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Agricultural irrigation equipment — Manually operated small plastics valves

Matériel agricole d'irrigation — Petites vannes en matière plastique commandées manuellement

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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 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 9911 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 9911:1993), which has been technically revised.

Agricultural irrigation equipment — Manually operated small plastics valves

1 Scope

This International Standard specifies the general requirements and test methods for manually operated small plastics valves intended for operation in agricultural irrigation systems. It is applicable to manually operated plastics valves of nominal sizes DN 8 (1/4") to DN 100 (4").

The valves are intended for installation in irrigation piping networks, using water at temperatures up to 60 °C. Nominal pressures of the valves are as designated by the manufacturer.

2 Normative references

The following referenced documents are indispensable for the application 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 48:1994, *Rubber, vulcanized or thermoplastic — Determination of hardness (hardness between 10 IRHD and 100 IRHD)*

ISO 188:1998, *Rubber, vulcanized or thermoplastic — Accelerated ageing and heat resistance tests*

ISO 815, *Rubber, vulcanized or thermoplastic — Determination of compression set at ambient, elevated or low temperatures*

ISO 1167 (all parts), *Thermoplastics pipes, fittings and assemblies for the conveyance of fluids — Determination of the resistance to internal pressure*

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 5752, *Metal valves for use in flanged pipe systems — Face-to-face and centre-to-face dimensions*

ISO 7349, *Thermoplastics valves — Connection references*

ISO 7508, *Unplasticized polyvinyl chloride (PVC-U) valves for pipes under pressure — Basic dimensions — Metric series*

ISO 8233, *Thermoplastics valves — Torque — Test method*

ISO 8242, *Polypropylene (PP) valves for pipes under pressure — Basic dimensions — Metric series*

ISO 8659, *Thermoplastics valves — Fatigue strength — Test method*

ISO 9393-1, *Thermoplastics valves for industrial applications — Pressure test methods and requirements — Part 1: General*

ISO 9625, *Mechanical joint fittings for use with polyethylene pressure pipes for irrigation purposes*

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

3 Terms and definitions

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

3.1
body
main component of the valve which provides the fluid flow passageways and the body ends

3.2
seat
part of the valve which provides the obturator seating surface

NOTE It can be either integral or a separate component.

3.3
dividing wall
integral part of the valve body which separates the inlet and outlet ports of a valve, and on which the valve seat is formed

3.4
nominal pressure
PN
alphanumeric designation for reference purposes related to the mechanical strength of a valve

NOTE It usually corresponds to the service pressure in bar, with water at 20 °C, for which the valve is designed (1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm^2).

3.5
nominal size
numerical designation used to refer to the size of a valve which is identical to the diameter of the pipe or pipes to which the valve is intended to be connected directly

NOTE A single number designation is adequate if the inlet and outlet ports are the same size.

3.6
angle valve
valve with a generally cylindrical body in which the body ends are in planes perpendicular to each other and having a stem the axis of which is co-linear with the axis of one body end

3.7
ball valve
valve in which a ball can be turned to move its port, or ports, relative to the ports in the valve body, to control the flow of water

3.8
diaphragm valve
valve in which a flexible diaphragm constitutes the closing and regulating mechanism to control the flow of fluid through the valve

3.9
globe valve
valve with a generally cylindrical body in which the axes of the body ends are co-linear and in which the axis of the stem is perpendicular to the axes of the body ends

3.10
oblique valve
Y-globe valve
valve in which the axes of the body ends are co-linear and in which the axis of the stem is oblique to the axes of the body ends

3.11
closing disc
part of an obturator of any shape on which the disc face is formed and to which the disc facing ring, if used, is secured

3.12
obturator
moving member in a valve that operates to close the valve and, where applicable, contains a washer or similar sealing device

3.13
disc face
smooth face of the obturator in a valve which makes contact with the valve seat when the valve is closed

3.14
disc facing ring
ring, of material different from the closing disc, secured to the disc and used to ensure water-tightness when a valve is closed

3.15
stem
shaft
component of an obturator by which the actuating thread is formed and by which control of the closing component is effected

3.16
closing torque
torque exerted over the closing operation to achieve full tightness of the valve at nominal pressure

3.17
opening torque
torque exerted initially to open the valve from fully closed or over the full opening operation at nominal pressure

3.18
shell test
test intended to check the design strength of a valve body, under internal hydrostatic pressure

4 Marking

Each manually operated plastics valve that meets the requirements of this International Standard shall bear a readily visible, clear and durable marking, which shall give the particulars listed under a), b) and e) below. Particulars listed under c) and d) may be given on an attached label or on the packaging.

a) Name of manufacturer or registered trademark.

b) Nominal size of inlet and outlet ports: for direct slip-on type connections to plastics pipe, the outside nominal diameter of the connecting pipe shall be given in millimetres; for threaded connections, the nominal thread size shall be given in accordance with ISO 7-1.

c) Nominal pressure, in hundreds of kilopascals.

d) Type of valve material: PE, PVC, PP, NP, etc.

e) Direction of flow, if required, which should be shown on the valve body.

5 Sampling and acceptance requirements

5.1 Type-tests

Ensure that the test laboratory representative takes the sample of test specimens at random from a total of at least 100 valves. Ensure that the number of test specimens used for each test is in accordance with Table 1.

Table 1 — Required number of test specimens and acceptance number

Clause	Test	Number of test specimens	Acceptance number
6	Technical characteristics	2	0
7.2.1	Closing torque	3	1
7.2.2	Resistance to increased torque	3	0
7.3	Pressure loss	2	0
7.4	Resistance of valve and valve material to internal hydrostatic pressure	4	0
7.5	Seat and stem sealing test	5	1
7.6	Valve performance at increased hydraulic pressure	2	0
7.7	Endurance testing	2	0
A.1	Moulded plastics material of valve body — Pressure test	2	0
A.2	Shell test	3	0

If the number of defective specimens in the sample is equal to or less than the acceptance number given in Table 1, the lot shall be considered acceptable. If the number of defective specimens found in the test is greater than the acceptance number, the lot shall be rejected.

All parts of the valve shall be of good workmanship, whole and smooth, and shall contain no holes.

5.2 Acceptance tests

When acceptance of manufacturing lots or of shipments of valves is required, conduct the sampling in accordance with ISO 2859-1:1999, based on AQL 2,5 and special inspection level S-4.

Test all specimens in the sample, selected at random in accordance with ISO 2859-1:1999, Table II-A, for 1 h, as specified in 7.5.

The shipment or the lot complies with this International Standard if the number of defective specimens found in the test does not exceed the acceptance number according to ISO 2859-1.

For the other tests, the number of test specimens shall be selected at random from the sample in accordance with Table 1.

The shipment or the 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 1.

6 Technical characteristics

6.1 General

All valve components that come into contact with water shall be suitable for use with water, fertilizers and chemicals commonly used in irrigation, including treated sewage water.

The body material shall be opaque.

All parts of the valve shall be of good workmanship, whole and smooth, and shall contain no holes, air bubbles, flash, projections or any other defects that could impair performance or cause injury.

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

The manufacturer shall supply written certification that the materials used in the manufacture of the valve are in accordance with this International Standard.

On request, the manufacturer shall supply any available information on the resistance of the valve to corrosive attack by fertilizers and chemicals used in agriculture.

6.2 Dimensions

According to the type of end connections of the valve, the basic dimensions of the valve shall be in accordance with the International Standards listed in Table 2.

Table 2 — Basic dimensions

Material	International Standard
Polypropylene (PP)	ISO 8242
Polyethylene (PE)	ISO 9625
Unplasticized polyvinyl chloride (PVC-U)	ISO 7508
Reinforced Polyamide (NP)	ISO 5752

6.3 Connections to pipeline

The connections of the valve to the pipeline shall be in accordance with ISO 7349 and Table 2.

NOTE Flanged connections are not included.

In valves with threaded ends intended for direct connection to the pipeline, the threads shall be in accordance with ISO 7-1. However, other threads are allowed, provided that a suitable adaptor is supplied with each threaded connection such that it complies with ISO 7-1. In valves intended for connection to polyethylene pipe by mechanical jointing fittings, the fittings shall be in accordance wit ISO 9625.

6.4 Handwheel or handle

The handwheel or handle shall be free from sharp projections, burrs or other defects that could cause injury.

The handwheel or handle shall be securely connected to the valve stem and shall be replaceable.

6.5 Specific construction requirements for globe, oblique and angle valves

6.5.1 Threaded valve stems or spindles

The threads of the valve stems or spindles shall be as designed by the manufacturer, provided they are self-locking.

The valve stem shall be of sufficient length to permit full closure of the valve when the handwheel or handle is mounted on the stem and the disc facing ring is removed.

6.5.2 Disc facing ring

6.5.2.1 General

The disc facing ring, if used, shall remain securely attached to the disc when in operation, but shall be removable for replacement without requiring removal of the valve from the system — with or without the closing disc.

When the disc facing ring is of elastomeric material, the material shall meet the requirements given in 6.5.2.2 to 6.5.2.4.

6.5.2.2 Hardness

Test the hardness of the disc facing ring in accordance with ISO 48:1994, using methods N or M, depending on the disc facing ring shape.

The hardness of the disc facing ring shall be 80 Shore A ± 5.

6.5.2.3 Compression set

Test the compression set of the disc facing ring in accordance with ISO 815 for 24 h at 70 °C.

The compression set after compression shall not exceed 20 %.

6.5.2.4 Ageing

Repeat the hardness test (6.5.2.2) after keeping the disc facing ring at 70 °C for 16 h, in accordance with ISO 188 (accelerated ageing in oxygen).

The change in hardness due to ageing shall be in the range of -5 IRHD to $+$ 8 IRHD.

6.6 Specific construction requirements for ball valves

6.6.1 The stem shall be provided with sealing means to ensure tightness. The sealing means shall be of elastomeric or other material of suitable mechanical properties and chemical resistance.

6.6.2 If the sealing means is of O-ring shape, the hardness of the O-rings shall be determined using the test method specified in ISO 48 and shall be not more than 75 IRHD.

The compression set of the O-ring material shall be determined using the test method given in ISO 815 (22 h at 70 °C) and shall be not more than 20 %.

7 Mechanical and functional tests

7.1 General

Unless otherwise required, the tests shall be performed with water at a temperature of 23 $\pm$ 3 °C.

The permissible deviation of the measuring device readings from the actual values of the measured quantities shall be in accordance with Table 3.

Table 3 — Accuracy of measurement

Measured quantity	Allowable deviation %
Flow-rate	±2
Pressure	±2
Torque	±2

NOTE Calibration of the measuring devices is according to national regulations.

7.2 Operating torque

7.2.1 Closing torque

The test shall be performed in accordance with ISO 8233. The torque required to change the valve position from fully open to fully closed at nominal pressure shall not exceed the closing torque according to Table 4.

Table 4 — Closing torque

Valve nominal diameter		Closing torque
mm	in	N · m
20	3/4	1,5
25	1	3
32	1 1/4	5
40	1 1/2	7,7
50	2	11
63	2 1/2	20
90	3 1/2	30

7.2.2 Resistance to increased torque

The test shall be carried out in accordance with ISO 8233, applying a torque equal to the closing torque (see Table 4) multiplied by three: for 1 min while closing the valve and for 1 min while opening the valve.

The valve and its parts shall withstand the torque without suffering damage and without any part becoming loose or disengaged.

After applying the increased torque, the valve shall pass the seat and packing tightness tests given under 7.5.

7.3 Pressure loss

The pressure loss parameters shall be determined using the test according to ISO 9644.

The measured parameters shall not exceed the values declared by the manufacturer by more than 5 %.

7.4 Resistance of valve and valve material to internal hydrostatic pressure

The resistance of the valve and valve material to internal hydrostatic pressure shall be tested in accordance with Annex A and shall comply with its requirements.

7.5 Seat and stem sealing test

7.5.1 Seat test

Connect the valve inlet to a water supply pipeline and leave the valve outlet open to the atmosphere. Using the test conditions according to Table 5, close the obturator by means of the specified test torque and apply the specified water pressure for the specified duration. Perform the test for both sets of test conditions.

Table 5 — Test conditions

Test temperature	Test torque	Test conditions	
		Pressure	Duration
°C	N · m	MPa	h
23 ± 3	1,2× closing torque[a]	1,5 × PN	1
	1,5× closing torque[a]	1,1 × PN	100
[a] See Table 4.			

The test specimen complies with the test requirements if there is no leakage through the valve seat. If, during the test time, leakage appears through the valve seat, the sealing may be tightened once again by applying a test torque in accordance with Table 5.

The test shall not cause permanent deformation in any part of the valve.

7.5.2 Stem sealing test

Connect the valve inlet to a water supply line with the obturator open and the valve outlet closed. Apply a water pressure of 1,5 times the nominal pressure for a duration of 1 h. Open and close the obturator alternately three times (i.e. six movements).

Care shall be taken to ensure that the pressure during the closing phase does not exceed the test pressure specified above.

The test specimen complies with the test requirements if no leakage occurs through the packing. If, during the test time, leakage appears through the packing, the packing may be tightened once again by means of the packing nut.

The test shall not cause permanent deformation in any part of the valve.

If the valve stem sealing consists of an O-ring, repeat the tightness test at a pressure of 20 kPa (0,2 bar).

Compliance requirements are as specified above.

7.6 Valve performance at increased hydraulic pressure

Connect the valve to a hydraulic pressure supply line in which a flow meter is installed. Check that the upstream hydraulic pressure (at flow) is 1,5 times the nominal pressure and that the valve outlet is open to the atmosphere. Adjust the valve to maintain a flow velocity of 0,1 m/s in a pipe of nominal diameter equal to that of the inlet port.

Maintain the pressure and flow velocity for 30 s.

The closing mechanism at the nominal pressure shall operate satisfactorily, the sealing parts shall not be displaced, and no vibration noise shall be detected.

7.7 Endurance testing

7.7.1 General

This testing shall be performed in accordance with ISO 8659, but with the additions of 7.7.2 and 7.7.3.

7.7.2 Initial leakage test

With the valve closed, apply a hydraulic pressure at the valve inlet equal to the nominal pressure for 1 min. The valve outlet shall be open to the atmosphere.

There shall be no visually detectable leakage.

7.7.3 Test procedure

The valve shall be left open for 10 s. The flow velocity shall not exceed 1,5 m/s.

After closing the valve, apply an internal hydrostatic pressure equal to the nominal pressure. Maintain this pressure for

— 5 s in valves of up to 32 mm (1 1/4 in),

— 10 s in valves of 40 mm (1 1/2 in).

The number of test cycles performed shall total 5 000, of which 2 500 cycles shall be performed with water at 45 °C, and 2 500 cycles at ambient temperature.

During opening and closing, there shall be no visually detectable leakage at the seal.

After completion of these cycles, repeat the tests according to 7.5.1 and 7.5.2.

There shall be no visually detectable leakage.

Annex A
(normative)

Resistance of valve and valve material to hydrostatic pressure

A.1 Moulded plastics material of valve body — Pressure test

This test may be omitted if the valve manufacturer supplies the test laboratory with a satisfactory test report on the strength requirements in accordance with Table A.1.

The pressure test shall be performed on an injection-moulded tube specimen made of the same material as the valve body.

The dimensions of the specimen shall be as shown in Figure A.1.

Dimensions in millimetres

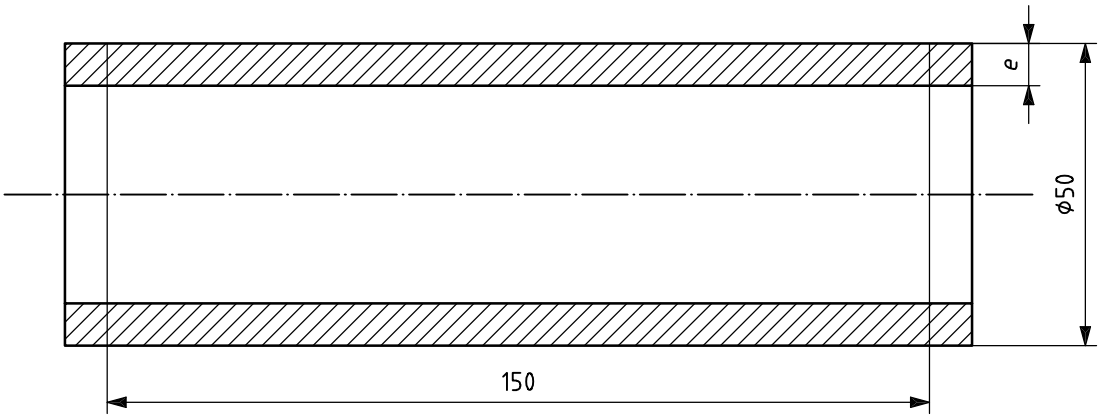

Figure A.1 — Free test length

The specimen shall be tested in accordance with ISO 1167 and shall meet the strength requirements specified in Table A.1. The specimen tested shall not suffer fracture or other damage.

Table A.1 — Test conditions and requirements

Material	Temperature °C	Circumferential stress N/mm^2	Minimum duration h
PVC-U	60	10	1 000
HDPE, Type I	80	3	170
HDPE, Type II	80	4	170
PP, Type I	95	3.5	1 000
PP, Type II	95	2.5	1 000
POM	60	10	1 000
ABS	70	4	1 000
NP (reinforced)	80	10	250

A.2 Shell test

This test shall be performed in accordance with ISO 9393-1, except for the test conditions, which shall be according to Table A.2, and the following:

a) tests under both sets of test conditions, i.e. for durations of 1 h and 1 000 h, shall be performed for each material (see Table A.2);

b) two sets of tests shall be carried out, each performed on a different valve;

c) during the test period, the closing mechanism shall be open;

d) all tests shall be performed with water at a temperature of 23 °C ± 3 °C.

Table A.2 — Test conditions

Material[a]	Duration h	Pressure MPa
PVC-U	1	4,2 × PN
	1 000	3,2 × PN
HDPE, Type I	1	3 × PN
	1 000	2,3 × PN
HDPE, Type II	1	2,3 × PN
	1 000	2 × PN
PP, Type I (homopolymer)	1	3,2 × PN
	1 000	2,5 × PN
PP, Type II (homopolymer)	1	2,7 × PN
	1 000	2,1 × PN
POM	1	4,2 × PN
	1 000	3,2 × PN
ABS	1	3,2 × PN
	1 000	2,5 × PN
NP (reinforced)	1	4,2 × PN
	250	3,2 × PN

[a] Test conditions for plastics materials other than those specified in Table A.2 are under study.

The test specimen complies with the test requirements if there is no evidence of leakage from the valve shell and no fracture or other failure occurs during the test period.

The test specimen is considered as having failed if the valve bursts or the joints show signs of leakage before the end of the minimum test period.

Packing leakage during the test shall not be cause for rejection.

Bibliography

[1] ISO 9393-2, *Thermoplastics valves for industrial applications — Pressure test methods and requirements — Part 2: Test conditions and basic requirements*

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