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Irrigation equipment — Volumetric valves — General requirements and test methods

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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.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 7714 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*.

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Irrigation equipment — Volumetric valves — General requirements and test methods

1 Scope and field of application

This International Standard specifies general requirements and test methods for volumetric valves capable of delivering automatically preset quantities of water for irrigation purposes, at various rates of flow, by measuring volumetrically the quantities of water flowing through the valves.

This International Standard applies to volumetric valves which are actuated by pipeline pressure alone, and do not require any external source of energy.

2 References

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

ISO 228/1, *Pipe threads where pressure-tight joints are not made on the threads — Part 1: Designation, dimensions and tolerances.*

ISO 2084, *Pipeline flanges for general use — Metric series — Mating dimensions.*

ISO 4064/1, *Measurement of water flow in closed conduits — Meters for cold potable water — Part 1: Specification.*

3 Definitions

For the purposes of this International Standard, the following definitions apply.

3.1 maximum flow rate, q_{\max} : The highest flow rate at which the valve is required to operate for a limited period of time without deteriorating.

3.2 nominal flow rate, q_{nom} : The highest flow rate at which the valve is required to operate over a long period of time, under normal service conditions. This flow rate is used to designate the valve.

3.3 minimum flow rate, q_{\min} : The lowest flow rate at which the valve is required to operate within the maximum error tolerance, under normal service conditions.

3.4 range of flow rate: The range limited by the maximum and minimum flow rates (q_{\max} and q_{\min}).

3.5 nominal working pressure: The maximum static water pressure immediately upstream of the valve, at which the valve is required to operate.

3.6 minimum working pressure: The minimum static water pressure immediately upstream of the valve, at which the valve is required to operate.

3.7 range of working pressures: The range of water pressures between the minimum and nominal working pressures.

4 Classification

Volumetric valves are classified as follows:

4.1 Class 1

Volumetric valves containing a control mechanism with cumulative counter, and having an accuracy as required by water meters complying with ISO 4064/1.

4.2 Class 2

Volumetric valves containing a control mechanism with cumulative counter, but having an accuracy less than that required by water meters complying with ISO 4064/1.

4.3 Class 3

Volumetric valves containing a control mechanism, but no cumulative counter.

5 Marking

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

- a) name of manufacturer or registered trademark;
- b) nominal flow rate, q_{nom} ;
- c) serial number;
- d) arrow indicating the direction of flow;
- e) arrow indicating the direction of setting the control device, if necessary;
- f) range of working pressures.

6 Technical characteristics

6.1 General

All parts belonging to volumetric valves of the same size, type and model and 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.

Plastics parts of the volumetric valve that enclose waterways and are exposed to UV radiation shall be opaque and shall include additives to resist UV radiation.

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

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.

Table 1 — Flow rates and dimensions

Nominal flow rate m ³ /h	Designation of thread	Nominal diameter of flanges and connections* mm
1,5	G 3/4 B	—
5	G 1 B	—
12	G 1,5 B	—
25	G 2 B	50
40	G 3 B	80
60	G 4 B	100
150	—	150
250	—	200
400	—	250
600	—	300

* According to ISO 2084.

6.3 Threaded and flanged connections

In volumetric valves with threaded ends intended for direct connection to the pipeline, the threads shall comply with ISO 7/1. In valves with threaded ends intended for connection to the pipeline with compression pipe connectors, the connector threads shall comply with ISO 228/1.

Volumetric valves with threaded ends shall be provided with spanner flats on the body, or other means of preventing rotation of the valve during connection or disconnection. If special tools are required, the manufacturer shall supply them.

7 Mechanical, functional and accuracy tests

7.1 General

The water used shall be at a working temperature not exceeding 50 °C or at a temperature specified by the manufacturer, and shall contain no solids larger than can pass through a 200 µm screen, and no dissolved salts in excess of 2 g/l.

This specified water temperature limit of 50 °C differs from the water temperature limit of 30 °C specified in ISO 4064/1 and from the test temperature. All tests shall be performed with water at a temperature of 25 ± 5 °C and at a static water pressure between minimum and nominal working pressures of the valve.

The instruments used for measuring flow rates and pressures shall permit measurements within an accuracy of ± 1 %.

7.2 Sampling and acceptance requirements

From a lot of 50 or less volumetric valves, a sample of test specimens is selected at random by the testing laboratory representative. The number of test specimens required for each test shall be as specified in table 2.

If the number of defectives found in the test specimens is equal to or less than the acceptance number shown in table 2, the lot shall be considered acceptable. If the number of defectives found in the test is greater than the acceptance number, the lot shall be rejected.

7.3 Test of resistance of volumetric valve to hydrostatic pressure

This test is performed once with the valve in open position and its outlet closed, and once with the valve in closed position and its outlet open.

7.3.1 Metal valves

Apply a hydraulic pressure internally and increase it gradually to 1,6 times the nominal working pressure declared by the manufacturer. Maintain this pressure for 1 min.

No signs of leakage shall appear through the body of the valve or its outlet.

Table 2 — Test specimens required

Sub-clause number	Name of test	Number of test specimens	Acceptance number
7.3	Resistance of volumetric valve to hydrostatic pressure	5	1 *
7.4	Manual opening and closing	5	1
7.5	Accuracy	3	0
7.6	Pressure loss	2	0
7.7	Endurance	2	0
7.8	Water hammer	2	0

* Refers only to leakage; damage to valve body or valve operation is cause for rejection of lot.

Slight leakage through the control ports is acceptable, provided that it does not exceed 1 drop in 5 s.

The volumetric valve shall withstand the test without incurring damage or malfunctioning.

7.3.2 Plastics valves

Test methods and requirements for resistance to hydrostatic pressure of plastics valves are under study and will be added at a later stage.

7.4 Test of manual opening and closing

Open the volumetric valve by means of its setting device while the water pressure at the valve inlet is at minimum working pressure. Wait until full opening of the valve. Return the setting device to closing position and ascertain that the valve has actually closed.

Repeat the test procedure with the water pressure at the valve inlet at nominal working pressure.

Perform this series of test procedures three times.

The valve shall open and close satisfactorily during all three tests.

7.5 Tests of accuracy

7.5.1 General

These tests are performed according to the class of valve.

Volumetric valves with cumulative counter (Class 1 and Class 2) are subjected to two tests of accuracy:

- accuracy of measurement;
- accuracy of dosing.

Volumetric valves without cumulative counter (Class 3), are subjected only to the test of dosing accuracy.

7.5.2 Tests of volumetric valves of Class 1 and Class 2

7.5.2.1 Accuracy of measurement

a) Volumetric valves Class 1

Allow water to flow through the valve at rates equal to the standard flow rates of water meters of equivalent size, provided that the rates are in the range between q_{\min} and q_{\max} .

Compare the volume of flow registered on the indicating device with the volume actually measured and compute the error.

The maximum permissible error shall not exceed the requirements of ISO 4064/1.

b) Volumetric valves Class 2

Allow water to flow through the valve at $0,5 q_{\text{nom}}$, q_{\min} and q_{\max} of the given volumetric valve.

Compare the volume of flow registered on the indicating device with the volume actually measured and compute the error.

The error shall not exceed $\pm 4\%$.

7.5.2.2 Accuracy of dosing

Allow water to flow through the valve at a flow rate of q_{nom} while the dose of the valve is adjusted to 50 % of the maximum scale value. Then allow water to flow through the valve at q_{\min} while the dose of the valve is adjusted to 20 % of the maximum scale value.

Compare the volume set on the control mechanism with the volume of water which flowed through the valve up to its automatic closure, as measured and indicated on the cumulative counter, and compute the error.

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

7.5.3 Tests of volumetric valves of Class 3

Allow water to flow through the valve at flow rates of q_{nom} and q_{\min} .

Measure the volume of water which flowed through the valve up to its automatic closure and compare it with the volume set on the control mechanism, using any means having an accuracy at least equal to that of a calibrated water meter. Compute the error.

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

7.6 Test of pressure loss

Measure the pressure loss of the valve at least at the following three flow rates: q_{min} , q_{nom} , q_{max} .

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

7.7 Test of endurance

7.7.1 Endurance of measuring mechanism

Operate the valve at nominal flow rate for 2 000 h. Adjust the volume periodically to the maximum possible value of the scale.

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

At the completion of the test, repeat the tests described in 7.5.2 for volumetric valves Class 1 and Class 2 and the tests described in 7.5.3 for volumetric valves Class 3.

The maximum deviation in the test results shall not exceed 50 % of the original error in the same valve at the beginning of the endurance test.

7.7.2 Endurance of operating mechanism

Activate the operating mechanism for a duration of 10 000 cycles, each consisting of the following steps:

- a) set operating mechanism to opening position;
- b) wait for full opening of the valve and steadying of the flow;
- c) maintain in open position for at least 5 s;
- d) return operating mechanism to closed position;
- e) wait for full closure of the valve;
- f) maintain it in the closed position for at least 5 s, while applying nominal working pressure.

At the completion of the test, subject the valve to the hydrostatic pressure test (see 7.3) in the closed position and to the manual opening and closing test (see 7.4).

The valve shall pass both tests satisfactorily.

7.8 Test of water hammer

Allow water to flow through the volumetric valve at the nominal flow rate of the valve, then close the valve manually.

The closing operation of the volumetric valve shall be gradual and the maximum transient water pressure during the closure shall not exceed twice the hydrostatic pressure that exists in the pipeline at no-flow conditions. Furthermore, the hydrostatic pressure in the pipeline shall not exceed 1,5 times the nominal working pressure of the valve.

8 Information to be supplied by manufacturer

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

8.1 General information

- a) name and address of manufacturer;
- b) installation instructions.

8.2 Operational data

- a) nominal working pressure, in kilopascals;
- b) minimum working pressure, in kilopascals;
- c) maximum rate of flow, in litres per minute (in cubic metres per hour);
- d) nominal rate of flow, in litres per minute (in cubic metres per hour);
- e) minimum rate of flow, in litres per minute (in cubic metres per hour);
- f) pressure loss curves;
- g) accuracy of measurement (according to class of volumetric valve).

8.3 Maintenance and spare parts

The manufacturer shall provide precise information on the following:

- a) the recommended frequency of the various maintenance operations;
- b) the recommended frequency of replacement of spare parts.

The manufacturer shall ensure the regular supply of spare parts for a minimum of five years.