance requirements

5.1 General

Perform all tests at a water temperature of (23 ±3) °C, unless otherwise specified. Ensure that all tests are performed on the valve as it was delivered to the test facility.

NOTE All pressure values are in bars.

5.2 Mechanical strength

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

The valves shall withstand, without visible damage, an internal pressure equal to the higher of the two values: allowable site test pressure or 1,5 × allowable operating pressure.

In order to verify this requirement, test the valve, as delivered, in accordance with the test method given in Annex A, following which there shall be no visually detectable external leakage and no other sign of defect.

5.2.2 Resistance of obturator to differential pressure

The valves in the closed position shall withstand, without visible damage, a differential pressure applied to the obturator equal to the lower of the two values: 1,5 × allowable operating pressure or allowable operating pressure +5. If the maximum allowable pressure indicated for the valves is higher than this value, apply a differential pressure equal to the maximum allowable pressure.

In order to verify this requirement, test the valve in accordance with the test method given in Annex B, following which it shall pass the seat tightness test as set out in 5.3.2.

5.2.3 Resistance of valves to bending

Valves which are designed to be rigidly connected at both ends to adjacent pipes, excluding wafer type valves, shall withstand the stresses transmitted to them without sustaining any deformation likely to alter their functional capabilities beyond the limits specified in Annex C.

In order to verify this requirement, test the valve using the test method and with a bending moment, *M*, as set out in Annex C, at a differential pressure across the obturator equal to allowable operating pressure ±5 %. It shall, under the bending test load

— show no visually detectable external leakage, and

— exhibit a leakage rate at the obturator (see 5.3.2) not higher than that immediately above the seat leakage rate specified for new valves (for example, rate B if the specified rate is rate A as set out in Annex G).

5.2.4 Resistance of valves to operating loads

Valves having a mechanically-operated obturator shall withstand, in the fully open and in the fully closed positions, the torque (mST) without any damage likely to impair their functional capabilities beyond the limits specified in other parts of this International Standard.

The test method, the torques (mST) to be applied, and the acceptance criteria shall be those given in ISO 9635-2:2014, Clause A2.

5.3 Watertightness

5.3.1 Watertightness of shell and all pressure-containing components

5.3.1.1 Internal pressure

The valves shall be leak-tight under an internal water pressure equal to the higher of the two values: allowable site test pressure or 1,5 × allowable operating pressure.

In order to verify this requirement, subject the valve to a water pressure test as set out in 5.2.1, or to an air pressure test at (6 ±1) bar as set out in Annex F, following which there shall be no visually detectable leakage.

NOTE Air testing is applicable only when pressure vessel regulations permit.

5.3.1.2 External pressure

Valves shall be watertight to ingress of air, water, or any foreign matter.

In order to verify this requirement, the valve shall be tested in accordance with the method given in Annex D. Any variation of pressure during the test shall not exceed 0,02 bar.

5.3.2 Seat tightness

5.3.2.1 Seat tightness at high differential pressure

The seat of valves in the fully closed position shall be watertight within a defined leakage rate, selected from rate A to rate F according to Annex G. The allowed leakage rate shall be given in the manufacturer's technical data.

In order to verify this requirement, the valve as delivered shall be subjected to the test in accordance with Annex G under a differential pressure equal to 1,1 × AOP for water, or (6 ±1) bar for air. The measured leakage rate shall not exceed the allowed leakage rate.

5.3.2.2 Seat tightness at low differential pressure

Carry out the test as set out in 5.3.2.1, but under a differential water pressure of 0,5 bar.

The requirement shall be as set out in 5.3.2.1.

5.4 Hydraulic characteristics

5.4.1 Pressure loss

Carry out this test as set out in ISO 9644. The pressure loss measured at a particular flow rate in the fully open position shall not exceed the pressure loss declared by the manufacturer at that same flow rate by more than +10 %.

5.4.2 Other

Other hydraulic characteristics of control valves shall be given in the manufacturer's catalogues. Test them as set out in ISO 9635-5:2014, Annex B.

5.5 Resistance to chemicals and fertilizers

The functional capabilities of the valves shall not be impaired after prolonged use with fertilizers and other chemicals of the types and concentrations used in agriculture.

In order to verify this requirement, test the valve, as delivered, as set out in Annex E, following which it shall not exhibit any deterioration of its components and it shall pass the seat tightness test as set out in 5.3.2.1 and 5.3.2.2.

Perform the test on a valve with a DN that is representative of the range between two DNs of adjacent smaller diameters (of the same design, same materials, and produced by the same manufacturer).

5.6 Endurance test

Test the endurance of each type of valve as set out in the relevant part of ISO 9635.