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Agricultural irrigation equipment — Sprinklers —

Part 2: Design and operation requirements

Matériel agricole d'irrigation — Asperseurs —

Partie 2: Exigences de conception et de fonctionnement

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Foreword

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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).

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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 first edition of ISO 15886-2 cancels and replaces ISO 7749-1:1995, which has been technically revised.

The main changes compared to the previous are as follows:

— the definitions have been updated;

— the sampling and acceptance tests have been deleted;

— references to ISO 7749-2 have been deleted;

— the distribution tests have been modified and developed in ISO 15886-3;

— a new Annex A "Drop size test" has been added.

A list of all parts in the ISO 15886 series can be found on the ISO website.

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 — Sprinklers —

Part 2:
Design and operation requirements

1 Scope

This document specifies the design and operational requirements of irrigation sprinklers and their test methods.

The term sprinkler is used in this document in a broad generic sense and it means to cover a wide variety of products as classified by ISO 15886-1. This document applies to rotating sprinklers.

This document is applicable to sprinklers intended for installation on a pipe lateral and for operation with irrigation water.

2 Normative reference

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 15886-1, *Agricultural irrigation equipment — Sprinklers — Part 1: Definition of terms and classification*

ISO 15886-3, *Agricultural irrigation equipment — Sprinklers — Part 3: Characterization of distribution and test methods*

ISO 15886-4, *Irrigation equipment — Irrigation sprinklers — Part 4: Test methods for durability*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 15886-1, ISO 15886-3 and the following 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
ambient temperature
temperature of the air surrounding a *sprinkler* (3.3)

3.2
clean water
water processed, if necessary, so as to contain suspended particles no larger than 74 µm (200 mesh equivalent) and to contain no dissolved chemicals known to have short-term effects on the sprinkler materials

3.3
sprinkler
water distribution device of a variety of sizes and types

EXAMPLE Impact sprinklers, fixed-nozzle sprinklers, irrigation guns.

3.4
nozzle
aperture of a sprinkler through which water is discharged

3.5
regulated flow sprinkler
sprinkler (3.3) that maintains a relatively constant *flow rate* (3.6) at varying water pressures at the sprinkler inlet within the limits specified by the manufacturer

3.6
flow rate
volume of water flowing through a device per unit time

3.7
nominal flow rate
volume of water discharged per unit of time from a *sprinkler* (3.3) under *test pressure* (3.14)

3.8
inlet connection size
numerical designation used to characterize the *sprinkler* (3.3) which is identical to the size of the connection to the irrigation pipe

3.9
distribution curve
graphical plot of *effective application rate* (3.12) as a function of distance from a *sprinkler* (3.3) along a specified radius

3.10
irrigation lateral
branch supply line in an irrigation system on which distribution devices are mounted directly or by means of fittings, risers or tubes

3.11
sprinkler spacing
conventional designation including the distance between the *sprinklers* (3.3) along an *irrigation lateral* (3.11) and the distance between consecutive irrigation laterals

3.12
effective application rate
application rate equal to or exceeding 0.26 mm/h for *sprinklers* (3.3) with *flow rates* (3.6) exceeding 120 l/h and 0,13 mm/h for sprinklers with flow rates equal to or less than 120 l/h

3.13
range of working pressure
pressures between the minimum working pressure and the maximum working pressure

3.14
test pressure
P_n
pressure at the inlet of a *sprinkler* (3.3) declared by the manufacturer as the pressure to be used for test purposes

3.15
trajectory angle
angle above the horizontal plane of the water stream discharged from ***a*** sprinkler nozzle operating at *test pressure* (3.14)

4 General requirements

4.1 Materials

Sprinklers shall be made of metal or plastics. Metal sprinklers shall be made from a copper alloy or from other materials whose mechanical properties and resistance to corrosion are similar to those of copper alloys.

Plastics parts of the sprinkler which conduct water and which are exposed to sunlight shall be opaque and shall contain an additive to protect against UV radiation.

On request, the manufacturer shall provide information about the resistance of the sprinkler to chemicals used in agriculture.

4.2 Manufacture and installation

4.2.1 The sprinkler shall not have manufacturing defects which are detrimental to its operation.

4.2.2 The sprinklers shall incorporate features for easy installation. All sprinklers equipped with removable parts shall be easy to assemble manually or by using common tools. If a specific tool is required, it shall be supplied by the manufacturer. The removable parts of one sprinkler, including nozzles, shall be interchangeable with those of other units of the same make and type.

4.2.3 The sprinkler shall be connected to the riser by means that ensure proper strength of the connection according to 6.5 and facilitate manual assembly and removal.

4.2.4 Replaceable nozzles shall be attached to the sprinkler by threads, push-in or any other method that permits rapid and effective replacement under service conditions.

4.3 Connections

The sprinkler connections shall be specified according to the connection type and the corresponding International Standard.

4.3.1 Threaded connection. For sprinklers designed for threaded connection to irrigation laterals, the screw threads shall comply with ISO 7-1. Alternatively, other threads are allowed provided that a suitable adaptor is available with each threaded connection, making it conform with ISO 7-1.

4.3.2 Threaded nozzle. On metal sprinklers with metal nozzles, the threaded nozzle (if applicable) shall be in accordance with ISO 7-1.

4.3.3 On line connection. The manufacturer shall specify the type and size of flexible tube for which the connections are suitable. All complementary information shall be supplied by the manufacturer.

4.4 Performance requirements

The following performance requirements apply to sprinklers having one or more nozzles.

4.4.1 Effective pressures. The sprinkler shall rotate continuously and regularly in its designed direction within its entire range of working pressure from the minimum working pressure, P_{min}, to the maximum working pressure, P_{max}.

4.4.2 Actuating mechanism. The actuating mechanism of the sprinkler shall operate at any deviation of the riser up to 10° from the vertical.

5 General test conditions

5.1 Accuracy of measuring devices

The accuracy required for all measurements not specifically addressed in this document is ±3 %.

Water depth within collectors shall be measured with an accuracy of ±3 %.

Pressure shall be measured with an accuracy of ±1 %.

Flow rate through the sprinkler shall be measured with an accuracy of ±2 %.

Time shall be measured with stop watches accurate to ±0,1 s.

Temperature shall be measured with an accuracy of ±0,5°C.

5.2 Test pressure

The test pressure shall be measured at the height of the main nozzle. Refer to ISO 15886-3 for pressure tap construction. There shall be no flow obstructions between the pressure tap and the sprinkler base.

5.2.1 Regulated flow sprinklers: the test pressure shall be the midpoint of the range of working pressures.

5.2.2 Non-regulated flow sprinklers: the test pressure shall be according to the nominal test pressure (P_n).

5.3 Test liquid

Conduct the test using water that has passed through a filter with an aperture recommended by the manufacturer for normal field conditions. In the absence of a recommendation, use clean water.

Unless otherwise noted, perform the test with water at ambient temperature.

5.4 Atmospheric conditions

Relative humidity and ambient temperature shall be measured at the start, midpoint, and end of the test.

6 Strength tests

6.1 Construction and parts test

Dismantle the sprinkler and check its parts visually.

The parts shall show no manufacturing defects, such as bubbles, cracks or projections.

6.2 Resistance of threaded connections test

6.2.1 Threaded connections to riser

For sprinklers made of metal the threaded connection shall withstand a torque of 50 N·m for threads up to 1 mm without showing signs of damage, and a torque of 100 N·m for threads greater than 1 mm without showing signs of damage.

6.2.2 Nozzle threads intended for threaded connection

The nozzle threads shall withstand a torque of 5 N·m without showing any signs of damage to the nozzle or sprinkler.

6.3 Resistance to hydrostatic pressure at ambient temperature test

6.3.1 General

Connect the sprinkler to the test bench according to the recommendations of the manufacturer for field assembly and plug the nozzles such that no leakage occurs at the connection during the test.

Check that no air remains in the system, then gradually increase the water pressure beginning with one quarter of the test pressure in stages of 100 kPa, holding the system pressure for 5 s at each pressure stage.

6.3.2 Metal sprinklers

Increase the water pressure to twice the maximum working pressure, P_{max}, and maintain it at that level for 10 min at ambient temperature.

No defects in the sprinkler body shall appear during the test and no leakage shall occur through the sprinkler body or its gaskets.

6.3.3 Plastics sprinklers

Increase the water pressure to twice the maximum working pressure, P_{max}, and maintain it at that level for 1 h at ambient temperature.

No defects in the sprinkler body shall appear during the test and no leakage shall occur through the sprinkler body or its gaskets.

6.4 Resistance to hydrostatic pressure at high temperature test

Connect the sprinkler to the test bench in accordance with the recommendations of the manufacturer for field assembly and plug the nozzles. Ensure that all connections are tight so that no leakage occurs during the test.

While the sprinkler 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 hydraulic pressure source and increase the 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 metal sprinklers, or

— 24 h for plastics sprinklers.

Remove the sprinkler from the hot water bath and apply the test pressure at the inlet. When technically possible, manually rotate the sprinkler 2 full rotations within 1 min and inspect for leakage through the sprinkler body and its connections, and careful inspection of the rotary sealing mechanism.

No defects in the sprinkler body shall appear during the test and no leakage shall occur through the sprinkler body or its gaskets.

6.5 Watertightness test

Perform the test with nozzles in the mid-range of the size of nozzles made available by the manufacturer for the specific sprinkler.

Connect the sprinkler with a nozzle to the test bench according to the recommendations of the manufacturer for field assembly.

Increase the water pressure from P_{min} to P_{max} in steps of 100 kPa and maintain the pressure at each step for 1 min. Throughout the test the total leakage of the sprinkler shall be collected by suitable means.

Perform the watertightness test after 24 h of sprinkler operation at the test pressure ±10 %.

Watertightness shall meet the following requirements.

a) The total leakage rate shall not exceed 2 % of sprinkler flow rate at the test pressure.

b) For sprinklers with a nominal flow rate of ≤250 l/h, the leakage rate shall not exceed 5 l/h.

c) There shall be no leakage through the threaded connection to the supply line.

7 Operating tests

7.1 General

Perform separate tests for each sprinkler nozzle or combination of nozzles.

7.2 Installation of sprinklers under test

The sprinkler selected for testing shall be representative of general production capabilities particularly related to the speed of rotation. New sprinklers shall be operated before the test for a period sufficient to demonstrate that the time per revolution has stabilized to ±5 %.

Mount the sprinkler on a riser with the same nominal size designation as the sprinkler inlet connection size. Ensure that the riser is fixed rigidly vertically, and that it does not vibrate sufficiently to cause a visual effect on the sprinkler operation, bend or deviate from the vertical during the test. The maximum allowable deviation from the vertical during the test shall not exceed 2°.

A steel pipe riser is recommended to provide the required mechanical strength and facilitate the installation of a standard pressure tap.

7.3 Rotation speed uniformity test

Perform the uniformity of rotation test as specified in ISO 15886-3.

NOTE This test is only applicable to sprinklers declared by the manufacturer as having rotation uniformity.

7.4 Flow rate uniformity test

Perform the flow rate uniformity test as specified in ISO 15886-3.

7.5 Distribution characteristics test

Perform the test of distribution characteristics as specified in ISO 15886-3.

7.6 Radius of throw test

Perform the test of radius of throw as specified in ISO 15886-3.

7.7 Trajectory height test

Perform the test of trajectory height as specified in ISO 15886-3.

7.8 Flow rate as a function of inlet pressure test

Measure the flow rate of each sprinkler unit with pressures in increments not greater than 50 kPa, from $0{,}9 \cdot P_{min}$ up to $1{,}1 \cdot P_{max}$.

Plot the curve of flow rate as a function of the inlet pressures.

The curve of flow rate as a function of the inlet pressure shall conform to the manufacturer's published curve within an allowable deviation of not more than ±5 %.

7.9 Range of working pressure test

Before performing this test, keep the sprinkler immersed in water, maintained a T = 60 °C, for 1 h. Then operate the sprinkler for 10 min at the test pressure.

Mount the sprinkler on the riser as recommended for field service by the manufacturer. Increase the water pressure from zero to the pressure at which the sprinkler begins to rotate steadily in one direction.

Operate the sprinkler at this pressure for 2 min. Increase the water pressure gradually to the maximum working pressure, P_{max}. Then operate the sprinkler at this pressure for 1 min.

Repeat the test with the sprinkler inclined 10° from the vertical.

The sprinklers shall rotate consistently in one direction throughout the entire range between the minimum and the maximum working pressures.

8 Durability tests

Perform the durability test as specified in ISO 15886-4.

9 Identification and marking

9.1 Sprinklers

Each sprinkler shall be marked clearly and permanently with the name of manufacturer or the manufacturer's registered trademark.

9.2 Nozzles

Each nozzle shall be marked clearly and permanently with the nozzle size and position, by colour code or by any other permanent mark.

10 Data to be supplied by the manufacturer

10.1 General data

The manufacturer shall make appropriate information available to the user on irrigation sprinklers in the form of catalogues, instructions or data sheets, which include the following data:

a) the manufacturing year;

b) catalogue number of sprinkler;

c) size of sprinkler connection threads and specification for connection to supply piping;

d) materials used for the manufacture of the sprinkler;

e) limitations of sprinkler use;

f) instructions for nozzle assembly in correct position, if this affects sprinkler operation;

g) list of spare parts. Including illustrations;

h) explanation of any code used in the manufacturer's catalogue or information sheets, if any marking is in code;

i) recommendations for filtration requirements.

10.2 Operating and performance data

The manufacturer shall provide the following operating and performance data for each nozzle or assembly nozzles:

a) instructions for assembly, operation, maintenance and storage;

b) range of working pressures;

c) flow rate as a function of inlet pressure;

d) spacing arrangement (type and dimensions);

e) radius of throw;

f) trajectory angle;

g) trajectory height for sprinklers with low trajectory angle at all the working pressures;

h) distribution curves;

i) on request, the values of the Christiansen's Uniformity Coefficient (UCC) for the recommended combinations of sprinkler spacings, nozzles and working pressures;

j) droplet size (optional). See Annex A. Annex A addresses the procedures for characterizing the distribution of drop sizes discharged by the sprinkler.