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Agricultural irrigation equipment — Sprinklers —

Part 1: Definition of terms and classification

Matériel d'irrigation agricole — Asperseurs d'irrigation —

Partie 1: Définition des termes et classification

Please see the administrative notes on page iii

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Foreword

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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

3.4.4.2 Other

Classification according to a characteristic other than the mechanism of the drive motor.

3.5 According to sealing mechanism

3.5.1 Bearing/washer stack

3.5.1.1 Open

3.5.1.2 Protected, closed or internal:

— O-rings;

— face seals;

— other.

3.6 According to intended use

3.6.1 Agriculture

3.6.1.1 Type of system

3.6.1.1.2 Movable fixed-grid systems

3.6.1.1.3 Stationary fixed-grid systems

3.6.1.1.4 Continuous-move systems

3.6.1.2 Type of crop

3.6.1.2.1 Plant size, spacing and extent of root system:

— trees;

— dwarf trees;

— vines;

— bushes;

— row crops;

— continuous cover crops.

3.6.1.2.2 Plant value:

a) high economic return per unit area;

b) medium economic return per unit area;

c) low economic return per unit area.

3.6.1.2.3 Plant sensitivity to water stress:

a) high sensitivity;

b) medium sensitivity;

c) low sensitivity.

3.6.2 Turf/landscape

3.6.2.1 Residential and small business

3.6.2.2 Commercial (parks, large industrial, schools, highway landscaping)

3.6.2.3 Golf

3.6.2.4 Other athletic fields (soccer, football, tennis, cricket, rugby, etc.)

3.6.2.5 Other

3.6.3 Home garden

Classification under the intended-use category *home garden*.

3.6.4 Nursery/greenhouse

Classification under the intended-use category *nursery/greenhouse*.

3.6.5 Environmental uses

3.6.5.1 Frost protection

3.6.5.2 Evaporative cooling:

a) to avoid heat stress;

b) to avoid accumulation of degree-days to prolong dormancy.

3.6.5.3 Dust suppression

3.6.5.4 Irrigation with, or disposal of, effluent water

3.6.6 Chemigation

This category of intended use includes fertilizers and other agronomic chemicals.

3.6.7 Quality of intended water source

Such as “dirty water” products.

3.7 According to additional functions incorporated into sprinkler

3.7.1 Pop-up/pop-down

3.7.2 Pressure regulation

While 3.3.4.4 dealt with pressure- or flow-regulating nozzles, the following covers sprinklers employing pressure-regulating mechanisms other than at the nozzle, which are classified according to their use of either

a) elastomeric parts sensitive to pressure, or

b) variable internal openings to adjust nozzle pressure, which can be

   1) spring-controlled,

   2) weight/gravity-controlled,

   3) rolling-diaphragm, or

   4) other.

3.7.3 Flow control (see ISO 9911:1993)

While 3.3.4.4 dealt with pressure- or flow-regulating nozzles, the following covers sprinklers employing flow-regulating mechanisms other than at the nozzle, which are classified according to their use of either

a) elastomeric parts sensitive to velocity or pressure loss, or

b) variable internal openings to adjust nozzle pressure, which can be

   1) spring-controlled,

   2) weight/gravity-controlled,

   3) rolling-diaphragm,

   4) other.

3.7.4 Valve in head (see ISO 9635, ISO 9952 and ISO 10522)

3.7.4.1 Anti-drain valve

3.7.4.2 On/off valve

3.7.4.3 Complex valve (on/off and other functions)

3.7.5 Pressure accumulator

Classification according to whether the sprinkler has a pressure accumulator.

3.7.6 Volume accumulator

Classification according to whether the sprinkler has a volume (water) accumulator.

3.7.7 Other

Classification according to any additional function(s) the sprinkler might have.

Bibliography

[1] ISO 7-1:1994, *Pipe threads where pressure-tight joints are made on the threads — Part 1: Dimensions, tolerances and designation*

[2] ISO 7005-1:1992, *Metallic flanges — Part 1: Steel flanges*

[3] ISO 7005-2:1988, *Metallic flanges — Part 2: Cast iron flanges*

[4] ISO 7749-1:1995, *Agricultural irrigation equipment — Rotating sprinklers — Part 1: Design and operational requirements*

[5] ISO 8026, *Agricultural irrigation equipment — Sprayers — General requirements and test methods*

[6] ISO 9635, *Irrigation equipment — Hydraulically operated irrigation valves*

[7] ISO 9911:1993, *Agricultural irrigation equipment — Manually operated small plastics valves*

[8] ISO 9952, *Agricultural irrigation equipment — Check valves*

[9] ISO 10522, *Agricultural irrigation equipment — Direct-acting pressure-regulating valves*

[10] ISO 13460, *Agricultural irrigation equipment — Plastics saddles for polyethylene pressure pipes*

[11] ANSI B2.4, *Hose coupling screw threads*

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