Assets Planning and Delivery Group
Engineering

DESIGN STANDARD DS 240-01

Low Risk Reuse – Filtration Equipment

VERSION 1
REVISION 0

DECEMBER 2023

FOREWORD

The intent of Design Standards is to specify requirements that assure effective design and delivery of fit for purpose Water Corporation infrastructure assets for best whole-of-life value with least risk to Corporation service standards and safety. Design standards are also intended to promote uniformity of approach by asset designers, drafters and constructors to the design, construction, commissioning and delivery of water infrastructure and to the compatibility of new infrastructure with existing like infrastructure.

Design Standards draw on the asset design, management and field operational experience gained and documented by the Corporation and by the water industry generally over time. They are intended for application by Corporation staff, designers, constructors and land developers to the planning, design, construction and commissioning of Corporation infrastructure including water services provided by land developers for takeover by the Corporation.

Nothing in this Design Standard diminishes the responsibility of designers and constructors for applying the requirements of the Western Australia's Work Health and Safety (General) Regulations 2022 to the delivery of Corporation assets. Information on these statutory requirements may be viewed at the following web site location:

Overview of Western Australia’s Work Health and Safety (General) Regulations 2022 (dmirs.wa.gov.au)

Enquiries relating to the technical content of this Design Standard should be directed to the Senior Principal Engineer, Water Resource Recovery, Advisory Section, Engineering. Future Design Standard changes, if any, will be issued to registered Design Standard users as and when published.

Head of Engineering

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Water Corporation accepts no liability for any loss or damage that arises from anything in the Standards/Specifications including any loss or damage that may arise due to the errors and omissions of any person. Any person or entity which relies upon the Standards/Specifications from the Water Corporation website does so that their own risk and without any right of recourse to the Water Corporation, including, but not limited to, using the Standards/Specification for works other than for or on behalf of the Water Corporation.

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Any interpretation of anything in the Standards/Specifications that deviates from specific Water Corporation Project requirements must be referred to, and resolved by, reference to and for determination by the Water Corporation's project manager and/or designer for that particular Project.

REVISION STATUS

The revision status of this standard is shown section by section below:

REVISION STATUS						
SECT.	VER./REV.	DATE	PAGES REVISED	REVISION DESCRIPTION (Section, Clause, Sub-Clause)	RVWD.	APRV.
All	1/0	28.11.23	All	Scheduled review of document, no change to content required. Minor formatting and WHS regulations link in foreword updated only.	WB	WB

DESIGN STANDARD DS 240 - 01
Low Risk Reuse – Filtration Equipment

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1 SCOPE AND GENERAL

1.1 Scope

Design Standard DS240-01 is the first section of a multi-section standard to specify equipment used for low and extra low-risk treated water recycling. This standard sets out the Water Corporations requirements, recommendations and rationale for the selection of filtration equipment used within extra-low risk and low-risk water recycling systems.

The most cost effective forms of used water recycling are via extra-low and low risk reuse, as defined by the Department of Health WA (DoH). See Nexus:103427580 for the "Guideline for the non-potable uses of recycled water in WA" for a guide to the different reuse classes and water quality requirements.

For extra-low and low risk reuse, there are minimal requirements for solids removal. Although the DOH guideline indicates a limit of 30mg/l for TSS, this value is not applicable if reuse water is sourced from a treatment lagoon or pond system where elevated TSS are generally due to the presence of algae. This means that for WC pond treatment systems, there is effectively no TSS limit. For activated sludge systems, the limit of 30mg/L is high enough that an effectively designed and operated treatment facility should be meeting this limit without the need for filtration. Therefore there is generally no requirement to remove the bulk of suspended solids in extra-low and low risk reuse systems. However, the removal of solids which have the potential to block equipment in the irrigation system is an important objcective.

On occasion, the solids load is sufficiently high to create excessive chlorine demand or causes biofouling of the irrigation system. In these situations, please consult the WRR team for further advice.

The filtration standard is intended to cover the typical suspended solids concentration expected from an effectively designed and operated WRRF, whether an activated sludge or waste stabilization pond system. The expected suspended solids range is between 10-150mg/L . For filtration requirements outside this range please discuss with the WRR team.

Extra-low and low risk filtration systems have a limited ability to reduce the solids content of a WRRF discharge. If a site is producing more than 150mg/L TSS, a more detailed investigation of the upstream process is required to determine why the water quality is poor.

This filtration standard may also assist as a guide for pre-treatment to some membrane based medium and high risk reuse systems. These systems commonly use the same filtration technology with similar aperture as protection for the downstream membrane process. Design requirements and loading rates are likely to be applicable but please contact WRR team for application specific recommendations.

For helminth removal, fine apperature screening is required, E.g. 5 Micron, which is approaching the lowest range filtration for the majority of filters listed within this document. For this reason, advice should be sought from WRR team if intending to install a filtration system for this purpose.

1.2 Purpose

The Water Corporations filtration equipment design standards are documented within this document. Designers shall comply with these standards for the design specification of filtration equipment for assets being acquired for the Corporation.

The Purpose of the DS240 Standards series is to provide:

a) Standards and guidelines applicable in the design of Corporation assets,

b) Explanatory or specific design information,

c) Information and commentary relating to the Corporations preferences and practices which have evolved from accumulated experience of owning and operating a significant number of water recycling systems throughout WA.

1.3 Design Process

The designer shall comply with the requirements stated within the DS 240 Standard.

Exemptions to the standard may be sought from the Senior Principal Engineer, Water Resource Recovery (SPE-WRR).

Approvals of such exemptions are at the sole discretion of the SPE-WRR.

1.4 Standards

All materials and workmanship shall comply with latest revisions of the relevant codes and standards.

Water Corporation Strategic Product Specifications (SPS), or in their absence the latest editions of Australian Standards, or Water Services Association of Australia (WSAA) Codes, shall be referenced for design and specification. In the absence of relevant Australian Standards or WSAA Codes, relevant international or industry standards shall be referenced.

1.5 Referenced Documents

Corporation Standards and Specifications, and Australian Standards and International Standards referred to throughout this document are listed in full in Appendices A.

1.6 Notation

Statements governed by the use of the word ‘shall’ are mandatory or ‘normative’ requirements of the Standard. Statements expressed by the use of the words ‘should” or ‘may” are ‘informative’ but not mandatory and are provided for information and guidance. Notes in the Standard text are informative. Notes forming part of Standard Tables are normative.

1.7 Nomenclature

1.7.1 Engineering Definitions and Preferred Terminology

A list of Engineering Definitions and Preferred Terminology referred to in this Standard is detailed below:

Backwash – Reversing the filtration direction to clean a filter.

Note: This is different to a "Flush".

Cleaning Cycle – Terminology used to refer to either a flush or backwash cycle to clean a filter.

Deadhead Pressure – The maximum achievable pressure a centrifugal pump system can produce at zero flow.

Feed Water (Feed Flow) – Used water entering the filter.

Filtrate – Water that has passed through the filter.

Filtration Area – The total combined surface area of the feed side to the duty filter/s.

a) For screen filters, this will typically be the inner area of a cylindrical screen.

b) For disc filters, this will typically be the external area of the compressed stack of filtration discs.

c) For Multimedia filters, this will typically be the inner cross-sectional area through the center of the media filter vessel.

Filtration Velocity – Feed flowrate divided by filtration surface area, expressed as a filtration speed in m/h. Filtration velocity can also be expressed as surface loading rate (SLR) which is specified as flowrate (m^3/h) per unit of filtration area (m^2), E.g $100m^3/h.m^2$. This is the same value and interchangeable with filtration velocity. $100m/h = 100m^3/h.m^2$

Flush – The cleaning process relating to a screen filter where solids are removed from the feed (dirty) side of a screen. This involves feed and filtrate water being redirected on the feed side of the screen in order to remove captured solids. This normally involves opening a valve (discharging to a lower pressure) and rotating the suction nozzles around the screen (as well as up/down) to clean the full surface area of the screen.

Note: A flush is different to a backwash as the flow through the filter does not reverse in direction. A flush can occur whilst a filter is still online.

Pass – Refer to "stroke".

Recovery Rate – The volume of water treated by a filter divided by the total volume of water supplied to the filter (over a set period of time), expressed as a percentage.

Stroke – With respect to screen filters, the process for moving the suction nozzles support shaft from the top to bottom of the filter is referred to as a pass or stroke. eg. 1 stroke/pass of a flush cycle allows the entire surface area of the screen to be cleaned once. Two strokes/passes allows the surface to be cleaned twice by the shaft travelling down then back up in one flush cycle and so on.

1.7.2 Acronyms and Symbols

A list of abbreviations referred to in this Standard is detailed below:

CDR – Concept Design Report

ESR – Engineering Summary Report

DD – Detailed Design

PSV – Pressure Sustaining Valve

TSS – Total suspended solids, measured in mg/L

OEM – Original Equipment Manufacture

WC – Water Corporation

WRR – Water Resource Recovery, the team responsible for this standard (part of Advisory Section, Engineering Business Unit).

DAF – Dissolved Air Flotation, a type of water treatment process.

MMF – Multimedia Filter.

UV – Ultraviolet Light.

1.7.3 Standard Units and Relationships

The units and relationships used for mechanical designs based on this standard shall be in accordance with those specified in the SI Units, Relationships and Prefixes. Below is a list of units used in this standard:

kL – kilo Litre of liquid (1000L)

kPa – kilo Pascal

m^3 – cubic metre (approx. equal to 1 kL of water)

µm – micro metre. (1000 µm = 1mm)

m/s - velocity

m/h - velocity

h – hour

kL/h – kilo Litre per hour

m^3/h – cubic metre per hour

2 SELECTION CRITERIA

2.1 General

There is no standard filtration system which may be recommended for all applications. The intent of this Standard is to specify the minimum requirements for different types of filtration systems commonly used by the Water Corporation and to provide guidance on the appropriate selection and use of such systems.

The selection table in this section facilitates elimination of unsuitable options. The selection criteria are necessarily general to simplify the selection process. Nevertheless, the designer shall ensure that site-specific requirements are carefully considered and allowed for in definition of a filtration system. Final system selection shall be subject to approval by the SPE-WRR. Achieving such approval shall be a Hold Point in the design process.

2.2 Selection Criteria

1) Is the purpose of the filter to protect Irrigation sprinklers, valves and general irrigation equipment? (Y/N)
2) Is there a specific requirement to remove solids (E.g. 50% reduction in TSS) OR reduce the chlorine demand? (Y/N)
3) Does the system immediately upstream of the filter use chemicals for coagulation, flocculation or phosphorous removal? (Y/N)
4) Is the upstream process a pond system OR a system utilising an uncovered storage pond or dam prior to the filter? (Y/N)
5) Is the upstream process an activated sludge system with preliminary treatment screening ≤ 5mm? (Y/N)
6) Does the filter need to be installed inline to an existing pressurised pump system? (Y/N)
7) Is there a requirement for the backwash/flush water to be discharged from the filter under pressure? (E.g. The backwash waste cannot flow to an existing sump/drain or pond via gravity and must be pumped under pressure.) (Y/N)
8) Does the site have an existing chlorination system that could be used for low strength chemical cleaning of the filter? (Y/N)

The table below indicates suitable filtration equipment based on the above questionnaire as well as notes for guidance.

2.3 Selection Matrix & Notes

	Filtration Matrix Note: ** Refer to WRR for more options	Guideline for Filter Options						
		Standard Screen Filter (Suction Nozzle)	Disc Filter (Depth Filtration)	High Solids Screen Filter	Multimedia Filters	Cloth Filters	Rotating Micro Screen Disc & Drum Filters	DAF
1	Is the purpose of the filter to protect Irrigation sprinklers, valves and general irrigation equipment. (Y/N)	Yes -Suitable for protection of irrigation systems	Yes -Suitable for protection of irrigation systems	Yes -Suitable for protection of irrigation systems	Yes -Suitable for protection of irrigation systems	Yes -Suitable for protection of irrigation systems	Yes -Suitable for protection of irrigation systems	No**- Not suitable as there is no physical protection from large particles.
2	Is there a specific requirement to remove solids (E.g. 50% reduction in TSS) OR reduce the chlorine demand. (Y/N)	No - Not suitable for reducing TSS and chlorine demand	No - Not suitable for reducing TSS and chlorine demand	No - Not suitable for reducing TSS and chlorine demand	Yes - Suitable to reduce TSS and chlorine demand	Yes - Suitable to reduce TSS and chlorine demand	Yes - Suitable to reduce TSS and chlorine demand	Yes - Suitable to reduce TSS and chlorine demand
3	Does the system immediately upstream of the filter use chemicals for coagulation, flocculation or phosphorous removal. (Y/N)	No - Not suitable to managed chemical sludge	No - Not suitable to managed chemical sludge	No - Not suitable to managed chemical sludge	Yes - Application dependant **	Yes - Application dependant **	Yes - Application dependent **	Yes - Suitable for chemical sludge removal
4	Is the upstream process a pond system OR a system utilising an uncovered storage pond or dam prior to the filter? (Y/N) Note: Coarse suction strainer (5-10mm) required in all applications	No - Not suitable for pond system with poor screening.	Yes - Suitable for pond system with poor screening.	No - Not suitable for pond system with poor screening without a med/coarse screen or suction strainer (<5mm)	Yes - Suitable for pond system with poor screening	Yes - Suitable for pond system with poor screening	Yes/No** - Coarse screening may be required depending on make/model.	Yes - Suitable for pond system with poor screening.
5	Is the upstream process an activated sludge system with primary screening ≤ 5mm. (Y/N)	Yes - Suitable for screened A/S applications	Yes - Suitable for screened A/S applications	Yes - Suitable for screened A/S applications	Yes - Suitable for screened A/S applications	Yes - Suitable for screened A/S applications	Yes - Suitable for screened A/S applications	Yes - Suitable for screened A/S applications
6	Does the filter need to be installed inline to an existing pressurised pump system. (Y/N)	Yes - Filter can be pressurised	Yes - Filter can be pressurised	Yes - Filter can be pressurised	Yes - Filter can be pressurised	No - Filter is for low pressure, gravity systems only.	No - Filter is for low pressure, gravity systems only.	No - Filter is for low pressure, gravity systems only.
7	Is there a requirement for the backwash/flush water to be discharged from the filter under pressure? E.g The backwash water cannot flow to an existing sump/drain or pond via gravity and must be pumped under pressure. (Y/N)	No**- Requires gravity discharge of waste. Refer to WRR for exceptions.	No**- Requires gravity discharge of waste. Refer to WRR for exceptions.	No**- Requires gravity discharge of waste. Refer to WRR for exceptions.	Yes - Suitable to pump backwash waste at pressure	Yes - Suitable to pump backwash waste at pressure	Yes - Suitable to pump backwash waste at pressure	Yes - Suitable to pump backwash waste at pressure
8	Does the site have an existing chlorination system that could be used for low strength chemically cleaning of the filter (Y/N)	No - Chemical cleaning for bio fouling not required	Yes** - Chemical cleaning required to manage bio fouling.	No - Chemical cleaning for bio fouling not required	Yes** - Chemical cleaning required to manage bio fouling.	Yes** - Chemical cleaning required to manage bio fouling.	Yes** - Chemical cleaning required to manage bio fouling.	No - Chemical cleaning for bio fouling not required

**** Refer to WRR for more detail**

Filtration Matrix	**Filter Notes**						
	Standard Screen Filter (Suction Nozzle)	**Disc Filter (Depth Filtration)**	**High Solids Screen Filter**	**Multimedia Filters**	**Cloth Filters**	**Rotating Micro Screen Disc & Drum Filters**	**DAF**
CAPEX - Cost	Low	Low-Medium	Medium	Medium	High	High	High
OPEX - Energy Cost	High	High	High	High	Low	Low	Medium
OPEX – Labour Cost	Low	Low	Medium	Medium	Medium	High	High
Filtrate quality (approx. reduction in TSS)	0%	0%	0%	50-75%	75% (<5 µm)	75% (<5 µm)	95% (with coagulation)
Typical filtration aperture	300-100µm	130 - 20µm	300-50µm	500-5µm (Approx. equivalent)	2.5-5µm	2.5-5µm	N/A
Typical recovery rate (%)	>90%	>90%	>90%	>90% (>80% if using chemical coagulation)	>90% (>80% if using chemical coagulation)	>95%	>95%
Typical disinfection combination (chlorine - inline , chlorine - contact tank, UV - inline)	Chlorine & UV inline**	Chlorine & UV inline**	Chlorine & UV inline**	Chlorine & UV inline**	Chlorine - contact tank	Chlorine - contact tank	Chlorine - contact tank
Suitability for Low/Medium exposure risk reuse systems	Low	Low	Low	Low or Medium (if combined with coagulation)**	Low or Medium (if combined with coagulation)**	Low or Medium (if combined with coagulation)**	Low or algae pre-treatment for Medium Risk

**** Refer to WRR for more options**

3 DESIGN REQUIREMENTS

3.1 General

This section discusses the criteria that should be applied during the design and selection of filtration equipment or systems.

3.2 Screen Filters

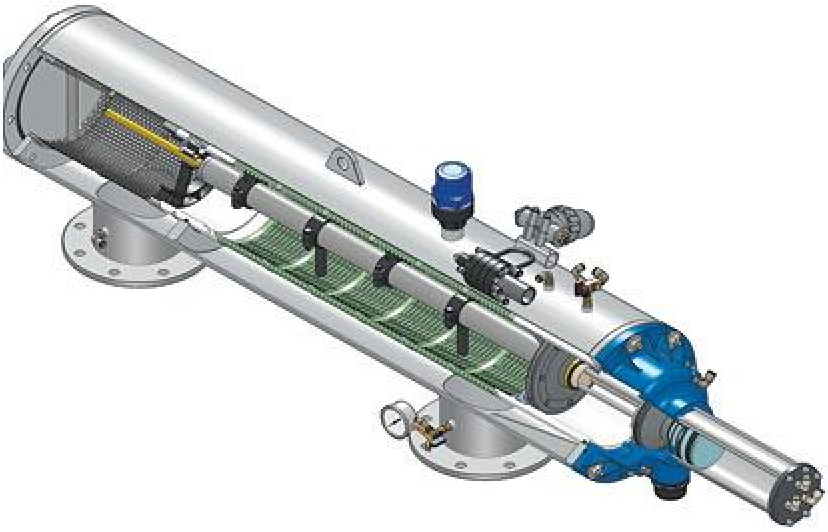

Figure 1.0 - Image of a generic screen filter

3.2.1 General

Screen filters used by the Water Corporation shall be inline cylindrical screens with automatic cleaning via a rotating flushing mechanism on the feed side of the screen. Specific requirements are discussed in the following sections.

3.2.2 Aperture Size

Preferred aperture range: 100 – 300µm

This type of filter is typically used to protect downstream equipment/irrigation systems, rather than to remove suspended solids or algae. The aperture specified should be the largest aperture recommended by manufacturer(s) of downstream equipment or irrigation products for the protection of their equipment.

3.2.3 Pressure Rating

The screen filter system shall be rated for minimum 600kPa pressure, or 120% of the dead head or maximum pressure of the associated pump system, whichever is the higher value.

3.2.4 Filter Housing and Screen Material

Filter housings shall be constructed from either 316 grade stainless steel or epoxy coated mild steel. Refer to WC coating specification DS95 for further requirements regarding protective coatings.

Screen material - Grade 316 stainless steel is preferred for general applications however 304 grade will be considered upon request to SPE-WRR where there is a durability advantage over 316.

3.2.5 Screen Mesh Weave

Screen mesh is available in a range of weaves, such as Plain, Dutch, Twilled Dutch and Hollander. Dutch weave is common for smaller aperture mesh because of its strength. However, it is difficult to clean because of the overlapping wire.

Plain weave is preferred and shall be the default selection. Exemption from this requirement shall be referred to the SPE-WRR for consideration.

3.2.6 Filtration Velocity:

The recommended filtration velocity for an aperture range of 100 – 300μm is 100m/h, for duty filters. Filtration velocity shall not exceed 150m/h.

If a filter system flushes or cleans its filters offline, the designer must exclude the offline filter and any standby filters from the filtration velocity calculation. Unless there is a specific need or requirement to have an offline or standby screen, it is recommended that screen systems are designed as duty/assist rather than duty/standby, to reduce filtration velocity.

3.2.7 Flow Measurement:

Single screen system: For a system consisting of a single screen only, flow must be measured via online magnetic flow meters provided by both the inlet and outlet (filtrate side) of the filter system. The flush line flow can be calculated online as the difference between the two flowmeters however installing an individual flow meter on this line is highly recommended.

Multiple screen systems: Where multiple screens are installed in parallel as part of one system, flow must be measured via online magnetic flow meters on the common inlet, common outlet and common flush waste lines.

For a multiple screen system, if an offline cleaning/flush pump which already has a flow meter fitted is installed, a flow meter to the common flush waste line is no longer required.

The intent is for all flow streams in and out of the filter to be measurable and have the ability to display, record and trend flowrates continuously.

3.2.8 Cleaning Mechanism:

The filter shall use suction/vacuum type rotating cleaning nozzles on the feed (dirty) side of the screen. Brush type screen cleaning is not acceptable.

The mechanism to drive the rotating cleaning nozzle assembly shall be via electric motor/gearbox drive with limit switches. Hydraulic drive systems are non-preferred due to the tendency of the hydraulic chamber filling or blocking with solids.

3.2.9 Cleaning Control:

Filter cleaning shall be initiated via Operator-configurable pressure differential set-point. Differential pressure shall be measured between screen inlet and outlet. Run time based cleaning may be used as a secondary back-up mode of control.

3.2.10 Pressure Measurement:

Online pressure measurement is required on both filter inlet and outlet, within 1m of the pipework connection to the filter element. Differential pressure is to be calculated via the inlet/outlet pressure transmitters or via a separate differential pressure transmitter. Pressure switches are not acceptable.

3.2.11 Cleaning Intensity:

Cleaning intensity is measured by the suction nozzle velocity. Suction nozzles are split into two classes:

- Spring loaded nozzles, which contact the screen surface. These nozzles have consumable tips which will wear and require infrequent replacement (min design of 5 years). The cleaning intensity required for spring loaded nozzles is a minimum of 10 m/s flow velocity through the nozzle.
- Fixed position nozzles, which require a gap between the screen and the nozzle. The cleaning intensity required for spring loaded nozzles is a minimum of 12 m/s flow velocity through the nozzle.

The flush line connecting to the suction nozzles shall discharge to gravity. For example, discharge into an open sump, gravity drain or pond (at a lower elevation) where no backpressure is measured on the flush line. If the design requires the flush line to be pressurized this shall be referred to the SPE-WRR for review.

For suction type cleaning systems, a significant pressure difference (eg. 400kPa) is required between the filter discharge and the flush line which connects to the nozzles. This pressure difference is what drives water through the suction nozzle at high velocity, cleaning the screen. Some systems will require a pressure sustaining valve or isolation valve on the discharge of the filter to direct water into the suction nozzles as opposed to the filter discharge if the system does not have sufficient back pressure from the downstream system.

3.2.12 Cleaning Duration or Cleaning Passes/Strokes:

Although not a requirement, the ability to set the duration or the number of passes/strokes performed during a cleaning cycle is desirable.

3.2.13 Pressure Sustaining Valve:

The requirement to install a pressure sustaining valve (PSV) on the discharge (outlet) of the filter is dependent on the design of the overall system. Systems which under normal operation do not produce sufficient pressure/flow to achieve the stated cleaning intensity (10-12m/s nozzle velocity) shall have an actuated pressure sustaining valve fitted to the discharge of the filter. The PSV must be actuated during a cleaning cycle to ensure there is sufficient backpressure to meet the cleaning intensity requirements.

In addition to the installation of a PSV, the feed pump system must be designed so that with the pressure sustaining valve activated, the pump will be able to supply sufficiently high flow/pressure to meet the cleaning intensity requirements. Typically, this will result in a drop in pressure/flow to the downstream equipment/irrigation field. This drop in flow/pressure to the irrigation field must be considered in the design.

3.2.14 Offline Cleaning:

To save on energy, or in order to meet the cleaning intensity requirements, a designer may decide to install a dedicated offline flush/cleaning pump to ensure sufficient pressure/flow is received by the filter for effective cleaning. This is acceptable with the following requirements:

- The filter being cleaned must operate offline whilst cleaning, with no filtrate produced. If the filter is part of a multi-filter system, than the filter/s not being cleaned may continue to produce filtrate
- Cleaning/flush discharge may be pressurised (e.g does not need to be discharged to gravity. However the system must be designed to achieve the cleaning intensity described above.
- Motorised valves to be fitted to the inlet/outlet and flush lines of all filters.
- A magnetic flow meter and pressure transmitter must be installed in the cleaning/flush pump feed.

3.3 High Solids Screen Filters

3.3.1 General

The requirements for a high solids screen filter are identical to those covered under section 3.2 "Screen Filters". The difference between a standard screen filter and a high solids screen filter is the ability to wash the screen under pressure at the same time as cleaning/flushing. This further assists the removal of solids.

The high solids filter recommended for use at Water Corporation sites is the FILTOMAT MCFM series (8000, 12000).

3.4 Disc Filters

3.4.1 General

The description "disc filter" is used to describe various types of filters in the water treatment industry. In this standard, a "disc filter" consists of a series of discs stacked on top of each other to form a filter cartridge. Water is allowed to flow through the cartridge due to the rippled or "W" shaped profile of the individual discs which creates the filtration surface.


Figure 2.0 – Disc filter elements.

Arkal Spinklin is the preferred brand of automatic cleaning disc filter used by the Water Corporation.

3.4.2 Aperture Size:

Preferred aperture range: 70 – 130µm

This type of filter is typically used to protect downstream equipment/irrigation systems, rather than to remove suspended solids or algae. The aperture specified should be the largest aperture recommended by manufacturer(s) of downstream equipment or irrigation products for the protection of their equipment.

3.4.3 Pressure Rating:

The minimum pressure rating for the filter and housing shall be 600kPa. However, depending upon the requirements of the downstream hydraulic system, this may need to be increased.

3.4.4 Disc Material:

The discs shall be manufactured from Polypropylene. The use of any other material shall be referred to the SPE-WRR for consideration.

3.4.5 Sizing and Filtration Velocity:

The filtration velocity for the aperture range of 130-70µm shall be between 70 – 90 m/h for the combined filtration surface area of duty filters (excludes cleaning/flushing filters and standby filters).

Due to the fundamental design of disc filters, it is uncommon to increase the physical size of the filter element much larger than 100mm in diameter and 300mm in length. Instead, multiple filter elements are commonly housed in a single vessel (or pod) and will function as a single element (E.g All disc elements within a pod, clean/flush at the same time). These pods are commonly arranged in banks to further increase the filtration area as well as allowing continuous flow if a pod is offline or in a cleaning cycle.

Sizing of the filters should be calculated based on the highest filtration velocity which is likely to occur under normal operation. If there is a requirement for a filter element or pod to be offline for servicing, than that filter element/pod should be excluded from the filtration velocity calculation of the system. Similarly, it would be normal to expect flushing/cleaning to occur during a filtration cycle. If this involves one filter element or pod going offline to clean, this pod should also be excluded from the filtration velocity calculation.

For example: A system comprising of 6 filter pods, each with 5 filter elements per pod. The system is designed such that one pods is allowed to be offline for maintenance whilst the remaining pods are online. A cleaning cycle will take 1 pod offline. This means that out of 6 pods, 1 may be offline for maintenance and a second offline for cleaning, leaving 4 online under normal operation (worst case). Of the 4 pods online, each contains 5 filter elements of 1000 cm^2 each. Total filtration surface area would be 4 pods x 5 elements per pod x 1000cm^2 = 20,000cm^2 (2m^2). Using a filtration velocity of 70-90 m/h per , this equates to a flow capacity range of 140 – 180kL/h.

3.4.6 Flow Measurement:

Single pod system: For a system consisting of a single pod only, flow must be measured via online magnetic flow meters provided on both the inlet and outlet (filtrate side) of the filter system. The flush/waste line flowrate can be calculated online as the difference between the two flowmeters however installing an individual flow meter on this line is highly recommended.

Multiple pod systems: Where multiple pods are installed in parallel as part of one system, flow must be measured via online magnetic flow meters on the common inlet, common outlet and common flush waste lines.

For a multiple pod system, if an offline cleaning/flush pump which already has a flow meter fitted is installed, a flow meter on the common flush/waste line is no longer required.

The intent is for all flow streams in and out of the filter to be measurable and have the ability to display, record and trend flowrates continuously.

3.4.7 Cleaning Mechanism:

Typically, feed water pressure is used to actuate/expand the discs during a flush. There are no restrictions on the method used to actuate the flushing mechanism.

If a disc filter system requires feed pressure to power the cleaning mechanism, careful attention should be paid to the pressure required. Most systems will require a minimum of 280 kPa feed pressure for cleaning.

Some suppliers offer air assisted cleaning systems to reduce the backwash supply pressure. This may be an acceptable solution if sufficient compressed air is readily available onsite OR the relevant Operations stakeholders have been consulted and accept- the additional requirements of operating/maintaining a compressed air system.

3.4.8 Cleaning Cycle Control:

Filter cleaning shall be initiated via Operator-configurable pressure differential set-point. Differential pressure shall be measured between screen inlet and outlet. Run time based cleaning may be used as a secondary back-up mode of control.

3.4.9 Pressure Measurement

Online pressure measurement is required on both filter inlet and outlet, within 1m of the pipework connection to the filter element. Differential pressure is to be calculated via the inlet/outlet pressure transmitters or via a separate differential pressure transmitter. Pressure switches are not acceptable.

3.4.10 Cleaning Intensity

Cleaning intensity will be measured by the velocity achieved during a flush. The flush velocity should be 100 – 120m/h of the combined filters surface area in a flush/cleaning cycle at any one time.

3.4.11 Pressure Sustaining Valve:

The requirement to install a PSV on the discharge of the filter is dependent on the design of the overall system. Systems which do not operate at sufficient pressure/flow for flushing will require an actuated pressure sustaining valve to be fitted on the discharge of the filter. The PSV must be actuated during a cleaning cycle to ensure there is sufficient backpressure to meet the cleaning intensity requirements.

In addition to the installation of a pressure sustaining valve, the feed pump system must be designed so that with the pressure sustaining valve activated, the pump will be able to supply sufficiently high flow/pressure to meet the cleaning intensity requirements. Typically, this will result in a drop in pressure/flow to the downstream equipment/irrigation field. This drop in flow/pressure to the irrigation field must be considered in the design.

3.4.12 Offline Cleaning:

There are no specific requirements or restrictions to offline cleaning of these filters. The modular design of these systems (multiple filters, in multiple pods) typically eliminates the suitability for offline cleaning on larger systems.

3.5 Multimedia Filters

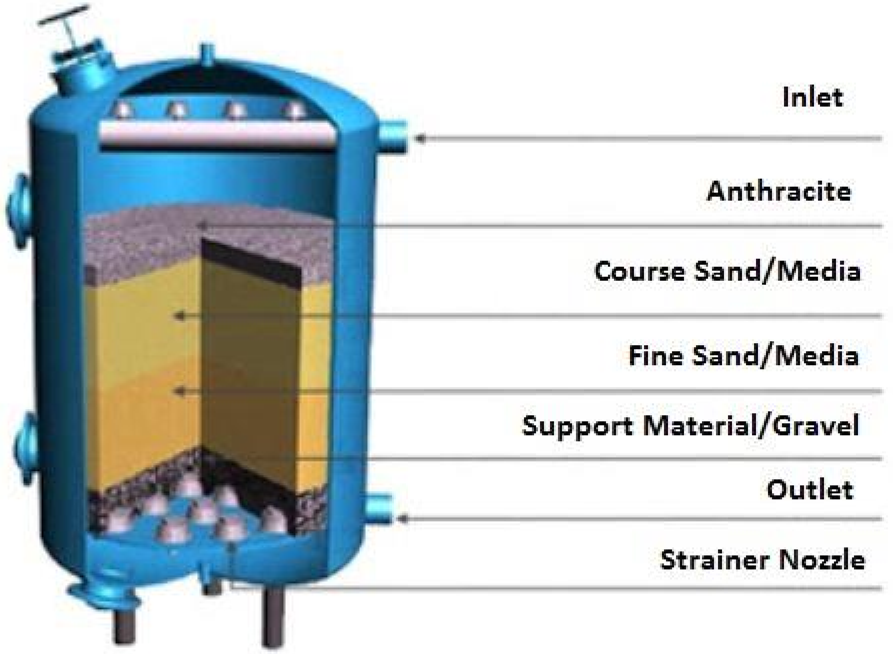

Figure 3.0 – Multimedia Filter.

3.5.1 General

This section covers pressurized multimedia filters operating in a down flow arrangement. Gravity, up-flow or continuous backwash filters are not commonly used for re-use applications and their potential selection shall be referred to the SPE-WRR for consideration.

Although there are no specific requirements for filter vessel orientation (vertical or horizontal), the use of horizontally mounted media filters will be rare for reuse systems covered under this standard. This is because the requirements for filtration media depth, bed expansion and filter floor/diffuser arrangement will commonly rule out horizontally mounted filters.

Please refer to SPS-250 for further details and additional filter vessel requirements.

3.5.2 Material:

Fibre-reinforced plastic (FRP), including Glass-reinforced plastic (GRP) or fibreglass, is the preferred material of construction. Stainless steel is an acceptable alternative for vessels requiring a high pressure rating (above 600kPa) when standard FRP/GRP vessels cannot achieve the required pressure ratting. Coated mild steel and galvanized steel are specifically excluded due to the abrasive nature of the filter media.

3.5.3 Filtration Velocity:

Filtration velocity determines the cross sectional area of the filter vessel. Maximum allowable filtration velocity, including filtration velocities during backwash, shall be:

- Filters WITHOUT chemical coagulation or flocculation – Filtration velocity <15m/h

- Filters WITH Chemical coagulation – Filtration velocity <10m/h

3.5.4 Filter Media Depth:

For deep bed, down flow multimedia filters, the bed depth of active material (filter sand, filter coal, anthracite or engineered media) must be >950mm. This excludes gravel and other support material.

For other types of media filter designs (slow rate, up flow or continuous backwash), please refer to the SPE-WRR for direction.

3.5.5 Bed Expansion Allowance:

There are two requirements for the minimum height allowed for bed expansion;

- Bed expansion to internal backwash collector.
- Bed expansion to the tapering of the vessels dome.

Both heights/percentages will be measured from the start (lowest point) of the filtration media, excluding gravel. E.g. Interface between gravel and filter media.

Bed expansion to internal backwash collector: The vessel height must allow for the internal backwash collector to be located no lower than 1450mm from the lowest point of filtration media (gravel-sand interface) or 150% of the filter media total depth (excluding gravel), whichever is larger.

Bed expansion to the tapering of the vessels dome lid: The vessel height must allow for the start of the dome lid to be located no lower than 1250mm from the lowest point of filtration media (gravel-sand interface) or 130% of the filter media total depth (excluding gravel), whichever is larger.

The requirements above are to minimize the loss of filter media during a backwash. The requirement to allow 130% bed expansion (or min 1250mm) to the start of the dome lid is to compensate for the acceleration of the water as the surface area is reduced in the dome.

3.5.6 Pressure Rating:

The pressure ratting of the vessel shall be either a minimum of 800kPa, or 120% of the dead head pressure of the pump system (as seen by the filter), whichever value is higher.

Although there is no limit on the maximum pressure rating, large vessels with high pressure ratings may become subject to Worksafe Western Australia regulations, to register the vessel as a pressure vessel due to exceeding Hazard class A,B or C of AS4343. Please refer to AS4343 for vessels hazard classes and requirements.

Irrespective of pressure ratting, the Installation of a pressure relief valve is required. Please refer to SPS-250 for further details

3.5.7 Filter Floor and Diffuser Arrangement:

It is recommended that media filter vessels utilize a plenum floor or nozzles supported from a flat base floor/plate for the collection of filtrate (specific to down flow filters). Discrete pipework mounted diffusers are discouraged.

This recommendation is due to integrity concerns when a lattice of pipework is used to support diffusers/nozzles under the filtration media. If support media (gravel) is incorrectly installed, the weight of media combined with the differential pressure of the filter is likely to result in diffuser failure.

3.5.8 Air Scour:

An air scour system is required for all systems utilizing chemical dosing for coagulation prior to the filter.

Although air scour is not required for all filters, filter systems designed for > 30kL/h must allow for simple retrofitting of air scour pipework and diffusers as part of their design.

If air scour is required, the air flowrate shall > 60m/h flow velocity.

Additional requirements for air scour and air release valves are included in SPS-250.

3.5.9 Filtration Media:

Due to the large variety of filter media and sizes available, there are no set requirements for specific type/size of media to be used. However, the SPE- WRR team should be consulted for guidance.

The following is a guideline for standard sand/anthracite in a direct filtration or non-coagulated application for a tri-layer media filter:

- Three different grades of media should be used. A fine media with effective size from 0.55 – 0.65mm, a medium coarse media with effective size from 0.85 – 0.95mm and Anthracite with a size range of 1.0 – 3.0mm.
- The suggested composition of the filter media is 33% Anthracite, 33% medium/coarse and 33% fine sand, represented as a percentage of filtration bed depth.

The following is a guideline for standard sand/anthracite in a direct coagulation (chemically enhanced) application for a tri-layer media filter:

- Three different grades of media should be used. A fine media with effective size from 0.55 – 0.65mm, a medium coarse media with effective size from 0.85 – 0.95mm and Anthracite with a size range of 1.0 – 3.0mm.
- The suggested composition of the filter media is 58% Anthracite, 28% medium/coarse and 14% fine sand, represented as a percentage of filtration bed depth.

Media configuration may be varied to suit the specific application. The key requirements are the dimensions of the filter vessel to allow the media to be changed if the filters are performing poorly.

Designers should be cautious of claims from media suppliers regarding additional advantages or properties (other than physical) that engineered media can produce eg. disinfection, nitrogen reduction, ion attraction, etc.

3.5.10 Backwash Volumes:

The filter system shall be designed to allow up to 5 filter bed volume changes per filter per backwash. This shall be calculated as the volume of filtration media, excluding any gravel/support material.

Typically, a filter system will only require approx. 3 volume changes per backwash cycle, however 5 is selected as a conservative volume. This volume is important if the system is designed to backwash from a filtered water tank. If the volume of the tank is not sufficient to manage both the filtered water flow and the worst-case backwash demands, this may result in the system running out of water.

3.5.11 Backwash Velocity

Backwash velocity needs to be sized relative to the lowest density filtration media used. Backwash velocity shall be calculated to achieve a bed expansion of 20%. Typically, this will require a backwash velocity between 35-55m/h. Filter systems shall therefore be designed with pipework and nozzles having the ability to backwash at up to 55m/h.

Pumps must be sized for the specific backwash flow rate relative to the installed media. However, consideration should be given to the future upsizing of electrical equipment (chassis size, circuit breaker, soft starters and VSD's, power demand) in the event a larger pump capable of 55m/h velocity is required (at a later date).

The intent of this requirement is that the system has the ability to operate with a variety of different media. Engineered media may have the advantage of backwashing at a lower velocity, however if this media is changed to a traditional sand media, the system must be adjustable to a higher backwash velocity.

3.5.12 Backwash Water Supply:

Backwash water can be supplied to the filter system in two ways:

- Dedicated backwash pump.
- Forward flow of the online filters supplying backwash water.

If using the forward flow from the online filters, consideration should be given to the reduction in filtered water volume and the impact of this on the down-stream system.

Maximum filtration velocities still apply if a filter is offline for backwash.

Forward flow backwashing of media filters is common in smaller systems (< 100kL/h). Typically, this would work by using a bank of 4-6 filters. If one filter is taken offline for backwashing, filtrate flow is redirected to backwash the offline filter. The number of filters required is dictated by the filtration and backwash velocity. For example, for media with a filtration velocity of 10m/h and a backwash velocity of 50m/h a 6-vessel system would be required. This would allow 5 x filters to operate in forward flow (5 x 10m/h) to backwash the offline filter at 50m/h. The net filtrate flow produced during a backwash would be zero.

3.5.13 Air Relief Valve:

Each filter must be fitted with an individual automatic air relief valve fitted at the thighest point of the media filter. For acceptable air relief valves, please refer to the WC PSP specification.

The discharge from all air relief valves must be individually labelled and piped to a drain point which is visible to the Operator.

It is common for air relief valves in this application to leak. The intent is that an Operator will be able to easily see and identify which valve/s are leaking and repair/replace as required.

3.5.14 Water Quality Instrumentation and Sample Point

As multimedia filters are recommended for applications where solids removal is required (reduce TSS and chlorine demand), monitoring of filtrate water quality for solids or turbidity is required to ensure the water is within specification. The site process control table will dictate the frequency of checking the filtrate quality in accordance with the scheme license however continuous online monitoring is highly recommended and required for systems larger than 30kL/hh.

Turbidity measurement is the common method used to determine the filtrate quality from a multimedia filter system. For larger systems >30kL/h, a turbidity meter located on the common discharge manifold is required. The analyses must be monitored online via the SCADA network to allow operations to monitor the quality of the effluent and automate alarms.

If multiple filter vessels are installed into a single system, the measuring of the individual filters water quality becomes difficult and installing multiple turbidity instruments is unnecessary as it is the combined filtrate quality which is the process control value. Instead, small diameter (5-10mm) sample points and ball valves shall be fitted to the filtrate pipework of each media filter immediately after the pipework connects to the filter to allow sampling of the filtrate quality for each filter individual.

When an online turbidity meter is required, a single turbidity meter shall be installed on the common discharge of the filter system. The turbidity meter shall be supplied with filtrate from a side stream offtake of the common filtrate line but manifolded so that filtrate from each individual filters sample point could be directed to the turbidity meter by manual operator intervention. Sample lines shall be small diameter (6-10mm) and be as short as possible to reduce lag time and settling within the sample line.

Due to the design of the multimedia filter and the fact that it is not a rigid or fixed barrier for solids removal, monitoring the filtrate quality is key to its performance. Turbidity can be a key parameter to adjusting the process parameters to achieve optimal efficiency and understanding the “ripening” period for the filter and when solids breakthrough is likely to occur.

3.5.15 Flow Control:

There is no requirement to have individual flow control to each filter within a multi-filter system. The use of flow controlling devices such as Maric valves is discouraged due to the tendency of blocking or causing pressure/energy loss within the filter system.

Instead, focus should be on ensuring the filters are effectively backwashed to a base line pressure differential every backwash.

This will require techniques such as alternating the order/sequence of when a filter is backwashed, every backwash cycle.

Eg. For a 5 Filter system, the backwashing sequence may be

Backwash 1 = Filter sequence 1-2-3-4-5
Backwash 2 = Filter sequence 2-3-4-5-1
Backwash 3 = Filter sequence 3-4-5-1-2
Backwash 4 = Filter sequence 4-5-1-2-3
Backwash 5 = Filter sequence 5-1-2-3-4
Backwash 6 = Filter sequence 1-2-3-4-5

This will help ensure that filters are evenly loaded and do not block at different rates due to preferential flow.

Designers shall also consider filter header and discharge header pipework sizing to ensure preferential flow to individual filters does not occur. It is recommended to keep header velocity <1m/s and design symmetrical header pipework where possible.

3.5.16 Backwash Control:

Backwashing of filters shall be primarily controlled via differential pressure. Secondary control measures such as filtration time, filtration volume, turbidity, etc. are permitted but should not be the primary form of backwash control.

3.5.17 Pressure Measurement:

Pressure readings via an online pressure transmitter are required on both the common inlet and outlet manifolds for the filter system. Differential pressure is to be calculated via the inlet/outlet pressure transmitters or via a separate differential pressure transmitter. Pressure switches are not acceptable.

The intent is to have visibility for recording and trending the inlet, outlet and differential pressure which is not possible via a pressure switch.

3.5.18 Flow Measurement:

Single & multiple vessel system <30kL/h: For small systems consisting of one or more multimedia filter vessels, flow must be measured via an online magnetic flow meter provided on both the (common) inlet and (common) outlets of the filter system. The flowrate of the backwash waste line can be calculated online as the difference between the two flowmeters however installing an individual flow meter on this line is highly recommended.

Single & multiple vessel system ≥30kL/h: For larger systems consisting of one or more multimedia filter vessels, flow must be measured via an online magnetic flow meter at A) the common inlet, B) common outlet and C) the common backwash waste line.

For a larger system (≥30kL/h), if an offline backwash pump which already has a flow meter fitted is installed, a flow meter on the common backwash line is no longer required.

The intent is for all flow streams in and out of the filter to be measurable and have the ability to display, record and trend flowrates continuously.

3.5.19 Recovery Rate:

Where no prior information is available to determine recovery rate, the designer shall design the system around a conservative recovery rate of:

- 90% Recovery – Systems with NO chemical coagulation/flocculation
- 85% Recovery - Systems WITH chemical coagulation/flocculation

The above recovery rates are conservative, but will ensure that the system is not undersized and can meet the daily filtrate requirements.

3.5.20 Chemical Cleaning:

All multimedia filter system for reuse applications must have the ability to manage biofouling via a simple chemical cleaning system. The control system must have an adjustable timer capable of operating a dosing pump when the filters are operating to allow chlorine to be injected either continuously or intermittently to control biofouling.

If chemical coagulation is proposed (pre-filter) with the intent that the filter system would be used to remove the chemical sludge/residue, the system shall be designed to easily accommodate chemical cleaning.

A chemical cleaning system can be a manual process however must have the ability to fill and recirculate chemicals and shall meet the WC DS70 chemical standard.

If large amounts of biological growth persist, a filter may need to be taken offline and treated with chlorine for 6-12h to remove bio solids fouling. Pipework shall be designed to allow individual filters to be easily taken offline and connected to a circulation loop for manual chemical cleaning.

Prevention is often preferable to maintenance. Therefore, consideration should be given to permanently dosing chlorine upstream of the filters to prevent biological growth. For large systems prone to fouling, a dedicated chlorinated backwash water tank which maintains a free chlorine residual may be required.

3.6 Cloth Filters

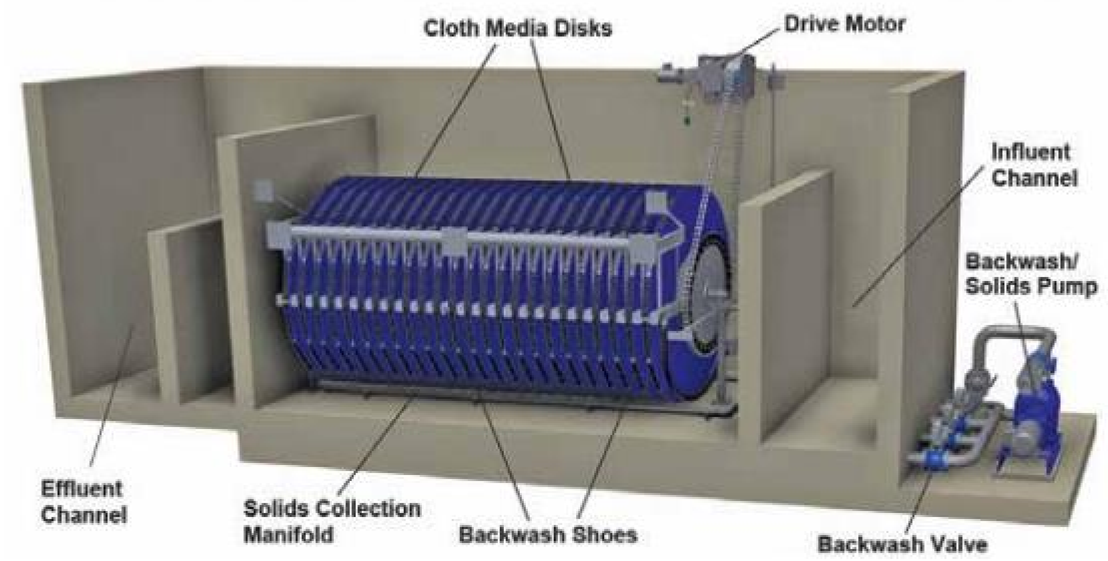

Figure 4 – General layout of a multi disc cloth filter.

Although suitable, cloth filters are not commonly used in low risk reuse applications by the WC due to their high cost and added complexity as compared to other filter types. For this reason, please contact the WRR team for further details regarding the suitability and design requirements of cloth filters.

3.7 Rotating Micro Screen Disc & Drum Filters

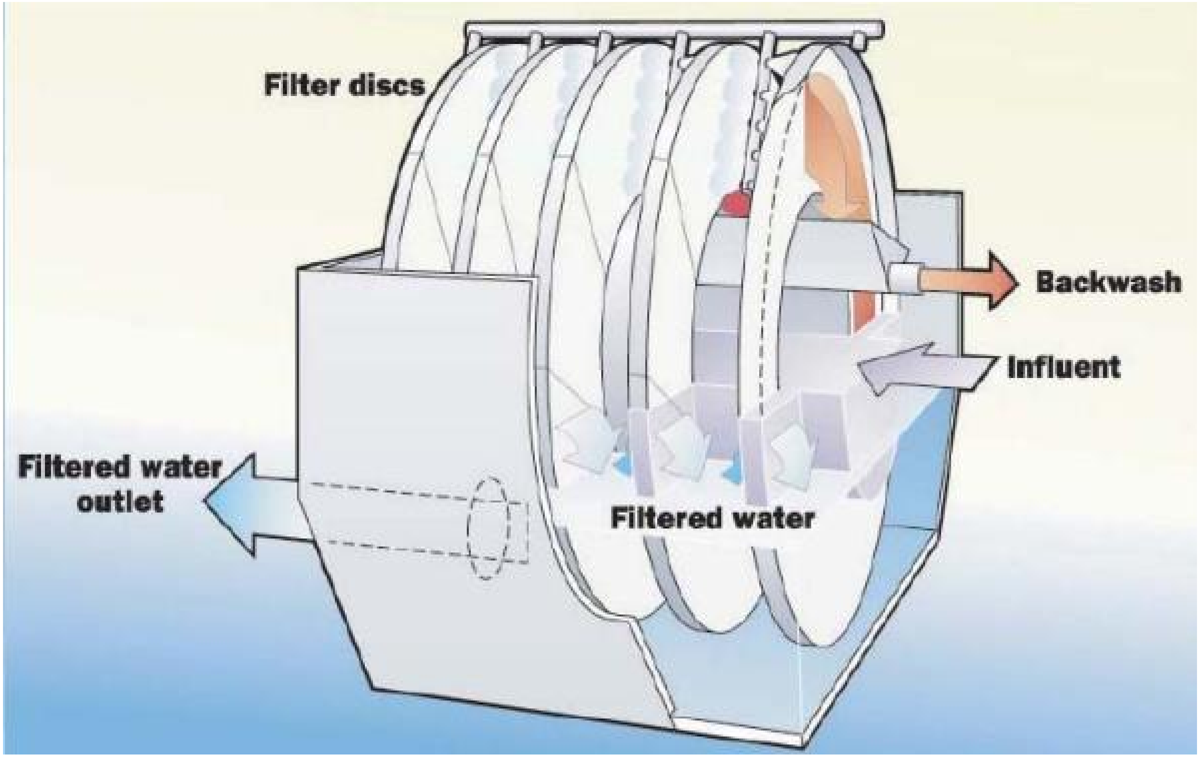

Figure 5 – Example of multi disc micro screen filter (inside-out)

Although suitable, Rotating Micro Screen Disc & Drum filters are not commonly used in low risk reuse applications by the WC due to their high cost and added complexity as compared to other filter types. For this reason, please contact the WRR team for further details regarding the suitability and design requirements of Rotating Disc or Drum filters.

3.8 DAF (Dissolved Air Flotation)

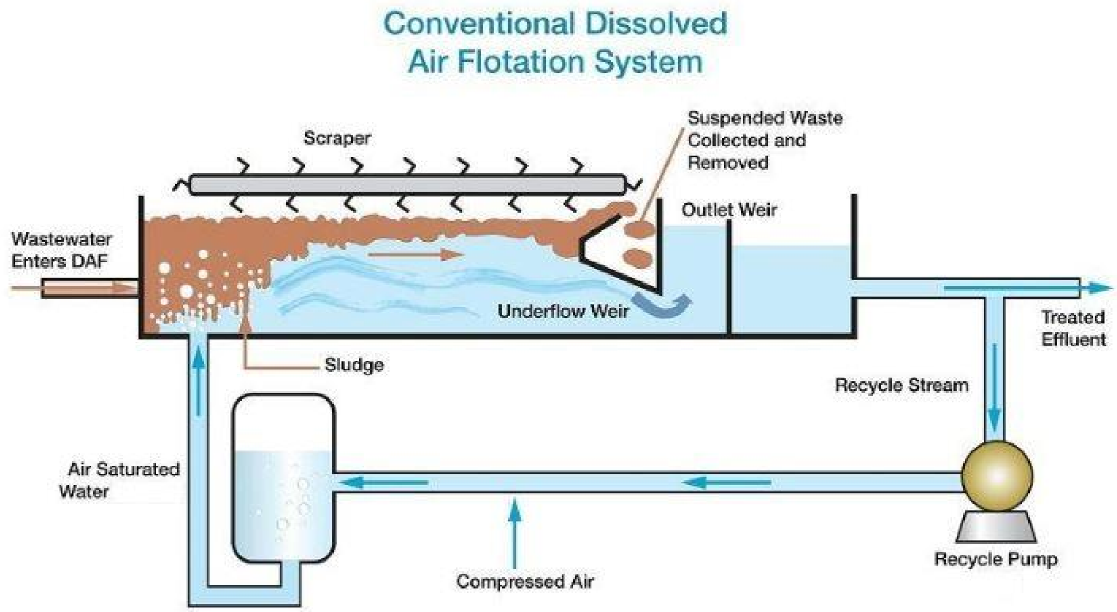

Figure 6 – Dissolved Air Flotation

Although suitable, DAF's are not commonly used in low risk reuse applications by the WC due to their high cost and added complexity as compared to other filter types. For this reason, please contact the WRR team for further details regarding the suitability and design requirements of DAF systems.

4 GENERAL REQUIREMENTS

4.1 Other Requirements

4.1.1 Material Compatibility

All filtration system components shall be resistant to all chemicals proposed for cleaning. With respect to chlorine, a minimum exposure rating of 500,000 ppmh shall be provided.

4.1.2 Weather Protection

A significant number of filtration systems have non-metallic (plastic) components such as valves, covers, switches, pressure sensors, touch screens, cabling, etc. All filtration installations with non-metallic components shall be suitably protected from the elements by a shade structure or enclosed building/shed.

4.1.3 Valves Requirements

For valve types approved for use in Water Corporation treatment systems, please refer to the relevant Strategic Product Specification. In addition, the designer shall note that:

- Pilot driven diaphragm valves (both 2 and 3 way) shall not be used where the actuating fluid is reuse water. If they are to be used, the actuating fluid must be either potable water or compressed air.
- All filtration equipment shall have isolation valves fitted directly onto the filter and allow each filter element to be individually isolated whilst the remainder of the system is operational.

4.1.4 Sample Point Requirements

Sample points shall be installed on filtration equipment as follows:

- Common inlet is to have a minimum of 1 sample point.
- Backwash/flush lines are to be fitted with one sample point immediately following each individual filter element. Location to be as close to the filter discharge as practical.
- Filtrate lines are to be fitted with one sample point immediately following each individual filter element. Location to be as close to the filter discharge as practical.
- Common filtrate line is to be fitted with one sample point located at a point downstream of the filters where a representative combined filtrate sample can be taken.

Sample points should consist of 6mm (1/4") SS316 manual ball valve. The discharge of the sample point shall have a small section of rigid tube, directed towards the ground that allows an operator to easily access and place a 1L sample bottle underneath to take a sample.

Where practical, excess/flush water from the sample point shall be directed towards a drain via a slopped slab. Where this is not practical, the designer shall allow sufficient room to place a 15L bucket underneath the sample point and still have room to take the sample with any spills being caught in the bucket.

4.1.5 Colour Coding and Pipe Markers

All above ground recycled water pipework must be readily identifiable and distinguishable from potable water piping on the same site. The pipes shall be clearly identified and coloured lilac in accordance with AS 2700S:2001. Pipe markers shall also indicate flow direction and fluid type (Effluent, Filtrate & Backwash).

4.1.6 Spare Parts and Critical Spares

Critical spares are components which will prevent the system from operating if they fail. A critical spares list is required to be created for all filtration systems during detailed design and the critical spares listed shall be supplied as part of the filtration package installation.

Critical spares are defined as non-generic or proprietary components which are not readily available or interchangeable with readily available, off the shelf components. Any component likely to fail at least once in a 5 year period and with a lead time exceeding 1 week is defined as a critical spare .

Designers shall discus likely failure scenarios and review the critical spares list during the Operability review to insure the critical spares listed meet the sites criticality requirements.

4.1.7 Maintenance and Access

Designers shall consider and plan for how a filter can be maintained during normal operation. Specifically, the designer shall consider room/access to undertake the servicing of equipment and ensure there is a suitable area for laydown and cleaning of large components. Consideration should also be given to the availability of wash down/potable water for cleaning and how the maintenance area can be cleaned off afterwards.

4.1.8 Backwash/Flush Water Management

High solids water removed from the filter during a flush/backwash cycle should not be returned into the treatment storage system. Sludge drying beds, geobags and evaporation basins should be considered as part of the filter system design. Refer to WRR team for advice on disposing of backwash/flush water.

5 CONTROL REQUIREMENTS

5.1 General

This section details the control requirements for effective operation and troubleshooting of all low-risk reuse filtration systems.

The Water Corporation operates and maintains a large range of filter systems of differing sizes and criticality. Low criticality systems are considered to be those where filtration could be stopped for up to 7 days without adverse effects on either upstream or downstream systems.

This standard covers two categories of system criticality and flow rate.

1) Smaller systems (<30kL/h) with low criticality.
2) Larger systems (≥30kL/h), or non-low criticality systems.

Note: Criticality of the site should be discussed and assessed with the relevant Operations stakeholders.

5.2 Original Equipment Manufacturer (OEM) Standard Control Systems

This standard allows the use of simple OEM controllers for small filtration systems (<30kL/h) assessed to be of low criticality, and also when it is considered practical and cost effective to do so.

Smaller systems in low criticality installations may consider utilizing simple OEM controllers, provided that the mandatory requirements for flow and pressure readings are provided by another control panel (such as a site PLC). For these systems of low criticality, the high cost of custom-design control infrastructure may not be warranted.

The use of OEM controllers may be considered if the following criteria are met:

1) Any OEM controller must have a sub main feed of less than 50 amps and meet the requirements set out in DS20 – Proprietary Electrical Power Systems

2) The complete replacement value of the entire OEM controller must not exceed $6,000 and it must be an item that the supplier stocks in Australia with a lead time <7 days.

Sufficient flow/pressure monitoring (via SCADA) shall be available to identify problems and assess if a service technician is required to repair a filter onsite. This can be achieved with a filter controlled by an OEM controller, with a site PLC that monitors the flow/pressure within the filtration system.

. Typically, parameters such as differential pressure, cleaning intervals, cleaning durations etc. can only be changed in the field for most OEM controllers. For systems with high criticality, this is not acceptable. In this case, such parameter shall be Operator-configurable via SCADA.

For further clarity on the appropriate use of OEM controllers, please contact SPE-WRR.

5.3 Control Requirements for Small (<30kL/h), Low Criticality Systems

5.3.1 Local Control

A filter system should have the following local control functionality which can be set / adjusted / initiated by the Operator onsite:

a) Reset all local alarms
b) Manual Initiation of a cleaning cycle/backwash/flush.
c) Sub-Sequences for cleaning. If the cleaning/backwash cycle is designed with multiple sub-sequences (eg. Backwash, Drain Down, Air Scrub, Forward Flush, no of passes/strokes) the control system shall have the functionality to manually adjust the variables for each sub-cycle.
d) Differential pressure set points. If the filters cleaning system operates by differential pressure set points, the control system shall have the functionality to adjust the differential pressure set point for each cleaning cycle and alarm set point.
e) Timer based cleaning systems. If the filter has a secondary time-based cleaning command, functionality to adjust the time interval is required.
f) Feed pump speed control. If the feed pump/s are operated on VSD, the following is required:
    a. Set point must be adjustable (either pressure of flow)
    b. Manual speed selection override (ability to run at a manually selected speed Hz).
g) Cleaning/Flush/backwash pump speed control (if applicable). If the system uses a dedicated clean/backwash pump/s and this pump is operated on VSD, the following is required:
    a. Set point must be adjustable (either pressure of flow)
    b. Manual speed selection override (ability to run at a manually selected speed Hz)
h) The control system must be installed with a weather-proof, 10A, 240v GPO outlet linked to an adjustable timer. The intent of this is to allow a 240V dosing pump to be run from the GPO/timer if intermittent chemical cleaning/bio-fouling control is required at a later date.

Note: For items e), f) - adjusting these set points within the VSD is acceptable if:
1) The operator can access the VSD safely ie. does not require electrical licenses to open the cabinet and access the VSD.
2) Detailed instruction with a step by step guide to setting/adjusting and restoring default settings is provided – the VSD O&M manual is not sufficient for this purpose.

5.3.2 Remote Control

The filter system should have the following remote-control functionality which can be set / adjusted / initiated by the Operator/engineer via OT:

a) Remotely reset all alarms
b) Manual Initiation of a cleaning cycle/backwash.

5.3.3 Operational Technology (OT) Information & Displays:

The following information must be available on the filter system OT/SCADA screen(s):

a) Flow rates for:
   a. Feed flow rate,
   b. Filtrate flow rate,
   c. Clean/Backwash/Flush flow rate.
b) Totalised flow (Current 24hr period - midnight to midnight) for:
   a. Feed volume,
   b. Filtrate volume,
   c. Clean/Backwash/Flush volume.
c) Totalised flow (previous 24hr period) for:
   a. Feed volume,
   b. Filtrate volume,
   c. Clean/Backwash/Flush volume
d) Recovery rate for current 24hr period expressed as a %.
e) Recovery rate for previous 24hr period expressed as a %.
f) Pressure (kPa) for;
   a. Inlet,
   b. Outlet
g) Differential Pressure
h) Cleaning cycle counter (24hr period– midnight to midnight).
i) Cleaning cycle counter for previous 24hr period.

5.4 Control Requirements for Medium-Large (≥30kL/h) & Non-Low Criticality Systems

5.4.1 Local Control

A filter system should have the following local control functionality which can be set / adjusted / initiated by the Operator onsite:

a) Reset all local alarms
b) Manual Initiation of a cleaning cycle/backwash/flush. If the filter is designed with multiple cleaning cycles (eg. flush & super flush OR backwash & extended backwash), the control system shall have the functionality to manually initiate ALL cleaning cycles.
c) Sub-Sequences for cleaning. If the cleaning/backwash/flush cycle is designed with multiple sub-sequences (eg. Backwash, Drain Down, Air Scrub, Forward Flush, no of passes/strokes) the control system shall have the functionality to manually adjust the variables for each sub-cycle
d) Differential pressure set points. If the filters cleaning system operates by differential pressure set points, the control system shall have the functionality to adjust the differential pressure set point for each cleaning cycle and alarm set point.
e) Timer based cleaning systems. If the filter has a secondary time-based cleaning command, functionality to adjust the time interval is required.
f) Feed pump speed control. If the feed pump/s are operated on VSD, the following is required:
   a. Set point must be adjustable (either pressure of flow)
   b. Manual speed selection override (ability to run at a manually selected speed Hz).
g) Cleaning/Flush/backwash pump speed control (if applicable). If the system uses a dedicated clean/backwash pump/s and this pump is operated on VSD, the following is required:

a. Set point must be adjustable (either pressure of flow)
b. Manual speed selection override (ability to run at a manually selected speed Hz) Note:

h) The control system must be installed with a weather-proof, 10A, 240v GPO outlet linked to an adjustable timer. The intent of this is to allow a 240V dosing pump to be run from the GPO/timer if intermittent chemical cleaning/bio-fouling control is required at a later date.

Note: For items f), g), adjusting these set points within the VSD is not acceptable. The OIP/HMI which controls the pump(s) must have the functionality to set these parameters and start the pump(s) manually at the desired speed/flowrate.

5.4.2 Remote Control

The filter system should have the following remote-control functionality which can be set / adjusted / initiated by the Operator/engineer via OT:

a) Remotely reset all alarms. (Other than E-Stops)
b) Manual Initiation of a cleaning cycle/backwash. If the filter is designed with multiple cleaning cycles (Eg Flush and Super Flush OR backwash & extended backwash), the control system shall have the functionality to manually initiate ALL cleaning cycles.
c) Differential pressure set points. If the filters cleaning system operates by differential pressure set points, the control system shall have the functionality to adjust the differential pressure set point for each cleaning cycle and alarm set point remotely.
d) Timer based cleaning systems. If the filter has a secondary time-based cleaning command, functionality to adjust the time interval is required.
e) Feed pump speed control. If the feed pump/s are operated on VSD, the following is required:
    a. Set point must be adjustable (either pressure of flow)
    b. Manual speed selection override (ability to run at a manually selected speed Hz)
f) Cleaning/Flush pump speed control (if applicable). If the system uses a dedicated clean/backwash pump/s and this pump is operated on VSD, the following is required:
    a. Set point must be adjustable (either pressure of flow)
    b. Manual speed selection override (ability to run at a manually selected speed Hz).

5.4.3 Operational Technology (OT) Information & Displays:

The following information must be available on the filter system OT screen(s):

a) Flow rates for:
   a. Feed flow rate,
   b. Filtrate flow rate,
   c. Clean/Backwash/Flush flow rate.

b) Totalised flow (Current 24hr period - midnight to midnight) for:
   a. Feed volume,
   b. Filtrate volume,
   c. Clean/Backwash/Flush volume.

c) Totalised flow (previous 24hr period) for:
   a. Feed volume,
   b. Filtrate volume,
   c. Clean/Backwash/Flush volume

d) Recovery rate for current 24hr period expressed as a %.

e) Recovery rate for previous 24hr period expressed as a %.

f) Pressure (kPa) for;
   a. Inlet,
   b. Outlet

g) Differential Pressure

h) Cleaning cycle counter (24hr period– midnight to midnight).

i) Cleaning cycle counter for previous 24hr period.

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