
**Agricultural irrigation equipment —
Filters for micro-irrigation —**

**Part 1:
Terms, definitions and classification**

*Matériel agricole d'irrigation — Filtres pour micro-irrigation —
Partie 1: Termes, définitions et classification*



Reference number
ISO 9912-1:2004(E)

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Published in Switzerland

Foreword

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ISO 9912-1 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 9912 consists of the following parts, under the general title *Agricultural irrigation equipment — Filters for micro-irrigation*:

- *Part 1: Terms, definitions and classification*
- *Part 2: Strainer-type filters*
- *Part 3: Automatic self-cleaning strainer-type filters*

Introduction

Clogging of irrigation system components and, in particular, of drip emitters, is one of the main problems encountered in micro-irrigation. Materials causing clogging include debris, suspended particles of organic and inorganic origin (sand, silt, clay, plastics, algae and water-borne insects), chemical deposits (calcium carbonate and magnesium carbonate, calcium sulphate, metal oxides and metal hydroxides) and biological suspensions (slime secretions and fibres). Severe clogging problems are often the result of a combination of a number of these.

The effect of the clogging materials differs according to the water source (see Annex A for a list of irrigation water sources). With surface water supplies, water quality may also vary from one season to another and with chemical injection. In addition, clogging hazards depend on the operating conditions, pumping regime, irrigation system and chemical injection program.

The function of the filter in an irrigation system is to remove materials from the water that can clog or otherwise foul the various components of the system. However, under typical irrigation conditions, and in view of the wide range of size and hardness of suspended particles in irrigation water, complete removal of all suspended particles cannot be expected.

Moreover, under conditions of alkaline or hard water when accompanied by conditions of high biological activity and/or high suspended organic particle content, the materials passing through the filter are liable to coalesce in the piping system and/or in the emitters and to cause clogging. Hence, depending on the water quality, it could be necessary to use two or more filters in series in different parts of the system to minimize clogging.

Under conditions of problematic water and high filtration efficiency, clogging of the filters themselves may prove to be the main problem and completion of an irrigation set may be impeded due to the need for their frequent cleaning.

Various operating methods, using either absorption or separation, are employed in order to separate and/or remove clogging materials from irrigation water. In turn, separation can be by means of surface separation (gravity surface separation, pressurized surface separation or self-circulating separation), centrifugal separation, entrapment or interception.

Agricultural irrigation equipment — Filters for micro-irrigation —

Part 1: Terms, definitions and classification

1 Scope

This part of ISO 9912 defines terms used in relation to filters intended for agricultural micro-irrigation systems — in particular, pressurized systems — and provides a means of classifying those filters according to filtration method, structure, operating principle and function. It does not deal with classification according to the type of water intended to be filtered; nor does it apply to the classification of filters for potable or domestic water use.

2 Terms and definitions

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

2.1 filtration

process employing a permeable medium and/or spinning component to separate, from water, materials that would clog an irrigation system, also employing a means for removing those materials from the permeable medium or spinning component such that the capacity of the medium or component to separate the materials is renewed

2.2 pre-filtration

process for separating primarily large particles from water to be filtered with the object of reducing the clogging of the filter elements and, consequently, the head loss across the filter elements

2.3 interception

method of removing suspended particles from water, by gravity, employing gravel partitions between reservoir basins to separate the suspended particles from the water

2.4 surface separation

method of unpressurized separation that depends on gravity and employs an inclined separating element, such as a screen, mesh or strainer, to separate suspended particles and larger clogging material from the water

2.5 centrifugal separation

method of separation that separates, from water, clogging material heavier than water and that employs a spinning technique using centrifugal forces exerted by the filtered water, as in a hydrocyclone

- 2.6**
entrapment
method of filtration in which clogging material is captured within the interior of a three-dimensional filter medium
- 2.7**
self-circulating separation
method of filtration that employs a screen, or any other suitable filter medium, and a spinning technique used with or without flow adjustment, for separating clogging materials from water
- 2.8**
strainer-type filter
strainer
device containing one or more filter elements, such as a screen or mesh, used for separating clogging materials from water flowing through the device by collecting it on the surface of the filter element, or elements
- 2.9**
filtrate
debris, suspended particles of organic or inorganic origin, or other contaminants removed from water in the filtration process
- 2.10**
flushing
method of removing clogging material from a filter using water without removal of the filter element or, following removal of the element, by manually removing clogging material from the filter element using water
- 2.11**
back flushing
reverse flushing
method of removing filtrates from a filter by passing filtered water through the filter medium or over the surface of the filter element, in a direction opposite to the normal flow of water, to remove accumulated, trapped or separated filtrates from the filter, without disassembling the filter
- 2.12**
continuous flushing
method of removing clogging material from a filter element by controlled continuous flow of purge water
- 2.13**
through flushing
flushing by means of high-velocity, high-pressure flow through a discharge valve or outlet used for filters especially designed for this type of flushing
- 2.14**
simultaneous back flushing
flushing occurring simultaneously through all areas of the filter element or through all the individual elements of a multi-element filter
- 2.15**
sequential back flushing
back flushing of one or more individual filter elements functioning in parallel after their removal from service for back flushing, frequently using filtered water from some or all of the remaining filter elements
- 2.16**
directed jet flushing
flushing that employs a high-velocity stream of clean water directed at a portion of the area of a filter element on the downstream side of the filter, thus causing a localized reverse flow that flushes the filtrate from a portion of the filter element, and which then moves over the entire area of the element to progressively back flush all of it

2.17**disposable element filter**

filter that cannot be flushed or cleaned from which clogging material is removed when the filter element is replaced

2.18**automatic flushing filter**

filter in which both the initiation and the termination of discrete flushing cycles are activated automatically by different means (pressure drop, time, volume of water passing through the filter, etc.)

2.19**semi-automatic flushing filter**

filter in which the flushing sequence or cycle is manually activated, followed by automatic termination of flushing, generally by means of time or volume of flushing water

2.20**manual flushing filter**

filter constructed so that manual opening of a valve causes a discharge appropriately oriented and of sufficient volume and velocity to flush the filter without disassembly

2.21**manually cleaned filter**

filter that must be disassembled and manually washed using water to remove filtrates from the filter element

2.22**disc filter**

filter in which the filter element is composed of discs with grooved or textured surfaces arranged one on top of the other to form a stack, creating a porous space between adjacent discs within which the filtrate is trapped or deposited

2.23**cartridge filter**

filter using a media filter element held together as a single replaceable component of the filter for cleaning purposes

2.24**filter element**

component or assembly that embodies or holds together the filter medium or surface separation device that removes the filtrates from water by entrapment or separation

2.25**strainer filter element**

component of a strainer-type filter consisting of a perforated plate, screen, mesh, or a combination of these, intended to retain clogging materials larger than a specified size from the water flowing through the component

2.26**media filter element**

depth filter element

component, housing or assembly containing a three-dimensional filter medium such as sand, gravel, textile, fibres or a porous mass of bonded particles, employing entrapment as a method of filtration

2.27**filter medium**

porous permeable material employed in filtration within which the filtrate is trapped or deposited

2.28**pressurized filter**

filter designed for operation with an inlet pressure greater than atmospheric pressure

2.29

gravity filter

filter that does not employ pressure or a vacuum to produce a high differential pressure but in which the driving force for filtration is provided solely by the elevation of the free surface of water contained in the filter above the filter medium

2.30

vacuum filter

filter designed for operation in which the discharge side of the filter is below atmospheric pressure, as on the suction side of a pump

2.31

hydrocyclone

device in which clogging material is separated from water by a centrifugal force resulting from rotation of the water, generally by introducing the water so that it flows in a tight vortex and the clogging material is thrown to the walls, causing the bulk of the water to exit from the chamber at the centre of the vortex and the clogging material and the rest of the water to exit from the chamber through its apex or bottom

2.32

in-line filter

co-axial filter

filter for which the inlet and the outlet are coaxial

2.33

on-line filter

non-coaxial filter

filter in which the inlet and the outlet are not coaxial

2.34

filter housing

component of a filter that houses or supports the filter medium

2.35

media filter

depth filter

filter in which clogging material is trapped within the interior of a three-dimensional filter medium, such as sand, gravel, textile, fibres or a porous mass of bonded particles

2.36

sand filter

media filter in which the filter medium consists of sand, gravel or other natural or synthetic particles, in some cases employing layers of the filter medium, each of a different particle size

2.37

nominal flow rate of filtration

flow rate through a filter for proper filtration, as declared by the manufacturer

3 Classification

3.1 General

Filtration devices for irrigation water shall be classified under the following major categories and according to any particular characteristic(s) the device possesses, as specified in 3.2 to 3.11. The intention is to cover all possibilities for different types of devices by classifying them according to

- filtration method, configuration and filter medium,
- system used to remove filtrates from the filter,
- method used to achieve flushing of the filter,
- pressure requirements for operation of the filter,
- velocity of filtration,
- filter structure and flushing arrangement,
- location of the filter inlet and outlet,
- orientation of the filter housing,
- principal material of the filter housing, and
- planned location of the filter in the irrigation system.

3.2 According to filtration method, configuration and filter medium

3.2.1 Strainer-type filters

- 3.2.1.1 Single-element filters
- 3.2.1.2 Multi-element filters
- 3.2.1.3 Configured-element filters

3.2.2 Hydrocyclones

- 3.2.2.1 Single-centrifuge
- 3.2.2.2 Dual-centrifuge

3.2.3 Media filters

- 3.2.3.1 Sand filters
 - 3.2.3.1.1 Uniform-particle filters (single-media)
 - 3.2.3.1.2 Filters with layers of graduated particle sizes (multi-media)
- 3.2.3.2 Disc filters
- 3.2.3.3 Cartridge filters
- 3.2.3.4 Other media filters

3.2.4 Integrated filters

These are filters containing two or more of the type devices 3.2.1 to 3.2.3.

3.3 According to system used to remove filtrates from filter

3.3.1 Disposable-element type filters

3.3.2 Manually cleaned filters

3.3.3 Flushing filters

3.3.3.1 Manual flushing filters

3.3.3.2 Semi-automatic flushing filters

3.3.3.3 Automatic flushing filters, classified according to

a) method of activation:

- preset times or time intervals between flushings,
- pressure differential between inlet and outlet,
- quantity of irrigation water passed through the filter,
- other methods,
- combination of methods;

b) flushing sequence:

- simultaneous flushing,
- sequential flushing,
- directed jet flushing.

3.3.3.4 Continuous flushing filters

3.4 According to method of flushing

3.4.1 Back-flushing filters

3.4.2 Through-flushing filters

3.4.3 Filters using other means of flushing

3.5 According to pressure requirements for operation

3.5.1 Gravity filters

3.5.2 Pressurized filters

3.5.3 Vacuum filters

3.6 According to velocity of filtration

3.6.1 Slow filtration (also known as low-rate filtration) — velocity of filtration ≤ 15 m/h

3.6.2 Rapid filtration (also known as high-rate filtration) — velocity of filtration > 15 m/h

3.6.2.1 Continuous-flow

3.6.2.2 Intermittent-flow (as interrupted for back flushing)

3.7 According to filter structure and flushing arrangement

3.7.1 Single-filter housing

3.7.2 Composite filters (filters with two or more filter housings assembled as one manifold with single inlet and single outlet)

3.7.2.1 Composite filter with mechanism for simultaneous flushing of all filter housings

3.7.2.2 Composite filter with mechanism for sequential flushing of filter housings

3.8 According to alignment of filter inlet and outlet

3.8.1 In-line filters

3.8.2 On-line filters

3.9 According to orientation of filter housing

3.9.1 Filter housing axis vertical

3.9.2 Filter housing axis horizontal

3.9.3 Filter housing axis inclined

3.9.4 Filter housing axis installed in any other position

3.10 According to principal material of filter housing

3.10.1 Metal

3.10.2 Plastics

3.10.3 Other materials

3.10.4 Combination of materials

3.11 According to planned location of filter in irrigation system

3.11.1 Filter installed at supply source

EXAMPLE River, reservoir, pumping station.

3.11.2 Filter installed in water supply system (piping)

EXAMPLE On a rising main.

3.11.3 Filter installed in irrigation control head

3.11.4 Filter installed at intake of irrigation lateral

Annex A **(informative)**

Irrigation water sources

A.1 Surface water

Water from rivers, canals, lakes and reservoirs storing surface water. These may present significant problems which will vary according to the type, source and degree of contamination in the water. Contaminants can be organic (e.g. leaves, seeds, algae, eggs or larvae), inorganic (water-borne silt or clay), industrial wastes or domestic wastes.

A.2 Groundwater

Water originating from wells, boreholes, springs and other sources. Possible contaminants are mineral (sand), chemical (Calcium, iron, manganese and sulphur) and biological (e.g. bacteria, algae and larvae). This water is generally of good physical quality, even though during commissioning of pumps a considerable amount of coarse sand can enter the irrigation system.

A.3 Recycled or wastewater sources

Water from domestic or industrial wastewaters after various levels of treatment. Filtration techniques can remove clogging materials from raw, untreated waste waters. However, the techniques cannot be expected to remove pathogens. Additional disinfection treatment is needed if the waste waters are to be used on crops for human or animal consumption. Partially treated or reclaimed wastewater can be suitable for irrigation if suitable filtration equipment and waste treatment processes are used.

A.4 Multiple (integrated) water sources

Water originating from several different sources presenting potentially complex water treatment and filtration problems, owing to the variety of contaminants and possible interactions between them. Water from multiple sources can also cause induced pollution, i.e. development of new water organisms or deposits of varying particle size which flow with the water as a result of the high velocities associated with high demand requirements at peak irrigation periods. The clogging hazards vary, depending on the position of the water inlet in the system, with the low-lying and terminal sections of the system often being particularly vulnerable to clogging.

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ICS 65.060.35

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