PRODUCT OVERVIEW MMF

water | wastewater | treatment | recycling

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Overview

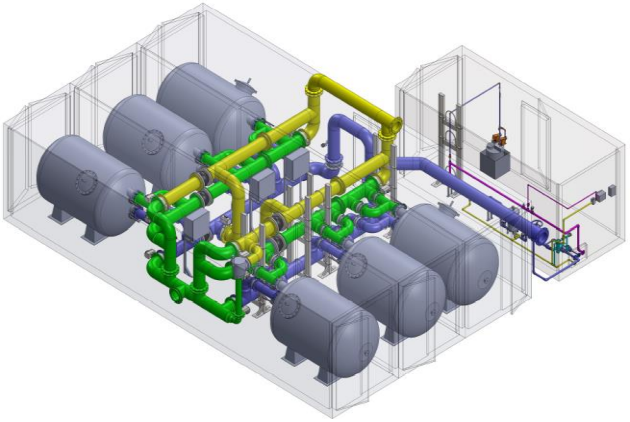
MAK Water's Multimedia Filtration (MMF) plants are designed to treat ground water, surface water, tertiary treated effluent, storm water and waste water to achieve potable/ process water or used as pre-treatment to reverse osmosis. It treats a range of water with <15 NTU of turbidity and <30 mg/L of suspended solids.

The MAK MMF plants are available as skid mounted units or containerised systems.

MAK Containerised 300 m^3/day MMF Plant

The MAK Advantage:

- High quality Australian designed and built systems
- Experienced team with >100 water treatment plants operating nationally
- Nationwide service & maintenance capabilities
- Remote monitoring for expert process support
- Fully automated systems minimise operator attendance
- MAK standard designs for fast lead times
- Optimised designs to suit client's objectives
- Fully customisable to accommodate client specific engineering standards, vendor data requirements and site preferred electrical equipment
- Extensive hire fleet available for rapid deployment



MAK Containerised 15,110 m^3/day MMF Plant

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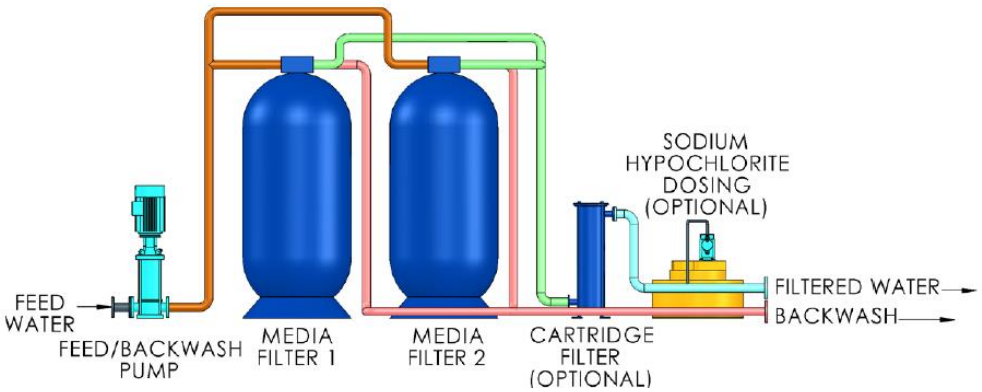
Overview



The standard treatment process involves filtration with auto backwashing multimedia filters.

Additional pre or post MMF treatment steps may be added to suit feed or filtered water requirements such as iron removal, odour removal, colour removal, hydrocarbon removal, pH correction or sterilisation.

The MAK MMF plants are available as skid mounted or containerised systems for easy deployment to remote locations.

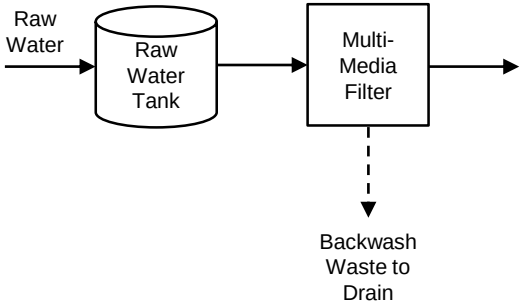
Overview

The following table summarises typical raw water and treated water values.

Parameter	Unit	Raw Water (typical)	Treated Water (typical)
Recovery Rate	%	-	95~98% (varies according to feed water quality)
Total Suspended Solids	mg/L	<30 (nominal, can be improved with glass media)	<10 (nominal, can be improved with cartridge filtration)
Turbidity	NTU	<15	<5 (nominal, can be improved with cartridge filtration)
Particle Size	-	95% > 10 µm, 5% > 1 µm (nominal, can be improved with glass media)	-
Temperature	°C	15 to 45	-

NOTE: MAK Water recommends a water analysis be carried out prior to detailed design.

Process Steps



Multimedia Filtration

The low pressure pump takes flooded suction from the raw water tank and supplies raw water to the multimedia filter(s), which remove suspended solids (20 micron or greater) from the water. The filter is periodically backwashed, based on operator adjustable time clock setting through the multiport control head, pressure differential or turbidity depending on options selected.

Where ClearAccess™ remote monitoring is installed, pressure transmitters continuously monitor the differential pressure across the media filter; the filter is automatically backwashed when the differential pressure set point is triggered. The filtrate turbidity is continuously monitored; alarms are generated by any abnormal readings.

Options – ClearAccess™

Optional ClearAccess™ Remote Monitoring enables personnel to view and operate the plant remotely. This saves time in response to emergencies and assists local operators to diagnose problems. It prevents unnecessary service call-outs and improves reliability and plant uptime.

Process Support via ClearAccess™

Key Functionality:

- Remotely view and operate the plant on your PC, smart phone or tablet
- Automatic alerts (email or SMS) on alarm conditions
- Automatic report generated daily and emailed to your inbox
- Real time monitoring of process data, such as flow rates, pressure and alarm conditions/status messages
- Password protected system with two login security levels

ClearAccess™ from your Smart Phone or Tablet

Inclusions:

- Additional electrical instrumentation (premium package)
- Additional PLC hardware and programming
- Programming of email alert system

NOTE: Remote monitoring requires an internet connection or mobile network coverage (client to provide SIM card).

Options – Containerised Plant

MAK BWRO plants can be installed in ISO sea container(s) for safe, fast deployment by sea, road and rail. Installing the plant inside sea container(s) is an ideal way to protect the plant and equipment from harsh operating conditions in remote sites. The durable construction assures the plant is able to be transported through rough terrain and perform to the design requirements on arrival at remote sites (plug and play operation).

Standard 20' Container

Premium Fit Out (insulation, floor coating and access door)

Standard Inclusions:

- As new, freshly painted inside and out (high gloss enamel)
- Distribution board with separate circuits for lights & aircon
- Overhead internal lighting & reverse cycle air conditioning
- GPO's for maintenance work

Premium Container Fit Out Options:

- Chemically resistant, non-slip floor coverings
- Wall and ceiling insulation
- Personal access doors & windows
- Smoke detectors and alarming
- Safety shower & eyewash station with flow switch & lighting
- Winterisation for extreme climates (-40ºC/-40ºF)
- High spec/high build two-pack epoxy container painting

Containerised WTP with access door, window and safety shower & eyewash station

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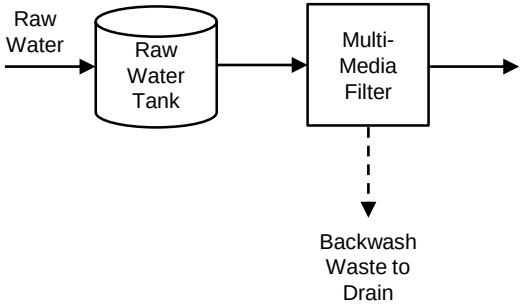
Options - Glass Media

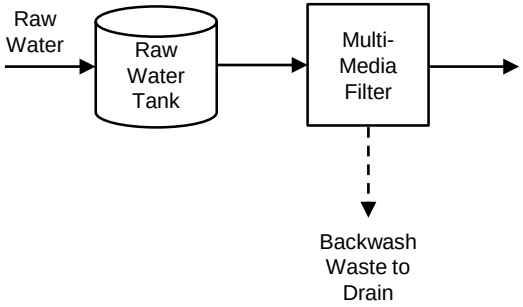


Multimedia Filtration with Glass Media – Filtration Cycle

The low pressure pump takes flooded suction from the raw water tank and supplies raw water to the Glass Media, which removes suspended solids from the water. The filter is periodically backwashed, based on operator adjustable time clock setting through the multiport control head, pressure differential or turbidity depending on options selected.

Glass Media has been engineered to combine the most advantageous features needed in a media filtration system – high dirt loading capacity, very low pressure differential during operation, anti-fouling, aseptic properties, anti-compaction properties & more.

Options – Glass Media



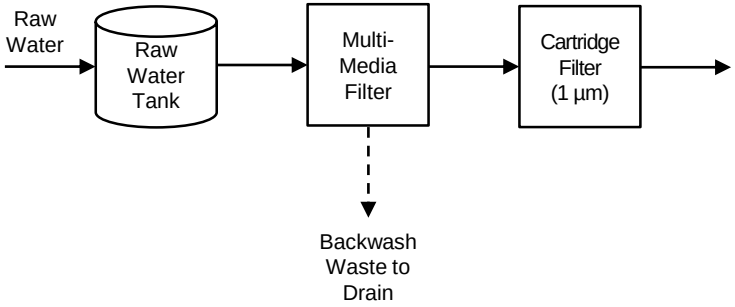
Multimedia Filtration with Glass Media – Filtration Cycle

The Glass Media has a 20 year design life, and enables most particles >1 micron to be captured and removed.

The grain design of Glass Media technology provides a microscopically smooth surface which prevents bacteria proliferation. Incapable of fastening to the grain's surface, the bacteria are efficiently expelled by the backwash process. The aseptic nature Glass Media creates a sterile environment. Therefore, biocide chemicals are not required.

The filtrate turbidity is continuously monitored; alarms are generated by any abnormal readings.

Options – Cartridge Filtration

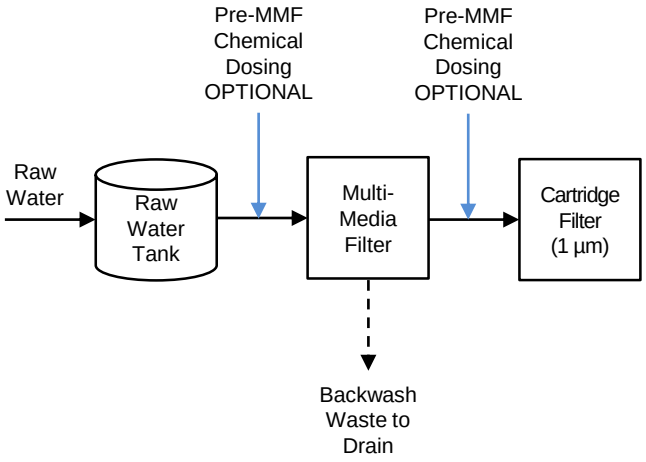


Cartridge Filtration

The water then passes though a 5 and/or 1 micron cartridge filters, which trap any remaining sediment/suspended solids greater than 1 micron. The cartridge filter elements are typically replaced on a monthly basis as part of routine planned maintenance procedure.

Where ClearAccess^{TM} remote monitoring is installed, pressure transmitters continuously monitor the differential pressure across the cartridge filter; an alarm is generated on high differential pressure, to alert the operator that the filter elements require replacement.

Options – Chemical Dosing



Acid, caustic and sodium hypochlorite dosing systems

Pre/Post-MMF Chemical Dosing

Pre and post MMF chemical dosing systems may be added as required to suit feed water conditions and/or treated water quality requirements. Typical chemicals include acid and/or caustic for pH correction, sodium hypochlorite for sterilisation or iron/manganese oxidation, sodium meta-bisulphate for chlorine neutralisation, and calcium chloride for hardness correction.

Depending on the application, chemical dosing rates are pre-set based on flow rate (flow paced), or automatically controlled by the PLC, based on online instrumentation (such as pH, ORP or chlorine analysers) downstream of the dose point.

All chemical storage tanks are fitted with a low level switch for auto-shutdown & to alert the operator of a low level condition; the tank levels should be checked regularly and topped up as required.

Options – Iron & Manganese Removal

Dissolved iron and/or manganese over 0.3 mg/L is above the Australian Drinking Water Guidelines and will need to be removed; depending on feedwater chemistry, it may need to be oxidised prior to removal.

There are a number of ways to achieve this, each method has its own advantages and disadvantages:

	Chemical Oxidation + DMI-65 Media Filtration	Chemical Oxidation + Multimedia Filtration	Venturi (Air) Oxidation + Multimedia Filtration
Feed Water pH	5.8 to 8.6	5.8 to 8.6	7.2 to 8.0 for $Fe2^+$ ≥ 9.5 for $Mn2^+$
Feed Water $Fe2^+$	> 5 mg/L is tolerated	Maximum 5 mg/L	Maximum 3 mg/L
Feed Water $Mn2^+$	> 5 mg/L is tolerated	Maximum 5 mg/L	Maximum 3 mg/L
Reaction Time (Feed Tank Size)	Nil	15 to 30 minutes	45 to 60 minutes
Advantages	• Broadest application • Instantaneous reaction • Also removes arsenic, aluminium, some other metals and hydrogen sulphide	• Broad application • Lower capital cost than DMI-65 media	• Lowest capital cost • No chemical consumption
Disadvantages	• Chemical consumption • Higher capital cost • Does not tolerate clays, large organic molecules and very high hardness	• Slow reaction • Chemical consumption	• Slowest reaction • Narrow pH range • Limited application

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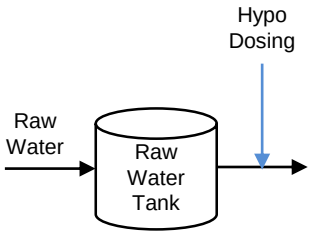
Options – Iron & Manganese Removal

Chemical Oxidation + DMI-65 Media Filtration



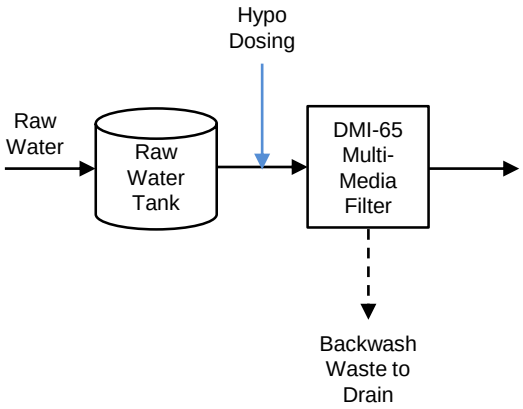
Chlorine Dosing (Oxidation)

Firstly, the raw water is dosed with chorine to promote oxidation of dissolved iron & manganese, aiding in removal via a DMI-65 media filter. The dose rate is automatically controlled via ORP sensor installed downstream of the DMI-65 media filter. Alarms are generated by any abnormal readings.

The chlorine storage tank is fitted with a low level switch for auto-shutdown and to alert the operator of a low level condition; the level should be checked regularly and topped up as required.

Options – Iron & Manganese Removal

Chemical Oxidation + DMI-65 Media Filtration



DMI-65 Granular Catalytic Media Filtration

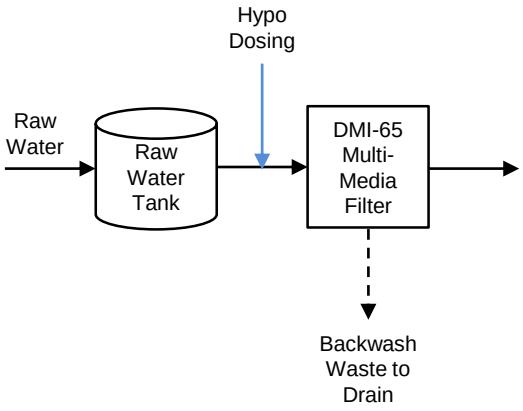
DMI-65 is an extremely powerful catalytic water filtration media that is designed for the removal of iron and manganese in aqueous solutions (water) without the need for potassium permanganate or chemical regeneration. The unique microporous structure of DMI-65 efficiently removes dissolved iron to almost undetectable levels as low as 0.001 ppm and manganese to 0.001 ppm.

The media is designed to operate in the presence of chlorine or other oxidant; it acts as an oxidation catalyst with immediate oxidation and filtration of the insoluble precipitates derived from this oxidation reaction.

Further reading on DMI-65 Media Filtration: http://www.dmi65.com/

Options – Iron & Manganese Removal

Chemical Oxidation + DMI-65 Media Filtration



DMI-65 Granular Catalytic Media Filtration

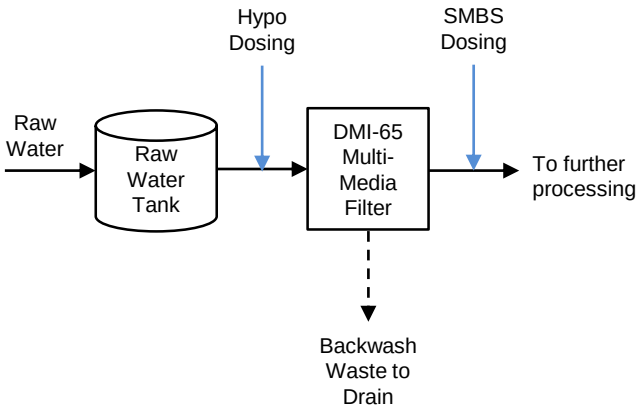
The low pressure pump takes flooded suction from the raw water tank and supplies the chlorinated raw water to the media filter containing DMI-65 media, which removes oxidised iron & manganese, as well as suspended solids (20 micron or greater) from the water.

The filter is periodically backwashed, based on operator adjustable time clock setting through the multiport control head, pressure differential or turbidity depending on options selected.

Where ClearAccess™ remote monitoring is installed, pressure transmitters continuously monitor the differential pressure across the media filter; the filter is automatically backwashed when the differential pressure set point is triggered.

Options – Iron & Manganese Removal

Chemical Oxidation + DMI-65 Media Filtration



SMBS Dosing (Chlorine Neutralisation)

Where free chlorine needs to be removed, the filtered water is dosed with SMBS to neutralise residual free chlorine. The dose rate is pre-set and need not be varied.

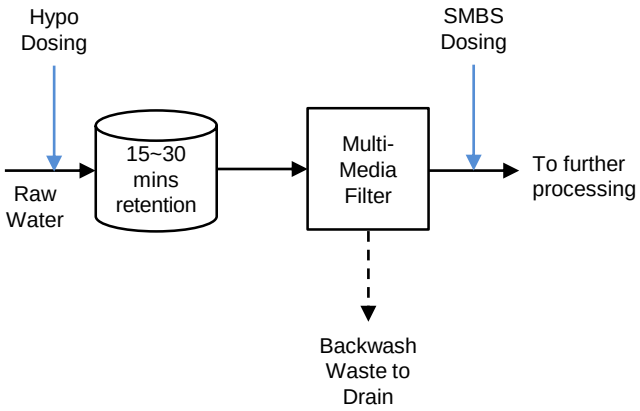
An ORP sensor continuously monitors the de-chlorinated water for the presence of chlorine; a shutdown alarm is generated on detection of chlorine.

The SMBS storage tank is fitted with a low level switch to alert the operator of a low level condition; the level should be checked regularly and topped up as required.

The pre-treated water is now available for further processing downstream.

Options – Iron & Manganese Removal

Chemical Oxidation + Conventional Multimedia Filtration

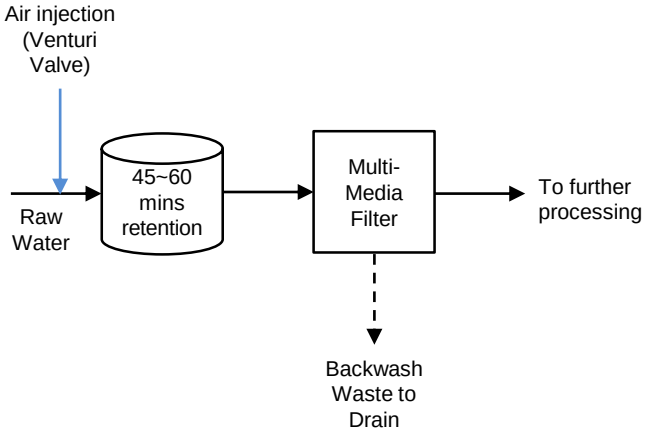


This process is the same as the DMI-65 process, except that the hypochlorite is dosed into the raw water tank upstream of the conventional multimedia filter, with a minimum 15 minutes of reaction time before filtration.

Steps should be taken to prevent “short circuiting” of the feedwater, though the use of appropriate baffles in the raw water tank, ensuring the minimum required contact time is maintained.

Options – Iron & Manganese Removal

Venturi (Air) Oxidation + Conventional Multimedia Filtration



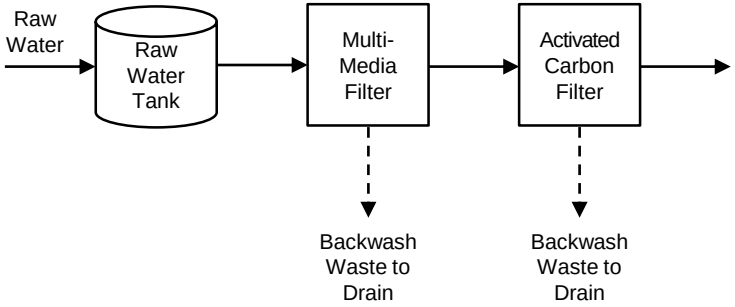
In this process, rather than dosing hypochlorite into the feedwater, a venturi valve is used to inject air into the water pipe supplying the raw water tank.

As no chlorine is used, the dechlorination (SMBS dosing) step is not required.

A minimum of 45 minutes of retention time is required.

Steps should be taken to prevent “short circuiting” of the feedwater, though the use of appropriate baffles in the raw water tank, ensuring the minimum required contact time is maintained.

Options – Activated Carbon Filtration



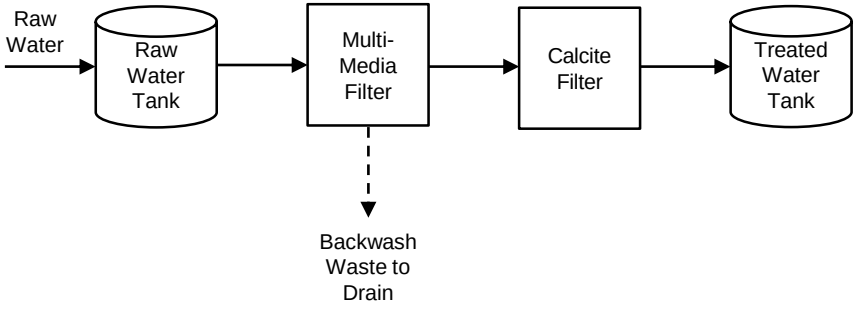
Activated Carbon Filtration

Activated carbon filters can be used to remove free chlorine and/or to remove trace amounts of hydrocarbons, colour, odour and other organics.

Where an activated carbon filter is used to remove free chlorine, an OPR sensor is installed downstream of the carbon filter to automatically shut down the MMF on detection of free chorine in the feed water. The filter is periodically backwashed, based on operator adjustable time clock setting through the multiport control head, pressure differential or turbidity depending on options selected

Where ClearAccess™ remote monitoring is installed, pressure transmitters continuously monitor the differential pressure across the carbon filter; the filter is automatically backwashed when the differential pressure set point is triggered.

Options – Calcite Filtration



Calcite Filtration

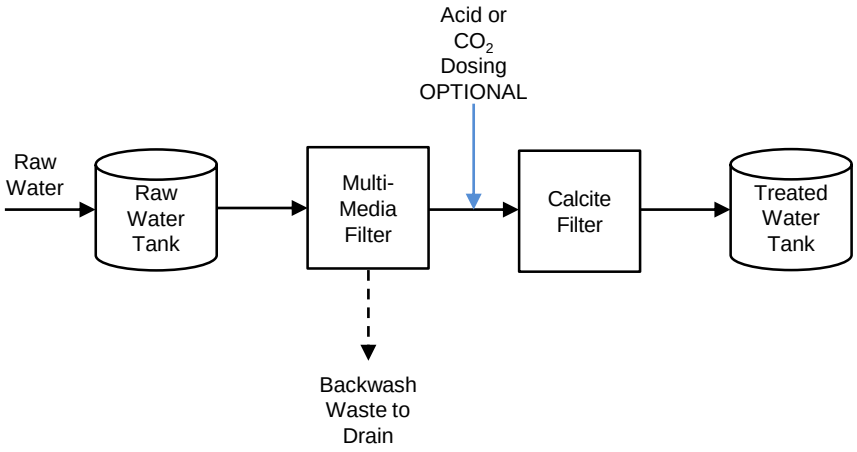
Some water sources can be corrosive (pH < 6.5) or lacking in hardness. This can cause corrosion problems for pipes and equipment downstream.

One effective way to neutralise the pH and increase hardness is to pass the filtrate through a calcite filter, which provides remineralisation and neutralises the pH.

The down-to-up flow configuration of the filter prevents compaction of the calcite bed without the need for backwashing.

The pH of the neutralised MMF filtrate is continuously monitored; an alarm is generated by any abnormal readings.

Options – Calcite Filtration

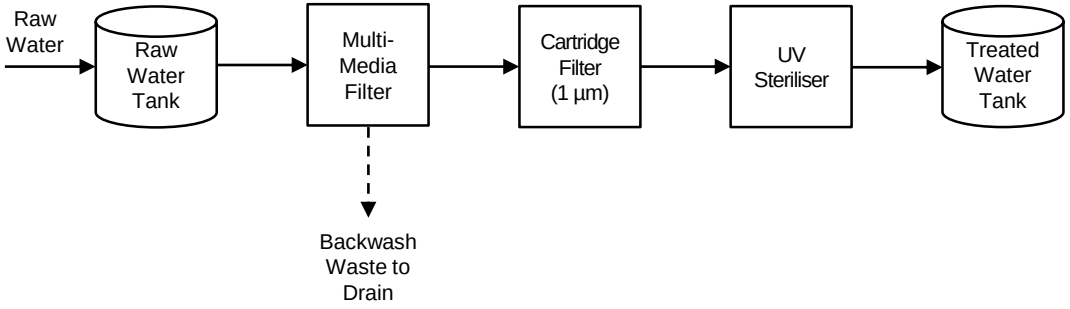


Calcite Filtration + Acid or CO_2 Dosing

The lower the pH of the permeate, the more hardness is absorbed by the calcite filter.

One way to guarantee a minimum level of hardness in the MMF filtrate is via acid or carbon dioxide dosing into the permeate stream, to reduce pH and promote sufficient calcite dissolution; the dose rate is automatically controlled by a pH transmitter installed downstream of the dose point.

Options – UV Sterilisation



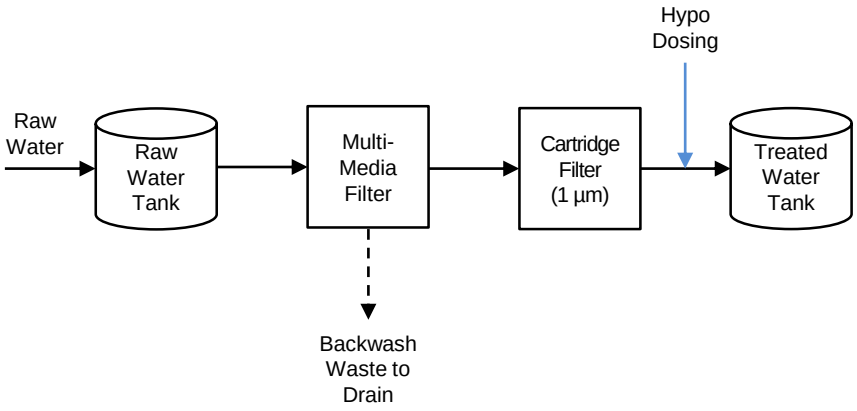
UV Sterilisation

UV sterilisers deliver a dose of UV radiation (typically >40 mJ/cm2 @ 85% UVT), ensuring effective eradication of viruses and pathogens. They are typically used to sterilise the treated water prior to human consumption.

The on-board UV intensity monitor continuously monitors the UV intensity; an alarm is generated if the UV intensity drops below the minimum requited dose rate.

Pre-validated UV systems are available on request.

Options – Hypochlorite Sterilisation



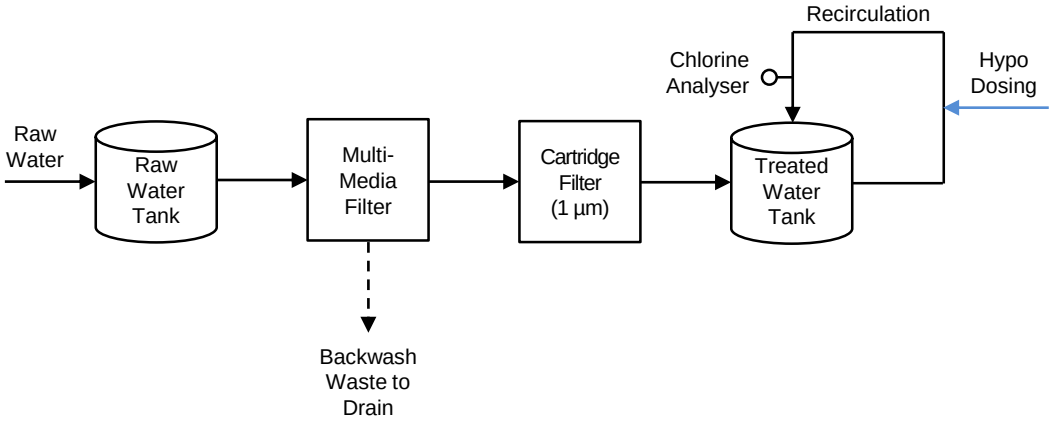
Flow Paced Hypochlorite Dosing

MMF filtrate can be dosed with sodium hypochlorite to maintain a sterile water supply. The operator adjustable dose rate is set based on the permeate flow rate to achieve the desired free chlorine concentration in the MMF filtrate .

The hypochlorite storage tank is fitted with a low level switch for auto-shutdown and to alert the operator of a low level condition; the tank level should be checked regularly and topped up as required.

An ORP transmitter can be fitted downstream of the chlorine dosing to monitor free chlorine in the permeate water.

Options – Hypochlorite Sterilisation

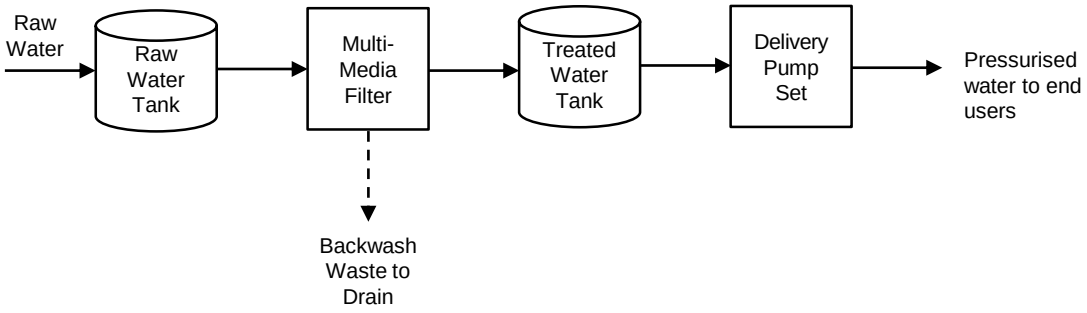


PLC Controlled (Residual Trim) Hypochlorite Dosing, with Recirculation & Monitoring

The recirculation pump circulates the contents of the storage water tank on a continuous basis; a chlorine analyser monitors the free residual chlorine, and the PLC controls dosing of sodium hypochlorite as required to ensure correct free chlorine levels are maintained in the tank at all times. Alarms are generated by any abnormal readings.

The hypochlorite storage tank is fitted with a low level switch to alert the operator of a low level condition; the tank level should be checked regularly and topped up as required.

Options – Delivery Pump Set



Treated Water Delivery Pump Set

A treated water delivery pump set can be provided to deliver treated water to end users.

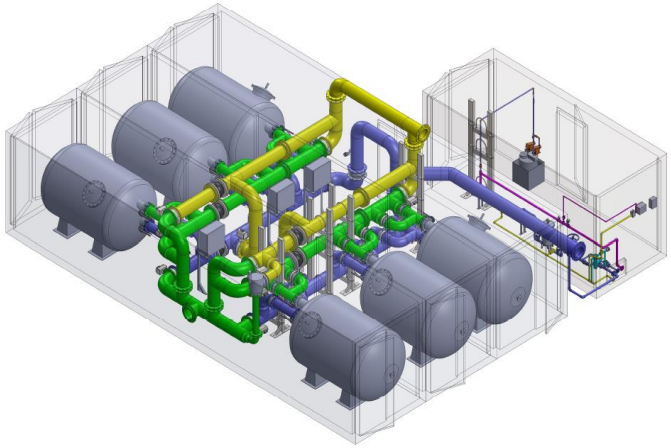
The system typically is configured as a constant pressure system, with the capability to deliver variable flow rates in response to downstream demand.

A pressure sensor is installed on the discharge manifold to automatically control the operation of the pump.

Various options are available for pumping configurations (jacking pump, standby pumps etc), and electrical controls, to suit the client's requirements.

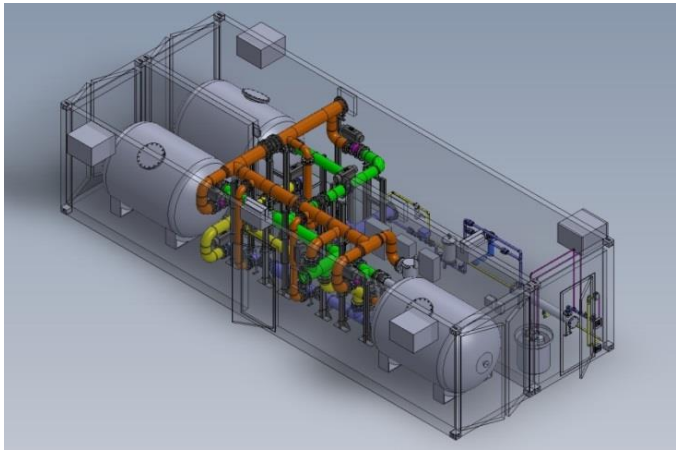
Projects Experience

Project	Kazakhmys – Bozshakol Sulphide Project
Location	Kazakhstan
Date	2013
Scope	Design & construct, commissioning & operator training
Capacity	Filtration Plant – 15,110 m3 per day Potable Water Plant – 144 m3 per day
Raw Water	Bore Water
Treated Water	Process water, Particle Size < 10 micron Potable Water, in accordance with WHO
Features	3 x 40’ & 1 x 20’ Containerised plant Post MMF cartridge filtration Post-MMF chlorine recirculation & monitoring Designed for ambient temperature +40^{o}C to -40^{o}C High spec engineering and vendor data requirements Project specific preferred electrical equipment



Projects Experience

Project	Kazakhmys – Bozshakol Sulphide Project
Location	Kazakhstan
Date	2013
Scope	Design & construct, commissioning & operator training
Capacity	Filtration Plant – 8,971 m3 per day Potable Water Plant – 100 m3 per day
Raw Water	Bore Water
Treated Water	Process water, Particle Size < 10 micron Potable water, in accordance with WHO
Features	2 x 40’ Containerised plant Post MMF cartridge filtration Post-MMF chlorine recirculation & monitoring Designed for ambient temperature +40^{o}C to -40^{o}C High spec engineering and vendor data requirements Project specific preferred electrical equipment



Projects Experience

Project	Grosvenor Project
Location	Moranbah, Queensland
Date	2013
Scope	Design & construct, commissioning & operator training
Capacity	300 m^3/day (2 x 150 m^3/day trains)
Raw Water	Surface water (TDS <500 mg/L)
Treated Water	Potable to ADWG
Features	1 x 40' Containerised plant Post-MMF granular activated carbon Post MMF cartridge filtration Post-MMF chlorine recirculation & monitoring High spec engineering and vendor data requirements Project specific preferred electrical equipment

Projects Experience

Project	Kitchen Manufacturer
Location	Rockingham, Western Australia
Date	2015
Scope	Design & construct, commissioning & operator training
Capacity	345 m^3/day
Raw Water	Waste process water
Treated Water	Filtration to 5 micron
Features	Skid mounted plant Glass Media MAK standard (data sheet product)

Projects Experience

Project	Grosvenor Project
Location	Moranbah, Queensland
Date	2013
Scope	Design & construct, commissioning & operator training
Capacity	50m^3/day
Raw Water	Surface water (TDS <500 mg/L)
Treated Water	Potable to ADWG
Features	1 x 20' Containerised plant Post-MMF granular activated carbon Post-MMF cartridge filtration Post-MMF chlorine dosing MAK standard (data sheet product)

Projects Experience

Project	Gorgon
Location	Barrow Island, Western Australia
Date	2011
Scope	Design & construct, commissioning & operator training
Capacity	2,500 m^3/day
Raw Water	Bore Water
Treated Water	Reverse osmosis feed water, particle size < 10 micron
Features	1 x 40’ Containerised plant SS304 cartridge filters Supplied in 4 weeks for urgent requirement MAK standard (data sheet product)

Projects Experience

Project	Hope Downs 4
Location	Pilbara, Western Australia
Date	2012
Scope	Design & construct, commissioning & operator training, service contract
Capacity	450m^3/day
Raw Water	Bore Water
Treated Water	Potable to ADWG
Features	40’ Containerised plant, with floor coatings Pre-MMF calgon dosing Pre-MMF pH adjustment High spec engineering and vendor data requirements Project specific preferred electrical equipment

Projects Experience

Project	Longford Gas Plant
Location	Sale, Victoria
Date	2013
Scope	Design & construct, commissioning & operator training
Capacity	220 m^3/day
Raw Water	Bore water
Treated Water	Potable to ADWG
Features	Post-MMF granular activated carbon Post-MMF iron removal Post-MMF calcite filter Post-MMF cartridge filtration Post-MMF UV steriliser Post-MMF chlorine dosing Potable water distribution pump set High spec engineering and vendor data requirements Project specific preferred electrical equipment

Projects Experience

Project	Mundaring Christian College
Location	Parkerville, Western Australia
Date	2015
Scope	Design & construct, commissioning & operator training
Capacity	72 m^3/day
Raw Water	Bore water
Treated Water	Potable to ADWG
Features	Online turbidity, free chlorine and pH monitoring Pre-MMF chlorine dosing (chemical oxidisation) DMI-65 media filtration (heavy metals removal) Post-MMF pH adjustment Post-MMF chlorine dosing, monitoring and recirculation of potable water storage tank Potable Water Management Plan Skid mounted plant MAK standard (data sheet product)

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