SUPERIOR
FILTRATION

PRODUCT SHEET

KLEERFLO AUTOMATIC SELF-CLEANING FILTER

Kleerflo Filters are in-line, pressurised, automatic self-cleaning filters. They are used for the removal of suspended solids from water. They offer continuous flow and a strong, positive backwash action that ensures thorough cleaning of the screens.

Kleerflo's unique design with no rotating parts or close tolerance elements, very few moving parts and no electric motor ensures robust performance, proven reliability and low maintenance.

Applications

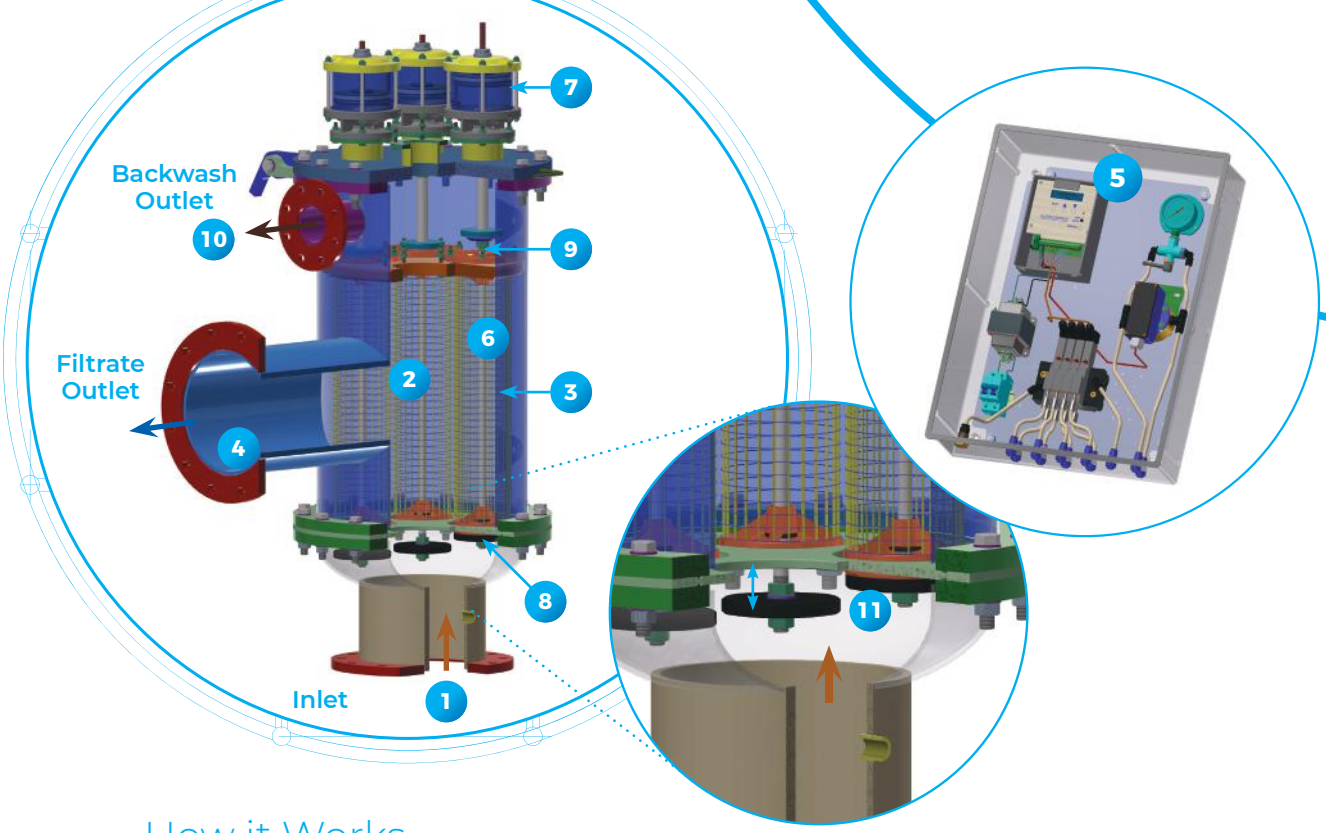
Kleerflo Filters are installed in process lines to remove suspended solids from water. Kleerflo applications include the following:

1. **Pre-Filtration:**
   - For membrane separation processes
   - For treatment processes on potable water- and sewage wastewater plants
   - For treatment processes on industrial process water plants
2. **Final Filtration**
   - To protect water spray systems or equipment
     - Water Spray Systems
       - Dust suppression
       - Irrigation
       - Filter presses
     - Equipment Protection
       - Pump glands (gland service water)
       - Measuring and metering equipment
       - Heat exchangers
       - Removal of solids from water for general purpose plant re-use

Industries

Kleerflo Filters are used extensively in all industries where water forms part of the process and where macro- and micro-particles need to be removed from suspension. These include:

- **Industrial Process Water**
  - Agricultural and Horticultural
  - Automotive
  - Brewing & Distilling
  - Food & Agri Processing
  - Nuclear
  - Pulp & Paper
  - Power Generation
  - Quarrying
  - Rubber Processing
  - Textiles
- **Mining**
- **Mineral Processing**
  - Steel Processing
- **Potable Water and Sewage Wastewater**
- **Petrochemicals**
  - Refining
  - Pharmaceutical
  - Plastics
- **Oil and Gas**



How it Works

The inherent simplicity of the Kleerflo Automatic Self-Cleaning Filter contributes to the low operating and maintenance costs and the ease of operation.

Kleerflo only requires single phase electricity supply (to power the local controller and instrumentation) and a supply of pneumatic or water pressure (to drive the backwash cycle).

Dirty water flows (under pressure) into the Kleerflo Filter 1. The water is then passed through several cylindrical, stainless steel wedge wire screens 2 that are installed in the main filtration chamber 3. Flow is from the inside to the outside and clean, filtered water is delivered to service via the filtrate outlet 4.

The screens are available in a wide range of apertures with the quantity and size of the screens dependent on the selected aperture, the flow rate and the solids load in the water.

Solids accumulate on the inside (dirty side) of the screens 2. As it blocks the gaps in the screens, a pressure differential gradually builds up between the dirty side and the clean side. This pressure differential is ultimately relieved by initiating the backwash cycle. A signal from the control system 5 initiates the backwash cycle, either on a predetermined time interval, or when the pressure differential reaches a predetermined limit. Backwash consists of a simple back and forth shuttle movement on the one screen that is to be backwashed 6.

The shuttle action is achieved by selectively applying and releasing pressure on the actuator 7 that controls the screen that is to be cleaned. This seals the water inlet to the filter screen 8 and simultaneously opens the top of the screen 9 to the backwash outlet 10.The backwash outlet is open to atmosphere.

The difference between the line pressure maintained in the main filtration chamber 3 and the backwash outlet that is open to atmosphere 10 causes a reversal of flow through the screen 6. The screens that are not in backwash mode continue to produce filtrate. Some of the filtrate in the main filtration chamber 3 flows from the outside to the inside on the screen that is being cleaned 6 creating a strong, positive backwash that carries the dirt out to waste 10. The remainder of the filtrate continues to flow to service 4.

Applying pressure to the active actuator 7 opens the water inlet to the filter screen 8 and simultaneously closes the top of the screen 9 – returning the screen to filter mode. Backwash takes place sequentially, one screen at a time. The screens that are in filter mode continuously produce filtrate. Process flow is uninterrupted with minimal losses to backwash. The unique shuttle mechanism allows the processing of oversized particles without the need for a manual pre-screen 11.

The Kleerflo design is inherently flexible and process parameters such as backwash frequency, the duration of each backwash and the dwell time between the backwash of each screen can be set independently with the local controller 5 - or written into the plant SCADA.

In addition, installation can be horizontal, vertical or at an angle, and the orientation of the inlet, outlet and backwash ports can be set independently.

Maintenance on Kleerflo Filters is easy. The strainer body does not need to be removed from the line for service. Access to the screens is allowed by removing the backwash cover plate. No heavy lifting equipment is required, and maintenance staff can be kept to a minimum.

African Rainbow Minerals - Two Rivers Platinum – Mpumalanga, South Africa

Mines recycle process water and use some of it for **Gland Service Water** (GSW). The recycled process water may have high suspended solids levels. The suspended solids cause damage to equipment. Specifically, dirty GSW will reduce the life of the slurry pump stuffing box components and gland packing.

African Rainbow Mineral's Two Rivers Platinum Mine installed **Kleerflo Automatic Self-Cleaning Filters** on the GSW line to protect slurry pumps. The reduction in TSS resulted in reduced wear and tear on the gland and shaft sleeves, reducing maintenance costs.

Kleerflo Filters are uniquely suited to the tough conditions experienced on mines. They are low in maintenance, durable and efficient in removal of suspended solids. They are self-cleaning.

Mineral Sands Mine – Brand-se-Baai, Western Cape, South Africa

At a Mineral Sands Mine on the West Coast of Southern Africa they use sea water as process water. Biological fouling of the pipelines (including colonization from mussels) is a constant problem. The sea water is chlorinated to eliminate the fouling. As a consequence, shells and other solids dislodge into the water stream.

Kleerfo Automatic Self-Cleaning Filters are installed at different locations throughout the process plant to remove these suspended solids. The following processes are protected by the Kleerflo filters:

- glands on slurry pumps (**Gland Service Water**)
- **spray nozzles**
- **WHIMS** (Wet High Intensity Magnetic Separation) wash water

Kleerflo Filters are uniquely suited to the tough conditions at this coastal mine. They are low in maintenance, durable and efficient in removal of suspended solids. They are self-cleaning.

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GRAVITY SCREEN FILTER

Our GraviFilter is a highly efficient gravity (non-pressurised) screen filter with an integral, continuous cleaning mechanism (self-cleaning). It is used for the removal of suspended solids from water. It is effective in the removal of soft, fibrous and organic solids and it operates efficiently in process systems with higher solids loads. GraviFilter offers extended flow intervals with limited operator intervention.

Applications

The GraviFilter is installed in process lines to remove macro- and micro-solids from suspension, specifically where there is a higher solids load and where the solids are soft, organic or fibrous. GraviFilter applications include the following:

1. **Pre-Filtration:**
   - For membrane separation processes
   - For treatment processes on potable water- and sewage wastewater plants
   - For treatment processes on industrial process water plants
2. **Final Filtration**
   - To protect water spray systems or equipment
     - Water Spray Systems
       - Dust suppression
       - Irrigation
       - Filter presses
     - Equipment Protection
       - Pump glands (gland service water)
       - Measuring and metering equipment
       - Heat exchangers
       - Removal of solids from water for general purpose plant re-use

Industries

The GraviFilter is used extensively in all industries where water forms part of the process and where macro- and micro-particles needs to be removed from suspension. These include:

- **Industrial Process Water**
  - Agricultural and Horticultural
  - Automotive
  - Brewing & Distilling
  - Food & Agri Processing
  - Nuclear
  - Pulp & Paper
  - Power Generation
  - Quarrying
  - Rubber Processing
  - Textiles
- **Mining**
- **Mineral Processing**
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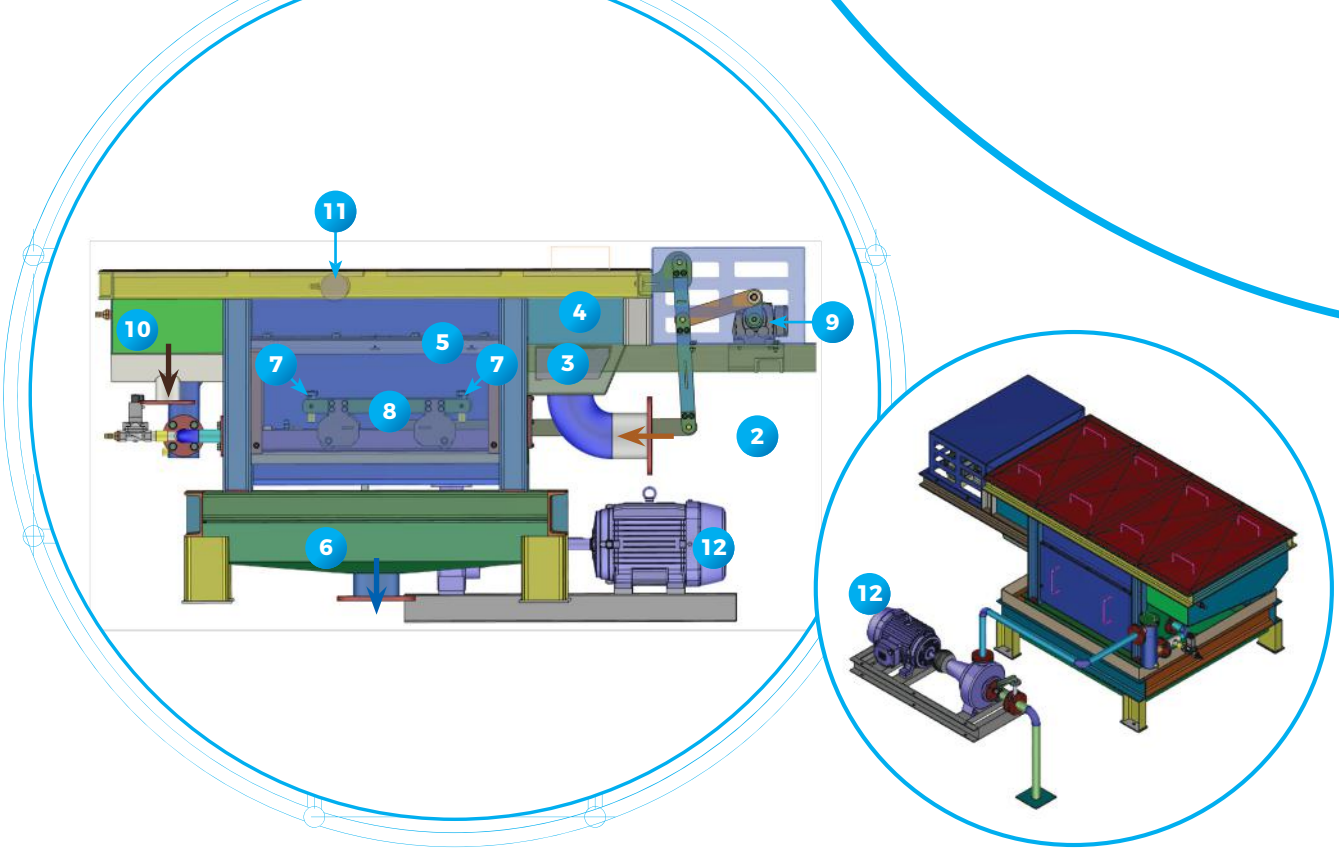
- **Potable Water and Sewage Wastewater**
- **Petrochemicals**
  - Refining
  - Pharmaceutical
  - Plastics
- **Oil and Gas**



How it Works

The GraviFilter consists of:

- Flow control
- Inlet and balancing sections
- Filtration screen and clean water sump
- Self-cleaning mechanism including high pressure pump and drive motor
- Waste sump

The flow of dirty water into the GraviFilter must be regulated. Control can be by control valve or by a dedicated feed pump. Controls can be implemented to activate and de-activate the filter based on availability of dirty water or based on the level of the clean water sump.

Dirty water is introduced to the GraviFilter via the dirty water inlet 2. A baffle plate 3 calms the water as it enters the balancing chamber 4 where the water is evenly distributed across the width of the screens.

As the water flows onto the screens 5, it falls under gravity into the clean water sump 6 underneath the screens. From the clean water sump the filtrate can flow under gravity into a reservoir from where it can be distributed to service. Solids that are larger than the screen apertures are retained on the screen surface.

Reciprocating spray nozzles 7, mounted on a trolley 8, are situated directly below the screens, facing upwards. The reciprocal movement of the nozzles is activated by a small electrical motor and gearbox 9, or a pneumatic cylinder.

The spray nozzles receive a continuous supply of clean, filtered water, typically drawn from the filtrate reservoir and delivered by a high pressure pump 12 or by the main system pumps. The nozzles spray upwards through the screen and lifts the retained solids from the screen surface back into the path of the forward flowing water.

A set of top spray nozzles are mounted on a bar 11 above the screens that spans the width of the screens. The same high pressure pump 12 that provides filtrate to the reciprocating spray nozzles 7 also supplies the top spray nozzles.

Any solids remaining on the screen are periodically blasted off into the waste sump 10 with these top spray nozzles. Flow to the top spray nozzles 11 is controlled by a solenoid valve. Duration and frequency of the pulses can be set.

The actions of the reciprocating spray nozzles 7 in conjunction with the top spray nozzles 11 constitute the integral, continuous cleaning function. The re-use of filtered water to feed the integral cleaning mechanism results in minimal water loss.

The benefit of gravity filtration is that you avoid the danger of permanent blockage or damage to the screens. The unforced filtration process also prevents the breaking up of flocculated particles and organic matter.

PPC Ltd – De Hoek Factory, Western Cape, South Africa

PPC Ltd uses raw river water for plant process water. High pressure pumps deliver the water to the plant. Suspended solids in the raw water damages the high-pressure pumps and block spray nozzles on the plant. Suspended solids consist of organic detritus (decomposing leaves, bark fibers), pebbles, grit and sand. These types of solids are best removed by gravity filters (not pressure filters).

PPC installed a **GraviFilter (Model VA4, 250µm, 100m³/h)** at the extraction point at the river. The filter provides efficient, non-pressurized, gravity filtration that is ideally suited to filter **organic, soft and fibrous** suspended solids. Pump maintenance costs and downtime attributed to blocked nozzles decreased.

Testimonial

'We are very satisfied with the results of installing this GraviFilter. It is self-cleaning with very low maintenance. It is durable and operates unattended for extended periods.'

Pieter van den Heever – PPC Ltd – De Hoek Factory

Industrial Laundry – Cape Town, South Africa

An Industrial Laundry in Cape Town recycles their process water. The treatment plant includes **prefiltration**, DAF, final filtration and membrane separation (UF / NF) stages. Lint is a significant component of the suspended solids in the process water. It interferes directly with the efficiency of the membrane separation processes and will debilitate the process if not removed.

Lint can not be removed efficiently with pressure filters and it blocks manual gravity screen filters within minutes. The client installed a **GraviFilter (Model VA1, 130µm, 10m³/h)** as the prefilter in their treatment process. The GraviFilter provides efficient filtration and allows optimal functioning of the downstream processes. The integral self-cleaning mechanism ensures long, uninterrupted filter runs. **GraviFilters** are designed for the efficient removal of soft, organic and fibrous suspended solids from process water.

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AGF AUTONOMOUS GRAVITY SAND FILTER

Our AGF Autonomous Gravity Sand Filter is a mechanical rapid gravity sand filter. It is a polishing filter used for the removal of fine suspended solids from water. It requires no external control system or electrical supply. The backwash cycle initiation occurs autonomously and is driven entirely by built-in hydraulic design features. Operator intervention is limited to periodic maintenance inspections.

Applications

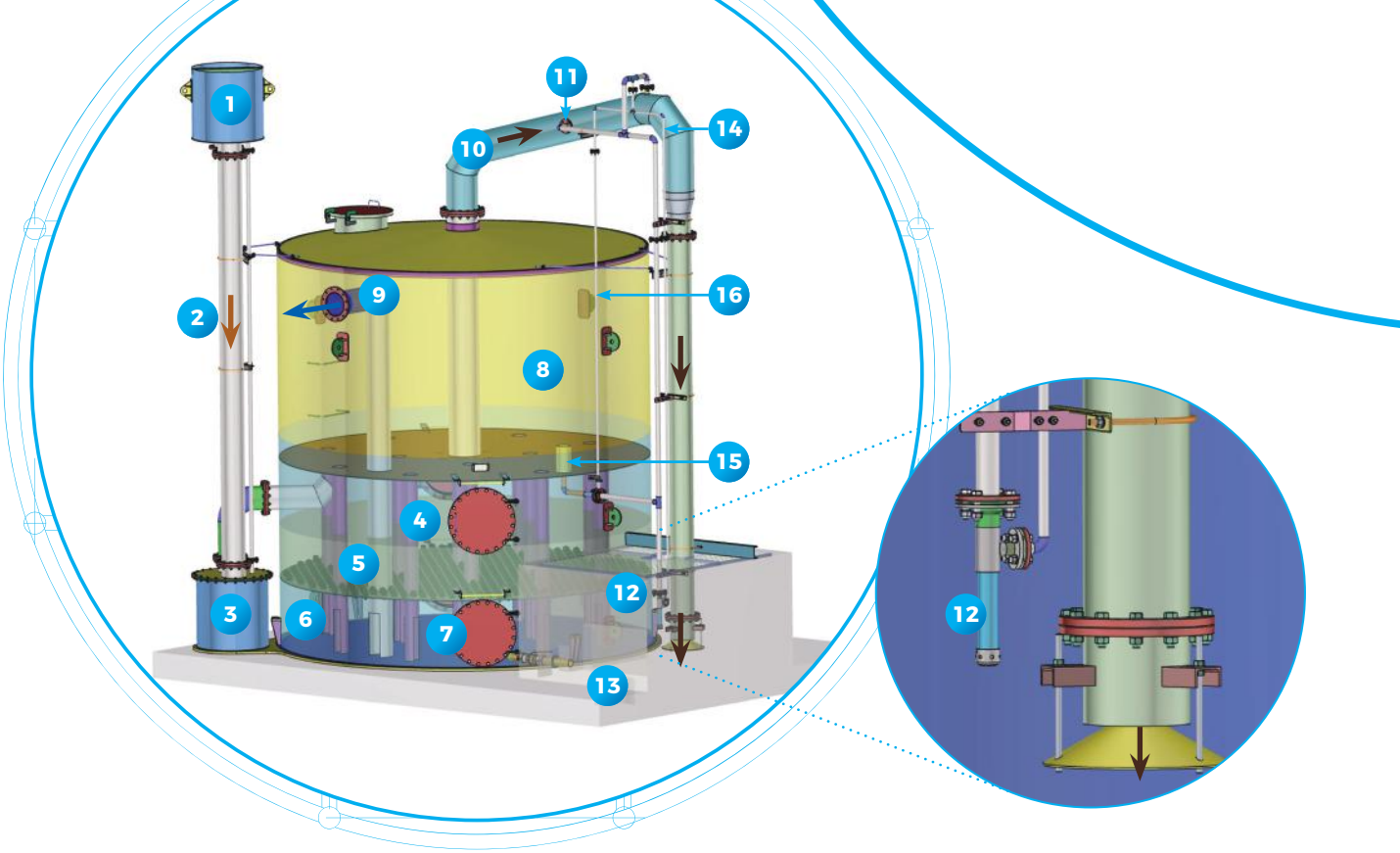
The AGF is commonly installed as polishing filters to remove unsettled flocculant and other suspended solids. Its applications include the following:

1. Polishing filter on potable water treatment plants where mixing, flocculation and sedimentation stages typically precede the AGF installation
2. Removal of precipitate in iron and manganese removal processes.
3. Side-stream filters on cooling systems

Industries

AGFs are used extensively in industries where polishing of process water is required. These include:

- **Industrial Process Water**
  - Agricultural and Horticultural
  - Automotive
  - Brewing & Distilling
  - Food & Agri Processing
  - Nuclear
  - Pulp & Paper
  - Power Generation
  - Quarrying
  - Rubber Processing
  - Textiles
- **Mining**
- **Mineral Processing**
  - Steel Processing
- **Potable Water and Sewage Wastewater**
- **Petrochemicals**
  - Refining
  - Pharmaceutical
  - Plastics
- **Oil and Gas**



How it Works

The AGF is designed to operate autonomously for extended periods of time, minimizing maintenance and operational costs. The AGF's only requirement is that the water supply:

- must be regulated so as not to exceed the prescribed flow rate
- must be supplied at the prescribed head

The head can be achieved through gravity or low-lift pumps. Once the above two requirements are met no further energy input, control or interventions are required.

Dirty water is supplied to the header tank 1 by gravity feed or by low-lift pumps. The water then flows down the feed pipe 2 and via the loop tank 3 into the central filtration compartment 4, where it is introduced above the media bed 5.

The loop tank serves to vent air and to deflect the force of the water. The water flows under gravity through the media bed and through the nozzles to the bottom filtrate collector compartment 6. Suspended solids are retained in the media bed.

The filtrate then flows upwards through a series of riser pipes 7 transferring it to the top filtrate storage compartment 8. When the filtrate storage compartment is full, flow to service commences 9. Accumulation of dirt in the media bed cause a gradual drop in the filter head which causes a rise in the level of the water in the backwash pipe 10 and the feed pipe 2.

Water continues to rise in the backwash pipe until it reaches the geometrically built-in maximum level 11, from where it is diverted to the venturi feed line. As the water passes the venturi 12, air is evacuated from the backwash pipe via the suction line 14 and vented into the backwash sump 13. A siphon is established that initiates backwash.

The backwash pipe 10 is designed large enough so that the water demand driven by the siphon is several times higher than the feed supplied to the filter. This immediately reduces the static pressure above the media bed in the central filtration compartment 4 to below the pressure in the filtrate storage compartment 8.

In the resultant reversal of flow, water from the filtrate storage compartment 8 is drawn down the riser pipes 7 and back up through the nozzles in the central filtration compartment 4. The media bed is expanded and thoroughly agitated. Loosened dirt is carried away via the backwash pipe 10 and discharged into the backwash sump 13.

Backwash continues until the water level in the filtrate storage compartment 8 clears the orifice of the siphon breaker pod 15. Air is introduced to the backwash pipe 10 via the siphon breaker line 16. This terminates the siphon.

The filter then reverts to filtering mode. The first filtrate (rinse water) refills the filtrate storage compartment before flow to service is restored 9. This cycle continues without the need for external controls or human intervention.

Alice Potable Water Treatment Plant – Eastern Cape, South Africa

Amathole District Municipality operates a 7MLD potable water treatment plant at Alice, a rural town in the Eastern Cape province in South Africa. In 2003, during the design phase, process engineers were looking for highly efficient polishing filters that would ensure compliance with **potable water** standards for Turbidity and TSS.

In addition, they required:

- zero electrical energy consumption
- high reliability
- low maintenance costs
- easy maintenance functions

They selected 3 x **AGF42S** (97m³/h per unit @ 7m/h) **autonomous, mechanical rapid gravity sand filters.** Since commissioning in 2004 the AGF filters have consistently produced high quality filtrate and fulfilled the requirements that the process / design engineers set.

Air Products SA (Coega) – Eastern Cape, South Africa

Air Products South Africa manufactures industrial and specialty gas products. Large, industrial **cooling water** units form part of their manufacturing plant. Atmospheric pollutants and other suspended solids contaminate the cooling water leading to substantial losses in efficiency.

Overcoming the inefficiencies requires increased energy inputs and chemicals consumption. Removal of the suspended solids with a **side stream filter** brings immediate and lasting economic benefits (reduction in energy consumption and chemicals usage).

Air Products SA uses **AGF Autonomous Gravity Sand Filters** on three of their production plants. At Coega they installed an **AGF21S** (35m³/h @ 10m/h) sand filter. Since commissioning in 2014 the AGF filter has consistently produced high quality filtrate, delivering economic benefits to the plant. Maintenance and operating costs have been kept at absolute minimum levels.

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