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ISO 15886-3

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Agricultural irrigation equipment — Sprinklers —

Part 3: Characterization of distribution and test methods

Matériel agricole d'irrigation — Asperseurs —

Partie 3: Caractérisation de la distribution et méthodes d'essai

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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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

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

ISO 15886-3 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 15886-3:2004), which has been technically revised.

ISO 15886 consists of the following parts, under the general title *Agricultural irrigation equipment — Sprinklers*:

— *Part 1: Definition of terms and classification*

— *Part 3: Characterization of distribution and test methods*

Agricultural irrigation equipment — Sprinklers —

Part 3:
Characterization of distribution and test methods

1 Scope

This part of ISO 15886 specifies the conditions and methods used for testing and characterizing the water distribution patterns of irrigation sprinklers. The term sprinkler is used in this standard in a broad generic sense and is meant to cover a wide variety of products as classified by ISO 15886-1. The specific performance measurements addressed include distribution uniformity, wetted radius, and water jet trajectory height. This standard applies to all irrigation sprinkler classifications for which these three performance measurements are required to verify the design objectives as defined by the manufacturer.

This part of ISO 15886 deals both with indoor and outdoor tests and with radial and full grid tests. It is organized so as to deal with conditions common to all tests first and then with conditions unique to indoor testing only and finally with conditions unique to outdoor testing only.

For any given sprinkler, a wide range of nozzle configurations, operating conditions, and adjustments generate at least a theoretical need for a correspondingly large number of tests. Testing agencies and manufacturers may use interpolation techniques to reduce the number of actual test runs provided accuracy standards are still being met.

This part of ISO 15886 does not address the specific performance testing required for sprinklers intended for use in frost protection.

This part of ISO 15886 does not address the topic of drop spectrum measurement and characterization and the related questions of soil compaction, spray drift, evaporative losses, etc., all of which can be considerations in the design of sprinkler irrigation systems.

To apply this part of ISO 15886 for evaluating irrigation coverage, all sprinklers must be identical and arranged in a fixed repeating geometric pattern. This part of the standard does not apply to moving systems.

This part of ISO 15886 applies to part-circle sprinklers provided that the testing agency can satisfy questions of potential anomalies in performance parameters.

Annex A addresses the procedures for the characterization of sprinkler pattern uniformity. Annex B addresses testing part-circle sprinklers.

2 Terms and definitions

For the purpose of this part of ISO 15886, the following terms and definitions apply.

2.1
ambient temperature
temperature of the air surrounding a sprinkler test site

2.2
area of coverage
wetted area from a sprinkler operated as specified in the manufacturer's literature where water is deposited at rates equal to or greater than the effective application rate

2.3
Christiansen's uniformity coefficient
UCC
coefficient using deviations from the mean to characterize the uniformity of field-measured or simulated water application from a grid of sprinklers

2.4
clean water
water processed, if necessary, so as to contain suspended particles no larger than 200-mesh equivalent (74 µm) and to contain no dissolved chemicals known to have short-term effects on sprinkler materials

2.5
collector
receptacle into which water is deposited during a water distribution test

2.6
critical dry area
experienced-based definition of the dry area size that defines uniformity of coverage objectives

2.7
densogram
areal map utilizing the density of dots representing the water application depth at locations in the areas of coverage of a sprinkler or a grid of sprinklers

2.8
distribution uniformity
DU
coefficient using the lowest 25 % of water application depths to characterize the uniformity of field-measured or simulated water application from a grid of sprinklers

2.9
minimum effective water application rate
application rate equal to or exceeding 0,26 mm/h for sprinklers with flow rates exceeding 75 l/h and 0,13 mm/h for sprinklers with flow rates equal to or less than 75 l/h

2.10
effective radius of throw
radius at which 95 % of the reconstituted volume of water discharged by a sprinkler, interpolated between points of measurement, is applied

2.11
flow rate
volume of water flowing through an irrigation component per unit of time

2.12
full grid collector array
collectors located at the intersections of a two-dimensional geometric grid pattern sufficient in number to give a desired statistical basis for determining water distribution uniformity

2.13
inlet connection size
nominal pipe size designation for commercial purposes or to manufacturer's declaration defined by reference to a recognized standard

2.14
irrigation lateral
branch supply line in an irrigation system on which sprinklers are mounted directly or by means of fittings, risers, or tubes

2.15
maximum working pressure
Pmax
highest pressure at the inlet to a sprinkler recommended by the manufacturer to ensure proper operation

2.16
minimum working pressure
Pmin
lowest pressure at the inlet to a sprinkler recommended by the manufacturer to ensure proper operation

2.17
nozzle
aperture of a sprinkler through which the water is discharged

NOTE A sprinkler may contain one or several cylindrical nozzles, or nozzles of other shapes. This term may refer to either a single nozzle, or to a combination of nozzles in a multi-nozzled sprinkler.

2.18
part-circle sprinkler
sprinkler with an adjustable feature that enables it to irrigate a sector of a circular area either with or without an attachment which enables it to be adjusted to irrigate another sector or the entire circular area

2.19
pop-up sprinkler
sprinkler designed for installation so that the sprinkler nozzle automatically rises from below ground when the system is pressurized and automatically lowers to its original position when the system is depressurized

2.20
pressure tap
precisely fabricated connection for accurately communicating internal conduit pressure to an external pressure-measuring device

2.21
radial collector array
collectors located only on the radial axis projected from the centerline of a sprinkler sufficient in number to characterize the water distribution curve

2.22
radius of throw
wetted radius
distance measured from the centerline of a continuously-operating sprinkler to the most remote point at which the sprinkler deposits water at the minimum effective water application rate measured at any arc of coverage except near the arc extremes for part-circle sprinklers

2.23
rotating sprinkler
water distribution device which, as a result of rotating motion around its vertical axis, distributes water over a circular area, part of a circular area, or a non-circular area

2.24
scheduling coefficient
SC
coefficient used to characterize the water uniformity of water application of sprinklers employing an analysis of full-grid data based on a definition of critical dry area

2.25
sprinkler spacings
conventional designation including the distance between the sprinklers along an irrigation lateral and the distance between consecutive irrigation laterals

2.26
statistical uniformity coefficient
UCS
coefficient using standard deviation as a measure of dispersion in statistical theory to characterize the uniformity of field-measured water application from a full grid of sprinklers

2.27
test pressure
pressure at the inlet of a sprinkler declared by the manufacturer as the pressure to be used for test purposes

2.28
maximum trajectory height
maximum height above a sprinkler of the water stream discharged from the sprinkler nozzle operating at test pressure

2.29
water application rate
mean depth of water applied per unit time

2.30
water distribution curve
graphical plot of water application depth as a function of distance from a sprinkler along a specified radius

2.31
wind speed
speed of the wind at a test site averaged over the time required for a sprinkler distribution uniformity test

2.32
working pressure
water pressure range recommended by the manufacturer to ensure proper operation of a sprinkler

3 Collectors

3.1 Collector design

All collectors used for any one test shall be identical. They shall be designed to minimize water splashes in or out and distortions of the catchment volume as may be caused by wind currents.

The height of a collector shall be at least twice the maximum depth of the water collected during the test, but not less than 150 mm.

The collectors shall have a circular opening with sharp edges free from deformities. The diameter shall be between 1/2 to 1 times the height, but not less than 85 mm.

Alternative collector designs may be used, provided that their measuring accuracy is not less than of those described above.

The catchment from a collector shall be quantified from a direct reading of mass, depth, or a volumetric determination provided that the required accuracy standard is met.

3.2 Collector orientation

The openings of all collectors shall be in a common horizontal plane with a slope not exceeding 2 % in any direction. The difference in height between any two adjacent collectors shall not exceed 20 mm.

For indoor testing, collector height is not critical. For outdoor testing, the collector height shall be sufficient to ensure that vegetation does not interfere with jet access to the collectors.

4 Installation of sprinklers under test

The sprinkler selected for testing shall be representative of general production capabilities particularly as relates 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. 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.

The sprinkler nozzle height above the collectors should simulate the conditions under which the sprinkler is normally used. For example, with the turf sprinklers the top of the sprinkler body should coincide with the top of the collectors.

For agricultural sprinklers used under a variety of field conditions the following height requirement applies: The height of the principal sprinkler nozzle above the openings of the collectors shall be selected from Table 1. Manufacturers can request additional heights but those in Table 1 must be included.

Table 1 — Sprinkler height

Sprinkler flow rate l/h	**Sprinkler nozzle height above the collector** m
Pop-up	0 (in a non-pressurized state)
0 to 300	0,3
301 to 1 500	0,5
1 501 to 2 500	1,0
> 2 500	1,5

If the manufacturer specifies any special test-related conditions, for example, testing at a minimum riser height or with straightening vanes, they shall be used if such items are provided as standard equipment with the sprinkler.

For a sprinkler that is not riser-mounted as described in above, the mounting shall be as specified by the manufacturer.

For single leg distribution patterns, a shelter may be used around the sprinkler to contain jet action provided the following conditions are met:

— The shelter is large enough and so constructed as to trap the water jets and not let them interfere with the sprinkler's operation or contribute to the collector catchment.

— The shelter is designed to allow air circulation to develop around the jets.

— The shelter provides a minimum sector for unrestricted jet operation of 45° centred on the collector radius. If the testing agency uses an angle less than 45°, it must demonstrate that the integrity of the results is not compromised. Special attention shall be put to sector size, to avoid interception of projections (spoon spit) generated by the impact arm.

— The shelter is designed so that no jet deflection or splash is directed into the collectors.

5 Measurements

5.1 Accuracy of measurements

Application depths within collectors shall be measured with an accuracy of ± 3,0 %.

Pressure shall be measured with an accuracy of ± 1,0 %.

Flow rate through the sprinkler shall be measured with an accuracy of ± 2,0 %.

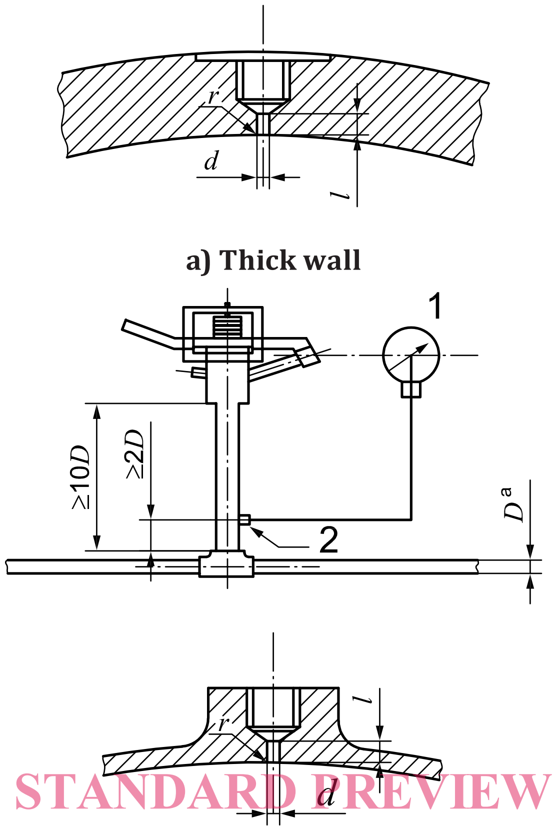
Temperature shall be measured with an accuracy of ± 0,5 °C.

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

The accuracy required for all measurements not specifically addressed in this part of ISO 15886 is ± 3,0 %.

5.2 Pressure measurement

The test pressure shall be measured at the height of the main nozzle. The pressure tap construction details are shown in Figure 1. There shall be no flow obstructions between the pressure tap and the sprinkler base. The bore of the pipe containing the pressure tap shall be clean and smooth.



a) Thick wall

b) Thin wall

Key

1 pressure gauge

2 pressure tap

a Internal diameter of the pipe.

Figure 1 — Pressure tap location and construction details

Figure 1 a), $l \geq 2{,}5d$ where d = 3 to 6 mm or 1/10 pipe diameter, whichever is smaller

Figure 1 b), $l \geq 2d$; $r \leq d/10$

5.3 Atmospheric conditions measurements

Relative humidity and ambient temperature shall be measured at the start, midpoint, and end of the test. For indoor testing, changes in temperature and humidity during the test shall not exceed ± 5,0 % of the pre-test ambient conditions.

Air conditioning systems may be required to ensure that the testing facilities meet this requirement.

5.4 Corrections for evaporative losses within collectors

Under some conditions, evaporative losses within collectors are known to result in measurement errors that exceed the required accuracy of ± 3,0 %. Under these conditions, a correction to the collector readings must be made using the following procedure:

Place a volume of water approximately equal to the average volume to be collected during the test in each of three collectors. Locate the collectors near the test area but outside the area of water application. Measure the volume of water before and after the test and apply the difference to the volume of water in each collector.

