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Irrigation equipment — Irrigation sprinklers — Part 1: Definition of terms and classification

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Foreword

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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. (Working group 3)

This second/third/... edition cancels and replaces the first/second/... edition (), [clause(s) / subclause(s) / table(s) / figure(s) / annex(es)] of which [has / have] been technically revised.

ISO 15886 consists of the following parts, under the general title *Irrigation equipment — Irrigation sprinklers*:

— *Part 1: Definition of terms and classification*

— *Part 2: Design and operation requirements*

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

— *Part 4: Test methods for durability (Pending)*

Irrigation equipment — Irrigation sprinklers — Part 1: Definition of terms and classification

1 Scope

This part of ISO 15886 specifies the classification of 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. It is intentionally broad to cover the widest possible range of sprinkler construction, performance, and intended use alternatives. References are found in the bibliography.

The primary sprinkler classifications used in this standard are by;

-Physical Factors

-Characteristics of water spray

-Mechanism for operation and water distribution

-Mechanism for sealing

-Intended use

-Additional functions incorporated into the sprinkler

References are found in the bibliography

2 Terms and definitions

For the purposes of this part of ISO 15886, the following definitions apply:

2.1
accumulator (pressure)
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 nozzles hydraulic properties

2.5
cross vane (nozzle)
flow conditioning vanes the design of which tends to trap waterborne contaminants

2.6
constant-acceleration nozzles
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 with fixed operating conditions (nozzle)
nozzle, the internal geometry of which 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 nozzles hydraulic properties in response to changes in operating pressure

2.9
continuous-move systems
irrigation system where sprinklers set positions are fixed in one direction and variable in the moving direction. For example : Center pivots, linear move systems, and travelers

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 changes so as to meet pre-specified hydraulic criteria relative to acceleration, turbulence, separation, etc.

2.12
elements parallel to water flow (nozzle)
nozzles incorporating upstream flow conditioning components the centerline of which is parallel to the nozzle centerline

2.13
element not parallel to water flow (nozzle)
nozzle incorporating upstream flow conditioning components the centerline of which is at an angle to the nozzle centerline

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

2.15
finger spray
each stream is an individual concentration of water either as a coherent jet or as 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 nozzles hydraulic properties

2.17
flow rate change (during operation) (sprinkler)
sprinkling device that automatically provide a change in hydraulic properties during operation

2.18
fluidic device
nozzle that employ fluidic principles to achieve the design hydraulic performance objectives as with jets directed over curved splash plates

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 or rifling along flow passages (nozzle)
flow conditioning element 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 provides 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 provides 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 a 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, for example : hand-move, wheel-move, tow-lines, continuous move, etc

2.27
moving sheet
sheet spray moves or rotates

2.28
no variation (during operation) (sprinkler)
(sprinklers) that operate on fixed mechanically controlled repeatable cycles

2.29
no statistical variation (during operation) (sprinkler)
(sprinklers) that operate without fixed mechanical control, but that produce statistically repeatable results

2.30
nominal size
reference dimension used to characterize the approximate size of a component for informational purposes

2.31
off-axis-bore nozzle
nozzle in which the orifice center line does not correspond to the nozzle centerline

2.32
open vane (nozzle)
flow conditioning vane that are designed to shed waterborne contaminants

2.33
opposed or 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.

2.34
pop up/pop down
mechanism within the sprinkler that automatically raises the nozzle height to improve crop clearance when the system is pressurized (pop up) and automatically lowers the nozzle to the original position (pop down) when the system is de-pressurized

2.35
ring or disk orifice
orifice formed by a hole in a ring or disk placed normal to the flow direction

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

2.36
sheet spray
water spread out into a flat plane-like spray, as after hitting a deflector plate

2.37
space-filling fog-spray
emission from an orifice which fills the air with a "cloud" of ultra-fine droplets

NOTE Actual droplet size may be specified. The orifice is relatively small and the pressure is high. The objective of the operation is usually crop cooling as opposed to meeting irrigation needs

2.38
space-filling mist-spray
emission from an orifice which fills the air with a "cloud" of very fine droplets

NOTE Actual droplet size may be specified.

2.39
space-filling rain-spray
emission from an orifice which fills the air with a volume of relatively medium to coarse drops

NOTE Actual drop size may be specified.

2.40
space-filling spray
emission from an orifice which fills the air with a "cloud" of relatively fine droplets

NOTE Actual droplet size range may be specified.

2.41
space filling spray combination
sprinkling device combining a number of space filling spray types

2.42
speed of rotation changes (during operation) (sprinkler)
(sprinklers) that provide mechanically adjustable speed control features

2.43
splash re-direct mechanism (rotating sprinkler, arm driven)
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

2.44
sprinkler
broad general term used to apply to all sizes and types of water distributions devices such as impact sprinklers, fixed nozzles, sprinklers, irrigation guns, etc

2.45
spray
any release of water from a sprinkler

2.46
stationary fixed-grid system
irrigation system where sprinkler set positions are rigidly fixed by semi-permanent or permanently installed lateral pipelines, for example : Portable solid-set or buried systems

2.47
straight-bore nozzle
nozzle design utilizing a cylindrical section approaching the orifice. Normally no vena contracta is associated with this design

2.48
stream breakup change (during operation) (sprinkler)
(sprinklers) variation in mechanically controlled stream breakup exhibited by sprinkling devices during operation as part of a series of pre-set repeatable cyclic patterns

2.49
taper-bore nozzle
nozzle design utilizing a conical section approaching the orifice

2.50
trajectory angle
angle, above the horizontal place at the water stream or spray discharged from a sprinkler nozzle or a sprayer operating at test pressure

2.51
trajectory angle change
(sprinkler) that automatically changes the trajectory angle during operation by, for example, adjusting the axis of rotation or mechanically changing the trajectory angle

2.52
valve-in-head (sprinkler)
valve mechanism fabricated as an integral part of the sprinkler that adds features independent of the sprinkling operation to control flow rate

2.53
variation between cycle
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.

2.54
variation-geometry (nozzle)
nozzle fabricated to a non-regular shape for a specific purpose such as pressure of flow regulation or jet breakup

2.56
variable internal geometry (nozzle)
(nozzle) the performance of which is significantly affected by the upstream flow passage components

2.57
variable with fixed operating conditions (nozzle)
nozzle, the internal geometry of which varies in some repetitive manner under fixed operating conditions and thus exhibiting variable hydraulic properties

2.58
wobbling (nutating) spray
an off-center rotary-action sprinkler. The name "wobbler" is a registered trade mark by Senninger Irrigation, Inc., Orlando, Florida

3 Classification

3.1 General

Sprinklers shall be classified according to the following major categories and their particular characteristics – specified in 3.2 to 3.7 and intended to cover all the possibilities for the different types of sprinkler.

a) Physical factors, for example : size, materials, operating pressure, etc.

b) Characteristics of water spray, for example : type of spray, area of coverage, etc.

c) Mechanism for operation and water distribution, for example : methods of spraying and sprinkler drive methods

d) Mechanism for sealing, for example : bearings, washers, o-rings

e) Intended use, for example: agricultural, turf, garden, nursery, greenhouse, frost and dust control, cooling, wastewater utilization

f) Additional functions incorporated into the sprinkler, for example: pressure or flow regulation, pop-up sprinkler

3.2 Sprinkler characteristics

The sprinkler characteristics listed below are meant to cover all the possibilities for different types of sprinklers.

3.3 Physical factors

3.3.1 Size of nozzle

3.3.2 Flow rate

3.3.3 Working pressure

– Minimum working pressure

– Maximum working pressure

– Range of working pressure

3.3.4 Nominal size of inlet connection

3.3.4.1 Type of connections

3.3.4.1.1 Type of connections at inlet (ISO 13460)

– Pipe thread (ISO 7-1:1994)

a. Male

b. Female

– "Garden Hose" thread (ANSI B2.4 :1974)

a. Male

b. Female

– Bayonet or quick-coupling

– Flange (ISO 7005-1 :1992 and 7005-2 :1988)

– Insert barb (as in micro-sprayers)

– Other

– Multiple (choice of vertical and horizontal inlets)

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

3.3.4.1.2 Type of nozzle connections

– Tapered threads

– Non-tapered threads

a. Butt seal

b. O-ring seal

c. Other

– Bayonet or quick coupling

– Snap-Fit

– Permanently attached

– Other

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

a) Up-Inlet Below Nozzle/Outlet

b) Down-Inlet Above Nozzle/Outlet

3.3.4.3 Typical or Recommended Riser or Drop Tube

– Height or Length

– Height of Nozzle/Outlet Above the Irrigated Surface

– Rigidity of Material

a. Rigid (metal)

b. Semi-Rigid (as lightweight PVC)

c. Flexible (as flex-PVC or other elastomer)

3.3.5 Degree of Replacement/Repair Intended

a. None (throw away when no longer serviceable)

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

c. Bearing/Washers

d. Major Drive Parts (arm springs, swirl plates, turbine assemblies)

e. Complete (full possibility to disassemble & replace/repair)

f. Intended Life

3.3.5.1 Based on hours of operation

3.3.5.2 Based on cycles of operation or number of actuations

a. Pop-up/Pop-down

b. Forward/Reverse

c. On/Off

3.3.6 Materials of Construction

a) Predominantly Metal

b) Predominantly Plastics

c) Other

3.4 Characteristics of Water Spray

3.4.1 Type of Spray

3.4.1.1 Sheet Spray

– Stationary Sheet

– Moving

3.4.1.2 Finger Spray

– Stationary Sheet

– Moving

3.4.1.3 Jet-Spray

3.4.1.4 Space-Filling Spray

a) Space-Filling Rain-Spray

b) Space-Filling Mist-Spray

c) Space-Filling Fog-Spray

3.4.1.5 Space Filling Spray Combination

3.4.2 Spray Trajectory

– Trajectory Angle

– Maximum Trajectory Height

– Location of Maximum Trajectory Height

3.4.3 Area of Coverage

3.4.3.1 Circular

3.4.3.1.1 Full-Circle

3.4.3.1.2 Part-Circle

– Fixed-Pattern

– Adjustable-Pattern

a) Adjustable in Discrete Steps

b) Adjustable to an Infinite Number of Settings

3.4.3.2 Other Patterns

3.4.4 Type of Nozzle(s)

3.4.4.1 Circular

– Ring- or Disk-Orifice

– Taper-Bore Nozzle

– Straight-Bore Nozzle

– Controlled-Acceleration Nozzle

a) Constant Acceleration Nozzle

b) Gradual-Acceleration Nozzle

c) Customized Nozzle

– Off-Axis-Bore Nozzle

– Other

3.4.4.2 Circular with Side Slots, Undercuts, etc.

3.4.4.3 Noncircular

a) Polygonal (triangle, square, rectangle, hexagon)

b) Stellated (as in circular with corners of triangle)

c) Rounded Noncircular (oval or other)

d) Multiple Openings in Same Nozzle Housing

e) Other

3.4.4.4 Variable-Geometry Nozzles

– Variable-Outlet-Geometry

a) Flexing-Orifice Nozzle

b) Compression-Disk Nozzle

c) Constricting-Passage Nozzle

d) Fluidic Devices

e) Other

– Variable Internal Geometry

a) Constant with Fixed Operating Conditions (Nozzles)

b) Variable with Fixed Operating Conditions (Nozzles)

3.4.4.5 Nozzles Incorporating Stream-Control Elements

– Elements Parallel to Water Flow

a) Open Vanes

b) Cross Vanes

c) Grooves or Rifling Along Passage

d) Other

– Elements Not Parallel to Water Flow

a) Open Vanes

b) Cross Vanes

c) Grooves or Rifling Along Passage

d) Other

– Other

3.4.5 Variability of Application Pattern During Operation

3.4.5.1 No Variation

– No Actual Variation

– No Statistical Variation

3.4.5.2 Variation During individual Cycle

– Speed of Rotation Changes

– Flow Rate Changes

– Stream Breakup Changes

– Trajectory Angle Changes

3.4.5.3 Variation Between Cycles

– Stream Breakup Changes

– Other Changes Between Cycles

3.4.5.4 Other Type of Variation

3.5 Mechanism for Water Distribution Operation

3.5.1 Stationary Spray

3.5.1.1 Direct Spray

3.5.1.2 Splash Plate or Deflection Plate

3.5.2 Wobbling (Nutating) Spray

3.5.2.1 Stationary Nozzle into Wobbling (Nutating) Deflector

3.5.2.2 Flexible Whip

3.5.3 Rotating Sprinklers – Vertical Axis of Rotation

3.5.3.1 Arm-Driven

3.5.3.1.1 Type of Arm Drive

a) Impulse Arm

b) Impact Arm

3.5.3.1.2 Energy Storage/Damping Mechanism or Principle

– Spring

a) Coil

b) Leaf

c) Torsion

d) Elastomer

e) Other

– Weight/Gravity

– Spring and Weight/Gravity in Combination

– Other Principle

3.5.3.1.3 Configuration of Water Engagement Part of the Arm

– Spoon and Vane

a) Open-Spoon

b) Closed-Spoon

– Wedge or V-Drive

– Counter-Weighted Wedge or V-Drive

– Splash Redirect Mechanism

a) With Splash Redirect Mechanism

b) Without Splash Redirect Mechanism

– Other

3.5.3.1.4 Arm Support

a) Fulcrum Pin Only

b) Single-Bridge

c) Double-Bridge

d) Bridge/Body Combination

e) Other

3.5.3.2 Driven by Motor (Internal or External)

– Turbine – Speed Control or Reduction Mechanism or Principle

a) Gears

b) Viscous Damping

c) Other

d) Uncontrolled

– Impact

a) Ball-Drive

b) Rotating-Cam

c) Spin Wheel

d) Other

– Driven by Reaction Forces

a) Unopposed - Spinner

b) Opposed or Balanced

3.5.4 Rotating Sprinklers – Horizontal Axis of Rotation

3.5.4.1 Mechanism of Drive Motor

– Turbine - Speed Control or Reduction Mechanism or Principle

a) Gears

b) Viscous Damping

c) Other

– Impact

a) Ball Drive

b) Rotating Cam

c) Other

– Piston

– External Motor

– Other

3.5.4.2 Other

3.6 Mechanism for Sealing

3.6.1 Bearing/Washer Stack

a) Open

b) Protected, Closed or Internal

– O-Rings

– Face Seals

– Other

3.7 Intended Use

3.7.1 Agriculture

3.7.1.1 Type of System

a) Movable Fixed-Grid Systems

b) Stationary Fixed-Grid Systems

c) Continuous-Move Systems

3.7.1.2 Type of Crop

– Plant Size, Plant Spacing, and Extent of Plant Root System

a) Trees

b) Dwarf Trees

c) Vines

d) Bushes

e) Row Crops

f) Continuous Cover Crops

– Plant Value

a) High Economic Return Per Unit Area

b) Medium Economic Return Per Unit Area

c) Low Economic Return Per Unit Area

– Plant Sensitivity to Water Stress

a) High Sensitivity to Water Stress

b) Medium Sensitivity to Water Stress

c) Low Sensitivity to Water Stress

3.7.2 Turf/Landscape

a) Residential and Small Business

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

c) Golf

d) Other Athletic Fields (soccer, football, tennis, cricket, rugby, etc.)

e) Other

3.7.3 Home Garden

3.7.4 Nursery/Greenhouse

3.7.5 Environmental Uses

– Frost Protection

– Evaporative Cooling

a) To Avoid Heat Stress

b) To Avoid Accumulation of Degree-Days to Prolong Dormancy

– Dust Suppression

– Irrigation With, or Disposal of Effluent Water

3.7.6 Chemigation (includes fertilizers and other agronomic chemicals)

3.7.7 Quality of Intended Water Source (as "dirty water" products)

3.8 Additional Functions Incorporated into the Sprinkler

3.8.1 Pop-Up/Pop-Down

3.8.2 Pressure Regulation

NOTE Clause 5.2.4.4 deals with pressure or flow regulating nozzles. This section covers sprinklers employing pressure-regulating mechanisms other than at the nozzle.

– Uses Elastomeric Parts Sensitive to Pressure

– Uses Variable Internal Openings to Adjust Nozzle Pressure

a) Spring-Controlled

b) Weight/Gravity-Controlled

c) Rolling-Diaphragm

d) Other

3.8.3 Flow Control (ISO 9911:1993)

NOTE Clause 5.2.4.4 deals with pressure or flow regulating nozzles. This section covers sprinklers employing flow-regulating mechanisms other than at the nozzle.

– Uses Elastomeric Parts Sensitive to Velocity or Pressure Loss

– Uses Variable Internal Openings to Adjust Nozzle Pressure

a) Spring-Controlled

b) Weight/Gravity-Controlled

c) Rolling-Diaphragm

d) Other

3.8.4 Valve-in-Head (ISO 09635, ISO 09952, and ISO 10522)

a) Anti-Drain valve

b) On/Off Valve

c) Complex Valve (On/Off and other functions)

3.8.5 Pressure Accumulator

3.8.6 Volume (Water) Accumulator

3.8.7 Other

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