INTERNATIONAL STANDARD

ISO 7714

Third edition
2000-10-15

Agricultural irrigation equipment — Volumetric valves — General requirements and test methods

Matériel agricole d'irrigation — Vannes volumétriques — Exigences générales et méthodes d'essai

Reference number
ISO 7714:2000(E)

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.ch
Web www.iso.ch

Printed in Switzerland

Contents

Page

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 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

International Standard ISO 7714 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 third edition cancels and replaces the second edition (ISO 7714:1995), which has been technically revised.

Annex A of this International Standard is for information only.

Agricultural irrigation equipment — Volumetric valves — General requirements and test methods

1 Scope

This International Standard specifies general requirements and test methods for volumetric valves able to deliver automatically preset quantities of water. It is applicable to valves actuated by pipeline pressure and flow alone, and which do not need any other, external, source of energy.

NOTE Volumetric valves are typically required to operate correctly with different qualities of irrigation water at a variety of flow rates and at temperatures of between 5 °C and 60 °C.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO/IEC Guide 2: *Standardization and related activities — General vocabulary.*

ISO 7-1: *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*.

ISO 2859-1:1999 *Sampling procedures for inspection by attributes — Part 1: Sampling schemes indexed by acceptance quality limit (AQL) for lot-by-lot inspection*.

ISO 4064-1:1993 *Measurement of water flow in closed conduits — Meters for cold potable water — Part 1: Specifications*.

ISO 4064-3: *Measurement of water flow in closed conduits — Meters for cold potable water — Part 3: Test methods and equipment*.

ISO 7005-1: *Metallic flanges — Part 1: Steel flanges*.

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

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

3 Terms and definitions

For the purpose of this International Standard, the terms and definitions given in ISO/IEC Guide 2 and the following apply.

3.1
volumetric valve
valve capable of automatically delivering preset volumes of irrigation water at various flow rates, as a result of measuring the volume of water flowing through the valve

3.2
serial volumetric valve
volumetric valve intended for in-series operation in a system of volumetric valves

3.2.1
two-way serial volumetric valve
serial volumetric valve with one inlet and one outlet, intended for connection in parallel in a system of volumetric valves designed to be opened by means of a hydraulic command when preset to the open position and which, on closing after delivering a preset volume of water, transmits a hydraulic command to the next **volumetric valve** in the system to bring it into operation

3.2.2
three-way serial volumetric valve
serial volumetric valve with one inlet and two outlets, normally open when the pressure at the inlet is the atmospheric pressure and designed so that when a preset volume of water has passed through the first outlet, this outlet shuts off automatically, the second outlet opens automatically and all the flow is passed through the second outlet to the next **volumetric valve** in the series

NOTE The opening and closing commands of the water in the inlet of the first valve in the system can be either manual or automatic.

3.3
non-serial volumetric valve
volumetric valve intended to operate alone and not in series

3.4
maximum flow rate
highest flow rate at which a **volumetric valve** is required to operate for a specified period of time without deteriorating

3.5
nominal flow rate
q_{nom}
numerical designation used to refer to a flow rate within the range of flow rates specified by the manufacturer for operation of a **volumetric valve** under normal service conditions and to designate the approximate capacity of the volumetric valve

3.6
minimum flow rate
low flow rate at which a **volumetric valve** is required to operate within the maximum error tolerance in volume, as specified by the manufacturer under normal service conditions

3.7
range of flow rates
all flow rates between the **minimum flow rate** and the **maximum flow rate**

3.8
maximum working pressure
highest water pressure at the inlet to a **volumetric valve** recommended by the manufacturer to ensure proper operation of the volumetric valve

3.9
minimum working pressure
lowest pressure immediately upstream from a **volumetric valve** at which the volumetric valve operates mechanically and functions properly, as specified by the manufacturer

3.10
range of working pressures
all pressures between the **minimum working pressure** and the **maximum working pressure**

3.11
nominal pressure
highest pressure immediately upstream from a **volumetric valve** at which the volumetric valve operates under normal service conditions, as specified by the manufacturer

4 Classification

4.1 According to accuracy of cumulative volume counter

Class 1: volumetric valve containing a control mechanism with a cumulative volume counter and having an accuracy as required by water meters complying with ISO 4064-1.

Class 2: volumetric valve containing a control mechanism with a cumulative volume counter and having an accuracy less than that required by water meters complying with ISO 4064-1.

Classes 1 and 2 are recommended for water measurement in agricultural irrigation applications.

Class 3: volumetric valve containing a control mechanism but without a cumulative volume counter.

4.2 According to method of operation as a system of volumetric valves

— Non-serial volumetric valve.

— Serial volumetric valve:

  — two-way serial volumetric valve;

  — three-way serial volumetric valve.

5 Marking

Each volumetric valve shall bear clear and permanent marking including the following information:

— name of manufacturer or the manufacturer's registered trademark;

— nominal flow rate, q_{nom};

— serial number;

— arrow indicating the direction of flow;

— arrow indicating the direction of setting the control device, if necessary;

— nominal pressure;

— for serial volumetric valves, a mark identifying the points of connection for serial operation, which shall be explained in the manufacturer's catalogue.

6 Technical requirements

6.1 General

All parts of volumetric valves of the same size, type and model intended for disassembly, maintenance and repair produced by the same manufacturer shall be interchangeable.

Upon request, the manufacturer shall supply information on the resistance of the valve to chemicals used in agriculture, and on the operation of the valve with water that does not comply with the properties specified in 7.1.

All parts of the volumetric valves which are made from plastics and which are exposed to ultraviolet (UV) radiation shall be protected against degradation from UV radiation under the normal operating conditions of the valve. Plastics parts of the valve which serve as water passages shall be opaque or shall be protected in some other manner (for instance, by a closed cover) against penetration of light to the water passages.

The flow-control mechanism of the volumetric valve shall allow a manual override so that the flow can be stopped at any time by some means, such as returning the setting device to zero.

The manufacturer shall ensure the regular supply of spare parts for a minimum period of five years after cessation of production of the specified model of the volumetric valve.

6.2 Flow rates and dimensions

The nominal flow rate of the valve and the dimensions of end connections shall be as specified in Table 1.

6.3 Threaded and flanged connections

The thread shall comply with ISO 7-1 in volumetric valves with threaded ends intended for direct connection to the pipeline. Alternatively, other threads may be allowed, provided that a suitable adapter is supplied with each threaded connection in accordance with ISO 7-1.

Table 1 — Flow rates and dimensions

Designation of thread [a]	Nominal flow rate m^3/h	Nominal diameter of flange [b] mm (in)
G ¾ B	1,5	—
G ¾ B	3	—
G 1 B	5	—
G 1½ B	12	—
G 2 B	20	50 (2)
G 3 B	40	80 (3)
G 4 B	60	100 (4)
—	150	150 (6)
—	250	200 (8)
—	400	250 (10)
—	600	300 (12)

[a] In accordance with ISO 7-1.

[b] In accordance with ISO 7005-1 and ISO 7005-2.

Volumetric valves with threaded ends shall be equipped with a hexagonal section, or at least a section with two parallel surfaces on the valve body, suitable for gripping with a standard open wrench in order to prevent rotation of the volumetric valve during connection or disconnection. The manufacturer shall supply special tools, if needed.

7 Mechanical, functional and accuracy tests

7.1 General

Use water for the test which is either clean or of an irrigation water quality equal to that of the total given in Table A.1.

Perform all tests with water at a temperature of between 5 °C and 30 °C, unless otherwise specified, and at a hydrostatic pressure within the range of working pressures.

NOTE Test methods and requirements for a water hammer test are under study and will be added in a future revision.

7.2 Accuracy of measuring devices

If not otherwise specified, ensure that the measuring devices allow the determination of flow rate, differential pressure, pressure in relation with atmospheric pressure, temperature and volume to an accuracy of within ± 2 % of the true value.

7.3 Sampling and acceptance requirements

7.3.1 Type test

Ensure that the test specimens are taken at random by the test laboratory representative from a quantity of 20 volumetric valves. Ensure that the number of test specimens taken for each test shall be as specified in Table 2.

If the number of defective specimens found in the sample is equal to or less than the acceptance number shown in Table 2, the sample shall be considered to conform with this International Standard. If the number of defective specimens in the sample is greater than the acceptance number, the sample shall be considered not to conform with this International Standard.

7.3.2 Acceptance tests

For acceptance of manufacturing lots or shipments, conduct the sampling according to ISO 2859-1, based on accepted quality level (AQL) 2,5 and special inspection level S-4. Select all test specimens in the sample at random according to Table 2-A of ISO 2859-1:1999 for testing in accordance with 7.4. The shipment or manufacturing lot shall be considered to conform with this International Standard if the number of defective specimens found in the test does not exceed the acceptance number specified in ISO 2859-1.

For the other tests, select the test specimens at random to according to the number specified in Table 2. The shipment or manufacturing lot shall be considered to conform with this International Standard if the number of defective specimens found in the other tests does not exceed the acceptance number specified in Table 2.

Durability tests performed in accordance with 7.8 are not required to be performed within the framework of the acceptance tests if the type test in 7.3.1 has been carried out for the same volumetric valve model and provided that the manufacturer has not introduced changes in the structure of the volumetric valve since the type test.

7.4 Test of resistance to hydrostatic pressure

Apply a hydrostatic pressure at the valve inlet and increase it gradually to 1,6 times the maximum working pressure. Maintain this pressure for 1 min.

Table 2 — Required number of test specimens and acceptance number

Subclause	Subject of test	Number of specimens	Acceptance number
7.4	Resistance to hydrostatic pressure	5	1 [a]
7.5	Manual opening and closing	4	1
7.6	Accuracy	3	0
7.7	Head loss	2	0
7.8	Durability	2	0

[a] Refers only to leakage. Damage to valve body or deleterious effect on the operation of the volumetric valve is cause for rejection of the lot.

Perform the test procedure twice: once with the valve open and its outlet or outlets closed, and a second time with the valve closed and its outlet or outlets open.

No signs of leakage shall appear through the valve body, its joints or outlets. Slight leakage through the control ports shall be deemed acceptable, provided that it does not exceed 0,1 × DN (mm^3/s) (nominal diameter of metering valve expressed in mm; see Table 1 for nominal diameters).

The volumetric valve shall withstand the test without incurring damage and without malfunctioning. The test is applicable to plastics as well as metal valves.

NOTE Particular test methods and requirements for resistance to hydrostatic pressure of plastics valves are under study and will be added in a future revision.

7.5 Test of manual opening and closing

7.5.1 Preconditioning

Precondition the volumetric valve at a temperature of 50 °C to 55 °C for a period of 24 h by carrying out one of the following.

a) Immerse it in water.

b) Pass water through it at a sufficiently low flow rate to maintain the preconditioning temperature.

c) Place it in an air oven.

Then carry out the test in 7.5.2, 7.5.3 or 7.5.4, as appropriate.

7.5.2 Test of non-serial volumetric valves

7.5.2.1 Open the volumetric valve by means of its setting device while the hydrostatic pressure at the valve inlet is at the minimum working pressure. Wait until the valve is fully opened. Return the setting device to the closed position and ascertain that the volumetric valve has actually closed.

7.5.2.2 Repeat the procedure with the hydrostatic pressure at the valve inlet at the maximum working pressure.

7.5.2.3 Perform the test three times. The valve shall open and close satisfactorily on each occasion.

7.5.3 Test of two-way serial volumetric valves

7.5.3.1 Main test

7.5.3.1.1 Adjust the setting device to the open position. Apply a hydrostatic pressure equal to the minimum working pressure at the valve inlet intended for receipt of the opening command.

7.5.3.1.2 Wait until the volumetric valve is fully open. Return the setting device to the closed position and confirm that the valve has actually closed.

7.5.3.1.3 Repeat the procedure with the hydrostatic pressure at the valve inlet equal to the maximum working pressure.

7.5.3.1.4 Perform the test three times. The valve shall open and close satisfactorily on each occasion.

7.5.3.2 Series operation

For volumetric valves intended to operate in series by transmitting a hydraulic command via a control tube, perform the test according to 7.5.2, with the following requirements.

When the valve outlet opens, the orifice intended for transmitting the hydraulic command to the next volumetric valve in the series shall remain closed. When the valve outlet closes, the orifice intended for transmitting the hydraulic command shall open and water shall flow through it.

7.5.4 Test of three-way serial volumetric valves

7.5.4.1 Adjust the setting device to the open position. Apply a hydrostatic pressure at the valve inlet equal to the minimum working pressure. Water shall flow from the first outlet while the second outlet shall remain watertight.

7.5.4.2 Adjust the setting device to the closed position. The first outlet shall close in a watertight manner while the second outlet shall open to the atmosphere.

7.5.4.3 Reduce the hydrostatic pressure at the valve inlet to atmospheric pressure. The second outlet shall close and the first outlet shall open to the atmosphere.

7.5.4.4 Repeat the procedure with the pressure at the maximum working pressure.

7.5.4.5 Perform the test three times. The valve shall open and close satisfactorily on each occasion.

7.6 Tests of accuracy

7.6.1 General

Perform the following tests according to the class of volumetric valve. Volumetric valves with a cumulative volume counter (class 1 and class 2) shall be subjected to two tests of accuracy:

— accuracy of measurement (7.6.2.1);

— accuracy of dosing (7.6.2.2).

Volumetric valves without a cumulative volume counter (class 3) shall be subjected to the test of accuracy of dosing only (see 7.6.3).

Perform the accuracy test or tests on the same volumetric valves tested according to 7.5 and which withstood that test.

7.6.2 Tests of class 1 and class 2 volumetric valves

7.6.2.1 Accuracy of measurement

7.6.2.1.1 Class 1 valves

Determine the accuracy of measurement according to ISO 4064-3.

The measurement error shall not exceed ± 2 % in the inclusive range from the minimum flow rate, q_{min}, up to the maximum flow rate, q_{max}.

7.6.2.1.2 Class 2 valves

Determine the measurement error by the method described in ISO 4064-3.

The measurement error shall not exceed ± 4 % in the inclusive range from the minimum flow rate, q_{min}, up to the maximum flow rate, q_{max}

7.6.2.2 Accuracy of dosing

7.6.2.2.1 Allow water to flow through the valve at the nominal flow rate, q_{nom}, with the flow volume setting for the volumetric valve set at 50 % of the maximum scale value.

7.6.2.2.2 Allow water to flow through the valve at the minimum flow rate, q_{min}, with the flow volume setting for the volumetric valve set at 20 % of the maximum scale value.

7.6.2.2.3 For each case, compare the flow volume set on the control mechanism with the flow volume through the volumetric valve up to its automatic closure, as measured and indicated on the cumulative volume counter. Compute the error.

The error shall not exceed 2 % of the maximum scale value of the volumetric valve.

7.6.3 Test of class 3 volumetric valves

Allow water to flow through the valve at the nominal flow rate and the minimum flow rate. Measure the volume of water which flowed through the volumetric valve up to its automatic closure and compare it with the volume set on the control mechanism, using any means available with an accuracy of ± 2 %. Compute the error.

The error shall not exceed the sum of 2 % of the maximum scale value of the volumetric valve plus 4 % of the set volume.

7.7 Test of head loss

7.7.1 Measure the head loss of the volumetric valve in accordance with the method specified in ISO 9644 at least at the minimum, nominal and maximum flow rates.

7.7.2 Test the head loss for three-way serial volumetric valves separately between the valve inlet and each of the valve outlets.

The measured head losses shall not exceed the values declared by the manufacturer.

7.8 Durability tests

7.8.1 Durability of measuring mechanism

7.8.1.1 Operate the valve at the nominal flow rate and at an inlet hydrostatic pressure of 300 kPa for 2 000 h. Adjust the volume periodically to the maximum setting of the scale.

For the purpose of this test, it is permissible to disconnect the control mechanism from the closing mechanism. The disconnection shall be performed by the manufacturer or according to the manufacturer's instructions and approval.

7.8.1.2 At the completion of the test, repeat the tests according to 7.6.2 for classes 1 and 2 or the test according to 7.6.3 for class 3 volumetric valves.

The shift in the error curve obtained after the durability test shall not exceed the original error curve obtained prior to the start of the durability test by more than 3 %.

7.8.2 Durability of operating mechanism

7.8.2.1 Activate the operating mechanism through 10 000 cycles, each of which shall consist of the following steps.

a) Set the operating mechanism to the open position. For two-way serial volumetric valves, apply, at the valve port intended for receiving the opening command, a hydrostatic pressure equal to the hydrostatic pressure at the valve inlet.

b) Wait for full opening of the volumetric valve and steadying of the flow.

c) Maintain the operating mechanism in the open position for 5 s.

d) Return the operating mechanism to the closed position.

e) Wait for full closure of the valve.

f) Maintain the operating mechanism in the closed position for 5 s. while applying a hydrostatic pressure equal to the nominal pressure.

7.8.2.2 Upon completion of the test, subject the volumetric valve to the hydrostatic pressure test (7.4) in the closed position, and to the manual opening and closing test (7.5).

The volumetric valve must pass both tests satisfactorily in order to be considered to conform with this International Standard.

8 Information to be supplied by manufacturer

The manufacturer shall include at least the following information with each volumetric valve.

a) General information:

- name and address of manufacturer;
- installation instructions;
- instructions for connecting and operating serial volumetric valves.

b) Operational data:

- maximum working pressure, kPa;
- minimum working pressure, kPa;
- maximum flow rate, l/m (or m^3/h);
- nominal flow rate, l/m (or m^3/h);

- minimum flow rate, l/m (or m^3/h);
- curves of the head losses between the valve inlet and each of the valve outlets for three-way serial volumetric valves;
- accuracy of measurement, according to class;
- classification according to Clause 4.

c) Maintenance and replacement of parts:

- recommended frequency for the various maintenance operations;
- recommended frequency for replacement of parts.