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Agricultural irrigation equipment — Direct-acting pressure-regulating valves

Matériel agricole d'irrigation — Vannes de régulation de la pression à action directe

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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.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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 second edition cancels and replaces the first edition (ISO 10522:1993), which has been technically revised.

The main changes compared to the previous edition are as follows.

— The range of pressure regulators sizes has been extended up to DN 100 (4").

— The water temperature of the irrigation system has been harmonized to 60 °C.

— The normative references have been updated.

— The terms and definitions have been updated.

— The testing water temperature range has been updated to 4 °C to 35 °C.

— The face-to-face distance of the flanged bodies of the pressure regulators has been updated to ±4 mm for plastics-body regulators.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Agricultural irrigation equipment — Direct-acting pressure-regulating valves

1 Scope

This document specifies construction and performance requirements and test methods for direct-acting pressure-regulating valves (hereinafter "pressure regulators") intended for operation in irrigation systems, with water at temperatures not exceeding 60 °C, which can contain fertilizers and chemicals of types and in concentrations commonly used in agricultural irrigation.

This document applies to pressure regulators in nominal sizes up to and including 100 mm (4 in).

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 7005-1, *Pipe flanges — Part 1: Steel flanges for industrial and general service piping systems*

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

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

ISO 24649:—,[1] *Agricultural irrigation equipment — Manually and hydraulically operated plastics valves*

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:

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

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

3.1
direct-acting pressure-regulating valve
pressure regulator
valve in which the water passage widens or narrows automatically without an external device to maintain the pressure at the outlet of the valve close to a pre-set value under varying pressures or flow rates at the inlet of the valve

Note 1 to entry: It is also called direct-acting pressure regulator.

3.2
ordinary pressure regulator
pressure regulator intended for installation upstream from an irrigation device and not integrated into the irrigation device or fitted specifically to it

1) Under preparation. Stage at the date of publication: ISO/DIS 24649:2021.

3.3
single-range pressure regulator
pressure regulator with a fixed non-adjustable pressure setting which cannot be varied

Note 1 to entry: See also see Annex A, Figure A.1.

3.4
multi-range pressure regulator
pressure regulator with alternative pressure settings and regulation ranges that may be changed by replacing pressure regulator components such as springs and discs but not by external adjustment

3.5
adjustable pressure regulator
pressure regulator in which the pressure setting can be adjusted externally without requiring replacement of parts in the regulation assembly

3.6
integral pressure regulator
pressure-regulating valve which is an integral part of an irrigation device or is fitted specifically to the particular irrigation device

3.7
regulated pressure
water pressure at the outlet of a pressure regulator

3.8
regulation range
all of the working pressures at the inlet of a pressure regulator within which the pressure regulator is declared by the manufacturer to regulate pressure within a specified accuracy

Note 1 to entry: See also Annex A, Figure A.2.

3.9
nominal pressure
PN
maximum static working pressure at which a piping component is stated to operate under normal service conditions

3.10
nominal diameter
DN
numerical designation used to refer to the size of a pressure regulator approximately equal to the diameter of the pipe or pipes to which the pressure regulator is to be connected directly

3.11
minimum flow rate
q_{min}
lowest flow rate at which the pressure regulating valve is designed to operate within the maximum permissible error

3.12
initial regulation pressure
lowest pressure at the inlet of a pressure regulator at which the *regulated pressure* (3.7) is within the range of regulation

3.13
declared pre-set pressure
P_s
pressure at the outlet of a pressure regulator pre-set and declared by the manufacturer using a *reference velocity* (3.16) of 1 m/s

3.14
regulated pressure at zero flow
regulated pressure (3.7) when pressure is applied at the inlet of a pressure regulator and the outlet of the pressure regulator is closed

3.15
regulation assembly
portion of the pressure regulator consisting mainly of working parts that narrow or widen the water passages in the pressure regulator to maintain a constant pressure

3.16
reference velocity
v_{ref}
velocity of flow through the valve calculated from the actual flow rate through the valve divided by the area of a circle with diameter equal to the nominal DN

3.17
accuracy level
deviation of the outlet pressure from the pressure setting or from the setting declared by the manufacturer

3.18
adjustable stop
device used for adjusting the range of movement of the operating mechanism up to full opening or closing of a hydraulically operated valve

4 Pressure regulator classification

4.1 According to construction of regulation assembly

Class 4.1.1 Single-range pressure regulator

Class 4.1.2 Multi-range pressure regulator

Class 4.1.3 Single-range adjustable pressure regulator

Class 4.1.4 Multi-range adjustable pressure regulator

4.2 According to construction of pressure regulator

Class 4.2.1 Ordinary pressure regulator

Class 4.2.2 Integral pressure regulator

4.3 According to regulated pressure at zero flow

Class 4.3.1 Pressure regulator in which the regulated pressure equals the inlet pressure at zero flow

Class 4.3.2 Pressure regulator in which the regulated pressure does not equal (is less than) the inlet pressure at zero flow

4.4 According to accuracy level [see 7.5.2.4 b)]

Class 4.4.1 Pressure regulators with accuracy level A (±10 %)

Class 4.4.2 Pressure regulators with accuracy level B (±20 %)

5 Marking

With the exception of integral pressure regulators (which are an integral part of the irrigation device and bear its marking), each pressure regulator shall bear readily visible, clear and durable marking including the following:

a) manufacturer's name and/or trademark;

b) nominal size;

c) nominal pressure;

d) arrow indicating direction of flow;

e) markings to indicate direction of adjustment, for classes 4.1.3 and 4.1.4:

— + to increase regulated pressure,

— – to reduce regulated pressure.

In addition, each pressure regulator or package of pressure regulator(s) shall carry a label specifying:

f) the declared pre-set pressure;

g) the accuracy level — A or B — of the regulator (see 4.4);

h) allowable temperature range.

The declared pre-set pressure given on the attached label or on the label to the packaging may be indicated by colour or by any other marking, as explained in the manufacturer's catalogue.

In multi-range pressure regulators (class 4.1.2) and in multi-range adjustable pressure regulators (class 4.1.4), the parts that can be replaced to vary the regulated pressure shall be marked by colour or by any other marking, as explained in the manufacturer's catalogue.

6 Technical characteristics

6.1 General

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

All parts belonging to pressure regulators of the same size, type and model designed to allow dismantling and produced by the same manufacturer shall be interchangeable.

Plastics parts of the pressure regulator that are exposed to ultraviolet (UV) radiation in the normal working conditions under which the pressure regulators operate 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 Pressure regulator body

Pressure regulators with threaded ends shall be provided with a hexagonal boss or with other means for gripping. The face-to-face distance of the flanged bodies of the pressure regulators shall not deviate from the length declared by the manufacturer in his catalogue, or other material describing the specifications of the pressure regulator, by more than ±2 mm for metal-body regulators or ±4 mm for plastics-body regulators.

6.3 Adjustment assembly

Balancing the regulated pressure to the pressure regulator set point is accomplished by means of a spring. The chamber containing the spring shall be sealed to prevent entry of water except in those cases where all the components within the chamber are constructed from corrosion-resistant materials. The housing of the adjustment assembly shall be constructed to prevent locking of the pressure regulator due to entry of water.

If the housing of the adjustment assembly is threaded to the pressure regulator body, it shall be equipped with a hexagonal boss or similar means to facilitate disassembly and reassembly.

The adjustment assembly of the pressure regulators shall be equipped with a handle, slot, a polygonal part, or similar means to permit adjustment.

6.4 Connections

The manufacturer shall use one of the following connection methods:

a) threaded ends for direct connection to the supply line: these shall be in accordance with ISO 7-1; however, other threads shall be allowed, provided that a suitable adaptor is supplied with each threaded connection making it conform with ISO 7-1;

b) flanged connections: these shall conform with ISO 7005-1 or ISO 7005-2;

c) other suitable means of connection.

6.5 Adjustable stop

Where the pressure regulator has an adjustable stop, it shall permit adjustment of the regulation assembly to full opening and full closing of the water passages.

The adjustable stop shall be easily adjusted, positive, and not subject to loosening by vibration. When assembled on a stem, the handle shall be mechanically secured to the stem.

The adjustable stop and its parts shall effectively resist an opening or a closing torque, in newton metres, numerically equal to the nominal size in millimetres or to 25 times the nominal size in inches.

7 Mechanical and functional tests

7.1 Overview

Integral pressure regulators shall be tested only according to 7.2, 7.3, 7.4, 7.8, 7.9, 7.10 and 7.11.

The test sample size and the acceptance number shall be in accordance with Table 1.

Table 1 — Required number of test specimens and acceptance number for mechanical, functional and durability tests

Clause number	Name of test	Number of test specimens	Acceptance number
7.3	Regulation uniformity	3	1
7.4	Tightness of pressure regulator with adjustable stop	3	1
7.5	Regulation curve	2	0
7.6	Regulated pressure as function of pressure regulator adjustment	2	0
7.7	Regulated pressure at zero flow	2	0
7.8	Regulated pressure as function of inlet pressures, at constant flow rate	2	0
7.9	Regulation curve of integral pressure regulator	2	0
7.10	Pressure loss	2	0
7.11	Resistance of pressure regulator body to internal hydrostatic pressure	5	0
Clause 8	Durability	2	0

7.2 General

It is considered that, with the exception of the test where work is done with small volumes of water, it is possible to control the water temperature. The hydraulic characteristics test and the endurance test shall be carried out at a water temperature of 4 °C to 35 °C.

Clean water shall be used in tests. The permissible deviation of the measuring devices from the actual value shall be ±2 %. Calibrate the measuring devices according to the existing calibration rules of the country concerned.

Before performing the functional tests, beginning with 7.3, condition the pressure regulator by operating it for 5 min at the initial regulation pressure, for 5 min at nominal pressure, and then for 10 min at 1,5 times the declared pre-set pressure, using a flow rate equivalent to a reference velocity of 1 m/s.

7.3 Regulation uniformity (in non-adjustable pressure regulators)

7.3.1 Conduct the test according to the class of pressure regulator as follows:

a) For ordinary pressure regulators (class 4.2.1), measure the regulated pressure in each pressure regulator of the sample at an inlet pressure of 1,5 times the declared pre-set pressure and at a flow rate equivalent to a reference velocity of 1 m/s.

b) For integral pressure regulators (class 4.2.2), measure the flow rate through each pressure regulator at an inlet pressure of 1,5 times the declared pre-set pressure.

7.3.2 From the results obtained in the tests in 7.3.1, calculate the coefficient of variation, CV, Formula (1) for ordinary pressure regulators:

$$CV = \frac{s_p \times 100}{p} \tag{1}$$

or Formula (2) for integral pressure regulators:

$$CV = \frac{s_q \times 100}{q} \tag{2}$$

where

s_p is the sample standard deviation of the regulated pressures;

s_q is the sample standard deviation of the flow rates;

p is the mean regulated pressure of the sample;

q is the mean flow rate of the sample.

The pressure regulators shall meet the following criteria.

a) For ordinary pressure regulators, the average regulated pressure of the sample shall not deviate from the declared pre-set pressure by more than 7 %.

b) For integral pressure regulators, the average flow rate of the sample shall not deviate from the flow rate declared by the manufacturer by more than 5 %.

c) For ordinary pressure regulators, the coefficient of variation, CV, shall not be greater than 10 %.

d) For integral pressure regulators, the coefficient of variation, CV, shall not be greater than 7 %.

7.4 Tightness of pressure regulator with adjustable stop

Move the adjustable stop to its fully closed position. When the adjustable stop is actuated by rotating the stem, apply a closing torque, in newton metres, metrically equal to the nominal size in millimetres. Apply a hydraulic pressure at the inlet of the pressure regulator, and raise it gradually to the nominal pressure declared by the manufacturer. Maintain this pressure for 1 min.

The pressure regulator shall show no signs of leakage at the outlet of the pressure regulator.

7.5 Regulation curve

7.5.1 Installation

Install the pressure regulator in a test assembly similar to that shown in Figure 1. Take any steps necessary to avoid air pockets in the test apparatus.

If difficulties arise in regulating the flow with valves D_1 and D_2, an additional pressure regulator or a flow regulator may be installed after the test specimen, R_x.