
**Agricultural irrigation equipment —
Sprinklers —**

Part 1:

Definition of terms and classification

Matériel agricole d'irrigation — Asperseurs —

Partie 1: Définition des termes et classification

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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.

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ISO 15886-1 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 18, *Irrigation and drainage equipment and systems*.

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*

Design and operational requirements, and test methods for durability, are to form the subjects of future parts 2 and 4.

Agricultural irrigation equipment — Sprinklers —

Part 1: Definition of terms and classification

1 Scope

This part of ISO 15886 defines terms used in relation to sprinklers intended for agricultural irrigation and provides a means of classifying those sprinklers according to physical factors, characteristics of water spray, mechanism for operation and water distribution, approach to sealing, intended use, and additional functions incorporated into the sprinkler. Its scope is intentionally broad in order to cover the widest possible range of sprinkler construction, performance and intended-use alternatives.

2 Terms and definitions

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

2.1

accumulator

hydraulic device that stores fluid under pressure and cushions shock waves

2.2

anti-drain valve

valve designed to remain closed whenever the system pressure does not exceed a pre-set value and to open for higher pressures

2.3

chemigation

application of chemicals through irrigation systems

2.4

compression-disk nozzle

nozzle fitted with an elastic disk that flexes under pressure so as to alter the nozzle's hydraulic properties

2.5

cross vane

flow-conditioning vane of nozzle, the design of which tends to trap waterborne contaminants

2.6

constant-acceleration nozzle

nozzle whose shape changes gradually and smoothly so as to cause a constant rate of acceleration in the flow passages

2.7

constant with fixed operating conditions

internal geometry of nozzle that does not vary under fixed operating conditions, thus maintaining constant hydraulic properties

2.8 constricting-passage nozzle
nozzle fitted with elastic sleeves that alter the nozzle's hydraulic properties in response to changes in operating pressure

2.9 continuous-move system
irrigation system where the sprinklers' set positions are fixed in one direction and variable in the moving direction

EXAMPLE Centre pivot, linear move system, traveller.

2.10 controlled-acceleration nozzle
nozzle whose shape changes gradually and smoothly so as to cause a specific rate or rates of acceleration in the flow passages

2.11 customized nozzle
nozzle whose design changes so as to meet pre-specified hydraulic criteria relative to acceleration, turbulence, separation, etc.

2.12 element parallel to water flow
upstream flow-conditioning component incorporated in a nozzle, the centreline of which is parallel to the nozzle's centreline

2.13 element not parallel to water flow
upstream flow-conditioning component incorporated in a nozzle, the centreline of which is at an angle to the nozzle's centreline

2.14 elevation of spray
height that a spray rises above a horizontal plane passing through the nozzle elevation

2.15 finger spray
spray whose every stream is an individual concentration of water — either as a coherent jet or a directed concentration of individual drops

2.16 flexing-orifice nozzle
nozzle fabricated from elastic materials that flex under pressure so as to alter the nozzle's hydraulic properties

2.17 flow-rate-change
function of a sprinkling device that, during operation, automatically provides a change in hydraulic properties

2.18 fluidic device
nozzle that employs fluidic principles, such as jets directed over curved splash plates, to achieve its design hydraulic-performance objectives

2.19 gradual-acceleration nozzle
nozzle whose shape changes gradually and smoothly so as to cause a gradual — usually linear — acceleration in the flow passages

2.20**groove or rifling along flow passages**

flow-conditioning element of a nozzle, designed to produce modified hydraulic properties by increasing flow passage turbulence

2.21**impact-arm rotating sprinkler**

sprinkler driven by the action of a balanced arm rotating about a vertical axis

NOTE The arm momentarily intercepts and deflects a portion of the jet, this action providing the torque required to rotate the sprinkling device.

2.22**impulse-arm rotating sprinkler**

sprinkler driven by the action of a balanced arm rotating about a horizontal axis

NOTE The arm momentarily intercepts and deflects a portion of the jet, this action providing the torque required to rotate the sprinkling device.

2.23**jet spray**

stream of water issuing from an orifice under pressure

2.24**location of maximum trajectory height**

radial distance from the sprinkler axis at which the maximum trajectory height is reached

2.25**maximum trajectory height**

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

2.26**moveable fixed-grid system**

agricultural irrigation system where sprinkler set positions are nominally fixed by supply pipeline, hydrant, infield access or other infrastructure constraints

EXAMPLE Hand-move, wheel-move, tow-lines, continuous-move.

2.27**moving sheet**

sheet spray that moves or rotates

2.28**no variation during operation**

characteristic of a sprinkler whereby it operates on fixed mechanically controlled repeatable cycles

2.29**no statistical variation during operation**

characteristic of a sprinkler whereby it operates without fixed mechanical control but produces statistically repeatable results

2.30**nominal size**

reference dimension used to characterize the approximate size of a component for informational purposes

2.31**nozzle**

aperture or adjutage of the sprinkler through which the water is discharged

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

2.32

off-axis-bore nozzle

nozzle in which the orifice centreline does not correspond to the nozzle centreline

2.33

open vane

flow-conditioning vane of nozzle designed to shed waterborne contaminants

2.34

opposed [balanced] rotating sprinkler [reaction force drive]

sprinkler device driven by hydraulic reaction forces from more than one jet

NOTE The rotational torques are balanced to provide speed control and rotational dependability.

2.35

pop up

action of a mechanism within the sprinkler that automatically raises the nozzle height to improve crop clearance when the system is pressurized

2.36

pop down

action of a mechanism within the sprinkler that automatically lowers the nozzle from the pop-up to the original position when the system is de-pressurized

2.37

ring [disk] orifice

orifice formed by a hole in a ring [disk] placed normal to the flow direction

NOTE The ring or disk is readily changed allowing for variations in the sprinkler hydraulic performance.

2.38

rotating sprinkler

sprinkler that uses a rotating motion around its vertical axis to distribute water over a circular area or part of a circular area

2.39

sheet spray

water spread out into a flat plane-like spray, as after hitting a deflector plate

2.40

space-filling fog spray

emission from an orifice, whose size is relatively small and pressure high, which fills the air with a "cloud" of ultra-fine droplets whose size can be specified

NOTE The objective of the operation is usually crop cooling as opposed to meeting irrigation needs.

2.41

space-filling mist spray

emission from an orifice which fills the air with a "cloud" of very fine droplets whose size can be specified

2.42

space-filling rain spray

emission from an orifice which fills the air with a volume of relatively medium to coarse drops whose size can be specified

2.43

space-filling spray

emission from an orifice which fills the air with a "cloud" of relatively fine droplets whose size can be specified

2.44**space-filling spray combination**

sprinkling device combining a number of space-filling spray types

2.45**speed-of-rotation-changes sprinkler**

sprinkler that provides speed control features that are mechanically adjustable during operation

2.46**splash re-direct mechanism**

tube or deflection device mounted on an arm-driven rotating sprinkler, which re-directs the drive action portion of the jet in a direction generally parallel to the main jet

2.47**sprinkler**

any size or type of water-distribution device

EXAMPLE Impact sprinkler, fixed-nozzle sprinkler, irrigation gun.

2.48**spray**

any release of water from a sprinkler

2.49**stationary fixed-grid system**

irrigation system where sprinkler set positions are rigidly fixed by semi-permanent or permanently installed lateral pipelines

EXAMPLE Portable solid-set system, buried system.

2.50**straight-bore nozzle**

nozzle design utilizing a cylindrical section approaching the orifice.

NOTE Normally, no *vena contracta* effect is associated with this design.

2.51**stream breakup change**

variation in mechanically controlled stream breakup exhibited by sprinkling devices during operation as part of a series of pre-set repeatable cyclic patterns

2.52**taper-bore nozzle**

nozzle design utilizing a conical section approaching the orifice

2.53**trajectory angle**

angle above the horizontal position of the water stream or spray discharged from a sprinkler nozzle or sprayer operating at test pressure

2.54**trajectory angle change**

automatic (by, for example, adjustment of the axis of rotation) or mechanical change in the trajectory angle of a sprinkler during operation

2.55**valve in-head**

valve mechanism fabricated as an integral part of the sprinkler that adds features independent of the sprinkling operation to control flow rate

2.56

variation between cycles

sprinkler that operates on fixed mechanically controlled repeatable sequences

NOTE Sequences consist of a number of cycles exhibiting one set of hydraulic properties followed by a number of cycles exhibiting a second set of hydraulic properties.

2.57

variable-geometry nozzle

nozzle fabricated to a non-regular shape for a specific purpose such as pressure of flow regulation or jet breakup

2.58

variable-internal-geometry nozzle

nozzle whose performance is significantly affected by the upstream flow passage components

2.59

variable-with-fixed-operating-conditions nozzle

nozzle whose internal geometry varies in some repetitive manner under fixed operating conditions, thus exhibiting variable hydraulic properties

2.60

wobbling spray

nutating spray

spray produced typically by an off-centre rotary-action sprinkler

3 Classification

3.1 General

Sprinklers shall be classified under the following major categories and according to any particular characteristic(s) the sprinkler possesses, as specified in 3.2 to 3.7. The intention is to cover all possibilities for the different types of sprinkler by classifying them according to

- a) physical factors, such as size, materials or operating pressure,
- b) characteristics of water spray, e.g. type of spray, area of coverage,
- c) mechanism for operation and water distribution, e.g. methods of spraying and sprinkler drive methods,
- d) mechanism for sealing (bearings, washers, O-rings, etc.),
- e) intended use (including agricultural, turf, garden, nursery, greenhouse, frost and dust control, cooling and wastewater utilization), and
- f) additional functions incorporated into the sprinkler, such as pressure or flow regulation or pop-up.

3.2 According to physical factors

3.2.1 Size of nozzle

3.2.2 Flow rate

3.2.3 Working pressure

3.2.3.1 Minimum working pressure

3.2.3.2 Maximum working pressure

3.2.3.3 Range of working pressure

3.2.4 Nominal size of inlet connection

3.2.4.1 Type of connection

3.2.4.1.1 At inlet (see ISO 13460)

3.2.4.1.1.1 Pipe thread (see ISO 7-1):

- male;
- female.

3.2.4.1.1.2 “Garden hose” thread (see ANSI B2.4):

- male;
- female.

3.2.4.1.1.3 Bayonet or quick-coupling

3.2.4.1.1.4 Flange (see ISO 7005-1 and ISO 7005-2)

3.2.4.1.1.5 Insert barb (as in micro-sprayers)

3.2.4.1.1.6 Other

3.2.4.1.1.7 Multiple (choice of vertical and horizontal inlets)

3.2.4.1.1.8 Flexible (incorporating part or all of a swing joint)

3.2.4.1.2 At nozzle

3.2.4.1.2.1 Tapered thread

3.2.4.1.2.2 Non-tapered thread:

- butt seal;
- O-ring seal;
- other.

3.2.4.1.2.3 Bayonet or quick-coupling

3.2.4.1.2.4 Snap-fit

3.2.4.1.2.5 Permanently attached

3.2.4.1.2.6 Other

3.2.4.2 Orientation of sprinkler when connected (flow direction through sprinkler)

3.2.4.2.1 Up-inlet positioned below nozzle/outlet

3.2.4.2.2 Down-inlet positioned above nozzle/outlet

3.2.4.3 Typical or recommended riser or drop tube

3.2.4.3.1 Height or length

3.2.4.3.2 Height of nozzle/outlet above the irrigated surface

3.2.4.3.3 Rigidity of material:

- a) rigid (metal);
- b) semi-rigid (e.g. lightweight PVC);
- c) flexible (e.g. flex-PVC or other elastomer).

3.2.5 Repair/replacement

3.2.5.1 According to extent of intended repair and/or replacement:

- none (throw away when no longer serviceable);
- nozzle and related parts such as stream straightener;
- bearing/washers;
- major drive parts (arm springs, swirl plates, turbine assemblies);
- complete (fully possible to disassemble and replace/repair);
- intended life.

3.2.5.2 According to hours of operation

3.2.5.3 According to cycles of operation or number of actuations:

- a) pop-up/pop-down;
- b) forward/reverse;
- c) on/off.

3.2.6 Materials of construction

3.2.6.1 Predominantly metal

3.2.6.2 Predominantly plastics

3.2.6.3 Other

3.3 According to water-spray characteristic(s)

3.3.1 Type of spray

3.3.1.1 Sheet spray

3.3.1.1.1 Stationary sheet

3.3.1.1.2 Moving

3.3.1.2 Finger spray**3.3.1.2.1** Stationary sheet**3.3.1.2.2** Moving**3.3.1.3 Jet spray****3.3.1.4** Space-filling spray:

- a) space-filling rain-spray;
- b) space-filling mist-spray;
- c) space-filling fog-spray;
- d) space-filling spray combination.

3.3.2 Spray trajectory**3.3.2.1** Trajectory angle**3.3.2.2** Maximum trajectory height**3.3.2.3** Location of maximum trajectory height**3.3.3 Area of coverage****3.3.3.1 Circular****3.3.3.1.1** Full-circle**3.3.3.1.1** Part-circle:

- a) fixed-pattern;
- b) adjustable-pattern, either
 - 1) adjustable in discrete steps, or
 - 2) adjustable to an infinite number of settings.

3.3.3.2 Other patterns**3.3.4 Type of nozzle****3.3.4.1 Circular****3.3.4.1.1** Ring- or disk-orifice**3.3.4.1.2** Taper-bore nozzle**3.3.4.1.3** Straight-bore nozzle

3.3.4.1.4 Controlled-acceleration nozzle

3.3.4.1.4.1 Constant acceleration nozzle

3.3.4.1.4.2 Gradual-acceleration nozzle

3.3.4.1.4.3 Customized nozzle:

- off-axis-bore nozzle;
- other.

3.3.4.2 **Circular nozzle with other features**

Classification for circular nozzles having side slots, undercuts, etc.

3.3.4.3 **Non-circular**

3.3.4.3.1 Polygonal (triangle, square, rectangle, hexagon)

3.3.4.3.2 Stellated (as in circular with corners of triangle)

3.3.4.3.3 Rounded non-circular (oval or other)

3.3.4.3.4 Multiple openings in same nozzle housing

3.3.4.3.5 Other

3.3.4.4 **Variable-geometry nozzles**

3.3.4.4.1 **Variable outlet geometry**

3.3.4.4.1.1 Flexing-orifice nozzle

3.3.4.4.1.2 Compression-disk nozzle

3.3.4.4.1.3 Constricting-passage nozzle

3.3.4.4.1.4 Fluidic devices

3.3.4.4.1.5 Other

3.3.4.4.2 **Variable internal geometry**

3.3.4.4.2.1 Constant with fixed operating conditions

3.3.4.4.2.2 Variable with fixed operating conditions

3.3.4.5 **Nozzles incorporating stream-control elements**

3.3.4.5.1 **Elements parallel to water flow**

3.3.4.5.1.1 Open vane

3.3.4.5.1.2 Cross vane

3.3.4.5.1.3 Grooves or rifling along passage

3.3.4.5.1.4 Other

3.3.4.5.2 Elements not parallel to water flow

3.3.4.5.2.1 Open vane

3.3.4.5.2.2 Cross vane

3.3.4.5.2.3 Grooves or rifling along passage

3.3.4.5.2.4 Other

3.3.4.5.3 Other

Classification for nozzles with another type of stream-control element.

3.3.5 Variability of application pattern during operation

3.3.5.1 No variation:

- no actual variation;
- no statistical variation.

3.3.5.2 Variation during individual cycle:

- speed of rotation changes;
- flow rate changes;
- stream breakup changes;
- trajectory angle changes.

3.3.5.3 Variation between cycles:

- stream breakup changes;
- other changes between cycles.

3.3.5.4 Other variations

3.4 According to mechanism for water distribution operation**3.4.1 Stationary spray**

3.4.1.1 Direct spray

3.4.1.2 Splash plate or deflection plate

3.4.2 Wobbling/nutating spray

3.4.2.1 Stationary nozzle into wobbling/nutating deflector

3.4.2.2 Flexible whip

3.4.3 Rotating sprinklers — Vertical axis of rotation

3.4.3.1 Arm-driven

3.4.3.1.1 Type of arm drive

3.4.3.1.1.1 Impulse arm

3.4.3.1.1.2 Impact arm

3.4.3.1.2 Energy storage/damping mechanism or principle

3.4.3.1.2.1 Spring, classified according to whether

— coil,

— leaf,

— torsion,

— elastomer, or

— other type.

3.4.3.1.2.2 Weight/gravity

3.4.3.1.2.3 Spring and weight/gravity in combination

3.4.3.1.2.4 Other principle

3.4.3.1.3 Configuration of water engagement part of arm

3.4.3.1.3.1 Spoon and vane:

a) open-spoon;

b) closed-spoon.

3.4.3.1.3.2 Wedge or V-drive

3.4.3.1.3.3 Counter-weighted wedge or V-drive

3.4.3.1.3.4 Splash redirect mechanism:

a) with splash-redirect mechanism;

b) without splash-redirect mechanism.

3.4.3.1.3.5 Other

3.4.3.1.4 Arm Support

3.4.3.1.4.1 Fulcrum pin only

3.4.3.1.4.2 Single-bridge

3.4.3.1.4.3 Double-bridge

3.4.3.1.4.4 Bridge/body combination

3.4.3.1.4.5 Other

3.4.3.2 Driven by motor (internal or external)

3.4.3.2.1 Turbine — speed control or reduction mechanism or principle:

- gears;
- viscous damping;
- other;
- uncontrolled.

3.4.3.2.2 Impact:

- ball-drive;
- rotating-cam;
- spin wheel;
- other.

3.4.3.3 Driven by reaction forces

3.4.3.3.1 Unopposed — spinner

3.4.3.3.2 Opposed or balanced

3.4.4 Rotating Sprinklers — Horizontal axis of rotation

3.4.4.1 Mechanism of drive motor

3.4.4.1.1 Turbine — speed control or reduction mechanism or principle:

- gears;
- viscous damping;
- other.

3.4.4.1.2 Impact:

- ball drive;
- rotating cam;
- other.

3.4.4.1.3 Piston

3.4.4.1.4 External motor

3.4.4.1.5 Other