



# Filtration System Design

Filtration is a critical component of an efficient nursery irrigation system. The correct filter type and good system design will improve water quality and decrease downtime due to blocked emitters. To achieve an efficient filtration system, there are a number of considerations to be taken into account when planning a new installation. The services of an irrigation design specialist should be used when designing filtration systems, as a poorly designed or installed system will add significantly to capital and running costs.

The method of filtration used, and sizing of the filters depends on;

- Water quality and type of debris to be filtered
- The amount of debris to be filtered
- The flow rate of the system
- The outlet orifice size of the emitters being used.
- Cost – a rule of thumb is approximately 10% of the cost of an irrigation system should be allocated to filtration.



The first step in designing an efficient filtration system is to have **a complete elemental water analysis** conducted to establish the water quality available. This gives information on the type of filtration

Table 1. Filtration size equivalents

micron	mm	Mesh
80	0.08	200
100	0.1	150
130	0.13	120
150	0.15	100
180	0.18	80
200	0.2	75
250	0.25	60
300	0.3	50

required, and if any pre- or post-filtration treatment is required. For water supplies with high iron levels, some form of aeration and subsequent settling and/or filtration will be required. Water with high conductivity levels may require membrane filtration to reduce salts to a level that doesn't cause damage to plants.

Some systems may require two or more stages of filtration, depending on the amount of suspended solids, colloids, organic matter, bacteria, fungi and viruses to be removed. The requirement for pre-treatment of the water supply will depend on the particle sizes to be filtered and the available water quality, e.g. pre-treatment to remove iron prior to

filtering. In water supplies with high levels of suspended matter and sand, a hydro-cyclone may be useful in removing the majority of large particles prior to secondary filtering. The removal of sand will also increase the longevity of equipment by reducing the amount of wear caused by abrasive materials.

The water quality required for efficient operation of the system determines the degree of filtration needed. The size of the hole in the emitter determines the degree of filtration required, e.g. drip irrigation requires a higher level of filtration than sprinklers. If the filter is too coarse the emitters will block, and if it is too fine, excessive filter blockages will occur, necessitating frequent cleaning or backwashing.

**For manually controlled sprinkler systems** the size of the mesh orifices must be no greater than one quarter of the sprinkler outlet diameter.

**For irrigation systems with automatic valves,** the manufacturer's specification must be followed, or a minimum of 180 micron filtration used.

**For micro-irrigation systems** filtration must be at least one fifth of the emitter orifice diameter or follow the manufacturer's recommendations.

**For drip irrigation** filtration levels must not be greater than one seventh of the drip emitter's outlet diameter unless otherwise specified by the manufacturer.

The flow rate required for the efficient operation of the irrigation system and for backwashing of filters is a critical design feature. Installing an undersized filter will cause excessive restriction of flow, increasing both filter maintenance and pumping costs.

Filters should be installed in sufficient size and numbers so that pressure loss through each filter bank, when clean, is no more than 0.5 m (5 kPa) for screen, mesh or disc filters, and 1.0 m (10 kPa) for media filters. The maximum velocity through filters must not exceed the manufacturer's recommendations. A good general rule is to be conservative by keeping below the manufacturer's guidelines for pressure loss and using 80% of the manufacturer's recommended maximum flow rates through filters. Media filters have specific criteria regarding maximum flow per unit area, media graduation and backwashing flows.

The operating pressure of the system needs to be considered to ensure the filter can withstand the pressures generated. Fogging systems have higher pressures with small holes and require a higher degree of filtration compared to sprinkler and drip irrigation.

The choice of filter element depends on the circumstances, water quality and application. A



comparison of filter types and brands can be made by looking at the effective filter area.

Other than pump intake screens and hydrocyclones, filters should never be installed on the suction side of a pump as this will significantly affect pump performance.

To catch impurities in the filtered water that the media filter may not remove, a secondary control screen or disc filter must be placed on the downstream side of a media filter.

Some filters, such as media filters, require a source of electricity to enable the filter controls to function, but others, such as simple disc filters, can be placed in-line at any point in the system, and only require a water source to enable cleaning of the filter elements.

System maintenance is critical to the efficient operation and longevity of a filtration system. Attention to back flushing and cleaning intervals, as part of a regular maintenance programme, will minimise costs and downtime, and maximise the effectiveness of the filtration system. Cost and frequency of replacing elements, the ability to automate the system, and ease of cleaning filter elements should be considered. Automatic back flushing of filters may be desirable if heavy algae or silt are encountered. For self-cleaning filters, additional flow is required to clean the filters and the disposal of the discharge needs to be considered. For automatic back-flushing systems, allow for potential damage due to water hammer and surge when designing the system.

For more information on filtration refer to "Managing Water in Plant Nurseries" and "Irrigation System Design Guidelines" from Irrigation Australia Limited.

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