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

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

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Foreword

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This document 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 fifth edition cancels and replaces the fourth edition (ISO 7714:2008), which has been technically revised.

The main changes are the following:

— addition of a paragraph to 6.1 that metering valves with metrological characteristics shall comply with the relevant standard for meters for irrigation water;

— addition of ISO 16399 to the Normative references.

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

1 Scope

This document specifies general requirements and test methods for volumetric valves able to automatically deliver 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 between 5 °C and 50 °C.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements 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 7-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

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

ISO 16399:2014, *Meters for irrigation water*

3 Terms and definitions

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

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— IEC Electropedia: available at http://www.electropedia.org/

— ISO Online browsing platform: available at https://www.iso.org/obp

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

3.2
serial volumetric valve
volumetric valve (3.1) designed to operate in a sequence of volumetric valves

3.2.1
single outlet serial volumetric valve
serial volumetric valve (3.2) 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
single outlet "skip over" serial volumetric valve
serial volumetric valve (3.2) 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, skips over the next volumetric valve in the system and transmits a hydraulic command to the second next volumetric valve to bring it into operation

3.2.3
dual outlet serial volumetric valve
serial volumetric valve (3.2) 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 closes automatically, the second outlet opens automatically and all the flow is passed through the second outlet to the next volumetric valve in the series

3.3
non-serial volumetric valve
volumetric valve (3.1) designed to operate alone

3.4
permanent flow rate
q_{V3}
highest flow rate within the rated operating conditions at which the meter is designed to operate in a satisfactory manner within the maximum permissible error

3.5
overload flow rate
q_{V4}
highest flow rate at which the water meter is designed to operate for a short period of time within its maximum permissible error, whilst maintaining its metrological performance when it is subsequently operated under normal service conditions

3.6
minimum flow rate
q_{V1}
lowest flow rate at which the *volumetric valve* (3.1) is designed to operate within the maximum permissible error

3.7
range of flow rate
flow rate between the *minimum flow rate* (3.6) and the *overload flow rate* (3.5), inclusive of limits

3.8
range of working flow rate
flow rate between the *minimum flow rate* (3.6) and the *permanent flow rate* (3.4), inclusive of limits

3.9
relative error
ε
difference between measured and actual volume divided by actual volume, expressed as a percentage

3.10
maximum working pressure
highest pressure immediately upstream from a device recommended by the manufacturer to ensure continuous operation and functionality

3.11
minimum working pressure
lowest water pressure at the inlet to a *volumetric valve* (3.1) at which it operates satisfactorily and performs the mechanical and hydraulic functions as specified by the manufacturer

3.12
range of working pressures
pressures between and including the *minimum working pressure* (3.11) and the *maximum working pressure* (3.10)

3.13
nominal pressure
pressure numerical designation equal to the *maximum working pressure* (3.10) specified by the manufacturer

3.14
accuracy
quality which characterizes the ability of a measuring instrument to give indications approximating to the true value of the quantity measured

3.15
uncertainty of measurement
parameter associated with the result of a measurement, obtained using an appropriate mathematical formula which takes into account all sources of error, that characterizes the dispersion of values that could reasonably be attributed to the measurement result

3.16
pattern approval
certification bestowed by an authorized and accepted body, recognizing that the pattern of a measuring instrument conforms to the requirements of accepted International Standards

3.17
granulometry
measure of the particle (grain) content of irrigation water, as characterized by size dispersion and total amount of solids

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 of volume measurement of ±2 %, within the range of flow rates.

Class 2: Volumetric valve containing a control mechanism with a cumulative volume counter and having an accuracy of volume measurement of ±4 %, within the range of flow rates.

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

Class 3: Volumetric valve containing a preset volume mechanism but without a cumulative volume counter.

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

4.2.1 Non-serial volumetric valve.

4.2.2 Serial volumetric valve:

— single outlet serial volumetric valve;

— single outlet “skip over” serial volumetric valve;

— dual outlet serial volumetric valve.

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.

5 Markings

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

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

— permanent flow rate, q_{V3};

— ratio, q_{V3}/q_{V1};

— serial number;

— arrow indicating the direction of flow;

— arrow indicating the direction of setting of 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;

— accuracy class (1, 2 or 3).

6 Technical requirements

6.1 General

Metering valves intended to be used as meters with a metrological purpose shall comply with the metrological characteristics described ISO 16399:2014, Clause 4.

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.

All parts of the volumetric valve shall be resistant to chemicals normally used in agriculture in their conventional concentrations, and shall operate smoothly for the water quality defined in 7.1.

Upon request, the manufacturer shall supply information pertaining to the operation and safety of the valve with water of purity levels not conventionally found in agriculture, such as corrosive water.

All non-metallic parts of the volumetric valves which are exposed to sunlight shall be protected against degradation from ultraviolet (UV) radiation under the normal operating conditions of the valve.

Non-metallic 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 means of manual override to stop the flow at any time, such as returning the setting device to zero.

6.2 Threaded and flanged connections

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

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.

6.3 Metrological requirements

6.3.1 General

Volumetric valves are designated according to the permanent flow rate, q_{V3}, in cubic metres per hour, and by the ratio q_{V3}/q_{V1}, which represents the range of working flow rates.

6.3.2 Class 1, Class 2 and Class 3 — Sizes DN16, DN20 and DN25

The minimum value of the permanent flow rate, q_{V3}, with respect to volumetric meter size (nominal diameter, DN, in millimetres) shall be in accordance with Table 1.

Table 1 — Minimum value of permanent flow rate — Sizes DN16, DN20 and DN25

Volumetric meter size mm	Minimum q_{V3} m^3/h
DN16	1,6
DN20	2,5
DN25	4,0

Higher values of the permanent flow rate, q_{V3}, in cubic metres per hour, may be chosen from the following list: 2,5; 4,0; 6,3; 10.

The value of q_{V3}/q_{V1}, in cubic metres per hour, shall be chosen from the following list: 8; 10; 12,5; 16; 20; 25; 31,5.

6.3.3 Class 1 and Class 2 — Sizes DN40 to DN300

The minimum value of the permanent flow rate, q_{V3}, with respect to volumetric meter size shall be in accordance with Table 2.

Higher values of the permanent flow rate, q_{V3}, in cubic metres per hour, may be chosen from the following list: 25; 40; 63; 100; 160; 250; 400; 630; 1 000; 1 600.

The value of q_{V3}/q_{V1}, in cubic metres per hour, shall be chosen from the following list: 10; 12,5; 16; 20; 25; 31,5; 40; 50; 63; 80; 100.

Table 2 — Minimum value of permanent flow rate — Sizes DN40 to DN300

Volumetric meter size mm	Minimum q_{V3} m^3/h
DN40	16
DN50	25
DN65	40
DN80	63
DN100	100
DN125	160
DN150	250
DN200	400
DN250	630
DN300	1 000