International Standard ISO 8026

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Irrigation equipment — Irrigation sprayers — General requirements and test methods

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 8026 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*.

Users should note that all International Standards undergo revision from time to time and that any reference made herein to any other International Standard implies its latest edition, unless otherwise stated.

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Irrigation equipment — Irrigation sprayers — General requirements and test methods

1 Scope and field of application

This International Standard specifies the general requirements for irrigation sprayers and test methods.

This International Standard applies to sprayers intended for assembly in pipeline networks for irrigation and for operation with irrigation water.

2 References

ISO 7/1, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Designation, dimensions and tolerances.*

ISO 3951, *Sampling procedures and charts for inspection by variables for percent defective.*

3 Definitions

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

3.1 irrigation sprayer: Device for distributing water over an area of up to 6 m effective diameter when any of its parts has a rotating motion, and over an area of unlimited diameter when none of its parts has a rotating motion.

3.2 nominal rate of flow: Quantity of water discharged by a sprayer per unit of time, at the nominal working pressure.

3.3 nominal working pressure, p_{nom}:

a) 200 kPa at the inlet of the sprayer;

b) any other working pressure at the inlet of the sprayer, provided it is specifically declared by the manufacturer.

3.4 range of effective working pressures: Pressure range between the minimum working pressure, p_{min}, and the maximum working pressure, p_{max}, in which the sprayer operates effectively.

3.5 ambient temperature: Temperature of the surroundings in the range of 25 ± 5 °C.

3.6 spray coverage pattern: Area wetted by the sprayer and described by an angular part circle pattern, for example, full circle, 360° pattern; half circle, 180° pattern; two circular sectors, such as the sector between 0° and 90° and the sector between 180° and 270°.

3.7 distribution curve: Average curve of heights of water accumulated in collectors laid out along the spray radius, as a function of the distances of the collectors from the sprayer.

3.8 effective diameter of coverage: Twice the distance of the sprayer from the farthest collector that collected at least 10 % of the average quantity of water collected in the collectors during the time the sprayer operates at nominal working pressure.

3.9 spray angle: Angle of the water spray above a horizontal plane, as discharged from the sprayer nozzle at nominal working pressure.

3.10 height of sprayer spray: Maximum height of the spray above the sprayer nozzle, when operating at nominal working pressure.

3.11 nozzle: That part of the sprayer through which the water spray is discharged.

3.12 collector: Receptacle used for collecting the water discharged by the sprayer during the test of spray distribution.

3.13 irrigation lateral: Branch supply line on which the sprayers are mounted directly or by means of a suitable fitting.

4 Marking

Each sprayer shall be clearly and permanently marked with the following particulars:

a) name of manufacturer or his registered trademark;

b) catalogue identification symbol;

c) nominal flow rate and nominal pressure or identifying mark;

d) marking indicating correct operating position, if necessary.

Replaceable parts, affecting sprayer performance, shall be marked separately.

Colours may be used as identifying marks.

NOTE — If space on sprayer is insufficient for all required markings, identification of manufacturer and catalogue identification symbol are acceptable.

5 General requirements

5.1 Materials

Metal parts of the sprayer shall be of copper alloy or zinc alloy (for example, Zamak).

Plastics parts of sprayers exposed to water or UV radiation shall be opaque and shall include additives to resist UV radiation.

If the sprayer is not suitable for operation with certain chemicals commonly used in agriculture, the manufacturer shall declare such limitations in his information sheets.

5.2 Construction and workmanship

Individual parts of a sprayer shall show no visible cracks, holes, air bubbles or other defects that may impair the performance and durability of the sprayer, its operation and suitability for installation.

The surfaces of the sprayer shall be smooth and free from flash or sharp edges that may cause injury or poor operation.

The construction of the sprayer shall permit replacement of parts manually or with standard tools. Should special tools be required, the manufacturer shall supply them.

Sprayer parts of the same make and type shall be replaceable, if applicable.

The design and manufacture of the sprayer shall ensure proper operation of the sprayer after installation in the pipeline.

5.3 Screw threads

In sprayers designed for threaded connection to pipelines, the screw threads shall comply with ISO 7/1. The number of screw threads in contact after assembly shall be at least three.

6 General test conditions

6.1 General

Unless otherwise noted, the tests shall be performed with water at a temperature of 25 ± 5 °C.

The instruments used for measuring flow rates and pressures shall permit measurements within an accuracy of ±1 %.

6.2 Sampling and acceptance number

From a lot of a minimum of 500 sprayers, a sample of test specimens is selected at random by the testing laboratory representative. The number of test specimens required for each test shall be as specified in the table.

Table — Number of test specimens required

Clause number	Name of test	Number of test specimens	Acceptance number
5.2	Check of construction and workmanship	10	1
7.1	Resistance of screw threads	10	1
7.2	Resistance to hydrostatic pressure at ambient temperature	5	0
7.3	Resistance to hydrostatic pressure at high temperature	5	0
8.2	Uniformity of flow rate	*	*
8.3	Performance characteristics	5	**
8.4.1	Water distribution curves	3	**
8.4.2	Effective diameter of coverage	3	**
8.4.3	Spray coverage pattern	3	**
8.4.4	Height of sprayer spray	3	**
9	Durability	5	**

* Number of test specimens and acceptance conditions according to ISO 3951.

** Acceptance conditions as specified in relevant clause.

7 Endurance tests

Sprayer test specimens shall be tested as attached to an irrigation lateral. Sprayers of the same type, but with different means of attachment, shall be tested separately for each combination of sprayer and means of attachment.

7.1 Test of resistance of screw threads

In sprayers made of metal, the threaded parts shall withstand a torque of 20 N·m, without showing signs of damage.

In sprayers made of plastics, the threaded parts shall withstand a torque of 7 N·m, applied for 1 h, without showing signs of damage.

7.2 Test of resistance to hydrostatic pressure at ambient temperature

Connect the sprayer to the test rig and plug up the spray outlet of the sprayer. The connection of the sprayer to the supply line shall be made according to the recommendations of the manufacturer for field assembly. All connections shall be tight, so that no leakage occurs during the test.

Connect the test assembly to a source of hydraulic pressure, and increase the water pressure gradually from zero up to twice the maximum working pressure p_{max}, but not less than 600 kPa.

Maintain this pressure for a period of 1 h.

The sprayer and its parts shall withstand the test pressure without being damaged, no leakage shall occur through the sprayer body or its connections, and the sprayer shall not pull out from the assembly.

7.3 Test of resistance to hydrostatic pressure at high temperature

Connect the sprayer to the test rig and plug up the spray outlet of the sprayer. The connection of the sprayer to the supply line shall be made according to the recommendations of the manufacturer for field assembly. All connections shall be tight, so that no leakage occurs during the test.

While the sprayer is immersed in water at 60 °C, allow it to fill with water and check that no air remains in the system.

Connect the test assembly to a source of hydraulic pressure and increase the water pressure from zero up to the maximum working pressure p_{max} within a period of about 15 s.

Maintain the maximum working pressure for a period of

- 1 h for sprayers made of metal;
- 24 h for sprayers made of plastics.

The sprayer and its parts shall withstand the test pressure without being damaged, no leakage shall occur through the sprayer body or its connections, and the sprayer shall not pull out from the assembly.

8 Functional tests

8.1 General

The tests shall be performed on sprayers which have previously been examined visually (without disassembly) and of satisfactory workmanship and quality.

Test sprayers shall be attached to the supply line according to the recommendations of the manufacturer for field assembly.

Sprayers of the same type, but with different nozzles or different means of attachment, shall be tested separately for each combination of sprayer and nozzle or sprayer and means of attachment.

Prior to conducting the functional tests, each test sprayer shall be operated for 1 h at nominal working pressure.

8.2 Uniformity of flow rate

The flow rate of a test sprayer shall be measured at the nominal working pressure.

The sprayers tested shall meet the sample requirements of ISO 3951, for an acceptable quality level (AQL) of 2,5 % and upper and lower specification limits of 7 %.

8.3 Performance characteristics

Measure the flow rate within the effective pressure range of the sprayer, extended by 20 % on either end of the pressure range (0,8 p_{min} to 1,2 p_{max}), at pressure differentials of 50 kPa maximum. Plot the results as a curve of flow rate against inlet pressure.

The performance characteristics (flow rate against pressure curve) shall conform to the performance characteristics shown in the publications of the manufacturer within a permissible deviation of ±5 %.

8.4 Water distribution, spray height, effective diameter of coverage

This test shall be performed indoors at no-wind conditions.

A test area is levelled evenly, and divided into squares with 25 cm max. sides. Collectors for collecting the water discharged by the test sprayer are placed at the corners of each square.

The collectors shall be cylindrical or conical, with side walls at least 45° from the horizontal. The collectors shall have sharp-edged, round openings, 10 to 15 cm in diameter, and shall be free from deformities. When installed, the openings of all the collectors shall be in the same horizontal plane. The number of collectors shall be sufficient to cover the entire spray coverage area.

Remove one collector from the centre of the test area and install the test sprayer in its place, in such manner that its spray is discharged at a height of 20 cm above the openings of the collectors.

8.4.1 Water distribution curves

Operate the sprayer for 2 h while maintaining the nominal water pressure at the sprayer inlet.

Measure the quantity of water collected in each of the collectors placed along two radii (preferably at right angles to each other) within the spray coverage area (see figure 1). Divide the quantity V (in cubic centimetres) collected in each collector by the area A (in square centimetres) of its opening and express the result in millimetres per hour as calculated from the formula:

$$\text{Collector collection rate} = 1/2 \times \frac{V \times 10}{A}$$

Plot the curves of all the collector collection rates that were measured as a function of the distance of each collector from the sprayer along the two radii. Compute and plot the average curve of heights from the above two curves (see figure 2).

The average curve of heights (water distribution curve) shall conform to the curve supplied by the manufacturer within a permissible deviation of ±10 %.

8.4.2 Effective diameter of coverage

Measure the distance from the sprayer to the farthest collector that collected at least 10 % of the average quantities of water collected in the receptacles along the two radii. The effective diameter of coverage is the average of the measured distances multiplied by 2.

The effective diameter of coverage shall conform to the values supplied by the manufacturer within a permissible deviation of ±10 %.

8.4.3 Spray coverage pattern

Measure the collection rates (in millimetres per hour) in all the collectors in the spray coverage area and mark their values on graph paper. Plot curves by connecting the points of equal collection rates (see figure 3).

The spray coverage pattern obtained from the test results shall conform to the pattern supplied by the manufacturer.

8.4.4 Height of sprayer spray

Measure the height of the spray after completion of the test of the water distribution curves.

The height of the spray shall not exceed the height declared by the manufacturer, and shall be less than 50 cm.

9 Durability test

Operate the sprayer continuously for 1 500 h at the nominal working pressure.

Measure the flow rate of the sprayer at the beginning of the test, after operation for 100 to 150 h, for 1 000 to 1 100 h, and for 1 500 h.

After this period

a) the measured flow rate of the test sprayer shall remain within ±10 % of the initial flow rate;

b) the sprayer shall show no visible defects on completion of the durability test.

10 Data supplied by the manufacturer

The manufacturer shall make available to the user suitable information on irrigation sprayers, in the form of catalogues, instructions, data sheets, all bearing marks of identification and date of issue.

10.1 General data

a) catalogue number of irrigation sprayer;

b) materials used for manufacture of sprayer;

c) instructions for installation and operation;

d) limitations of sprayer use (fertilizers, chemicals, etc.);

e) instructions for maintenance, storage and repair;

f) list of spare parts, including illustrations;

g) recommendations for filter requirements;

h) instructions for removal of sediments by means of chemicals.

10.2 Operating data

a) nominal flow rate, in litres per hour;

b) nominal working pressure, in kilopascals;

c) effective pressure range, in kilopascals;

d) graph of spray coverage pattern, and distribution curves (for sprayers with diameter of coverage greater than 2 m);

e) performance characteristics (curve of flow rate against pressure);

f) effective diameter of coverage, in metres;

g) spray angle;

h) height of spray, in centimetres;

j) qualitative description of size of spray droplets;

k) pressure losses at connection of sprayers to irrigation lateral, in kilopascals.

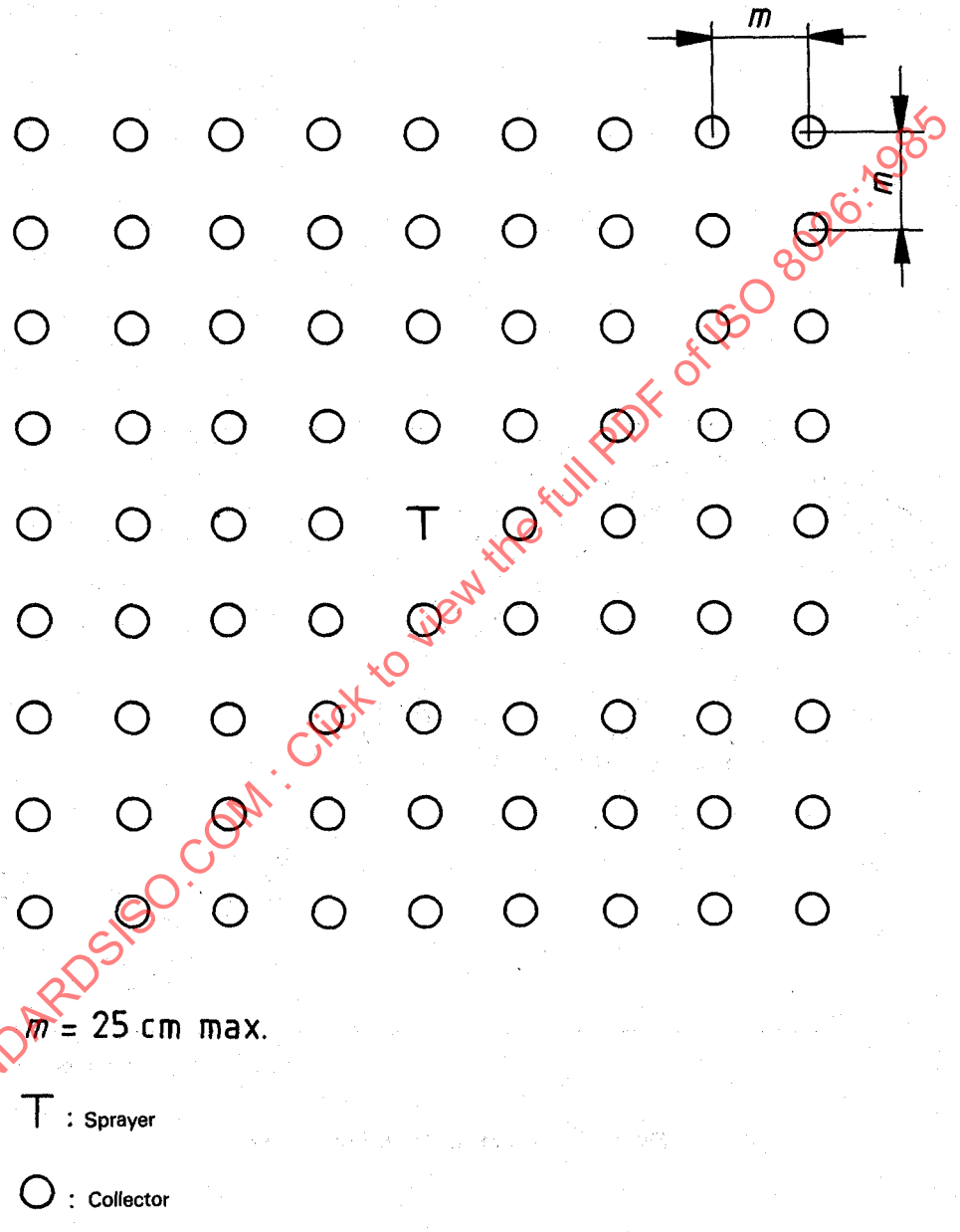

Figure 1 — Field arrangement for the testing of water distribution and effective diameter of coverage