THE IMPORTANCE OF PROPERLY DESIGNED FILTER LEAVES AND THE BASIC FILTRATION PROCESS

Liquid-Solid filtration, simply stated, is the separation of one or more solids from a liquid process stream. It is a "unit operation, in that it operates on the stream and changes its characteristics. The filter is the process device responsible for this operation.

The filter accepts incoming fluid (influent liquor) and discharges the liquor (effluent or filtrate) clear of its previous contaminant. The contaminant remains on the filtering surface within the filter, for either discharge to an approved waste disposal site or saved if of value.

The filter, therefore, consists of a vessel which houses the internal filter surfaces. It is these surfaces or filter components that we are concerned with; the most common component being the "Filter Leaf".

The type, size and style of the filter and filter leaves are determined by many factors. Governing factors include the type of process, importance of cake or filtrate, particulate type and level, process hydraulics, temperature and pressure. It is not the author's intention to assist in the choice of filter equipment, but rather to discuss the importance of the filter leaf, with filter aid, that performs the actual filtration. ***Various filter leaf styles are illustrated in Figure #1.***

The primary goal of the filter leaf is to provide a screening surface to which a filter aid is applied. It is the filter aid coating (pre-coat) on the screen that performs the actual retention. Specifications of the filter aid are determined by the condition and size of the contaminant (or particulate if retained). The retention and type of weave of the filter cloth on the leaves is then determined by the type and specifications of the filter aid.

With the leaves pre-coated, the influent liquor is admitted to the filter. The contaminant is retained on the pre-coat surface while the clear liquor passes through. This then, is the actual Filter cycle.

Many filter operations also utilize a body feed. This is the insertion of small amounts of filter aid to the influent during the filter cycle. This serves to separate the contaminant particles and prevent them from conglomerating and sealing off the surface of the pro-coat layer which would prevent further flow. Body feed (also termed Admix) creates a continuous addition of porous material between the non-porous contaminants allowing the influent to weave its way around the contaminants.

The filtration cycle is complete when:

A, The Batch of influent liquor is exhausted.

B, The resistance (pressure differential) across the leaves increases, as a result of contaminant build-up, making further filtration impractical or

C, The "Cake" buildup of pre-coat, contaminate and body-feed reaches a maximum thickness. This would be determined by the spacing between the filter leaves.

The cleaning of the leaves will vary according to lifter type and design. Some have internal sluicing devices to spray off the cake. Others will reverse the flow (backwash) and blow off the cake. Many are simply opened and hosed down. Vibrators are also used to aid in the cake removal

FILTER LEAF REQUIREMENTS

Considering the filtration process, it becomes clear that the filter leaf is a major factor in determining the efficiency of a filter. In summary, it is the responsibility of the filter leaf to:

1, Retain the pre-coat media (filter aid) evenly on the Filter Cloth screening surface.

The actual alloy Filter Cloth specifications are determined by the type of filter aid employed which in turn is dictated by the process requirements. 24 x 110 Dutch Weave is the most commonly used screening surface. It provides the strength, retention and surface characteristics for most of the filter-aids employed. It can withstand backwash and surface cleaning. It is rigid and has a smooth surface for ease of cake release. Also used are 60 x 60 and 80 x70 Twill Weave, 30 x 40 Braided Weave and 20 x 250 Dutch Weave. ***Typical filter cloth styles are illustrated in Figure #2.***

Filter cloth is often "Calendered" to improve retention and cake release properties. This is a process where the Filter Cloth is fed through rollers which "Flatten" and smooth the material.
Depending on methods of manufacture, Filter Leaves" can be economically rescreened when worn or damaged. Synthetic woven and nonwoven media are also commonly used when conditions are appropriate. They offer the ability to rescreen in the field and can be an economical alternative.

2. Allow uniform resistance to flow.

A properly designed filter leaf incorporates chamber screens that offer uniform filtrate collection across the entire face of the filter leaf filtering surface. If the chamber does not allow for uniform collection, the effluent will have a greater flow rate (least resistant) nearest the outlet. The result will be uneven cake build-up and shorter filter cycles. Typically, these instances in a vertical filter leaf arrangement, will cause a "Pear" shaped cross sectional cake. ***See Figure #3 for illustration.***

Filter leaf spacing within the filter is normally in the 3"-4" range. As this filtration progresses, the resultant cake will "Bridge" from leaf to leaf nearest the leaf outlet. "Bowing" and distortion of the filter leaves is a common result. As the uneven pressures continue to build, the leaves can permanently distort. Chambers that provide for uniform cross-sectional lateral flow of the filtrate to the outlet will minimize these conditions. In larger leaves (36" and greater) drain tubes can also be employed within the chamber to further collect and "Direct" the flow uniformly.

3. Remain rigid and flat during operation.

As the filtration process progresses from pre-coat to filtration to ad-mix, there is a natural tendency for pressure fluctuation. It is paramount that the Filter Leaf maintain its shape and rigidity during these fluctuations. Flexing of the leaf will interfere with the integrity of the filter cake. As the leaf flexes, the cake will "Break" and allow contaminant to penetrate to, and possibly through, the screen surface. Continuous flexing will result in either a contaminated filtrate or clogged screens. As above, a properly designed chamber screen and binder combination, reduces the possibility of flexing. In larger leaves, the addition of a drain tube reinforcing structuring also helps to eliminate this condition.

4, Ease of cleaning.

The ability to quickly and efficiently clean the filter leaves and initiate a new filtration cycle needs to be repeatable and predictable. All that has been discussed is important to assure the efficiency of the cleaning process. Downtime needs to be minimized. The chosen filter cloth needs to provide an impregnable surface to the filter aid and needs to allow for quick cake release. A rigid leaf with an even cake buildup will clean easier and more effectively. The chamber screen needs to allow, in the case of backwashing, an even distribution of the backwash fluid. In the case of an inefficient flow chamber the backwash fluid will exit at the path of least resistance and effectively shut down the process on the balance of the leaf.
It is important the leaf/filter cloth design withstand cleaning and washing. In the event the cake/contaminant is more tenacious, calendering of the filter cloth should be considered.

Filter leaf filtration is, by its nature, a “Batch” operation and therefore requires repetitive set-ups, cleanings etc. It is for this reason that a properly engineered Filter Leaf is imperative. Many factors need to be accounted for in the initial installation of a batch filtration process including size, corrosion, hydraulics and mechanical considerations. After these considerations and initial installation is complete, it is the filter leaf that deals with the day to day, maintenance and product quality details. It quickly and ultimately becomes the predominant feature in the process determining success or not.

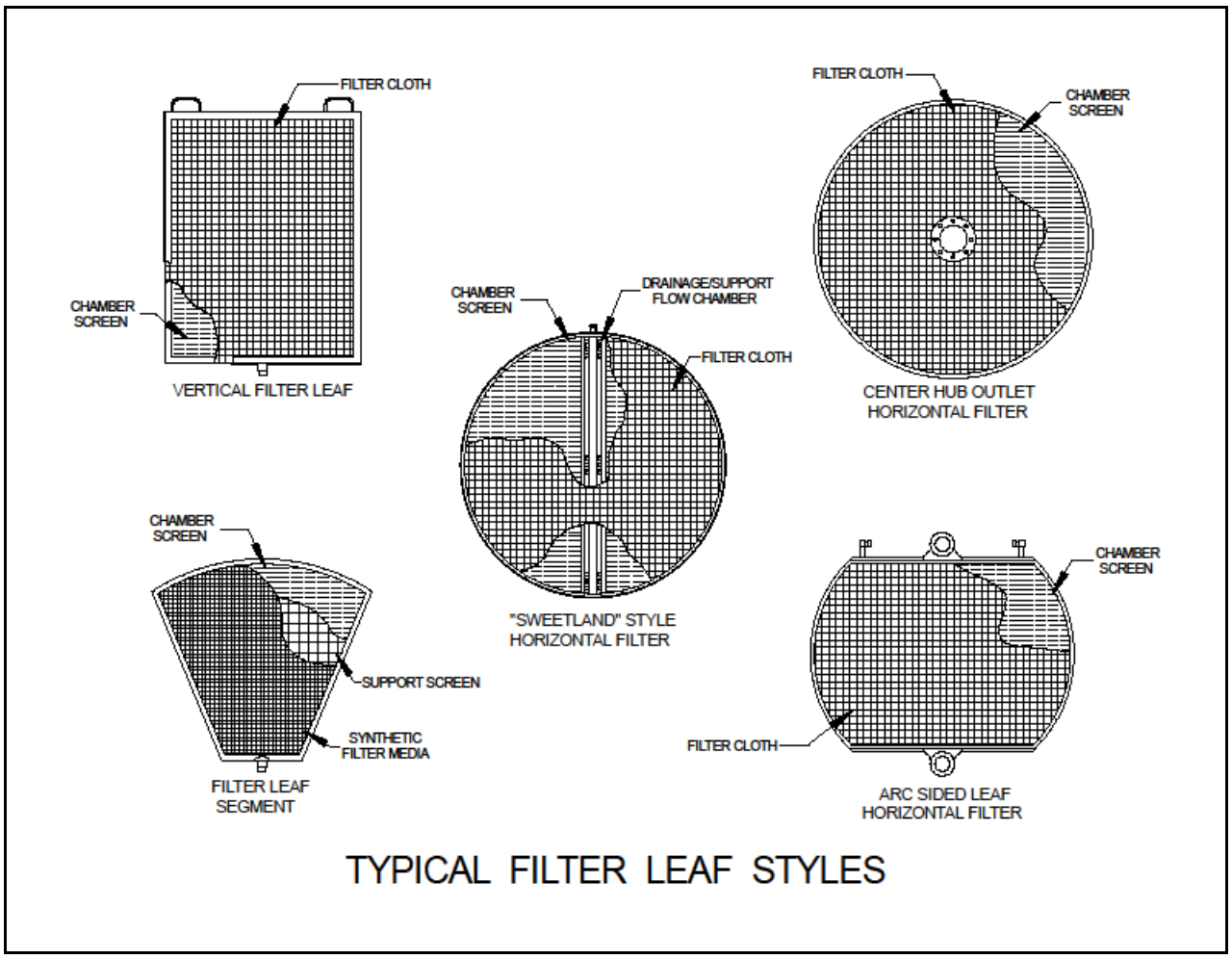
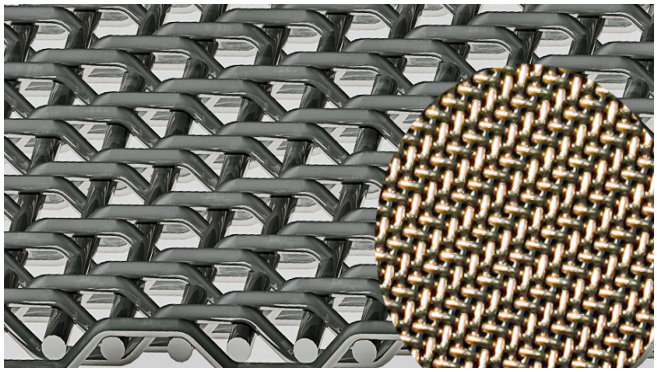
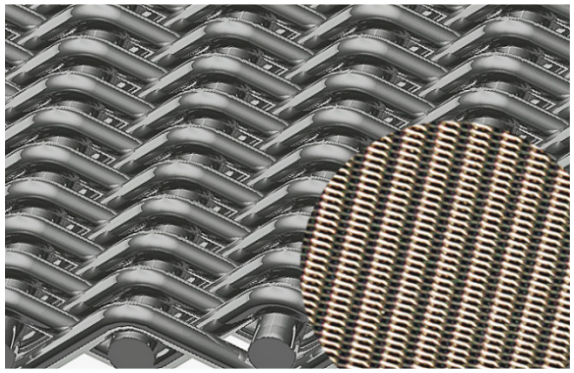


FIGURE # 1



TWILL WEAVE



DUTCH WEAVE

FIGURE #2

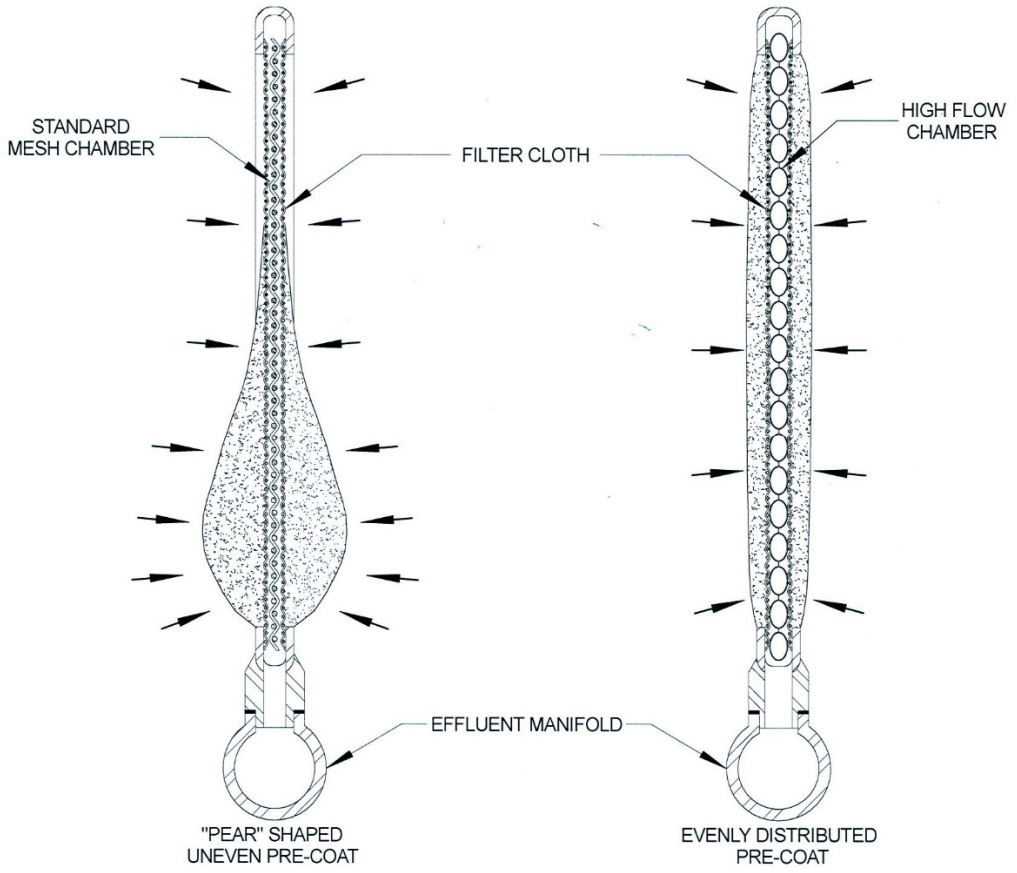


FIGURE #3