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Irrigation equipment — Hydraulically operated irrigation valves

Matériel d'irrigation — Vannes commandées hydrauliquement

Reference number
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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.

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.

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Irrigation equipment — Hydraulically operated irrigation valves

1 Scope

This International Standard specifies construction and performance requirements and test methods for hydraulically operated valves, intended for operation in irrigation systems, with water at temperatures not exceeding 50 °C, which may contain fertilizers and chemicals of the types and concentrations used in agriculture.

It applies to hydraulically operated irrigation valves of 15 mm (1/2″) diameter or greater which are designed for fully open and fully closed positions. However, they may also operate for prolonged use in any intermediate position.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 7-1:1982, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Designation, dimensions and tolerances.*

ISO 2859-1:1989, *Sampling procedures for inspection by attributes — Part 1: Sampling plans indexed by acceptable quality level (AQL) for lot-by-lot inspection.*

ISO 7005-2:1988, *Metallic flanges — Part 2: Cast iron flanges.*

ISO 9644:—[1], *Irrigation equipment — Valves — Test method for pressure losses.*

ISO 9911:—[1], *Irrigation equipment — Manually operated small plastic valves.*

ANSI/ASME B1.20.1, *Pipe threads — General purpose (inch).*

3 Definitions

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

3.1 hydraulically operated valve: Valve operated by means of water pressure.

3.2 operating mechanism: Portion of the valve consisting of moving parts that open and close the water passage hydraulically.

3.3 adjustable stop: Device used to limit the movement range of the operating mechanism up to full opening or closing of the valve.

3.4 control valve: Auxiliary valve operated mechanically, electrically, hydraulically or pneumatically, or by any other suitable means, and used to activate the hydraulically operated valve.

3.5 activating chamber: Spaces in the operating mechanism, on one or both sides of the piston or diaphragm, in which the water pressure is applied to open or close the valve.

3.6 full opening: Position reached by the operating mechanism either when the valve is fully open or when the operating mechanism reaches the adjustable stop.

3.7 one-side hydraulic activation: Activating mechanism capable of using water pressure to apply

1) To be published.

force on the valve in one direction only, either to open or to close it.

3.8 two-side hydraulic activation: Activating mechanism capable of using water pressure to apply force on the valve in two directions, either to open or to close it.

3.9 normally open (N.O.) valve: Valve which remains open, unless the minimum activating pressure is applied to the operating mechanism.

3.10 normally closed (N.C.) valve: Valve which remains closed unless the minimum activating pressure is applied to the operating mechanism.

3.11 nominal size: Conventional numerical designation used to indicate the valve size. This designation equals the nominal size of the pipe to which the valve can be connected without intermediate fittings.

3.12 nominal pressure; maximum working pressure, p_n: Maximum static water pressure immediately upstream of the valve, at which the valve is required to operate.

3.13 minimum activating pressure: Minimum static water pressure in the activating chamber which is required to activate the operating mechanism fully. In the event of the activating chamber being activated by the valve inlet pressure, then the minimum activating pressure is identical with the minimum working pressure.

3.14 maximum activating pressure: Maximum static water pressure in the activating chamber which is allowable to activate the operating mechanism. In the event of the activating chamber being activated by the valve inlet pressure, then the maximum activating pressure is identical with the nominal pressure.

3.15 minimum working pressure: Minimum static water pressure upstream of the valve at which the valve is required to operate.

3.16 nominal duration of opening or closing time: Period that elapses from the time that the control valve is activated until full opening or closing of the valve.

3.17 mean velocity of flow: Flow-rate of the water flowing through the valve divided by the internal cross-sectional area of a pipe with the same nominal size as the valve.

4 Classification

Irrigation valves are classified according to operating mechanism:

a) diaphragm-type operating mechanism:

   — diaphragm serves to activate operating mechanism and to seal the valve,

   — diaphragm serves only to activate operating mechanism;

b) piston-type operating mechanism.

5 Marking

5.1 Marking of valves

Each valve shall bear readily visible, clear and permanent marking including the following details:

a) manufacturer's name and/or trademark;

b) nominal size;

c) nominal pressure;

d) arrow for flow direction (if it affects valve operation).

5.2 Marking of diaphragm

In diaphragm-type valves, the diaphragm shall be suitably marked to permit identification in the manufacturer's catalogue, according to service conditions.

6 Technical characteristics

6.1 General

Valve parts that are in contact with water shall be of non-toxic materials, and shall be resistant to or protected against corrosion under the working conditions for which the valve is intended.

All parts belonging to valves of the same size, type and model, and produced by the same manufacturer, shall be interchangeable.

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.

6.2 Valve body length

Valve body length tolerances shall be in accordance with table 1.

Table 1

Dimensions in millimetres

Length of valve	Permissible deviation
⩽ 600	± 3
> 600	± 4

6.3 Connections

The manufacturer may use one of the following connection methods:

a) Threaded ends for direct connection to supply line, where the threads shall comply with ISO 7-1. Threads specified in ANSI/ASME B1.20.1 are acceptable if so agreed between manufacturer and purchaser.

b) Flanged connections, where the flanges shall comply with ISO 7005-2.

c) Other types of connections.

6.4 Adjustable stop

In valves with threaded adjustable stops, at least three full threads shall be engaged in the position of full opening or full closure. In valves with other types of stops, engagement shall be ensured. The stops shall be easily adjusted, positive and not subject to loosening by vibration.

When assembled on the spindle (stem), the handle shall be mechanically secured to the spindle (stem).

The adjustable stop and its related parts shall effectively resist an opening or a closing torque in newton metres numerically equal to the nominal valve size in millimetres.

7 Mechanical and functional tests

7.1 General

Unless otherwise specified, all tests shall be performed with fresh, debris-free water at a temperature of 20 °C to 30 °C. The water used in the mechanical and functional tests should first be passed through a strainer filter with a 120 µm strainer element. The measuring instruments used to measure the various parameters shall have a permissible deviation from the actual value not exceeding ± 2 %.

7.2 Sampling and acceptance requirements

7.2.1 Type tests

If valves are produced as a regular product series, the test specimens shall be taken at random by the representatives of the test laboratory from a quantity of at least 20 valves. The number of test specimens required for each test shall be as specified in table 2.

If the valves are not produced as a regular product series and the number of valves produced is less than 20, no requirement is stipulated as to sampling procedure.

If the number of defective specimens in the sample is equal to or less than the acceptance number cited in table 2, the lot shall be considered acceptable. If the number of defective specimens in the sample is greater than the acceptance number, the lot shall be rejected.

Table 2

Reference clause No.	Name of test	Number of test specimens	Acceptance number
7.3	Resistance of valve body to internal hydraulic pressure	5	1[1]
7.4	Resistance of activating chamber to hydraulic pressure	3	0
7.5	Seat pressure tightness	5	1
7.6	Closing of valve	2	0
7.7	Opening of valve	2	0
7.8	Pressure loss	2	0
8	Endurance	2	0

1) Refers only to leakage. Damage to valve body is cause for rejection.

7.2.2 Acceptance tests

When acceptance of manufacturing lots or of shipments of valves is required, the sampling shall be conducted according to ISO 2859-1:1989 based on AQL 2,5 and Special Inspection Level S-4.

All test specimens in the sample, selected at random according to table II-A of ISO 2859-1:1989, shall be tested according to 7.3.

The shipment or manufacturing lot complies 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, except the test in 7.3, the number of test specimens shall be selected at random from the sample according to table 2. The shipment or manufacturing lot complies 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.

7.3 Resistance of valve body to internal hydraulic pressure

7.3.1 General

This test is performed with the valve open and the water reaching all parts of the valve which are subjected to water pressure under normal working conditions.

The water passage in the valve is opened as follows:

a) In normally open (N.O.) valves with one-side activation, the water passage in the valve is opened by applying pressure through the inlet, while keeping the operating mechanism inactive and the outlet closed.

b) In normally closed (N.C.) valves with one-side activation, the water passage in the valve is opened by applying pressure through the outlet, while keeping the operating mechanism inactive and the inlet closed.

c) In valves with two-side activation which open against the water flow, the water passage in the valve is opened by applying pressure through the outlet and in the opening chamber of the valve, while keeping the inlet closed.

d) In valves with two-side activation which open with the water flow, the water passage in the valve is opened by applying pressure through the inlet and in the opening chamber, while keeping the outlet closed.

7.3.2 Metal valve body

With the valve open as described in 7.3.1, apply a gradually increasing pressure up to 1,6 times the nominal pressure declared by the manufacturer. Maintain this pressure for 5 min.

No signs of leakage shall appear through the valve.

7.3.3 Plastics moulded material valve body

The resistance to internal pressure of a valve body made from plastics shall be tested in accordance with 7.4 and ISO 9911, annex A, subclauses A.1.1 and A.1.2.

7.4 Resistance of activating chamber to hydraulic pressure

Apply a hydrostatic pressure in the activating chamber of the valve, while keeping both inlet and outlet open. Increase the pressure gradually to 1,6 times the maximum activating pressure and maintain this pressure for 1 min. In valves with two-side activation, apply the pressure once in the opening cell, and once in the closing cell.

No signs of leakage shall appear and no damage or malfunction of the operating mechanism shall occur.

7.5 Seat pressure tightness

7.5.1 Tightness at high pressure

The various types of valves shall be tested for watertightness as given in 7.5.1.1 to 7.5.1.3, with the valve outlet open to the atmosphere. Valves shall meet the requirement given in 7.5.1.4.

7.5.1.1 Normally open (N.O.) valves with one-side activation and valves with two-side activation which close against water flow

Apply equal hydraulic pressures at the valve inlet and in the closing chamber. Increase the pressure gradually from the minimum operating pressure to 1,6 times the nominal pressure. Maintain this pressure for 5 min for metal operating mechanisms, and for 1 h for plastics operating mechanisms.

7.5.1.2 Normally closed (N.C.) valves with one-side activation

Apply hydraulic pressure only at the inlet of the valve and increase the pressure gradually as in 7.5.1.1.

7.5.1.3 Valves with two-side activation, which open against water flow

Close the valve by applying a steady pressure to the closing chamber equal to 0,5 times the nominal pressure, but not less than the minimum operating pressure. Apply a pressure gradually increased in five near-equal steps from zero to 1,6 times the nominal pressure at the valve inlet. At each step maintain the pressure for 1 min for metal operating mechanisms, and for 10 min for plastics operating mechanisms.

7.5.1.4 Requirement

After closing the valve, the leakage at the valve outlet shall not exceed 500 ml/h for each 25 mm of nominal diameter.

7.5.2 Tightness at pressure below minimum working pressure

After completion of the tests specified in 7.5.1, reduce the pressure at the valve inlet and in the activating chambers to a pressure equivalent to 0,7 times the minimum working pressure, and

maintain this pressure for 1 min for metal operating mechanisms, and for 10 min for plastics operating mechanisms.

After closing the valve, no leakage shall occur at the valve outlet.

7.6 Closing of valve

Close the valve by activating the control valve, once by a pressure at the valve inlet equal to the nominal pressure, and once by a pressure of 0,3 times the nominal pressure, but not less than the minimum working pressure. Measure the duration of closing time until the operating mechanism closes the water passage to full tightness.

In no case shall the duration of closing time, t, in minutes, exceed the time calculated from the formula:

$$t = 0{,}2\sqrt{d} - 0{,}5$$

where d is the nominal size of the valve, in millimetres.

7.7 Opening of valve

7.7.1 Normally open (N.O.) valves with one-side or two-side activation which close against water flow

Apply half the minimum activating pressure at the valve inlet. Increase the pressure to the minimum that permits full opening of the valve. This pressure shall not deviate from the minimum activating pressure (as given by the manufacturer) by more than ± 15 %.

7.7.2 Normally closed (N.C.) valves with one-side activation, and valves with two-side activation that open against water flow

Apply a hydraulic pressure equal to 0,1 times the nominal pressure, but not less than the minimum working pressure, at the valve inlet and at the opening chamber.

The valve shall open to full opening.

Run water through the valve at test velocities of 0,5 m/s to 3 m/s, calculated as defined in 3.17.

The valve shall stay open throughout the duration of the test.

7.8 Pressure loss

This test shall be carried out 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.

8 Endurance

Connect the valve to a suitable source of water according to the manufacturer's instructions, and operate the valve for 10 000 cycles, each consisting of the following steps:

a) Close the valve according to its type and construction.

b) After the valve is closed for a duration, in seconds, equivalent to $d/5$ where d is the nominal valve size in millimetres, apply the nominal pressure at the valve inlet.

When applying the pressure at the closed valve inlet, the following pressures shall exist in the closing chamber, according to the type of valve:

— in normally open (N.O.) valves with one-side activation — nominal pressure;

— in normally closed (N.C.) valves with one-side activation — atmospheric pressure;

— in valves with two-side activation — atmospheric pressure in the closing chamber and nominal pressure in the opening chamber.

c) Open the valve to full opening and allow water to run through the valve for a duration, in seconds, equivalent to $d/5$ where d is the nominal valve size in millimetres.

When opening the valve, the following pressures shall exist in the closing chamber, according to the type of valve:

— in normally open (N.O.) valves with one-side activation — atmospheric pressure;

— in normally closed (N.C.) valves with two-side activation — nominal pressure;

— in valves with two-side activation — nominal pressure on the side causing opening of the valve, and atmospheric pressure on the other side of the valve.

The test for the first 9 500 cycles shall be performed with water at ambient temperature.

The test for the subsequent 500 cycles shall be performed with water at a temperature of 50 °C ± 3 °C.

At the completion of the endurance test, repeat the tests specified in 7.5.

The valve shall comply with all the requirements specified in 7.5.

9 Information to be supplied by manufacturer

The manufacturer shall supply the general information in 9.1 and the operational data in 9.2.

9.1 General information

a) name and address of manufacturer;

b) classification of valve according to clause 4;

c) instructions for installation and operation;

d) information on resistance of valve to fertilizers and chemicals used in agriculture.

9.2 Operational data

a) nominal pressure, in kilopascals;

b) minimum working pressure, in kilopascals;

c) minimum and maximum operating pressure (if the activating chamber is operated by an external pressure source);

d) pressure loss data (see 7.8);

e) known limitations of use (e.g. water quality);

f) recommended range of flow-rates;

g) technical data: it is recommended that the manufacturer supply the technical data in the form of tables such as table 3 and table 4.

Table 3

Flow rate m^3/h	Pressure loss kPa

Table 4

Pressure kPa	Duration of opening time min	Duration of closing time min

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Descriptors: irrigation, agricultural equipment, agricultural sprayers, control devices, valves, hydraulic valves, water supply valves, classification, specifications, tests, marking.

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