Municipal Solutions

- Primary wastewater treatment
- Stormwater treatment
- Secondary/tertiary wastewater treatment
- Reclaimed water for reuse
- Potable water treatment
Hydrotech filtration

Microscreens are used in a variety of different applications within water and wastewater treatment. Pretreatment to sand filters at potable water treatment works was one of the first applications. Just after the Second World War the first drum filters were installed for treatment of trickling filter effluent in the UK (Isaac & Hibberd 1972). Treatment of effluents from final clarification after activated sludge treatment was soon to come. Today, the Hydrotech Discfilter and the Hydrotech Drumfilter can be found in applications ranging from primary to tertiary wastewater treatment, and from reclamation of water for reuse to potable water treatment. A selection of feasible and tested solutions are introduced in the following pages.

Hydrotech develops, manufactures and markets high performance filter systems. Today the company is the world’s leading manufacturer of microscreens and there are more than 6000 Hydrotech Discfilter and Drumfilter units installed all over the world. The company is based in Vellinge, Sweden and is represented world-wide by a network of professional, highly qualified partners. Hydrotech is part of the Veolia Water Solutions & Technologies group of business.

The Hydrotech Discfilter™

Entering the Discfilter, water flows by gravity into a central drum supporting vertically mounted discs with filter cloth on each side. During filtration particles are retained on the inner side of the filter panels and the flow of water through the filter is impeded. Consequently, the water level inside the Discfilter rises and eventually backwashing is initiated by a level sensor. During backwashing, and only then, the discs rotate and nozzles spray the filter cloth thereby removing separated particles for discharge via a solids collection trough. Filtration is continuous and not stopped during backwashing.

The maximum operational differential pressure is typically in the range of 250 to 300 mm and filters can be placed in a gravity line or in a pumped feed system. The actual filtration process is gravity based. Available disc diameters range from 1,7 up to 3,1 m and the maximum filtration area for one unit with 24 discs is 134 m². The Discfilter can be supplied in two versions – a self-contained tank version or a frame version for installation in a concrete chamber.

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The Hydrotech Drumfilter™
Similar to the Discfilter, water flows into a central drum covered with filter cloth. During filtration, particles are retained on the inner side of the filter panels. The water level inside the drum rises and eventually, backwashing is initiated by a level sensor. During backwashing, the drum rotates and nozzles spray the filter cloth. Transportation of separated particles up from the water and to the spray nozzles is facilitated by the supporting frame construction on the filter panels. Separated particles are finally removed via the solids collection trough. Filtration is continuous and not stopped during backwashing.

The maximum filtration area for one unit is 21.6 m² and available drum diameters range from 0.5 up to 2.4 m. Also, the Drumfilter can be supplied in two versions – a self-contained tank version or a frame version for installation in e.g. a concrete chamber.

The Hydrotech Beltfilter™
The Beltfilter is an automatic, self-cleaning gravity belt thickener, specially designed for efficient filtration of sludge or wastewater. The filter belt is designed as a slowly moving conveyor and separated particles are drained on the belt to a high dry matter content. Dewatered sludge is removed at the top of the filter by a scraper and discharged into a hopper. The belt is cleaned by a high-pressure backwash system and the backwash reject is lead into a separate sludge trough.

The Beltfilter can be used for thickening of reject streams from the Discfilter, the Drumfilter or from other processes such as the Actiflo® process.

Primary wastewater treatment
After preliminary treatment with grit and grease removal, it is possible to use the Drumfilter or the Discfilter for primary treatment. In such applications, pore size ranging from 40 μm up to more than 100 μm are typically used.

Primary treatment based on microscreening can provide effluent results comparable to primary clarifiers but with a significantly lower foot-print. Full-scale sites can be found in Denmark, Norway, and Sweden.

Another option is addition of a metal salt and polymer for phosphorous removal thus providing a system for chemically enhanced primary treatment (CEPT) based on microscreening instead of primary clarification (Ljunggren et al. 2007).
Stormwater treatment
Associated with options for primary treatment are applications for stormwater treatment at the wastewater treatment plant. It is possible to use both the Drumfilter and the Discfilter with a wide range of pore size in various treatment configurations – with or without chemical pre-treatment.

Below are two possibilities (fig. 11), treating water before and after primary clarification, illustrated.

Another option is stormwater treatment in the sewage network. In Copenhagen, Denmark, Drumfilters and Discfilters have been combined with subsequent UV-treatment (Andersen 2005) in order to fulfil stringent bathing water criteria. The Filters are preceded by a 3 mm screen.

Secondary/tertiary wastewater treatment
Both the Discfilter and the Drumfilter can be used in various process configurations for secondary and tertiary wastewater treatment. Typically nominal pore size openings of 10 – 30 μm are used.

Activated sludge treatment
Tertiary filtration after activated sludge treatment and secondary clarification, sometimes referred to as “effluent polishing”, is one of the most common Discfilter applications. The largest plant (10 m³/s) of this type is under construction in Sweden. The Discfilter has been installed after various activated sludge processes, including for example bio-P removal, simultaneous P-precipitation and nitrogen removal with either pre- or post-denitrification.

In the case of stringent effluent requirements on phosphorous it is possible to extend the treatment with post precipitation. However, flocs need to be strengthened by polymer addition prior to filtration in the Discfilter.

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Biofilm processes

The Discfilter or the Drumfilter can be combined with a variety of biofilm processes, ranging from trickling filters to processes based on suspended carriers.

The Moving Bed™ Biofilm Process can be used in several process configurations, either as a combined or as a stand-alone process. By using the Discfilter for particle removal space and energy can be saved compared to other separation processes. The Discfilter combined with a post denitrifying MBBR-process is described by Persson et al (2003).

Reclaimed water for reuse

The well defined filter media enables the Hydrotech Discfilter to be considered as a barrier, which is beneficial in water reclamation and reuse applications where it is critical to remove specific pathogens of certain sizes. The suitability of the Hydrotech Discfilter for removal of Helminth eggs has for example been demonstrated by Quinzanos et al (2008).

The Hydrotech Discfilter meets the California Department of Health Services Title 22 criteria for the unrestricted reuse of treated effluent.

The ACTIDisk® - a combination of Actiflo® and Hydrotech Discfilter™ - is an example of an advanced treatment process suitable for applications with very high effluent quality demands, for example in reuse applications (Sanz et al 2007). One of the largest reference plants for reuse can be found in Barcelona (4 m³/s) where the process is combined with UV-disinfection.
Tertiary treatment based on the Discfilter or the Drumfilter is also suitable also as a membrane pre-treatment technology. One of the largest plants of this type (375,000 m³/d) is located in Sulabija, Kuwait, where Discfilters with pore size openings of 60 μm are used prior to UF (ultrafiltration) and RO (reverse osmosis).

**Potable water treatment**
Both Discfilters and Drumfilters are used for filtration of intake water from rivers and lakes at potable water treatment works. A wide range of pore size openings are used, from 10 to 500 μm. Drumfilters or Discfilters are also suitable in the case of downstream membrane treatment, i.e. as a membrane pre-treatment technology.

**The Hydrotech design**
With straining being the dominant separation mechanism there is basically only one chance to remove a particle. However, large enough particles is not the only condition that needs to be fulfilled, certain floc strength is also required. Furthermore, the separated solids – attached to the panels – should be efficiently removed, that is transported to the spray bar and washed off the panels in order for the filter to provide high effluent quality and maximum hydraulic capacity. These and other factors have all been considered in the Hydrotech patented design where key parameters like differential pressure, peripheral speed and backwash pressure are based on years of R&D and operations experience and with consideration to experiences found in the literature (Ljunggren 2006).

A twill weave monofilament polyester filter cloth is the standard filter media for the Discfilter and the Drumfilter. Apart from being light and mechanically very strong, polyester has a good resistance against chemicals. Filters can be equipped with filter panels with nominal pore sizes ranging from 10 up to 1000 μm (for special applications, larger openings can be used).

**Design example**
A tertiary treatment installation designed for a peak flow of 1100 m³/h and a maximum influent SS of 20 mg/l. 20 mg/l would, according to Hydrotech design guidelines, require a Discfilter HSF 2220, either in frame or tank version. The filter has a total filtration area of 112 m² and a footprint of 14 m² (walkways around the filter excluded).

The production of reject water, will be less than 1.4 % of the peak flow at maximum loading conditions. Compared to a sand filter the foot-print is very low, 6 – 7 times less area is required for the filters only.

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**Figure 22. Membrane prefiltration**

**Figure 23. Filtration of intake water**

**Figure 24. Tertiary treatment example**
Delivery and installation

Hydrotech provides technical guidance notes for correct installation of filter units. In order to prevent contamination of the filtered water in case of excessive flows or power failure, a separate by-pass facility is recommended. The tank versions, are available with an internal emergency by-pass and an outlet weir integral to the tank maintains the filtered water level.

Ideally the filters should be gravity fed however many installations are pump fed due to lack of available head in the system.

Figure 25. Tertiary treatment installation in the UK (tank version)

Figure 26. Typical lay-out of a Discfilter installation (frame version)

Pilot testing

Where appropriate pilot testing can be carried out. The pilot filters are basically full-scale filters of the smallest models. Discfilter pilots are for example based on one or two discs, whereas in full-scale plants the number of discs and filters are extended in order to achieve the desired filtration area. Therefore, critical parameters in the pilot correspond to those in full-scale meaning that up-scale problems can be minimised. Pilot filters, instructions and test protocols are available from Hydrotech. Furthermore, technicians and engineers can assist in installation and start-up of pilot tests.

Figure 27. Test filter at pilot test

Reports and articles


Reusing waste water

Baix Llobregat wastewater treatment plant in Barcelona, Spain

The plant is an activated sludge plant and one of Europe’s larger plants treating the wastewater for approx. 2 million people and having a capacity of 420,000 m³ wastewater/day.

Approx. 4 million people live in and around Barcelona and also the majority of the Catalan industry is located in this area.

The water supply to the town comes from groundwater as well as treated water from the river of Llobregat that is relatively saline.

Final effluent first treated in 3 Actiflo units, followed by 10 Hydrotech’s Disc-filters before passing through a UV plant and sent for re-use.
Hydrotech develops, manufactures and sells high performance filter systems. Our systems are used in more than 5000 installations around the world, proof of the quality, reliability and professionalism our customers have come to expect from Hydrotech.

Effluent polishing, stormwater, waterworks, process plants and fish farms are just some of the areas using Hydrotech’s water purification filters.