
**Agricultural irrigation equipment —
Test facilities for agricultural
irrigation equipment —**

**Part 1:
General**

*Matériel agricole d'irrigation — Installations d'essais pour le
matériel agricole d'irrigation —*

Partie 1: Général

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Published in Switzerland

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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*.

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.

This first edition cancels and replaces ISO/TR 15155:2005, which has been technically revised to include sprayers (ISO 8026) and water meters (ISO 16399).

A list of all parts in the ISO/TR 15155 series can be found on the ISO website.

Agricultural irrigation equipment — Test facilities for agricultural irrigation equipment —

Part 1: General

1 Scope

This document gives guidelines for the design, selection, installation and use of the equipment required to establish basic test facilities for irrigation equipment evaluation. It provides the information sufficient to complement the detailed procedures included in ISO 7714, ISO 8026, ISO 9261, ISO 9635 (all parts), ISO 9644, ISO 9911, ISO 10522, ISO 15886 and ISO 16399 for the testing of agricultural irrigation system components, specifically emitters, sprinklers, valves, sprayers and water meters.

2 Normative references

There are no normative references in this document.

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 <http://www.electropedia.org/>

3.1

test bench

collection of components, including water supply/receiving reservoir, piping, fittings and instrumentation, assembled to test an agricultural irrigation component

3.2

test facility

collection of components, including water supply, *test bench(es)* (3.1) and shelter, used to test agricultural irrigation valves, sprinklers and emitters

3.3

net positive suction head available

NPSHa

arithmetic difference between the available *total suction head at the impeller of a centrifugal pump* (3.6) and the *vapour pressure head* (3.7)

3.4

net positive suction head required

NPSHr

arithmetic difference between the *total suction head at the impeller of a centrifugal pump* (3.6) required for the pump to operate properly and the *vapour pressure head* (3.7), as specified by the manufacturer

3.5

static pressure head

sum of the head associated with atmospheric pressure and the gauge pressure head measured approaching the inlet of the impeller of a centrifugal pump

3.6

total suction head at the impeller of a centrifugal pump

sum of the *static pressure head* (3.5) and the velocity head measured approaching the inlet of the impeller of a centrifugal pump and corrected to the centreline of the impeller for a centrifugal pump mounted horizontally or to the datum of the tip of the inlet vanes for a centrifugal pump mounted vertically

3.7

vapour pressure head

head associated with the absolute pressure at which a liquid vaporizes, as determined by the physical properties of the liquid and its temperature

4 System components

4.1 Pumps and pump environment

4.1.1 General

For specific information prior to selecting a pump, see [Annex A](#) for sprinklers, [Annex B](#) for emitters and emitting pipe, [Annex C](#) for valves, [Annex D](#) for sprayers and [Annex E](#) for meters.

4.1.2 Selection

The size and type of pump selected depend on the requirements of the equipment to be tested. More than one pump may be required depending on the range of flows and pressures required by the equipment to be tested. The equipment, test flow range and test pressure range should be selected before selecting a pump.

A centrifugal pump or a turbine pump is selected based on the desired configuration of the test bench.

The pumps and controls should be selected to provide the required hydraulic characteristics continuously and without vibration to avoid affecting the measurement accuracy. Turbulence should be dampened or flow-straightening vanes should be used in critical locations, such as the inlet to a sprinkler test riser. A variable-frequency drive (VFD) should be employed to control the VFD rated motor, allowing the pump to operate over a wider range of flows and pressures.

The flow is controlled using equipment installed on the test bench (nozzle, emitters, valve, regulator and pipe size) and/or by the speed at which the pump is operated. The flow and/or pressure should be controlled with regulating valves on the inlet or outlet pipe, as needed.

The pump should provide at least 110 % of the maximum pressure at 110 % of the maximum flow rate required for the device being tested. The pump curve for the selected pump should be reviewed to ensure it will operate over the required range.

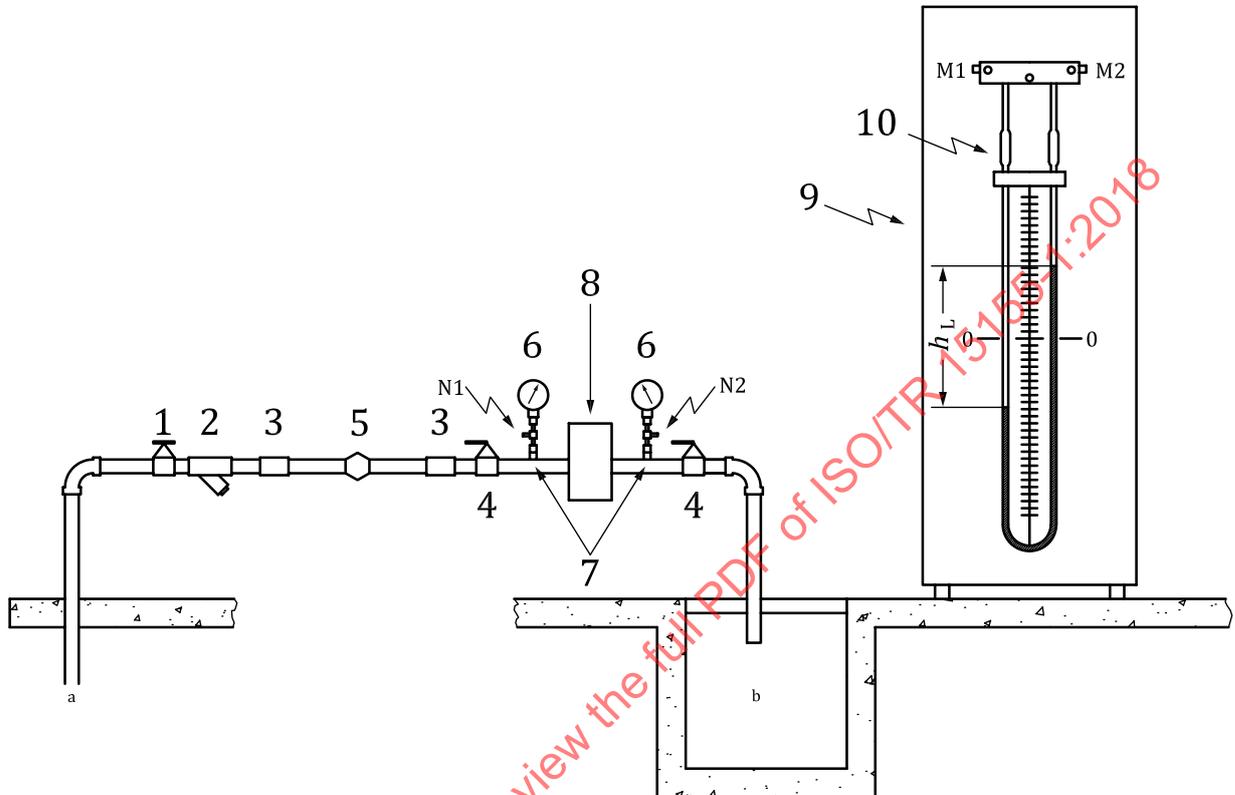
4.1.3 Installation

The pump should be installed in a configuration that does not require priming and in which the water supply/receiving tank has sufficient volume so that temperature change of the water during a test does not exceed the testing criteria.

Filtration should maintain the quality of the water supply and is necessary to meet the requirements of the equipment to be tested. If no specific filtration standard is required, the equivalent of a 200 mesh

(75 microns) filter is recommended. A by-pass circuit should be provided to effectively increase the operating range of the test bench.

See [Figures 1, 2, 3, 4](#) and [5](#) for typical test bench configurations for testing valves, sprinklers, emitters, sprayers and meters, respectively.



Key

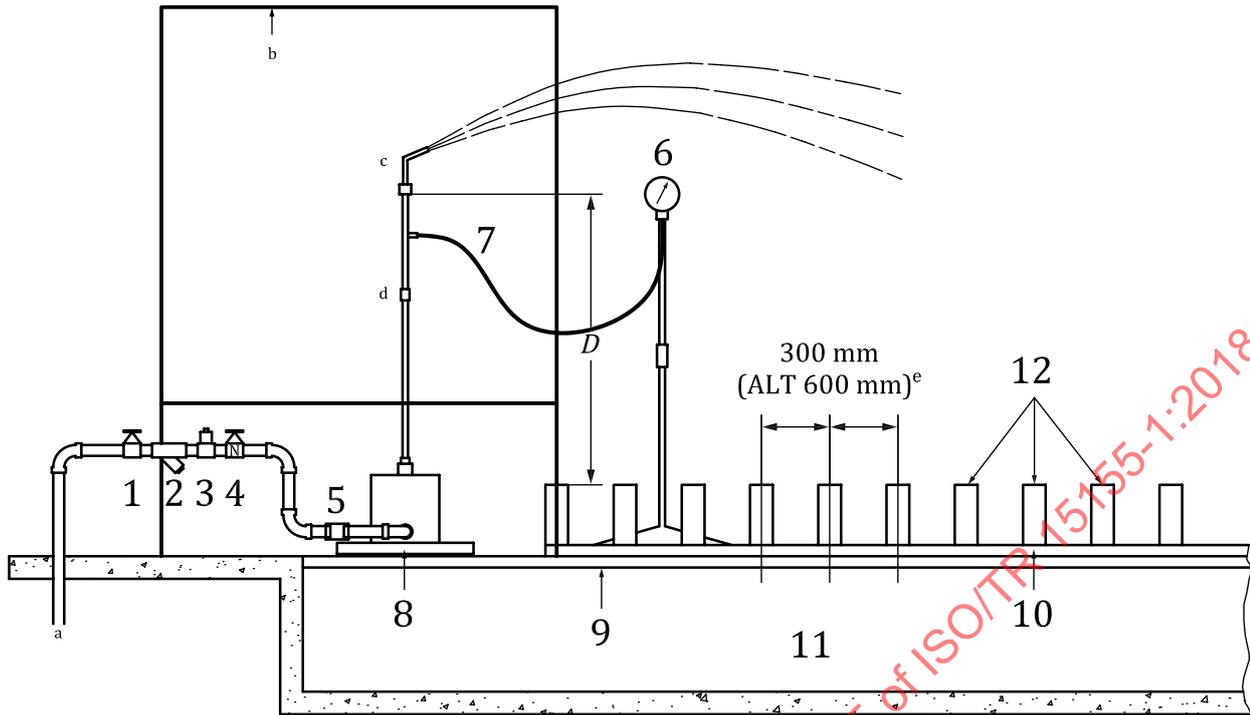
- | | | | |
|---|---|----|----------------------|
| 1 | isolation valve | 8 | component under test |
| 2 | "y" strainer 100-mesh | 9 | portable manometer |
| 3 | coupler/reducer | 10 | mercury traps |
| 4 | ball valve | a | Pressurized supply. |
| 5 | flow meter | b | Waste flow. |
| 6 | pressure gauge selected to operate in middle third of its range | | |
| 7 | pressure taps | | |

NOTE 1 N1 is connected to M1 and N2 is connected to M2 with flexible instrument tubing.

NOTE 2 The flow meter should be sized to match the range of test conditions.

NOTE 3 Pressure taps are sized to match the component under test.

Figure 1 — Typical test bench configurations for testing valves



Key

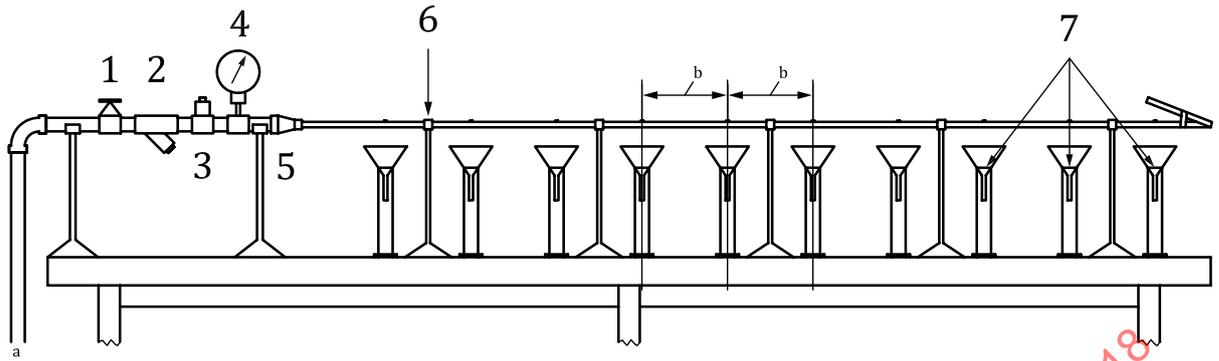
- | | | | |
|----|--|---|--|
| 1 | isolation valve | a | Pressurized supply. |
| 2 | "y" strainer 100-mesh | b | Approximate outline of splash shelter. |
| 3 | pressure regulator | c | Sprinkler under test. |
| 4 | needle valve | d | Pressure tap sized to match sprinkler. |
| 5 | union | e | Collector spacing. |
| 6 | pressure gauge selected to operate in middle third of its range | | |
| 7 | flexible instrument tubing | | |
| 8 | sprinkler mounting stand with mounting bolts to provide a stable and plumb riser support | | |
| 9 | grating over channel | | |
| 10 | steel channels with collector locations marked | | |
| 11 | drain | | |
| 12 | standard collectors | | |

NOTE 1 Dimension "D" corresponds to the geometry of field application (riser height).

NOTE 2 The pressure is adjusted vertically so that the centre of the gauge corresponds to the sprinkler base.

NOTE 3 The pressure regulator is set to 500 kPa for normal testing.

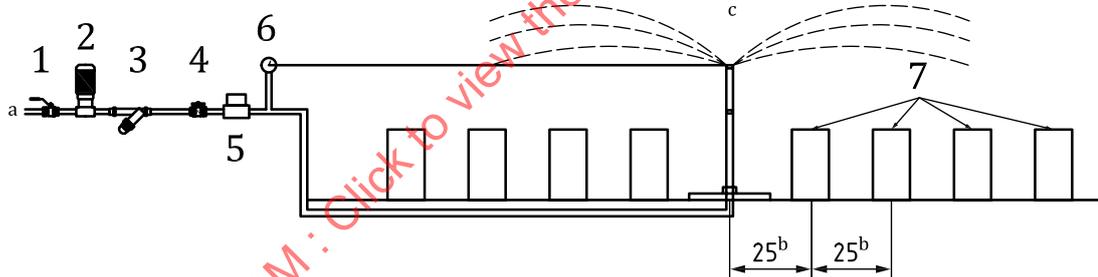
Figure 2 — Typical test bench configurations for testing sprinklers



Key

- | | | | |
|---|---|---|--|
| 1 | isolation valve | a | Pressurized supply. |
| 2 | "y" strainer – mesh meeting manufacturer's specifications | b | Graduated cylinder spacing to match emitter spacing. |
| 3 | pressure regulator | | |
| 4 | pressure gauge selected to operate in middle third of its range | | |
| 5 | union | | |
| 6 | drip tube support | | |
| 7 | graduated cylinders | | |

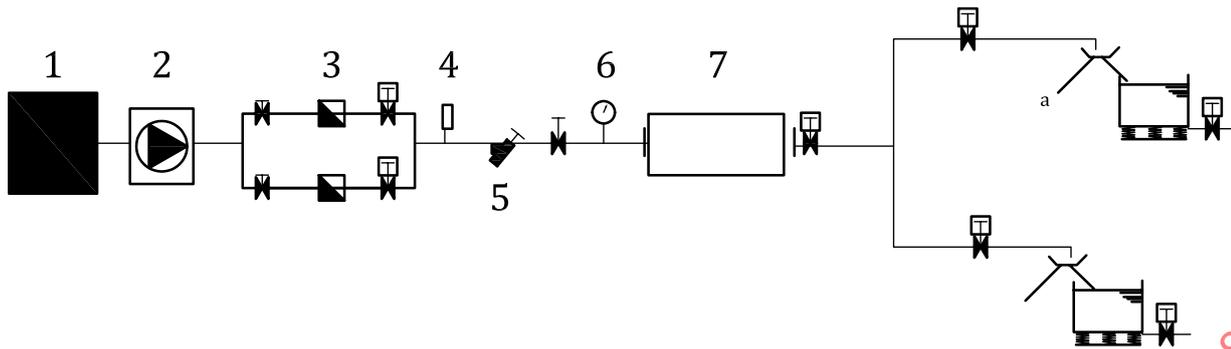
Figure 3 — Typical test bench configurations for testing emitters



Key

- | | | | |
|---|---------------------|---|---------------------|
| 1 | needle valve | a | Pressurized supply. |
| 2 | pump | b | Collector spacing. |
| 3 | filter | c | Sprayer under test. |
| 4 | globe valve | | |
| 5 | flow measurement | | |
| 6 | manometer | | |
| 7 | standard collectors | | |

Figure 4 — Typical test bench configurations for testing sprayers



Key

- | | | | |
|---|-----------------|---|------------------|
| 1 | reservoir | 5 | filter |
| 2 | pumping station | 6 | pressure |
| 3 | flow meters | 7 | tested equipment |
| 4 | temp. | a | To reservoir. |

Figure 5 — Typical test bench configurations for testing meters

4.1.4 Use

Proper safety equipment should be installed and operational procedures should be documented. Local codes ensure that installation and use meet safety standards.

4.2 Pressure measurement

4.2.1 General

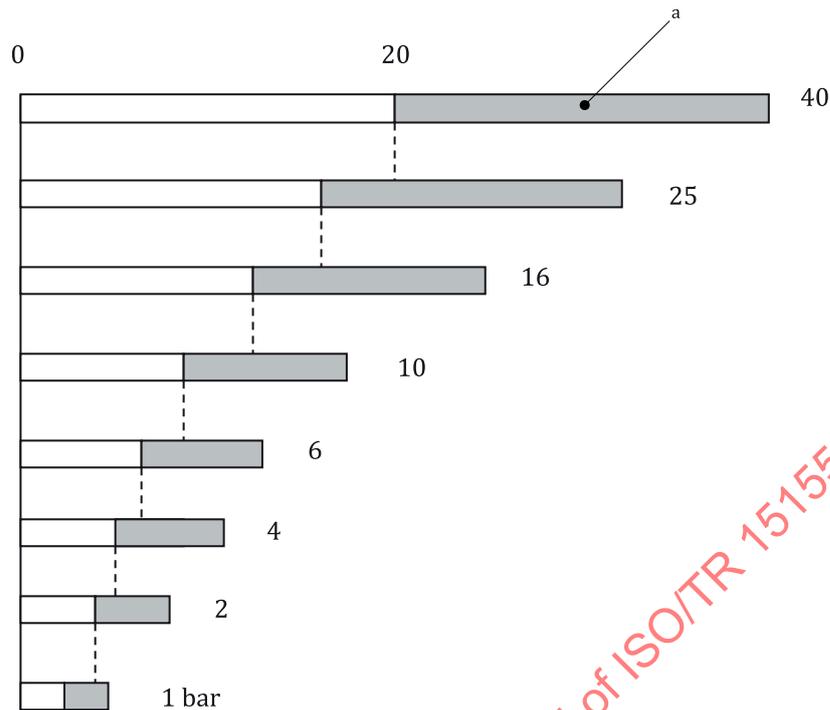
Pressure is measured using a manometer filled with mercury or another calibrated liquid. It is recommended to manually read gauges or recording transducers with an analogue or digital display, or record directly using a data-logger. The gauge pressure range should be higher than the expected pressures to prevent over-ranging of the gauge. See [Annexes A, B and C](#) for recommended specifications.

4.2.2 Selection

The size and type of gauges required depend on the requirements of the equipment to be tested. More than one gauge could be required, depending on the range of pressures dictated by the equipment to be tested. A gauge should be selected that operates in the middle of its operating range for the test procedure and which is large enough to be easily read with increments as required by the accuracy indicated in the test procedure. A 100 mm dial face and a minimum accuracy of $\pm 0,5\%$ of reading are recommended unless otherwise specified in the relative test procedure of the International Standard being used (see [Clause 1](#) for mention of the relevant standards). An electronic pressure transmitter can be used over a wide range of pressures.

[Figure 6](#) illustrates eight consecutive pressure gauges for the range of 0 MPa to 4 MPa (0 bar to 40 bar), where the grey area defines the range of the pressure with accuracy higher than $\pm 0,5\%$.

NOTE 1 bar = 0,1 MPa = 10^5 Pa; 1 MPa = 1 N/mm².

**Key**

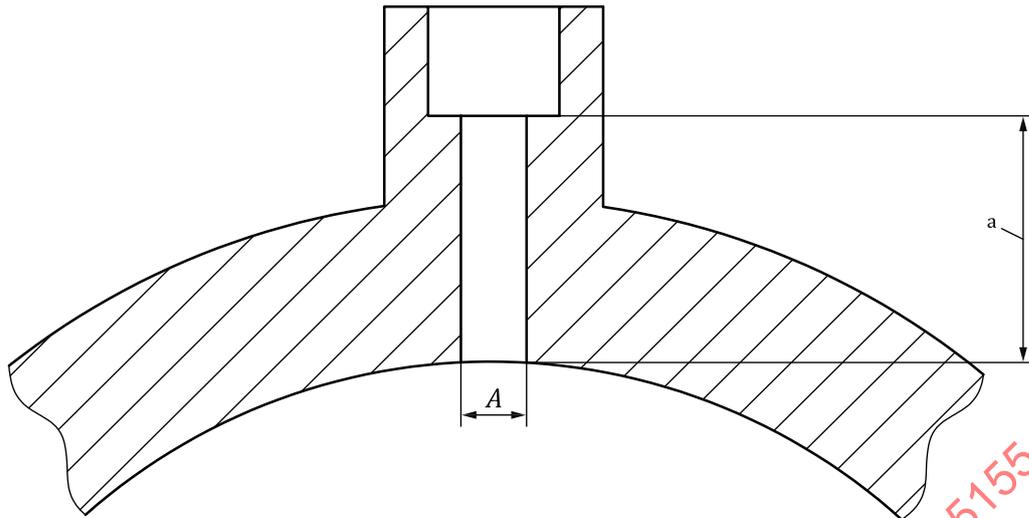
a Area with accuracy higher than $\pm 0,5\%$.

Figure 6 — Example of a range of pressure gauges for a test facility

4.2.3 Installation and location of sensors

The pressure taps should be provided at varying locations, as required by the equipment being tested. [Figure 7](#) shows information for design and installation of pressure taps. The gauges should be located away from areas of excessive vibration.

It is preferable to have pressure measurements made at the same elevation as the pressure tap, and at the exact location at which the pressure information is required, to eliminate mathematical calculations and approximations. If this is not physically possible, a correction should be made for the elevation difference. A correction should also be made if differential pressure measurements are made in pipes of a different size.



Key

a Minimum 2,5A, recommended 5A.

Size of pipe	A Not exceeding	A Not less than
Less than 50 mm	6 mm	3 mm
50 mm to 75 mm	9 mm	3 mm
100 mm to 200 mm	13 mm	3 mm
250 mm and greater	19 mm	3 mm

The edge of the hole is clean and sharp or slightly rounded, free from burrs, wire edges or other irregularities.

In no case does any fitting protrude inside the pipe.

Any suitable method of making the physical connection is acceptable if the above recommendations are satisfied.

SOURCE: ASME Performance Test Code PTC 19.5-1972.

Figure 7 — Design and installation of pressure taps

4.2.4 Calibration and certification

Pressure taps are designed to allow easy access for pressure gauge inspection and maintenance. A regular calibration schedule should be used to ensure the continuing reliability of the readings. It is recommended to give each gauge an identification number and maintain a calibration log. Commercial dead weight testers should be used to calibrate gauges. In general, the calibration is checked before and after a specific test programme. Inspection frequency and operation should conform to ISO/IEC 17025.

4.3 Flow and volume measurement

4.3.1 General

Actual flow rate and accumulated volume should be measured using calibrated flow meters or by recording the duration of the flow and the mass or volume of the water or other liquid, and then calculating the flow rate and total flow. Electromagnetic-type flow meters are considered the most accurate type of flow meter.

4.3.2 Flow meter alternatives and selection

There are several types of flow meters that are classified according to the operating principle. Turbine, impeller, magnetic and positive displacement types depend on a sensor installed in the piping system.

Differential-pressure types depend on orifice plates in the piping system. The meters or sensors should be installed as specified by the manufacturer.

A set of flow meters should be selected that give the required accuracy over the range of flow rates of the devices to be tested. The volumetric method may be used for devices with low flow rates such as nozzles and emitters and a flow meter for higher-flow devices. A suitable meter is one that is durable and maintains calibration.

4.3.3 Volumetric (time and mass/volume)

Time and mass or time and volume can be used to determine flow rate and volume over the selected time period. The time and mass method is easier to automate. Although this method is more difficult to design into a test bench, the need for periodic calibration is greatly reduced. Calibration of the mass or volume scale is required less frequently (annually) than calibration of a flow meter and is a simpler procedure. Once the receiving tank has been calibrated, there should be no need to re-calibrate unless the tank is relocated or damaged. This method may not be practical for measuring total volume of devices requiring high flow rates unless a large receiving tank is constructed.

4.3.4 Installation and maintenance

4.3.4.1 Piping considerations

Piping should be large enough so that pressure losses or turbulent flow in the system do not affect the test procedures or measurement conditions. The design should be for a recommended velocity of 2,5 m/s. If a centrifugal pump is selected, the intake should be straight into the pump with no changes in diameter and it should be carefully checked for air suction leaks. The net positive suction head available (NPSHa) should be at least 2 m greater than the net positive suction head required (NPSHr).

All return flows should be discharged below the free water surface to reduce the potential of introducing entrained air into the system.

4.3.4.2 Location considerations

The flow meter should be installed as specified by the manufacturer. If installation instructions are not provided, the flow meter should be installed at least 10 pipe diameters downstream and at least 5 pipe diameters upstream from any fitting or restriction. Alternatively, flow-straightening vanes may be installed to reduce turbulence if adequate pipe length is not available.

4.3.5 Calibration and certification

The flow meter should be periodically inspected for wear, corrosion or contamination. A dedicated calibration verification schedule, required to maintain the reliability of the readings, should conform to ISO/IEC 17025.

4.4 Test bench design

NOTE See [Annexes A, B, C, D](#) and [E](#).

4.4.1 Pressure control

The pressure should be controlled using one or more of the following devices:

- a correctly sized pressure regulator;
- a pressure sustaining valve;
- a manually controlled valve;
- a downstream air shaft.

Refer to the appropriate International Standard.

4.4.2 Flow control

The flow rate should be regulated

- using a by-pass with a valve that returns excess flow to the water reservoir tank,
- using a flow control valve,
- using a VFD on the pump motor,
- by selecting another pump, or
- by using multiple pumps.

The regulation should be as automatic as possible. Refer to the appropriate International Standard (see [Clause 1](#)).

4.5 Water processing

4.5.1 Screens and filters

Filtration requirements vary depending on the equipment being tested. If no specific filtration standard is specified and if filtration is desired, the equivalent of a 200 mesh (75 microns) filter is recommended. The filter manufacturer's literature should be consulted for operation and maintenance procedures.

Operation of irrigation components without proper filtration could lead to premature failure of the component. If the purpose is to evaluate a component capable of handling unfiltered water for durability, a filter is not required, but the evaluator should be aware of potential problems with plugged sensors.

Automatic self-cleaning strainer-type filters could produce variations of flows and pressures during the test and are not recommended. If these filters are used, it is important that the back flushing is turned off.

4.5.2 Disinfection

Methods of disinfection:

- a) a minimum of 5 ppm¹⁾ chlorine in the water is maintained to prevent algae growth; a liquid source of chlorine is used to reduce health and safety risks;
- b) ozone treatment;
- c) ultraviolet treatment.

4.5.3 Temperature control

Generally, recording water temperature is sufficient, unless specific requirements are specified in the test procedures. The temperature should be recorded at least three times during the test: at the start, in the middle and at the end, unless otherwise specified. See [Annexes A, B, C, D and E](#).

1) "Parts per million (ppm)" is a deprecated unit, i.e. not accepted by the International System of Units, SI. It is used exceptionally in this document in order to correspond to other, closely related and already published standards. The accepted SI form for the expression of a volume fraction is in units of microlitres per litre ($\mu\text{l/l}$), or, alternatively, as 10^{-6} or as a percentage by volume (% by volume); for mass fractions, it is expressed in micrograms per gram ($\mu\text{g/g}$). See ISO 80000-1:2009 and ISO 80000-9:2009.

4.6 Turbulence considerations

See [Annexes A, B, C, D](#) and [E](#).

5 Test facility procedures and policies

5.1 General

ISO/IEC 17025 contains procedures for data collection and data management and its Scope states:

“This document is applicable to all organizations performing laboratory activities, regardless of the number of personnel.

Laboratory customers, regulatory authorities, organizations and schemes using peer-assessment accreditation bodies, and others use this document in confirming or recognizing the competence of laboratories.”

5.2 Test results confidentiality

Test results are the property of the client, provided the fee paid was full cost recovery. A written policy should be developed to meet local requirements and the intent of the test facilities.

5.3 Control of records

Refer to ISO/IEC 17025:2017, 8.4.

5.4 Handling of test or calibration items

Refer to ISO/IEC 17025:2017, 7.4.

5.5 Public access to facilities and test results

A written policy should be developed to meet local requirements and the intent of the test facilities.

5.6 Vendor testing of competitors' products

A written policy should be developed to meet local requirements and the intent of the test facilities.

5.7 Commercial use of test data

A written policy should be developed to meet local requirements and the intent of the test facilities.

5.8 Expert witness policy

A written policy should be developed to meet local requirements and the intent of the test facilities.

Annex A (informative)

Sprinkler hydraulic properties in clear water

Refer to ISO 15886-1 and ISO 15886-3.

Building	See ISO 15886-3 (typically 30 m × 10 m × 6 m high) Humidity control (arid conditions) Temperature control (cold conditions) Ventilation
Outdoor test site	See ISO 15886-3
Sprinkler shelter	Minimum opening angle 45° and height 2 m, minimum size 2 m × 2 m × 2 m, inside cover designed to absorb jet splash
Pump	Type: preferably centrifugal (flat curve) or turbine with variable-frequency drive Range: capacity 110 % of maximum required pressure and flow rate or 7,0 l/s at 0,7 MPa (7,0 bar) for indoor test
Test bench	Type: steel or PVC piping, recirculating system Range: 25 mm to 100 mm Requirements: including by-pass for pressure and flow regulation
Water reservoir and conditioning	2 000 l reservoir or match to maintain temperature criteria Filtration: 1,5 mm or match to nozzle size Temperature: maintain within ±2,5 °C
Pressure regulation	Adjustable meeting requirements of various standards Accuracy: ±2,5 %
Pressure gauges	Type: Bourdon or electronic pressure transmitters Range: 0 MPa to 0,6 MPa (0 bar to 6 bar); 0 MPa to 1 MPa (0 bar to 10 bar) Dial: 150 mm minimum diameter Accuracy: ±1 %
Flow measurement	Accommodating the following range of flow: 2 l/min to 750 l/min, with accuracy given in relevant standard (±2,5 %)
Control valves	Type: throttling valve (globe and/or needle valve) Requirements: fine adjustment and holding setting
Sprinkler mounting	Avoiding creation of any turbulence that could impact the sprinkler performance (see ISO 15886-3)
Collector design	At least conforming to ISO 15886-3
Application measurement	Weighing or volumetric methods meeting accuracy requirement of ISO 15886-3

Wind measurement	Type: mechanical with analogue or electronic readout Accuracy: ± 1 % Resolution: 0,1 m/s Requirements: average wind speed provided every 5 s
Temperature measurement	Type: mechanical or electronic Range: 0 °C to 45 °C Accuracy: $\pm 0,5$ °C
Other measurement devices	Time: $\pm 0,1$ s accuracy Distance: ± 1 % of the measured distance
Life testing	To be covered in a future part of the ISO 15886 series
Water tightness	To be covered in a future part of the ISO 15886 series
Facility data sheet	Highly recommended to keep a hard copy of test results and to design a stylized datasheet
Data analysis	Computerized results with appropriate software in order to verify: flow rate reconstitution Overlap patterns calculation

Annex B (informative)

Drip emitters and emitting pipe hydraulic properties in clear water

Refer to ISO 9261.

Building	See ISO 9261 (typically 12 m × 6 m) Humidity control (arid conditions) Temperature control (cold conditions) Still air
Pump	Type: preferably centrifugal (flat curve) or turbine with variable-frequency drive Range: capacity 110 % of maximum required pressure and flow rate or 1 000 l/h at 0,5 MPa (5,0 bar)
Test bench	Requirements: designed to allow measurement of 25 emitters together: <ul style="list-style-type: none"> — 12 mm to 25 mm piping, as required — Loop mounting to avoid pressure differences between emitters in test — Device to direct the flow or drops to the collectors — Special system to install or remove all collectors simultaneously — By-pass for pressure and flow regulation — Water collection devices
Control valves	Type: globe valve for coarse control and needle valve for fine control Requirements: fine adjustment and holding setting
Water reservoir and conditioning	Capacity: minimum 200 l reservoir Filtration: 200 mesh (75 microns) Temperature: ±3,0 °C
Pressure regulation	Adjustable to meet requirements of various standards or 30 kPa to 500 kPa Accuracy: ±1 %
Pressure gauges	Type: Bourdon, electronic pressure transmitters or mercury manometer (well type), range 0 to 500 mm Range: 0 MPa to 0,1 MPa (0 bar to 1 bar); 0 MPa to 0,2 MPa (0 bar to 2 bar); 0 MPa to 0,5 MPa (0 bar to 5 bar) Dial: 150 mm minimum diameter Accuracy: ±1 %

Temperature measurement and control	<p>Type: mechanical or electronic</p> <p>Range: 5 °C to 60 °C</p> <p>Accuracy: ±1 °C</p> <p>Heating and cooling equipment provided to maintain the required test range</p>
Other measurement devices	<p>Time: stop watch with ±0,1 s accuracy</p> <p>Distance: ±1 % of the measured distance</p>
Test stand for tensile measurement	See ISO 9261
Tubing diameter and wall thickness measurement device	See ISO 9261
Facility data sheet	Highly recommended to keep a hard copy of test results and to design a stylized datasheet
Data analysis	Computerized results with appropriate software to verify: flow rate reconstitution

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Annex C (informative)

Valves hydraulic properties in clear water

Refer to ISO 7714, ISO 9635 (all parts) and ISO 10522.

Building	25 m × 10 m × 6 m high sump and channel preferably heated
Bridge crane or arm hoists	1-tonne or higher
Pump(s)	For valves up to DN200: — 1 l/s to 14 l/s at 0,5 MPa (5 bar) — 2 l/s to 55 l/s each at 0,5 MPa (5 bar) For valves up to DN600: — 1 l/s to 14 l/s at 0,5 MPa (5 bar) — 2 l/s to 55 l/s each at 0,5 MPa (5 bar) — 2 l/s to 110 l/s at 0,5 MPa (5 bar) The pumps can be connected in parallel to increase flow or in series to increase pressure Hydrostatic pressure test at 5 MPa (50 bar)
Test benches	Range: 25 mm to 80 mm, 100 mm to 250 mm, 250 mm to 600 mm Rating: PN 16, PN 25 Accessories: — assorted valves and reducers — pressure tap pipes (25 mm to 600 mm)
Flow conditioning (temperature, filtration)	Filtration: 20 mesh screen filter Temperature: 5 °C to 45 °C, accuracy ±1 °C
Pressure regulation	Pressure regulator or manually controlled valves Gate valve (25 mm to 500 mm), globe valve, butterfly valve VFD Multiple pumps Water hammer control devices
Flow control	Automatic flow control valve or manually controlled valves that hold their setting
Differential pressure gages	Type: mercury manometers or differential pressure gauge Range: 0 MPa to 0,16 MPa (0 bar to 1,6 bar)

Flow meters	<p>Type: electromagnetic or turbine with digital readout and totalizer</p> <p>Range: 25 mm for 0,156 l/s to 5,0 l/s 100 mm for flow of 2,5 l/s to 80,0 l/s 250 mm for flow of 15,0 l/s to 500 l/s</p> <p>Accuracy: $\pm 0,5$ %</p>
Pressure measurement	<p>Type: Bourdon or electronic pressure transmitters</p> <p>Range: 0 MPa to 0,6 MPa (0 bar to 6 bar); 0 MPa to 1 MPa (0 bar to 10 bar); 0 MPa to 6 MPa (0 bar to 60 bar)</p> <p>Dial: 150 mm minimum diameter</p> <p>Accuracy: $\pm 2,5$ %</p>
Valve close high-speed pressure measurement, surge measurement	Recording pressure gauge with a response time $< 0,1$ s

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Annex D (informative)

Sprayers hydraulic properties in clear water

Refer to ISO 8026.

Building	See ISO 8026 (typically 6 m × 6 m) Humidity control (air conditions) Temperature control (cold conditions) Ventilation
Outdoor test site	See ISO 8026
Pump	Type: preferably centrifugal (flat curve) or turbine with variable-frequency drive Range: flow rate of 0,77 m ³ /h, and pressure of 5,5 bar.
Test bench	Type: steel, PVC or PE piping, recirculating system Range: supply line with a nominal diameter of 300 mm Requirements: including by-pass for pressure and flow regulation
Water reservoir and conditioning	600 l reservoir or match to maintain temperature criteria Filtration: 75 microns Temperature: maintain within 23 °C ± 3 °C
Pressure regulation	Manually controlled valves (2 needle valves) Accuracy: ±2,5 %
Pressure gauges	Type: mechanical or electronic manometer Accuracy: ±0,5 %
Flow measurement	Type: Ultrasonic meter Accuracy: 0,25 %
Control valves	Type: throttling valve (globe and/or needle valve) Requirements: fine adjustment and holding setting
Sprayer mounting	See ISO 8026.
Collector design	At least conforming to ISO 8026
Application measurement	Weighing or volumetric methods meeting accuracy requirement of ISO 8026
Wind measurement	Type: mechanical with analogue or electronic readout Accuracy: ±1 % Resolution: 0,1 m/s Requirements: average wind speed provided every 5 s
Temperature measurement	Type: mechanical or electronic Range: 0 °C to 45 °C Accuracy: ±0,5 °C