INTERNATIONAL STANDARD

ISO 9635-5

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Agricultural irrigation equipment — Irrigation valves —

Part 5: Control valves

Matériel agricole d'irrigation — Vannes d'irrigation —

Partie 5: Vannes de contrôle

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.

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 9635-5 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 first edition of ISO 9635-5, together with ISO 9635-1, ISO 9635-2, ISO 9635-3 and ISO 9635-4, cancels and replaces ISO 9635:1990, of which it constitutes a technical revision.

ISO 9635 consists of the following parts, under the general title *Agricultural irrigation equipment — Irrigation valves*:

— *Part 1: General requirements*

— *Part 2: Isolating valves*

— *Part 3: Check valves*

— *Part 4: Air valves*

— *Part 5: Control valves*

Agricultural irrigation equipment — Irrigation valves —

Part 5:
Control valves

1 Scope

This part of ISO 9635 specifies construction and performance requirements and test methods for control valves, intended for operation in irrigation systems with water at temperatures not exceeding 60 °C, which can contain fertilizers and other chemicals of the types and concentrations used in agriculture.

It is applicable to hydraulically-operated control irrigation valves of DN 15 (1/2 inch) diameter or greater, designed to operate in any position, from fully open to fully closed. The valves can either be directly operated (i.e. the force applied via a spring or diaphragm to the obturator) or pilot-operated (i.e. the force is applied through an adjustable pilot valve via a diaphragm).

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 9635-1:2006, *Agricultural irrigation equipment — Irrigation valves — Part 1: General requirements*

ISO 9635-2:2006, *Agricultural irrigation equipment — Irrigation valves — Part 2: Isolating valves*

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

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 9635-1 and the following apply.

3.1
control valve
device intended to regulate, within specified limits, one or more functions

NOTE The functions are flow rate, water level control and pressure (upstream or downstream).

3.1.1
autonomous control valve
control valve having the integral capability of controlling the function using energy from the conveyed water by adjusting the position of the obturator

3.1.2
non-autonomous control valve
valve that requires external power in order to regulate the specified function

3.1.3
pressure-reducing valve
control valve that reduces higher inlet pressure to a lower and outlet pressure regardless of variations in the flow rate or variations of the inlet pressure

3.1.4
pressure-sustaining valve
control valve that maintains a constant pressure at the inlet regardless of variations in the flow rate or variations of the outlet pressure

3.2
flow coefficient
K_V
coefficient equal to the flow rate, in cubic metres per hour, of water at a temperature between 5 °C and 50 °C, passing through the valve and causing a loss of static head of 1 bar

NOTE 1 $Q = K_V\sqrt{\Delta p}$, where Q is the flow rate in cubic metres per hour (m^3/h), and p is the pressure in kilopascals per square centimetre (kPa/cm^2).

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

NOTE 3 Adapted from EN 736-3.

3.3
maximum differential pressure
PM
maximum differential pressure of the control valve in operation

NOTE It is a value given by the manufacturer.

4 Design requirements

Control valves shall be designed in accordance with ISO 9635-1:2006, Clause 4.

Control valves designed to control pressure or level shall be tightly seated when closed (see ISO 9635-1:2006,Table G.2, Rate A).

The manufacturer shall indicate in the relevant technical documentation the working limits of the valve and any special conditions for installation and commissioning.

5 Performance requirements

All tests are to be performed on the valve as delivered to the test facility.

5.1 Mechanical strength

5.1.1 Resistance of shell and all pressure-containing components to internal pressure

Requirements and testing shall be in accordance with ISO 9635-1:2006, 5.1.1.

If the manufacturer indicates that any feature of the control valve is not designed to withstand a high pressure, the technical documentation shall indicate the appropriate means to be used (e.g. isolating valves of the control system), in order to protect them during the test.

The features protected by these means shall be tested to the pressure given in ISO 9635-1:2006, 5.1.2.

5.1.2 Resistance of obturator to differential pressure

The valve shall comply with the requirement and test of ISO 9635-1:2006, 5.1.2.

If a control valve does not seat tightly, the requirement and test for the obturator shall be modified such that the differential pressure that the obturator can withstand is the lower of (1,5 × PM) bar and (PM + 5) bar.

After the test, the valve shall meet the performance requirements of 5.3.

5.1.3 Resistance of valves to bending

The requirements and testing shall be in accordance with ISO 9635-1:2006, 5.1.3.

The bending moment, M, to be applied during the test shall be in accordance with Table 1, as a function of DN.

Table 1 — Bending moments

DN	Bending moment M N · m
8	610
10	615
20	640
25	670
32	730
40	825
50	525
65	700
80	750
100	1 100
125	1 600
150	2 400
200	3 600
250	5 500
300	7 500
350	9 500
400	12 000
450	14 000
500	16 500

5.1.4 Resistance of valves to operating loads

Applicable only to control valves whose main obturator can be operated manually to override the control function, the requirements and testing shall be in accordance with ISO 9635-1:2006, 5.1.4.

5.2 Watertightness

5.2.1 Watertightness of shell and all pressure-containing components

5.2.1.1 Internal pressure

Requirements and testing shall be in accordance with ISO 9635-1:2006, 5.2.1.1.

5.2.1.2 External pressure

Requirements and testing shall be in accordance with ISO 9635-1:2006, 5.2.1.2.

5.2.2 Seat tightness

Applicable only to control valves where seat tightness is a requirement or is claimed by the manufacturer (see Clause 4).

For level control and pressure control valves, the leakage rate shall be rate A (see ISO 9635-1:2006, Table G.2), under the conditions defined in the manufacturer's documentation. For other valves, the leakage rate shall be in accordance with the manufacturer's documentation.

Seat tightness shall be checked at the highest and lowest values of the differential pressure, as follows:

a) 1,1 × PFA;

b) the lowest differential pressure allowed by the manufacturer in his documentation.

In both cases, the requirements and testing shall be in accordance with ISO 9635-1:2006, 5.2.2.1, with the values of the differential pressure as given in a) and b), above.

5.2.3 Maximum operating torque (MOT) for operation and watertightness

Applicable only to control valves whose main obturator can be operated manually to override or limit the control function.

Requirements shall be in accordance with ISO 9635-1:2006, 5.2.3. Testing shall be in accordance with ISO 9635-2:2006, 5.2.3.

If the required MOT exceeds the limits according to this part of ISO 9635, this should be specified in the manufacturer's product literature.

5.2.4 Watertightness and air-tightness of gearboxes to external pressure

Requirements and testing shall be in accordance with ISO 9635-1:2006, 5.2.1.2.

5.3 Hydraulic characteristics

5.3.1 Flow coefficient, K_V

The manufacturer shall give the flow coefficient, K_V, obtained from the head loss curve performed in accordance with ISO 9644.

— For autonomous control valves, it shall be given in the fully open position.

— For non-autonomous control valves, the manufacturer shall give K_V as a function of the opening position of the obturator.

When measured in accordance with ISO 9644, the flow coefficient shall be within a range of ± 10 % of the value given by the manufacturer.

5.3.2 Regulation hydraulic characteristics

Applicable to both autonomous control valves and to non-autonomous control valves where the manufacturer claims specific hydraulic characteristics linked to a designated control system.

5.3.2.1 Control valves providing flow regulation function

The control valve shall be tested in accordance with Annex A. The values obtained shall be within the tolerances given in the manufacturer's documentation.

5.3.2.2 Control valves providing pressure regulation function

The control valve shall be tested in accordance with Annex B. The values obtained shall be within the tolerances given in the manufacturer's documentation.

5.3.2.3 Control valves providing level regulation function

The control valve shall be tested in accordance with Annex C. The values obtained shall be within the tolerances given in the manufacturer's documentation.

5.4 Resistance to chemicals and fertilizers

Requirements and testing shall be in accordance with ISO 9635-1:2006, 5.4.

5.5 Endurance

After completion of the endurance test according to Annex D, the valve shall pass

— the hydraulic tests in accordance with 5.3, with values within the range of ± 5 % of those measured before the endurance test, and

— the tests in accordance with 5.2.1 and 5.2.2, with the same leakage rate when the valve is claimed to be seat tight.

6 Conformity assessment

6.1 General

Requirements shall be in accordance with ISO 9635-1:2006, 6.1.

6.2 Type tests

Requirements shall be in accordance ISO 9635-1:2006, 6.2. The type tests to be performed shall be those according to Table 2, below.

6.3 Control of production process and quality system

Requirements shall be in accordance with ISO 9635-1:2006, 6.3.

NOTE The production control tests given in Table 2 are for information only.

Table 2 — Requirements and testing

Subclause of ISO 9635-1:2006	Corresponding requirement	Type tests[a]	Production tests (informative)
4.1	Materials	See drawings and part lists	—
4.2	DN	See drawings	—
4.3	Pressures	See technical documentation	—
4.4	Temperatures	See materials	—
4.5	Design of the shell and obturator	See test report or calculation report	—
4.6	End types and interchangeability	See drawings and marking	—
4.7	Operating direction	See drawings	—
4.8	Maximum water velocity	See Clause 4	—
4.9	All materials, including lubricants, in contact with water intended for human consumption	See test reports in accordance with national regulations	—
4.10	Internal corrosion and ageing resistance	See drawings, part lists and technical documentation	Visual inspection of coatings
4.11	External corrosion and ageing resistance	See drawings, part lists and technical documentation	Visual inspection of coatings
5.1.1	Resistance of shell and all pressure containing components to internal pressure	See 5.1.1	See 5.1.1
5.1.2	Resistance of obturator to differential pressure	See 5.1.2	—
5.1.3	Resistance of valves to bending	See 5.1.3	—
5.1.4	Resistance of valves to operating loads	See 5.1.4	—
5.2.1.1	Leak-tightness to internal pressure	See 5.2.1.1	See 5.2.1.1
5.2.1.2	Leak-tightness to external pressure	See 5.2.1.2	—
5.2.2	Seat tightness	See 5.2.2	See 5.2.2
5.2.3	Maximum operating torque (MOT) for operation and leak-tightness	See 5.2.2 and 5.2.3	See 5.2.3
5.2.1.2	Leak-tightness of gearboxes to external pressure	See 5.2.4	—
5.3.1	Flow coefficient, K_v	See 5.3.1	—
5.3.2	Regulation hydraulic characteristics	See 5.3.2	—
5.4	Resistance to chemicals and fertilizers	See 5.4	—
5.5	Endurance	5.5	—

[a] References to subclauses in this column are to this part of ISO 9635.

7 Marking

Requirements shall be in accordance with ISO 9635-1:2006, Clause 7. In addition, the direction of flow shall be marked.

8 Packaging

Requirements shall be in accordance with ISO 9635-1:2006, Clause 8.

Annex A
(normative)

Test method for hydraulic characteristics of control valves providing flow regulation function

A.1 General

The test shall be performed at ambient temperature.

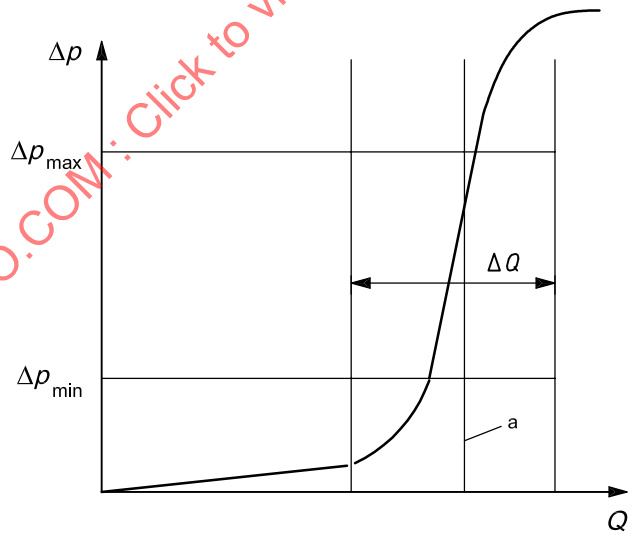
Cavitation shall be avoided.

A.2 Test procedure (see Figure A.1)

At flow Q, equal to the minimum allowed flow value as given by the manufacturer, the differential pressure, Δp, applied to the valve shall be given different values (Δp_{min}, Δp_{max} and two intermediate values), while measuring the controlled flow.

The resulting curve, $Q = f\ (\Delta p)$, shall be inside the area limited by the tolerance, ΔQ, given in the manufacturer's documentation.

Repeat the same procedure, choosing a flow equal to the maximum flow as given by the manufacturer.



[a] Set point Q.

Figure A.1 — Hydraulic characteristics

Annex B
(normative)

Test method for hydraulic characteristics of control valves providing pressure regulation function

B.1 General

The test shall be performed at ambient temperature.

Cavitation shall be avoided.

B.2 Test procedure (see Figures B.1 and B.2)

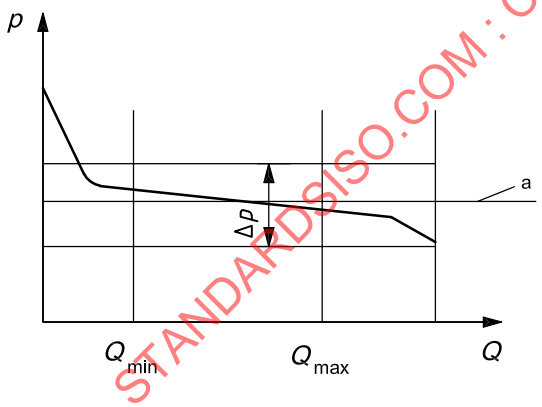
The test procedure is the following.

At set point, p, of the controlled pressure, equal to the minimum pressure as given by the manufacturer, provide a flow at different values (Q_{min}, Q_{max} and two intermediate values), while measuring the controlled pressure.

Maintain the differential pressure at the minimum value allowed by the manufacturer's documentation.

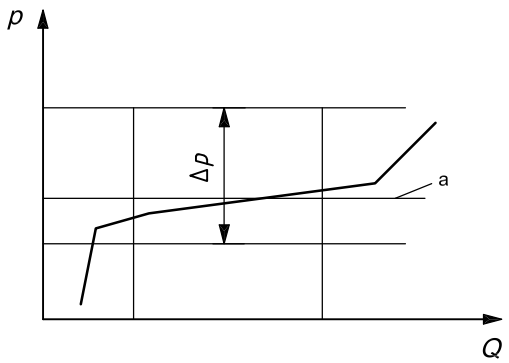
The resulting curve, $p = f(Q)$, shall be within the tolerances (Δp, Q_{min}, Q_{max}) indicated in the manufacturer's documentation.

Repeat the same procedure at the maximum pressure as given by the manufacturer.



a **Set point p.**

Figure B.1 — Pressure-reducing valve



b **Set point p.**

Figure B.2 — Pressure-sustaining valve