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Agricultural irrigation equipment — Pressure losses in irrigation valves — Test method

Matériel agricole d'irrigation — Pertes de pression dans les vannes d'irrigation — Méthode d'essai

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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 9644 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 second edition cancels and replaces the first edition (ISO 9644:1993), which has been technically revised. It also incorporates the Amendment ISO 9644:1993/Amd 1:1998.

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Agricultural irrigation equipment — Pressure losses in irrigation valves — Test method

1 Scope

This International Standard specifies a test method for determining the pressure loss in agricultural irrigation valves under steady-state conditions when water flows through them. The scope and accuracy of the valve performance specifications presented will assist agricultural irrigation system designers in comparing pressure losses through various types of valves.

The measurement of pressure losses provides a means for determining the relationship between pressure loss and flow rate through the valve.

This International Standard also describes the method of reporting pertinent test data.

No attempt is made to define product use, design or applications.

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The test method is suitable for valves with equal inlet and outlet nominal sizes.

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NOTE Unless otherwise specified, the equations are expressed in the SI units recommended by ISO 1000.

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2 Terms and definitions

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

2.1
nominal size
DN
conventional numerical designation used to indicate the size of an irrigation valve

NOTE It is expressed in millimetres, or in metres according to ISO 1000.

2.2
volume flow rate
flow rate
q_V
volume of water flowing through the valve per unit time

NOTE It is expressed in litres per second (l/s), cubic metres per hour (m^3/h), or in cubic metres per second (m^3/s) according to ISO 1000.

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2.3
pressure loss
Δp
difference in pressure due to water flow between two specified points in a system or in part of a system

NOTE It is expressed in pascals (Pa) according to ISO 1000, in kilopascals (kPa) or in bar[1)].

2.4
piping pressure loss
Δp_{p}
pressure loss in the upstream and downstream portions of the test bench piping between the pressure taps, but excluding the pressure loss in the valve tested

2.5
bench pressure loss
Δp_{b}
pressure loss in the test bench between the pressure taps upstream and downstream of the valve tested

2.6
valve pressure loss
Δp_{v}
pressure loss in the valve tested

2.7
reference velocity
v_{ref}
velocity of flow through the valve calculated from the actual flow rate through the valve divided by the reference cross-sectional area of the valve

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NOTE It is expressed in metres per second (m/s), in accordance with ISO 1000.

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2.8
steady-state flow
state of flow where the flow rate through a cross-section does not vary with time

2.9
valve flow coefficient
K_{v}
number equal to the flow rate of water, in cubic metres per hour, that will flow through a fully open valve with a one bar pressure loss across the valve

NOTE It is expressed as

$$\mathrm{m}^3/\mathrm{h}\sqrt{\frac{1}{\mathrm{bar}}}$$

2.10
flow resistance coefficient
ζ
coefficient used in non-dimensional presentation of valve loss

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

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3 Test installation

3.1 Permissible deviation of measuring devices

The permissible deviation of the reading indicated on the measuring devices from the actual value shall be as follows:

Flow rate:	± 2 %
Differential and actual pressure:	± 2 %
Temperature:	± 1 °C

The measuring devices shall be calibrated according to the existing calibration rules in the country concerned.

3.2 Test equipment

3.2.1 Piping

Upstream and downstream piping shall be the same diameter as that of the test valve connection. The lengths of the straight, uniform-bore pipe shall be as specified in Figures 1 and 2. The inside surface of the piping shall be free of flaking rust, mill scale and irregularities which might cause excessive turbulence.

In that part of the test apparatus shown within the frame, in Figures 1 and 2, the order of the fittings/devices shown in the key and the distances between them shall be adhered to, with the exception that the lengths indicated as $5d$ and $10d$ shall be understood to be the minimum allowable length.

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3.2.2 Throttling valve

A downstream throttling valve shall be used to control the flow through the test specimen. There are no restrictions on the size or type of this valve. The throttling valve shall be located downstream of the downstream pressure tap (used for measuring bench pressure).

3.2.3 Flow measuring device

Any device that can be used to measure flow with acceptable accuracy may be used. If a closed measuring device (such as a rotameter, Venturi meter or similar device) is used, it shall be located either upstream of the upstream pressure tap or downstream of the downstream pressure tap.

If an open measuring device (such as a calibrated volumetric tank) is used, it shall be located at the downstream end of the assembly, i.e. downstream of the downstream throttling valve.

The flow-measuring device shall be installed in accordance with the specific installation instructions and, where applicable, shall be installed with the required length of straight piping before and after the device.

3.2.4 Pressure differential measuring device

Any device capable of measuring pressure differential with acceptable accuracy may be used.

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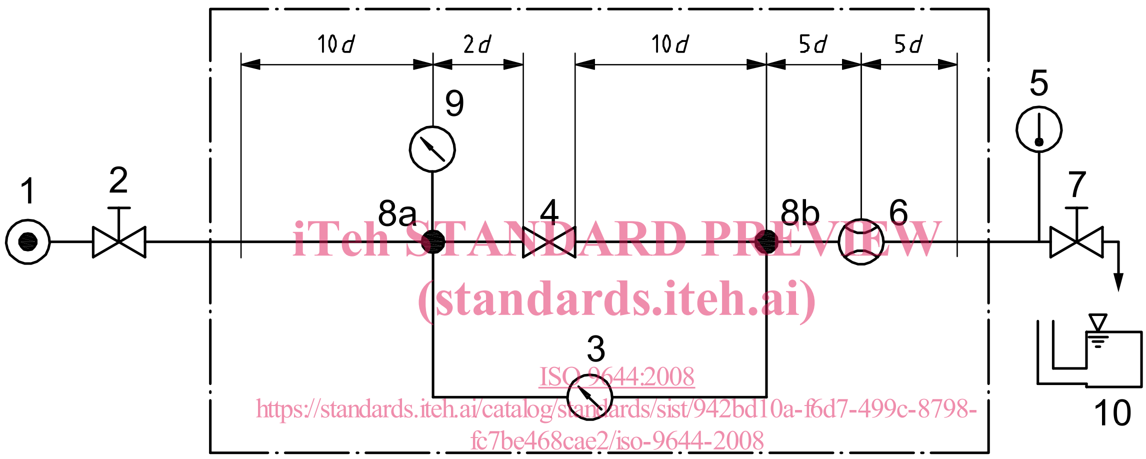
3.2.5 Pressure taps

Pressure taps (see Figure 3) shall be provided on piping for measurement of static pressure, and spaced as shown in Figures 1 or 2. The drilling centreline of the taps shall intersect the centreline of the pipe perpendicularly, as shown in Figure 3. The taps shall have a diameter, d_1, of no less than 2 mm and no greater than 9 mm. The length, l, of the tap bore shall be not less than twice the diameter of the bore. For thin-walled pipes where the wall thickness is less than $2d_1$, a boss may be added to the pipe wall where the pressure taps are to be located (see Figure 3).

Pressure taps shall be free of burrs and other irregularities and the inside wall of the piping shall be machine-finished. For pipes of 50 mm diameter and larger, four taps shall be made, situated 90° ± 5° apart on the circumference so that no tap is located on the lowest point of the pipe circumference. For pipe diameters of less than 50 mm, two taps will suffice. All taps, whether two or four in number, shall be connected by a conduit whose bore shall not be less than two pressure-tap cross-sections. The pressure taps shall provide appropriate values of d_1 and l, and may be made as illustrated in Figure 3.



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Key

1 controllable water supply
2 shut-off valve
3 pressure differential measuring device
4 test specimen, in-line valve
5 temperature sensor
6 flow measuring device, closed type (if used)
7 throttling valve
8a pressure tap
8b pressure tap
9 pressure gauge
10 calibrated water tank (if used)

d Nominal pipe diameter.

NOTE Dimensions $5d$ and $10d$ are minimal values.

Figure 1 — Test circuit diagram for in-line valves

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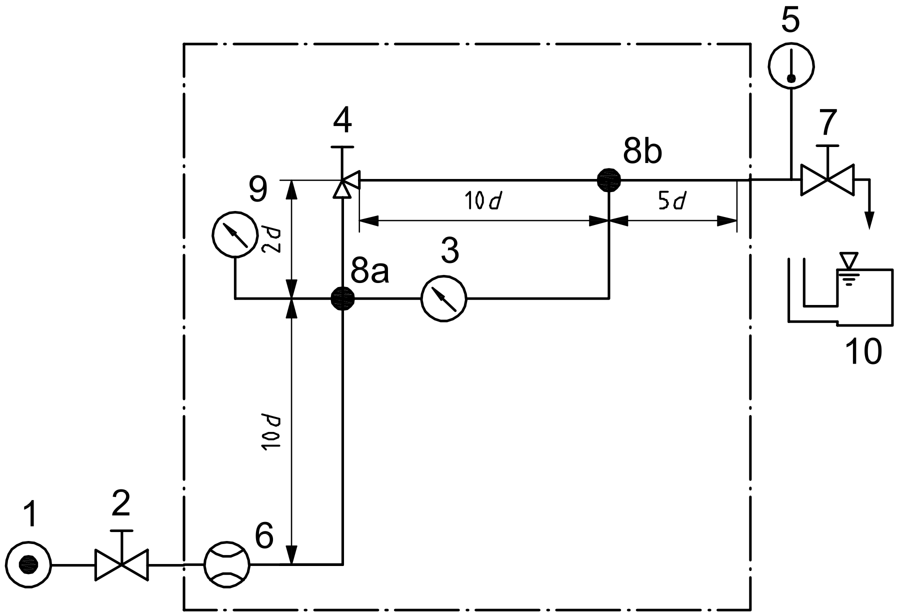

Key

1 controllable water supply
2 shut-off valve
3 pressure differential measuring device
4 test specimen, angle valve
5 temperature sensor
6 flow measuring device, closed type (if used)
7 throttling valve
8a pressure tap
8b pressure tap
9 pressure gauge
10 calibrated water tank (if used)

d Nominal pipe diameter.

NOTE Dimensions 5*d* and 10*d* are minimal values.

Figure 2 — Test circuit diagram for angle valves

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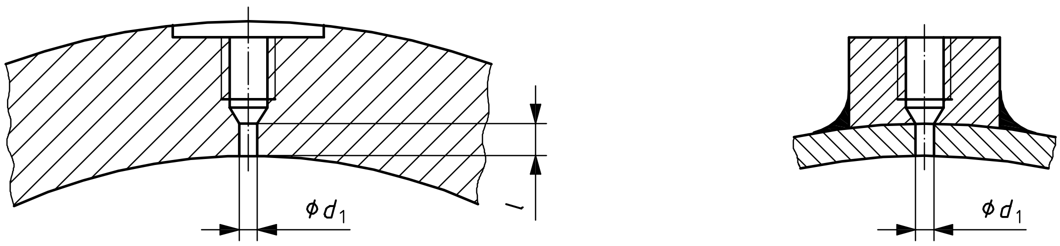

a) Thick wall **b) Thin wall**

Figure 3 — Static pressure taps in thick and thin-wall piping

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