Single – Multi Media Filtration

Optimized Filtration and Removal of Suspended Solids

Challenge

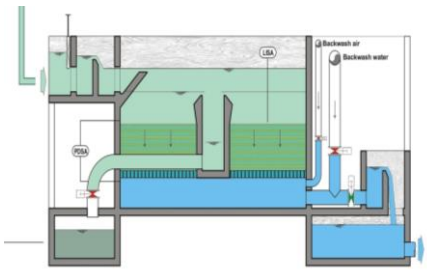
The Single media filtration (**SMF**) and Multi media filtration (**MMF**) a state of the art technology in all kind of water treatment requirements.

Multi media filtration

The MMF technology is the best alternative if conventional single media filtration is not sufficient due to high suspended solids (SS) influent, stringent requirements on effluent SS, long operation cycles required, etc.
E+B presents an optimized MMF technology, which is able to overcome these problems at high operation flexibility and stability as well as best performance and filtrate quality.

Single Media Filtration

Single Media Filtration (SMF) is used for the separation of particles and solids from water through a filtration media. As filtration media, mostly sand is used and a relatively homogeneous grain size is desired. The height of the filter sand usually ranges between 1.0 – 1.5 m in gravity filters and 1.0 to 2.0 m in pressure filters.



Principle of SMF

The filtration velocities depend on filter design, size and concentration of the SS particles to be removed as well as on type and grain size of the filtration media. Usually 5 to 20 m/h are applied.
Under these conditions, the retention capacity of a filter sand varies between 1.1 kg of SS per m³ of media for very light particles and a maximum of 6.6 kg/m³ for dense mineral matter. Removal of SS however takes place in the upper third of the filter only. The rest of the media has a supporting and fine cleaning nature. The reason is that after the backwash some classification of the filtration media occurs with the smallest grains remaining in the upper part of the filter bed and the largest grains being at the bottom. This leads to a relatively quick increase of the differential pressure. As far as operation is concerned, SMF need relatively constant flows and loads for best performance, increasing loads are leading to shortened operation cycles and higher backwash demands.

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Multi Media Filtration

MMF have two or three layers of different filtration media, such as filter sand, anthracite, expanded clay, etc. These layers are installed using different grain sizes, with the media having the largest grains and lowest density in the upper layer and the media having the finest grains with highest density in the lowest layer.

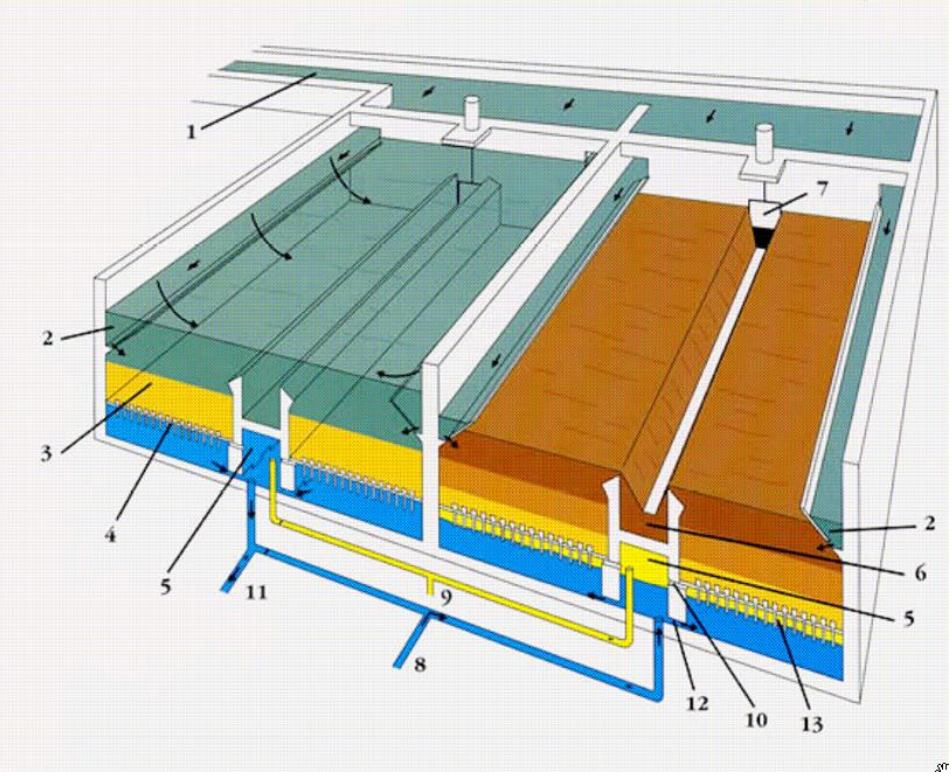
MMF (operation mode)

Therefore the filtration works much more as deep bed filtration with much higher retention capacities. This gives a higher flexibility vs. flow and load variations.

The **removal efficiency of MMF** is therefore better than in SMF and more stable over the whole filtration cycle.

Filtration design and function

1 –	Inlet of raw water
2 –	Weir for distribution of raw water flow
3 –	Media
4 –	Nozzles
5 –	Outlet of filtered water
	Inlet of water and air for backwash
6 –	Outlet of backwash water
7 –	Discharge valve for backwash water
8 –	Inlet of filtered water (for backwash)
9 –	Inlet of air
10 –	Repartition orifice of air
11 –	Outlet of filtered water
12 –	Repartition orifice of water
13 –	Air “mattress”



Filter Backwash (BW)

Each media filter needs a backwash after some operation time in order to remove the retained particles and solids and to prepare the filter for the next filtration cycle.
Good and effective backwash is very important for best filter operation.
A poor backwash can lead to irreversible clogging of parts of the media with the result that these areas cannot be used for the filtration process any more.

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For both filtration types,
SMF as well as MMF,
backwash is done by a series of different steps, using water, air and/or water and air together.
The backwash flows must be sufficient to expand the filtration media in order classify the layers of different grain sizes, the largest grain size/lowest density on top.

SMF can be backwashed with filtrate or with raw water, MMF need to be backwashed with filtrate.

Filter in Backwash Mode

BW Phase	Medium	SMF		MMF	
		Flow (m^3/h)	Time (min)	Flow (m^3/h)	Time (min)
1 Drain	./.	Same as feed		Same as feed	
2 Air wash	Air	50-70	2-5	50-70	2-5
3 Mixed wash	Air & Water	50-70 10-25	2 -5	50-70 10-25	0 - 5
4 Water wash	Water	15-20	5 - 15	50-70	2 - 8
5 Filter to waste	Feed water	Same as feed	0 - 20	Same as feed	0 - 20

Typical design data for filter backwash

Filter to waste for highest effluent requirements

Advantages of Multi Media Filtration

- Higher particle retention capacity
- Better adapted to high SS loads in raw water
- Better filtrate quality
- Higher operation flexibility
- Longer filtration cycles

References

Formosa Plastic, Taiwan*)	16.000	m^3/h	Surface water
Steelworks Wuhan, P.R. China*)	10.000	m^3/h	Surface water recycling
WW Budapest, potable water, Csepel, Hungary*)	6.250	m^3/h	River water
Abadan Refinery, Iran*)	1.500	m^3/h	Surface water
Leuna Power Plant, Germany*)	550	m^3/h	Surface water
Sugar Factory Wanze, Belgium*)	550	m^3/h	Surface water
Kozienice Power Plant, Poland*)	450	m^3/h	Surface water
Sotravic – Mauritius, potable water treatment*)	3330	m^3/h	Surface water

*) Implemented by BHU Umwelttechnik GmbH

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