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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.

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 9635-1 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 9635-1, together with ISO 9635-2, 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 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 15 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 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 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, *Metallic flanges — Part 1: Steel flanges*

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 9635-2:2006, *Agricultural irrigation equipment — Irrigation valves — Part 2: Isolating valves*

ISO 9635-3:2006, *Agricultural irrigation equipment — Irrigation valves — Part 3: Check valves*

ISO 9635-4:2006, *Agricultural irrigation equipment — Irrigation valves — Part 4: Air valves*

ISO 9635-5:2006, *Agricultural irrigation equipment — Irrigation valves — Part 5: Control valves*

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

ISO 9911:—[1], *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
maximum limit of torque which, when applied at the shaft, operates the valve and ensures compliance with the required leakage rate

3.2
minimum strength torque
minimum limit of 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
point where the load (torque) is applied in order to change the position of the valve obturator, which may be the end of the stem, or the input shaft of the reducer when the reducer is an integral part of the valve

3.4
type test
test made to prove that the design meets the corresponding performance requirements in this part of ISO 9635 and the part of ISO 9635 related to the specific valve being tested

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

[EN 736-2]

3.6
operating device
manual or power operated device used to operate the bare valve

[EN 736-2]

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

[EN 736-2]

1) To be published. (Revision of ISO 9911:1993)

3.8
DN
alphanumeric designation of the size of pipe work components, used for reference purposes, comprising the letters DN followed by a dimensionless round number which is loosely related to the effective dimensions, in millimetres, of the bore or external diameter of the end connections

NOTE Adapted from ISO 6708:1995, definition 2.1.

3.9
nominal pressure
PN
numerical designation which is a convenient rounded number for reference purposes, designated by the letters PN followed by a dimensionless round number which is loosely related to the pressure, expressed in bars

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

NOTE 2 Adapted from ISO 7268:1983/Amd 1:1984.

3.10
allowable operating pressure
PFA
maximum hydrostatic pressure that a component is capable of withstanding continuously in service

3.11
maximum allowable pressure
PMA
maximum pressure occurring from time to time, including surge, that a component is capable of withstanding in service

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

3.13
obturator
movable component of the valve whose position in the fluid flow path restricts or obstructs the fluid flow

4 Design requirements

4.1 Materials

4.1.1 Components and coating materials

Components and coating materials shall be selected from those conforming to the relevant standards, where existent. They shall also be in accordance with 4.9, 4.10 and 4.11, either alone or in combination with coating materials.

4.1.2 Elastomers

Elastomers shall be in accordance with ISO 4633 or EN 681-1 and 4.10 of this part of ISO 9635.

4.2 DN

The DN values shall be selected from the preferred values given in ISO 6708, with an upper limit of DN 2 000. The manufacturer shall indicate 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 (PFA), maximum allowable pressure (PMA) and allowable site test pressure (PEA) are in accordance with Table 1 for the corresponding PN (see also 4.4).

Table 1 — Valve pressures

PN	Pressure bar		
	PFA[a]	PMA[a]	PEA[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 PMA and PEA. 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, PEA shall not be less than the lesser of 1,5 PMA or (PMA + 5) bar.

4.4 Temperatures

Valves shall be designed for service temperatures from 1 °C to 60 °C and for storage temperatures between −40 °C and 70 °C. For valves made from materials with temperature-dependent mechanical behaviour, the PFA, PMA and PEA shall be established at (23 ± 3) °C and, if applicable, a factor (temperature/pressure table) for higher temperatures shall be given by the product standards and/or the manufacturer.

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 PFA, PMA and PEA 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 either one or the other 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 fifty-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 in accordance with ISO 9080.

— An experimental method, by means of pressure tests on valve shells subjected to a constant hydrostatic pressure equal to PMA 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 account of its fifty-year extrapolated minimum strength and of 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 be in accordance 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 be in accordance 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 the values given in Table 2 in steady flow conditions.

Table 2 — Maximum water flow velocity

PFA 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.

4.9.1 Plastic valves

Plastic valves shall be in accordance with ISO 9911.

Plastics 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. Plastics parts that enclose waterways shall be opaque or 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 shall be designed to permit internal repair and maintenance without removing the valve body from the line.

5 Performance requirements

All tests shall be performed at a water temperature of (23 ± 3) °C, unless otherwise specified. 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 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: PEA or 1,5 × PFA.

In order to verify this requirement, the valve, as delivered, shall be tested 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.

5.1.2 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 × PFA or PFA + 5. If the PMA indicated for the valves is higher than this value, the differential pressure applied shall be equal to PMA.

In order to verify this requirement, the valve shall be tested according to the test method given in Annex B, following which it shall pass the seat tightness test according to 5.2.2.

5.1.3 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, the valve shall be tested using the test method and with a bending moment M in accordance with Annex C at a differential pressure across the obturator equal to PFA ± 5 %. It shall, under the bending test load:

— show no visually detectable external leakage;

— exhibit a leakage rate at the obturator (see 5.2.2) not higher than that immediately above the seat leakage rate specified for new valves (e.g. rate B if the specified rate is rate A according to Annex G).

5.1.4 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 minimum strength torque (mST) without any damage likely to impair their functional capabilities beyond the limits specified in Annex B.

The test method, the mST to be applied and the acceptance criteria shall be in accordance with Annex C.

5.2 Watertightness

5.2.1 Watertightness of shell and all pressure-containing components

5.2.1.1 Internal pressure

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

In order to verify this requirement, the valve shall be subjected to a water pressure test in accordance with 5.1.1, or to an air pressure test at (6 ± 1) bar in accordance with Annex F, following which there shall be no visually detectable leakage.

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

5.2.1.2 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.

5.2.2 Seat tightness

5.2.2.1 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 × PFA for water, or (6 ± 1) bar for air. The measured leakage rate shall not exceed the allowed leakage rate.

5.2.2.2 Seat tightness at low differential pressure

The requirement shall be in accordance with 5.2.2.1.

The test shall be carried out in accordance with 5.2.2.1, but under a differential water pressure of 0,5 bar.

5.3 Hydraulic characteristics

5.3.1 Pressure loss

Carry out this test in accordance with ISO 9644. The pressure loss measured at a particular flow rate shall not exceed the pressure loss declared by the manufacturer at that same flow rate by more than +5 %.

5.3.2 Other

Other hydraulic characteristics of control valves shall be given in the manufacturer's catalogues and shall be tested in accordance with ISO 9635-5:2006, Annex B.

5.4 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, the valve, as delivered, shall be tested in accordance with Annex E, following which it shall not exhibit any deterioration of its components and shall pass the seat tightness test in accordance with 5.2.2.1 and 5.2.2.2.

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

5.5 Endurance test

The endurance of each type valve shall be carried out in accordance with the specific test specified in the relevant part of ISO 9635.

6 Conformity assessment

6.1 General

The conformity of products to the relevant parts of ISO 9635 shall be demonstrated by

— carrying out all the type tests (see 6.2) in order to ensure that all fitness for purpose criteria are met, and

— controlling the production process (see 6.3) in order to ensure that the required performance levels are continuously reached.

The manufacturer shall ensure that all delivered valves are in accordance with the relevant part of ISO 9635. Should the verification of a requirement be necessary on a supplied product, it shall be made by carrying out the corresponding type test.

6.2 Type tests

The type tests shall comprise the tests corresponding to all the requirements, as given in this part of ISO 9635 and the requirements of that part of the standard related to the specific valve being tested. Type tests shall be carried out on valves, which are representative of the current production.

The applicant shall set the sample size for the type tests in accordance with a quality assurance program.

Type test results shall be recorded in a test report giving the type, quantity, DN and PN of the valves tested, and indicating the test apparatus and measuring devices used, as well as their calibration criteria.