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Agricultural irrigation equipment — Sprinklers —

Part 1: Definition of terms and classification

Matériel agricole d'irrigation — Asperseurs —

Partie 1: Définition des termes et classification

Reference number
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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*.

This second edition cancels and replaces the first edition (ISO 15886-1:2004), 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: Characterizing of distribution and test methods*

Agricultural irrigation equipment — Sprinklers —

Part 1:
Definition of terms and classification

1 Scope

This part of ISO 15886 defines terms related to irrigation sprinklers and specifies the classification of sprinklers according to the following categories: physical factors; characteristics of the water spray; the mechanism for operation and water distribution; the mechanism for sealing; the intended use; additional functions incorporated into the sprinkler. The scope is intentionally broad 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
pressure 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 hydraulic properties of the nozzle

2.5
cross vane
flow conditioning vanes, the design of which tends to trap waterborne contaminants

2.6
constant-acceleration nozzle
nozzle, the shape of which changes gradually and smoothly so as to cause a constant rate of acceleration in the flow passages

2.7
constant-flow nozzle
nozzle, the internal geometry of which does not vary under fixed operating conditions thus maintaining constant hydraulic properties

2.8
constricting-flow nozzle
nozzle fitted with elastic sleeves that alter the hydraulic properties of the nozzle in response to changes in operating pressure

2.9
continuous-move irrigation machine
irrigation machine in which the position of sprinklers is fixed on a supply line which moves continuously in a particular direction

EXAMPLES Centre pivot irrigation machine, moving lateral irrigation machine, traveller irrigation machine.

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

2.11
customized nozzle
nozzle, the design of which meets specified hydraulic criteria for acceleration, turbulence and separation

2.12
element parallel to water flow
upstream flow conditioning component, the centreline of which is parallel to the nozzle centreline

2.13
element not parallel to water flow
upstream flow conditioning component, the centreline of which is at an angle to the nozzle centreline

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

2.15
finger spray
stream of water directed either as a cohesive or continuous jet or as a concentration of individual drops

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

2.17
flow-rate change mechanism
mechanism provided that automatically changes hydraulic properties during operation

2.18
fluidic device
device (such as an amplifier or control) that depends for operation on the pressures and flows of a fluid in precisely shaped channels

NOTE Definition based on that for “fluidic” from the Free Merriam-Webster Dictionary, accessed on 2012-01-24. [Available from: http://www.merriam-webster.com/dictionary/fluidic.]

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

2.20
groove along flow passages
rifling along flow passages
flow conditioning element designed to modify hydraulic properties of the flow passage thus increasing flow passage turbulence

2.21
impact arm
balanced arm of a sprinkler rotating about a vertical axis (usually corresponding to the sprinkler axis) that momentarily intercepts and deflects a portion of the jet so as to provide the torque required to rotate the water distribution component of the sprinkler

2.22
impulse arm
balanced arm of a sprinkler rotating about a horizontal axis that momentarily intercepts and deflects a portion of the jet so as to provide the torque required to rotate the water distribution component of the sprinkler

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

2.26
mechanically-controlled stream breakup sprinkler
sprinkling device with a capability for controlling stream breakup in a series of mechanically pre-set repeatable cyclic patterns

2.27
moveable fixed-grid agricultural system
irrigation system in which sprinkler set positions are nominally fixed by a supply pipeline, a hydrant, infield access or other infrastructure constraints

EXAMPLES Hand-move system, wheel-move system.

2.28
moving sheet
sheet spray which moves in a linear fashion or which rotates

2.29
no-variation sprinkler systems
sprinkler systems that operate on mechanically controlled repeatable cycles

2.30
no-statistical-variation sprinkler systems
sprinkler systems that operate without fixed mechanical control, but that produce statistically repeatable results

2.31
nominal size
numerical designation used to refer to the size of a sprinkler which is identical to the nominal diameter of a pipe to which the sprinkler is intended to be connected directly

2.32
nozzle
aperture or adjutage in a sprinkler through which water is discharged

2.33
off-axis-bore nozzle
nozzle in which the orifice centreline does not correspond to the nozzle centreline

2.34
open vane nozzle
nozzle with flow conditioning vanes that are designed to shed waterborne contaminants

2.35
opposed reaction-force driven sprinkling device
balanced reaction-force driven sprinkling device
sprinkling device driven by hydraulic reaction forces from more than one jet acting in opposite directions such that the rotational torque is balanced to provide speed control and rotational stability

2.36
pop up/pop down mechanism
mechanism within the sprinkler that automatically raises the nozzle height to improve crop clearance when the system is pressurized and automatically lowers the nozzle to the original position when the system is de-pressurized

2.37
ring orifice
disk orifice
aperture in a ring or disk placed in the nozzle of a sprinkler normal to the direction of flow

NOTE The ring or disk is readily replaceable to allow for change in the hydraulic performance of the sprinkler.

2.38
rotating sprinkler
device which by its rotating motion around its vertical axis distributes water over a circular area or part of a circular area

2.39
sheet spray
water spread out into a flat plane-like spray

EXAMPLE Spray that results when water impinges on a deflector plate.

2.40
space-filling fog spray
emission from an orifice which fills the air with a “cloud” of ultra-fine droplets the size of which may be specified usually for the purpose of crop cooling

2.41
space-filling mist spray
emission from an orifice which fills the air with a “cloud” of very fine droplets the size range of which may 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 the size range of which may be specified

2.43
space-filling spray
emission from an orifice which fills the air with a “cloud” of relatively fine droplets the size range of which may be specified

2.44
space-filling spray combination sprinkler
sprinkling device combining a number of space filling spray types

2.45
adjustable-speed sprinkler
sprinkler that provides mechanically adjustable speed control features

2.46
splash re-direct mechanism
tube or deflection device mounted on an arm driven sprinkler to re-direct the drive action portion of jet in a direction generally parallel to the main jet

2.47
sprinkler
water distribution device of a variety of sizes and types for example impact sprinklers, fixed nozzle, sprayers and irrigation guns

2.48
spray
release of water from a sprinkler

2.49
stationary fixed-grid system
irrigation system in which sprinkler set positions are rigidly fixed by semi-permanent or permanently installed lateral pipelines

EXAMPLE Portable solid-set irrigation system, buried irrigation system.

2.50
straight-bore nozzle
nozzle utilizing a cylindrical cross-section approaching the orifice, normally no vena contracta is associated with this design

2.51
taper-bore nozzle
nozzle utilizing a conical section approaching the orifice

2.52
trajectory angle
angle above the horizontal plane of the water stream or spray discharged from a sprinkler nozzle or a sprayer operating at test pressure

2.53
trajectory angle change mechanism
mechanism that automatically changes the trajectory angle during operation

2.54
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

2.55
variable-cycle sprinkler
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.

2.56
variable-geometry nozzle
nozzle fabricated to a non-regular shape for a specific purpose such as pressure of flow regulation or jet breakup

2.57
variable internal geometry nozzle
nozzle, the performance of which is significantly affected by the upstream flow passage components

2.58
variable-performance nozzle
nozzle, the internal geometry of which varies in some repetitive manner under fixed operating conditions to produce variable hydraulic properties

2.59
wobbling sprayer
nutating sprayer
wobbler
off-centre rotary-action sprinkler

3 Classification

3.1 General

Sprinklers shall be classified according to the following major categories and their particular characteristics, as specified in 3.2 to 3.7. The intention is to cover all possible sprinkler types, by classifying them according to

a) physical factors, such as size, materials, operating pressure,

b) characteristics of the water spray, e.g. type of spray, area of coverage,

c) the mechanism for operation and water distribution, e.g. methods of spraying and sprinkler drive methods,

d) the mechanism for sealing, e.g. bearings, washers, O-rings,

e) the intended use, e.g. agricultural, turf, garden, nursery, greenhouse, frost and dust control, cooling, wastewater utilization,

f) additional functions incorporated into the sprinkler, e.g. pressure or flow regulation, or pop-up.

3.2 Physical factors

3.2.1 Size of nozzle

3.2.2 Flow rate

3.2.3 Working pressure

— Minimum working pressure.

— Maximum working pressure.

— Range of working pressure.

3.2.4 Nominal size of inlet connection

3.2.4.1 Type of connections

3.2.4.1.1 Type of connections at inlet (ISO 13460)

— Pipe thread (ISO 7-1:1994):

  — male;

  - female.
- “Garden Hose” thread [ANSI/ASME B1.20.7-1991 (R2003)]:
  - male;
  - female.
- Bayonet or quick-coupling.
- Flange (ISO 7005-1:2011 and ISO 7005-2:1988).
- Insert barb (as in micro-sprayers).
- Multiple (choice of vertical and horizontal inlets).
- Flexible (incorporating part or all of a swing joint).
- Other.

3.2.4.1.2 Type of nozzle connections

- Tapered threads.
- Non-tapered threads:
  - butt seal;
  - O-ring seal;
  - other.
- Bayonet or quick coupling.
- Snap-fit.
- Permanently attached.
- Other.

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

- Up-inlet below nozzle/outlet.
- Down-inlet above nozzle/outlet.

3.2.4.3 Typical or recommended riser or drop tube

- Height or length.
- Height of nozzle/outlet above the irrigated surface.
- Rigidity of material:
  - rigid (metal);
  - semi-rigid (as lightweight PVC);
  - flexible (as flex-PVC or other elastomer).

3.2.5 Degree of replacement/repair intended

- None (throw away when no longer serviceable).

— Nozzles (nozzles and related parts such as stream straightener).

— Bearing/washers.

— Major drive parts (arm springs, swirl plates, turbine assemblies).

— Complete (full possibility to disassemble and replace/repair).

— Intended life.

3.2.5.1 Based on hours of operation

3.2.5.2 Based on cycles of operation or number of actuations

— Pop-up/pop-down.

— Forward/reverse.

— On/off.

3.2.6 Materials of construction

— Predominantly metal.

— Predominantly plastics.

— Other.

3.3 Characteristics of water spray

3.3.1 Type of spray

3.3.1.1 Sheet spray

— Stationary sheet.

— Moving.

3.3.1.2 Finger spray

— Stationary finger.

— Moving.

3.3.1.3 Jet-spray

3.3.1.4 Space-filling spray

— Space-filling rain-spray.

— Space-filling mist-spray.

— Space-filling fog-spray.

3.3.1.5 Space filling spray combination

3.3.2 Spray trajectory

— Trajectory angle.

— Maximum trajectory height.

— Location of maximum trajectory height.

3.3.3 Area of coverage

3.3.3.1 Circular

3.3.3.1.1 Full-circle

3.3.3.1.2 Part-circle

— Fixed-pattern.

— Adjustable-pattern:

  — adjustable in discrete steps;

  — adjustable to an infinite number of settings.

3.3.3.2 Other patterns

3.3.4 Type of nozzle(s)

3.3.4.1 Circular

— Ring- or disk-orifice.

— Taper-bore nozzle.

— Straight-bore nozzle.

— Controlled-acceleration nozzle:

  — constant-acceleration nozzle;

  — gradual-acceleration nozzle.

  — customized nozzle.

— Off-axis-bore nozzle.

— Other.

3.3.4.2 Circular with side slots, undercuts, etc.

3.3.4.3 Noncircular

— Polygonal (triangle, square, rectangle, hexagon).

— Stellated (as in circular with corners of triangle).

— Rounded noncircular (oval or other).

— Multiple openings in same nozzle housing.

— Other.

3.3.4.4 Variable-geometry nozzles

— Variable-outlet-geometry:
  — flexing-orifice nozzle;
  — compression-disk nozzle;
  — constricting-passage nozzle;
  — fluidic devices;
  — other.
— Variable internal geometry:
  — constant with fixed operating conditions (nozzles);
  — variable with fixed operating conditions (nozzles).

3.3.4.5 Nozzles incorporating stream-control elements

— Elements parallel to water flow:
  — open vanes;
  — cross vanes;
  — grooves or rifling along passage;
  — other.
— Elements not parallel to water flow:
  — open vanes;
  — cross vanes;
  — grooves or rifling along passage;
  — other.
— Other.

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 type of variation

3.4 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

— Impulse arm.

— Impact arm.

3.4.3.1.2 Energy storage/damping mechanism or principle

— Spring:

  — coil;

  — leaf;

  — torsion;

  — elastomer;

  — other.

— Weight/gravity.

— Spring and weight/gravity in combination.

— Other principle.

3.4.3.1.3 Configuration of water engagement part of the arm

— Spoon and vane:

  — open-spoon;

  — closed-spoon.

— Wedge or V-drive.

— Counter-weighted wedge or V-drive.

— Splash redirect mechanism:

  — with splash redirect mechanism.

  — without splash redirect mechanism.

— Other.

3.4.3.1.4 Arm support

— Fulcrum pin only.

— Single-bridge.

— Double-bridge.

— Bridge/body combination.

— Other.

3.4.3.2 Driven by motor (internal or external)

— Turbine — speed control or reduction mechanism or principle:

  — gears;

  — viscous damping;

  — other;

  — uncontrolled.

— Impact:

  — ball-drive;

  — rotating-cam;

  — spin wheel;

  — other.

— Driven by reaction forces:

  — unopposed – spinner;

  — opposed or balanced.

3.4.4 Rotating sprinklers — Horizontal axis of rotation

3.4.4.1 Mechanism of drive motor

— Turbine — speed control or reduction mechanism or principle:

  — gears;

  — viscous damping;

- other.

- Impact:
  - ball drive;
  - rotating cam;
  - other.
- Piston.
- External motor.
- Other.

3.4.4.2 Other

3.5 Mechanism for sealing

3.5.1 Bearing/washer stack

- Open.
- Protected, closed or internal:
  - O-rings;
  - face seals;
  - other.

3.6 Intended use

3.6.1 Agriculture

3.6.1.1 Type of system

- Movable fixed-grid systems.
- Stationary fixed-grid systems.
- Continuous-move systems.

3.6.1.2 Type of crop

- Plant size, plant spacing, and extent of plant root system:
  - trees;
  - dwarf trees;
  - vines;
  - bushes;
  - row crops;

- continuous cover crops.

- Plant value:
  - high economic return per unit area;
  - medium economic return per unit area;
  - low economic return per unit area.
- Plant sensitivity to water stress:
  - high sensitivity to water stress;
  - medium sensitivity to water stress;
  - low sensitivity to water stress.

3.6.2 Turf/landscape

- Residential and small business.
- Commercial (parks, large industrial, schools, highway landscaping).
- Golf.
- Other athletic fields (soccer, football, tennis, cricket, rugby, etc.).
- Other.

3.6.3 Home garden

3.6.4 Nursery/greenhouse

3.6.5 Environmental uses

- Frost protection.
- Evaporative cooling:
  - to avoid heat stress;
  - to avoid accumulation of degree-days to prolong dormancy.
- Dust suppression.
- Irrigation with, or disposal of effluent water.

3.6.6 Chemigation (includes fertilizers and other agronomic chemicals)

3.6.7 Quality of intended water source (as “dirty water” products)

3.7 Additional functions incorporated into the 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, this subclause covers sprinklers employing pressure-regulating mechanisms other than at the nozzle, which are classified according to their use of either

— elastomeric parts sensitive to pressure, or

— variable internal openings to adjust nozzle pressure which can be

  — spring-controlled,

  — weight/gravity-controlled,

  — rolling-diaphragm, or

  — other.

3.7.3 Flow control (ISO 9911:2006)

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

— elastomeric parts sensitive to velocity or pressure loss, or

— variable internal openings to adjust nozzle pressure which can be

  — spring-controlled,

  — weight/gravity-controlled,

  — rolling-diaphragm, or

  — other.

3.7.4 Valve-in-head (ISO 9635-3, ISO 9635-5 and ISO 10522)

— Anti-drain valve.

— On/off valve.

— Complex valve (on/off and other functions).

3.7.5 Pressure accumulator

3.7.6 Volume (water) accumulator

3.7.7 Other

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