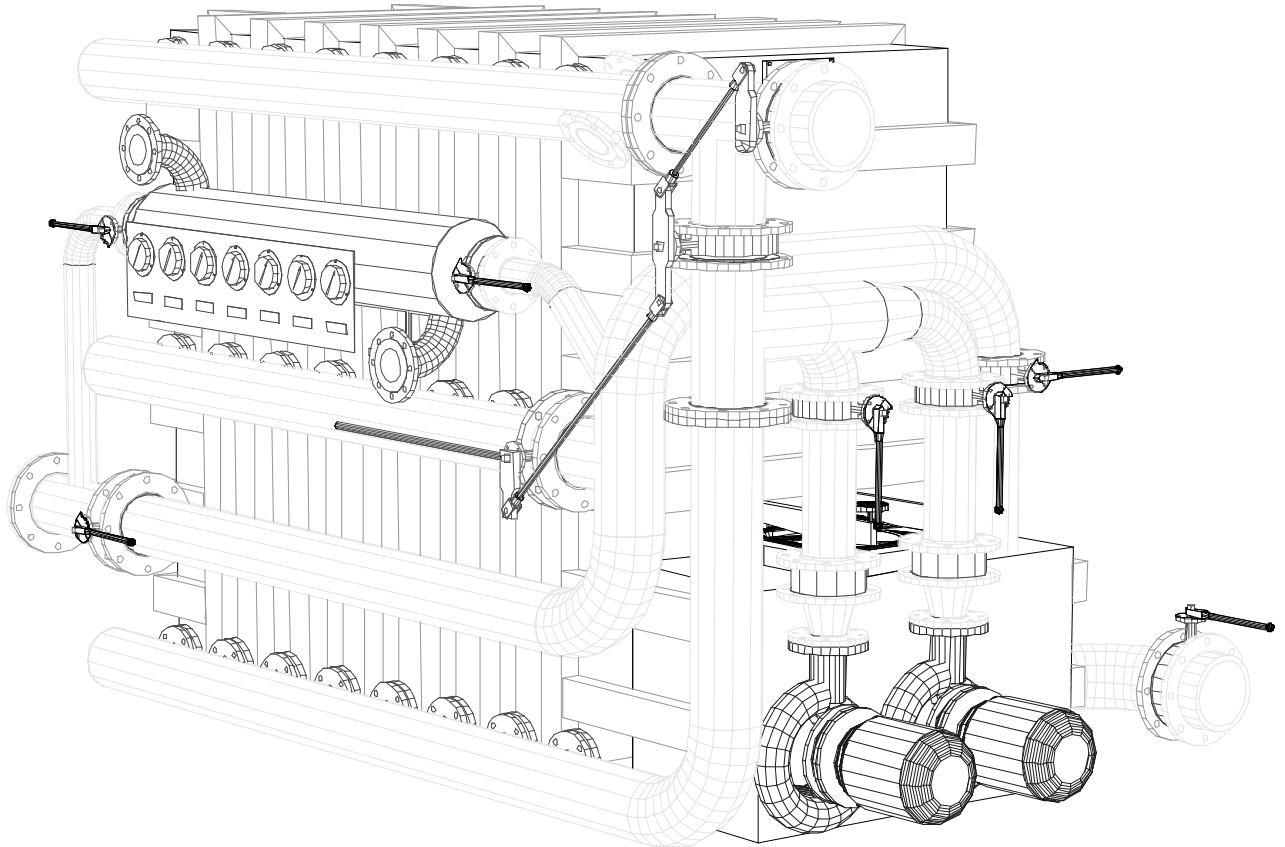


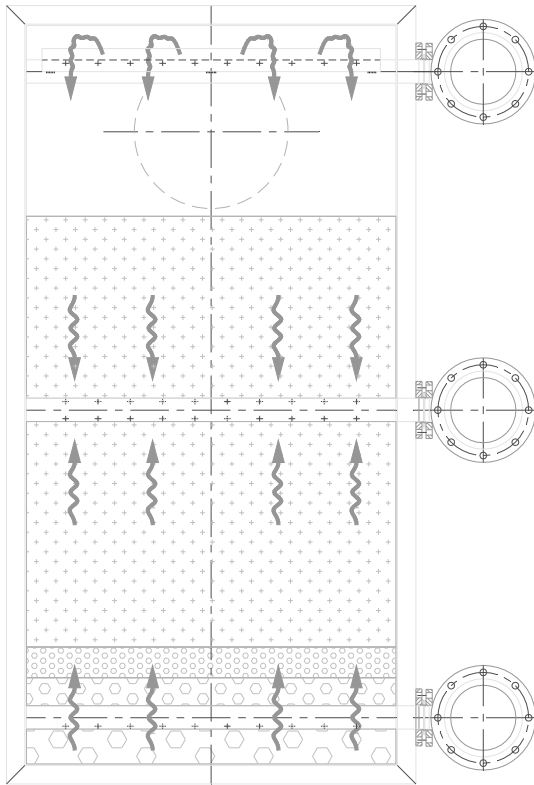
## **Bi-Flow filter:**

Our Bi-Flow filter is a pressure sand filter specially designed for use in municipal swimming pool water treatment systems. It consists of two filtration cells, an upper cell and a lower cell, housed in one enclosure (vessel) filled with support layers and filter media. Our Bi-Flow filter represents advanced technology in filtering contaminants from raw water. The filter combines up-flow and down-flow filtration through filter media of various arts.

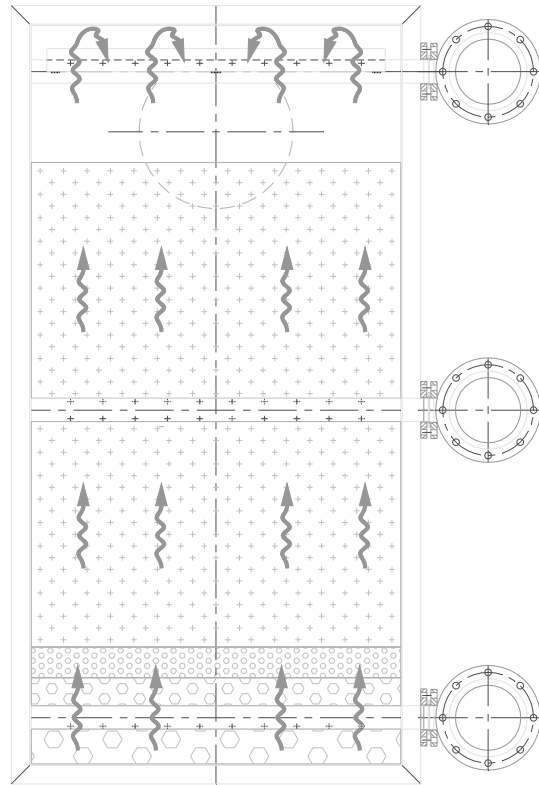


## **Principle:**

The water to be treated, the raw water, which has already been pre clarified and filtered from coarse materials by a strainer, is split into two pressurized flows (bi-flow or dual flow) where one flow enters the enclosure from the top into the upper cell and the other flow enters the enclosure from the bottom into the lower cell. The water entered from the top flows downward through the upper cell, equal as in often used “traditional” down-flow filtration filters, and the water entered from the bottom flows upward through the lower cell, equal as in rarely used up-flow filtration filters. Both flows join in the middle where the full filtered flow exits the enclosure. With this combination of filtration directions, the counteracting force for the up-flow filtration through the lower filtration cell is not only the submerged weight of the filtering material of both filter cells but also the filter resistance from the down-flow filtration part through the upper filtration cell. This counteracting force is an assurance that sudden expansion during filtration from the lower cell won't take place, which sometimes can cause problems in sec up-flow filtration filters.



FILTRATION

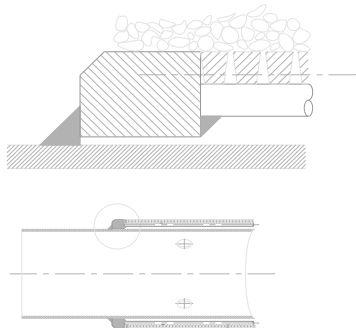


BACKWASH

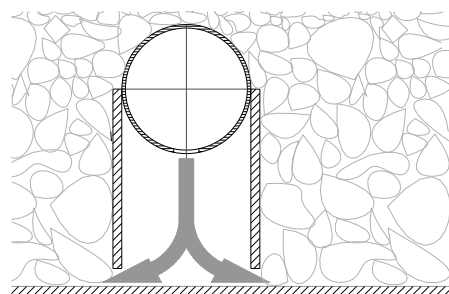
**Construction:**

The construction of these horizontal situated enclosures are designed as rectangular “boxes” to save floor space and do have a fixed width and height. Only the length is variable in equal steps for each equal step-up in capacity. Far more floor space though is saved compared to traditional filters due to the fact that the two filter cells (two filters) are located above each other in physically one single enclosure.

For entering the water into the enclosure in the top- and bottom and for the discharge in the middle, three heavy duty laterals above each other are used for each step-up in length (step-up in capacity). These laterals are designed heavy because they are also part of the construction of the enclosure to hold the side walls straight and flat against the inside pressure. The top- and bottom laterals are designed with special designed patterns of holes for an equal raw water distribution into the top- and bottom part of the enclosure where the top lateral is situated in the freeboard above the filter media and the bottom lateral is situated in the coarse gravel support layers. The middle lateral however, located straight in the filter media, also has a special designed pattern of holes but is covered with a special St.St. non clogging screen to hold back the filter media from the holes.



MIDDLE DRAIN



BOTTOM DRAIN

With the repeating length steps of three laterals above each other for each step-up in capacity, this filter tank construction appears modular that way but isn't in general. However, if access to the filtration area is limited (renovations); this filter also can be easily delivered in real modular sections which can be put together on site.

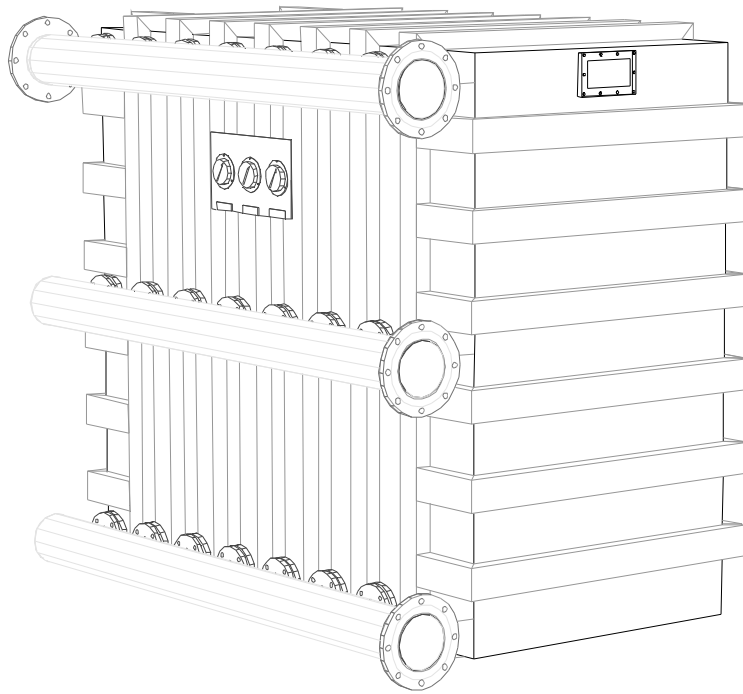
The enclosures of our Bi-Flow filters, as well as the laterals, are made out off St.St. AISI 316L. The outside reinforcements of the enclosure to overcome the inside pressure are made out off cold forged mild steel beams which are corrosion protected at the inside. These filters are so designed that no process water ever will be in touch with any of these mild steel parts. The enclosure as a whole is on the outside protected with a primer and a blue paint finish, which finish on request can be any other color.

Our Bi-Flow filters were the first filters on the market with a transparent manhole in the top section and a lamp on the opposite site of the filter tank to effectively watch the filtration and backwash processes. There is also an opaque manhole in the bottom section of the filter tank to get the filter medium out if required.

To equally distribute the separated flows of raw water over the top- and bottom series of laterals and to collect the filtered water from the middle series of laterals, three horizontal situated St.St. AISI 316L manifolds above each other, with in number and distance corresponding flanged branches, are used and flanged to the adjacent laterals.

### **Backwash:**

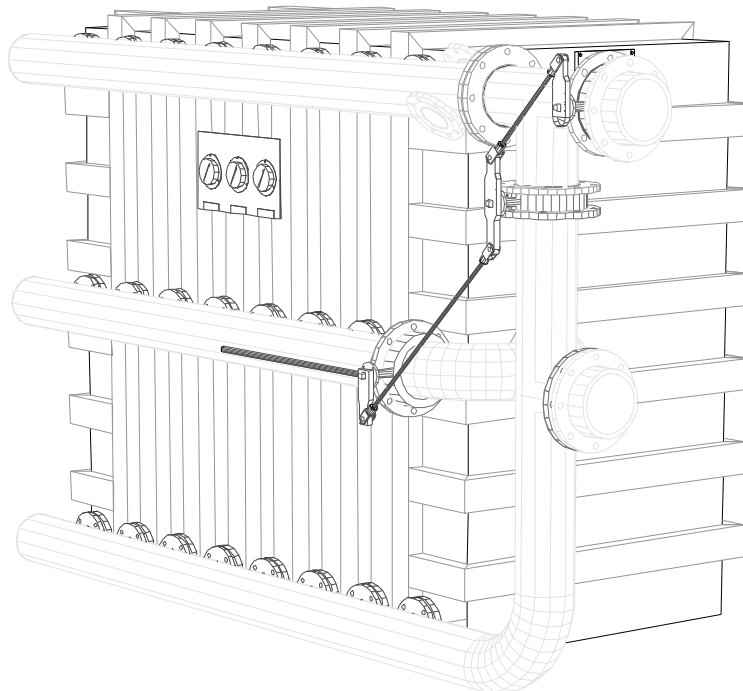
Any filter, when in operation, accumulates dirt and needs to be cleaned with a backwash stage once every so many hours or, more common in municipal swimming pool water treatment plants, days. In this case backwash takes place by entering backwash water – which can be the raw water - in the bottom of the enclosure (bottom laterals), fluidizing the filter media, and all the backwash water exits at the top of the enclosure (top laterals). Even though the vessel works as if it were two filters above each other, an up-flow filter and a down-flow filter, it backwashes just as one single filter, so the ratio of backwash volume to filtration volume is less than in conventional filters. Due to the fact that all the filter media in both filtration cells are in fluidization during the backwash (a must for good cleaning), the dirt accumulated in the bottom filtration cell also gets removed effectively from the top. This is however no different than with backwashing traditional down-flow filters with a deep bed filtration process or multi layer filters where also dirt accumulates in lower parts of the filter which also needs to be removed. There is a difference though; for traditional filters the backwash flow mostly needs to be increased heavily compared to the flow during filtration, which sometimes requires extra pump capacity, while the backwash flow for the Bi-Flow filters never exceeds the total filtration flow. This is due to the fact that the separated flows during filtration are not separated during backwash. Contrary to common belief, backwashing the Bi-Flow filters does not require more backwash water than conventional filters of the same capacity, because the backwash capacity to reach the same level of fluidization as in conventional filters is less, due to the smaller (50% less) filter surface during backwash. This means that using our Bi-Flow filters effectively saves water.



Sec. BI-FLOW FILTER

**Evolution:**

In nearly 30 years time several variants of our Bi-Flow filters entered the market mainly to “make live for the operator easier”. This evolution goes from sophisticated manual to operate one handle Bi-Flow filters, where an error free switch from filtration mode to backwash mode only needs one single handle to move, up to the fully automatic controlled very compact ComBi-Flow filter units, which are skid-mounted end products with the centrifugal pumps, strainer boxes, calorifiers, water probe taps, valves and all necessary pressure- and temperature gauges integrated.

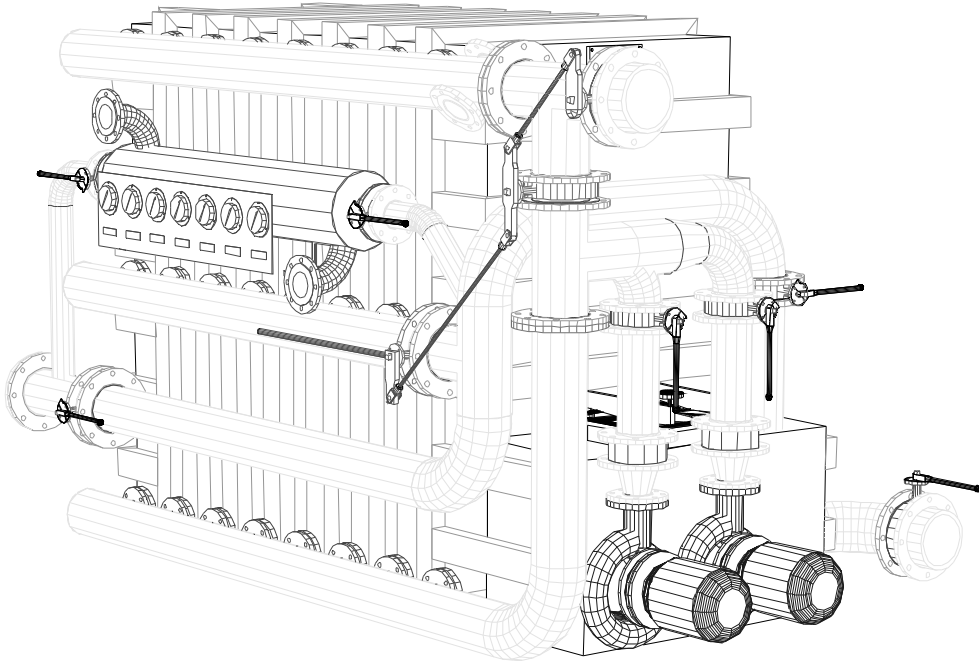


SINGLE HANDLE BI-FLOW FILTER

### **Space and Quality:**

The relatively high flow rates available with in our Bi-Flow filters mean that fewer and smaller units are required. The end result is substantial savings in capital costs, reduced weight and space for valving, piping, and control equipment.

If we talk filtration however, we really talk filtration quality of the effluent. The Bi-Flow filters are tested many times with outstanding results, in Germany, England and the Netherlands under the trade name “EDOCH Bi-Flow filter” as well as in the USA (NSF) under the name “WHITTEN Bi-Flow filter”, both products from the same designer. These Bi-Flow filters handles up to 40 m<sup>3</sup>/h/m<sup>2</sup> and with chemical pretreatment (flocculation) typically over 99% of all colloidal matter in the water to be treated will be removed.



COMBI-FLOW FILTER

### **Latest developments:**

The Bi-Flow filters are recently also often used with pre-ozonisation in a by-pass Ozone system in the raw water flow to the filter. The rest ozone then gets removed in the Bi-Flow filter by oxidation of the in the filter accumulated dirt, which drastically increases the run-times between backwashes. With these systems we experienced no noticeable increase in pressure difference over the filter even during a month. For swimming pools there than was only a need to backwash the filter to avoid accumulation of dissolved matter as urea and chlorides.

There are also made outstanding improvements in water quality with using UV in combinations with our Bi-Flow filters or even Bi-Flow filters in combination with Ozone and UV to form the most effective radicals to clean the water.

**The real world: (in COLOR)**

A ComBi-Flow filter put in place in a new municipal swimming pool.

