INTERNATIONAL STANDARD

ISO 15873

First edition
2002-09-15

Irrigation equipment — Differential pressure Venturi-type liquid additive injectors

Matériel d'irrigation — Injecteurs d'engrais liquides de type venturi à pression différentielle

Reference number
ISO 15873:2002(E)

PDF disclaimer

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

ISO copyright office
Case postale 56 • CH-1211 Geneva 20
Tel. + 41 22 749 01 11
Fax + 41 22 749 09 47
E-mail copyright@iso.ch
Web www.iso.ch

Printed in Switzerland

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 3.

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 International Standard may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 15873 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 18, *Irrigation and drainage equipment and systems.*

Irrigation equipment — Differential pressure Venturi-type liquid additive injectors

1 Scope

This International Standard specifies the construction of, and operational requirements and test methods for, differential pressure Venturi-type liquid additive injectors — a component of systems used to inject chemicals, including liquid fertilizers, liquid solutions of water-soluble fertilizers, acids, caustics, pesticides, herbicides and other liquid additives, into irrigation systems. This International Standard does not specify means of preventing backflow of liquid additives to potable water supply systems, the assembly of such means near to the Venturi injector being covered by water protection regulations.

2 Normative references

The following normative documents contain provisions which, through reference in this text, constitute provisions of this International Standard. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies. Members of ISO and IEC maintain registers of currently valid International Standards.

ISO 7-1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

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*

3 Terms and definitions

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

3.1
additive solution
water containing liquid additives or dissolved solid additives

3.2
differential pressure Venturi injector
device which functions by allowing a pressurized stream (either full-stream or side-stream) of irrigation water to enter through the device's inlet, constricting the stream as it passes through a chamber and thus causing a velocity increase and pressure decrease that draws a liquid additive through a suction port and mixes this additive into the motive stream of irrigation water for delivery to the device's outlet

3.3
injection rate
flow rate at which a liquid additive is injected into the motive water at a given injector inlet pressure and a given outlet pressure

3.4
injection ratio
ratio between the volume of liquid additive injected and the volume of motive water plus the volume of the liquid additive

EXAMPLE A litre of liquid additive injected into 99 l of motive water would yield an injection ratio of $1/(1 + 99) = 1/100 = 0{,}01$, to give an injection ratio of 1:100.

3.5
irrigation water flow rate
flow rate of irrigation water at the inlet to the body of an in-line Venturi fertilizer injector, or through the injector and the by-pass line for a by-pass mounting, or through the injector and the mainline for a side-stream mounting

3.6
liquid additive
chemicals, including liquid fertilizers, liquid solutions of water-soluble fertilizers, acids, caustics and pesticides or herbicides, added to the motive water by an injector

3.7
maximum injection rate
maximum flow rate at which a liquid additive can be injected into the motive water at any set of inlet pressure and outlet pressure conditions

3.8
maximum percent pressure differential
percent pressure differential required to obtain the maximum injection rate of a liquid additive

3.9
maximum working pressure
manufacturer's highest recommended motive water pressure to be applied to an injector

3.10
minimum percent pressure differential
lowest percent pressure differential required to initiate injection of a liquid additive

3.11
motive water
water introduced at the inlet of an injector

3.12
motive water flow rate
volume of irrigation water required to operate an injector over a specified period of time under stated pressure conditions

EXAMPLE 10 l/min at 100 kPa inlet pressure and 50 kPa outlet pressure.

3.13
motive water flow rate range
all motive water flow rates required to operate an injector between minimum and maximum working pressures

3.14
nominal size
injector diameter identical to the diameter of the pipe to which the injector is intended to be directly connected

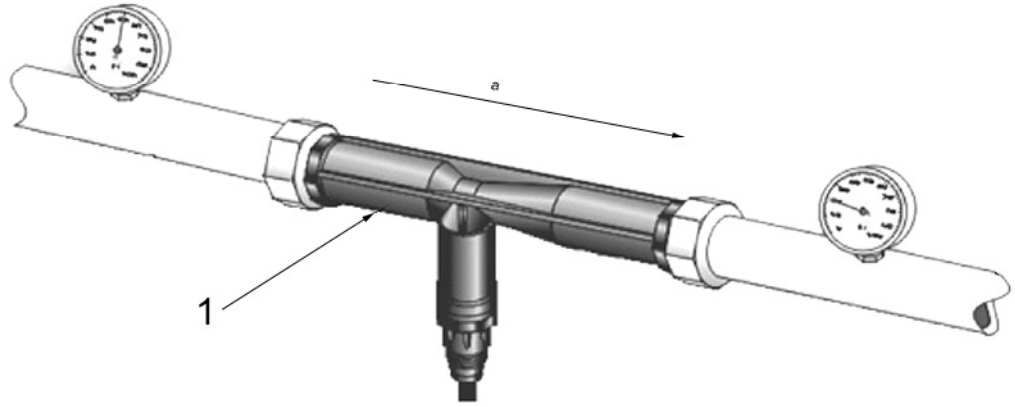
3.15
percent pressure differential
pressure differential of an injector divided by the inlet pressure and multiplied by a hundred

3.16
pressure differential
pressure difference between the inlet pressure and the outlet pressure or, if so specified, between the inlet pressure and the injection port pressure

4 Classification

A differential pressure venturi injector shall be classified according to its intended installation, as follows.

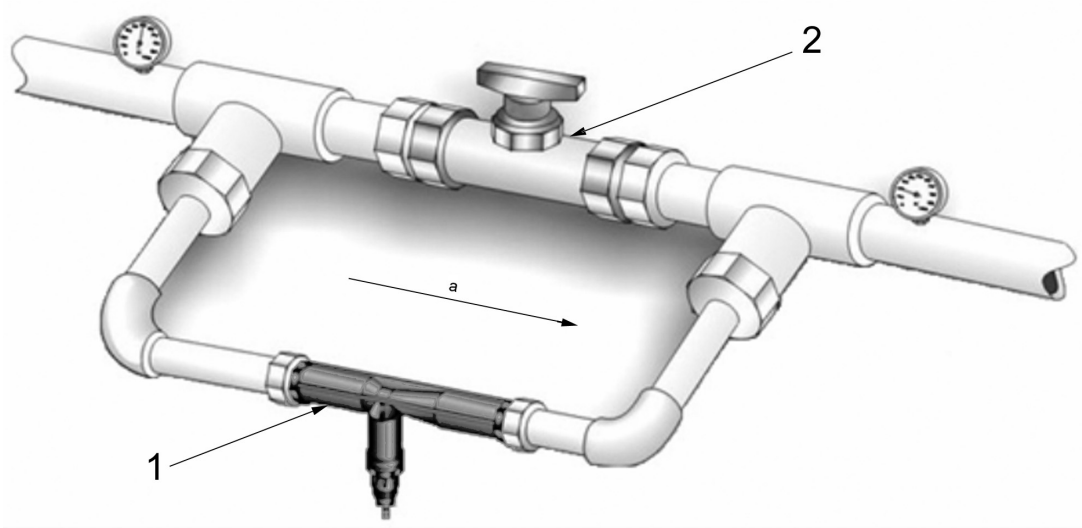
a) **Mounted in-line,** with the full main flow introduced as motive water at the injector inlet (see Figure 1).



Key
1 Injector
a Flow direction

Figure 1 — Injector mounted in-line

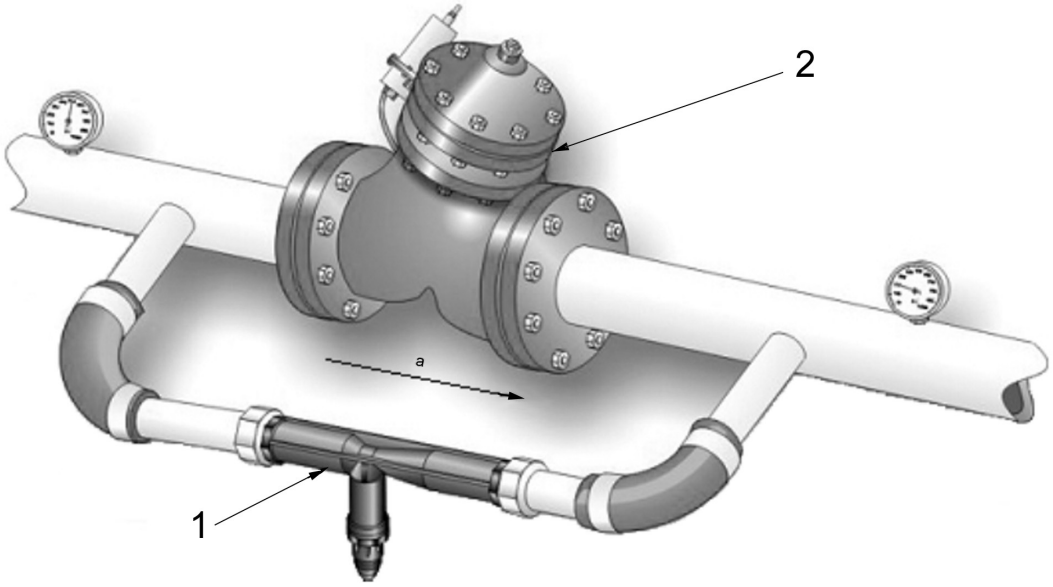
b) **Mounted in a by-pass assembly,** with only a portion of the main flow introduced as motive water flow through the injector inlet (see Figure 2).



Key
1 Injector
2 Flow control valve
a Flow direction

Figure 2 — Injector mounted in by-pass assembly

c) **Mounted in a by-pass assembly around a pressure reducing valve,** with only a portion of the irrigation water introduced as motive water flow at the injector inlet (see Figure 3). Total water flow through the by-pass assembly is controlled by the pressure reducing valve.

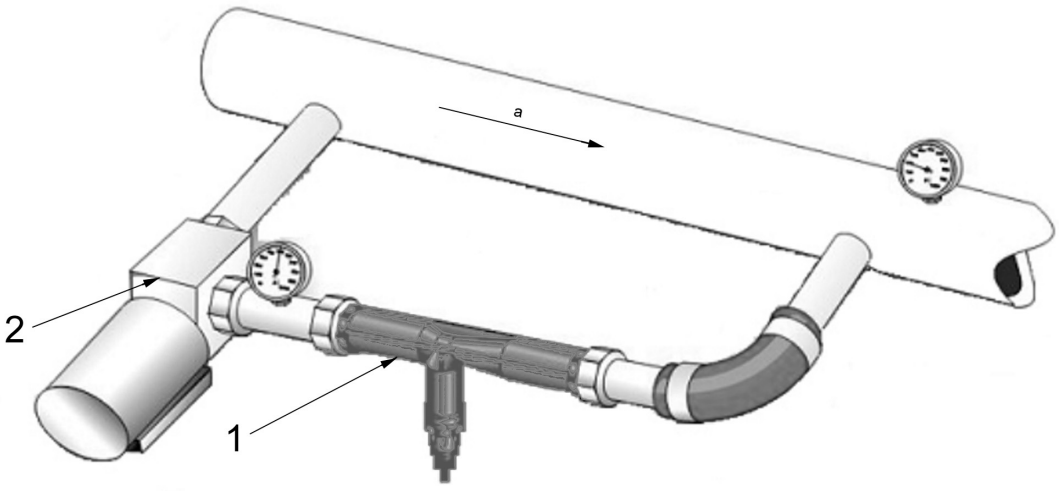


Key

1 Injector
2 Pressure reducing valve
a Flow direction

Figure 3 — Injector mounted in by-pass assembly around pressure-reducing valve

d) **Mounted in a side-stream assembly** with a booster pump supplying a pressurized portion of the main flow introduced as motive water flow through the injector inlet (see Figure 4.)



Key

1 Injector
2 Booster pump
a Flow direction

Figure 4 — Injector mounted in side-stream assembly

5 Markings

The differential pressure venturi injector shall bear a clear, legible and durable marking that provides the following information:

— name of manufacturer or manufacturer's trademark, or both;

— model number, identical to that given in the manufacturer's catalogue;

— markings indicating the direction of water flow into and out of the injector and the direction of liquid additive into the injector;

— nominal size and thread form designation;

— a notation allowing the manufacturer to determine the approximate date of manufacture.

6 Technical characteristics

6.1 General

The differential pressure venturi injector shall be free of defects that could limit its life or functionality.

6.2 Materials

The injector shall be manufactured to resist corrosion and chemical deterioration.

6.3 Resistance to chemicals and ultraviolet radiation

All parts of the injector coming in contact with water shall be resistant to both water and liquid additives normally used in agricultural applications. These shall include fertilizers, acids, bases (alkalis) and similar compounds. All injector surfaces exposed to ultraviolet (UV) radiation under normal operating conditions shall be made of compounds specifically formulated for resistance to UV radiation degradation.

6.4 Threads

The injector shall be fitted with threads in accordance with ISO 7-1. Other threads may be used, provided a suitable adapter is supplied with each threaded connection.

7 Mechanical and functional testing

7.1 General

All tests shall be performed using water in place of the injected liquid additive. Both motive water and injected water shall be at a temperature of 23 °C ± 2 °C. Both water streams shall be filtered with a screen filter of a rating specified in the differential pressure venturi injector manufacturer's product literature.

7.2 Accuracy

Measurement instruments used for testing purposes should be accurate to within ± 1 % of the true value.

7.3 Sampling and acceptance requirements

7.3.1 Selecting test specimens

Ensure that a representative of the testing agency selects test specimens for each test at random from a quantity of 20 units. The number of specimens selected for each individual test shall be in accordance with Table 1. When acceptance of manufacturing lots or shipments is required, sampling should be accomplished according to ISO 2859-1:1999, based on AQL 2,5 and special inspection level S-4. Ensure that test specimens are selected at random, in accordance with Table 2-A of ISO 2859-1:1999.

Table 1 — Required number of test specimens and acceptance number

Subclause of this International Standard	Test	Number of specimens	Acceptance number
7.4.1	Resistance to pressure	5	0
7.4.2	Resistance to temperature	5	0
7.4.3	Resistance to negative pressure	5	0
7.4.4.1	General (functions)	2	0
7.4.4.2	Motive fluid testing	2	0

7.3.2 Acceptance

If there are no failures of individual test specimens, the sample shall be considered as complying with this International Standard. The manufacturing lot or shipment shall be considered as complying with this International Standard if the number of defective test specimens found in the test does not exceed the acceptance number specified in ISO 2859-1.

7.4 Test methods and requirements

7.4.1 Resistance to pressure

Subject the injector to a static test pressure of three times the maximum working pressure for a period of 60 min. The pressurizing device shall be capable of applying a continuously increasing, non-pulsing internal hydraulic pressure to the test specimen. The test specimen shall not suffer fracture, deformation, leakage or other damage from the test.

7.4.2 Resistance to temperature

Subject the injector to the maximum working pressure using water at a temperature of 66 °C ± 2 °C. Maintain the test specimen under these conditions for a period of 5 min. The test specimen shall not suffer fracture, deformation, leakage or other damage from the test.

7.4.3 Resistance to negative pressure

Subject the injector to a negative pressure equal to 90,0 kPa (gauge) for a period of 5 min. The test specimen shall not suffer fracture, deformation, leakage or other damage from the test.

7.4.4 Functional tests

7.4.4.1 General

Test each injector for functionality. Use water as both the motive fluid and the injected fluid. Ensure that the relative elevations of the suction port and the surface of the suction water are the same and remain constant during testing. Operate each injector throughout the range of inlet pressures between the minimum and maximum working pressures. Determine motive and injected flow rates using separate calibrated flow meters. Measure the inlet and outlet pressures to which the injector is subjected using separate calibrated pressure gauges. Calculate the pressure differentials.

7.4.4.2 Motive fluid testing

Subject the injector to at least five separate inlet pressures. Ensure that the lowest of these is the lowest inlet pressure, and that the highest of these is the highest inlet pressure, stated in the manufacturer's product catalogue. Ensure that, for each inlet pressure, the outlet pressure is varied to develop at least five separate pressure differentials across the injector. Measure motive and injection flow rates at percent pressure differentials of 20 %, 40 %, 60 %, 80 % and 100 %. The injected flow rate measured shall be not less than 90 % of the injected flow rate declared by the manufacturer for the same conditions.

For each inlet pressure tested, ensure that the outlet pressure is reduced until liquid additive injection is initiated. Record the resulting pressure differential, which shall not exceed by more than 5 % the value declared by the manufacturer for initiation of injection at the same inlet pressure.

8 Information to be supplied by manufacturer

The manufacturer shall provide the following information in catalogues, product bulletins or technical data sheets, together with the date of publication of the respective publications:

a) model number of the differential pressure venturi injector;

b) size and type of connections for the injector;

c) dimensions and weight of the injector;

d) performance data for each injector, showing motive flow and injected flow for each set of anticipated operating conditions (data shall also be given stating the conditions that will initiate a liquid additive flow rate);

e) maximum allowable working pressure;

f) spare parts recommendation;

g) similar equipment available;

h) operating and storage temperature ranges.

ICS 65.060.35

Price based on 7 pages