FILTER PRESS FEED PUMP

The HEART of any Filter Press dewatering process is the correct selection and sizing of the filter press feed pump. Filter press is a static device which requires an external source of energy to perform the solid liquid separation process. The filter press feed pump is the source of this energy and as such the performance of the pump can produce the dryers cake in a timely manner. It is essential to understand the pump demand curve as it relates to the filtration throughput curve.

At the beginning of the filtering cycle the pump is required to deliver a high volume of slurry at a relatively low pressure differential across the filter press. As a filter cake begins to form on the surface of the filter cloths, the pressure differential across the press increases reducing the amount of mother liquor which will pass through the cake matrix at a given pump pressure. It is the reduction of porosity of the filter cake and its increasing resistance to flow that determines the pump demand requirements and thus establishes the demand curve. While the exact requirements for each application will differ based upon the material being filtered, the concentration, and the size of the press, the filtration throughput curve will remain relatively consistent with respect to percent of volume throughput versus percent of cycle time elapsed. Therefore, the curve may be used to establish pump demand at different points in the cycle.

The filtration throughput curve and the pump demand requirements can be broken down into two basic stages. The first third stage starts with a fast fill cycle. During this stage two thirds of the total material to be filtered has been pumped through the press. The second stage is referred to as the consolidation stage during which the remaining one third of the slurry is pumped through the press requiring two thirds of the total cycle time. A filter press feed pump system must satisfy both of these demand stages to operate the press effectively and efficiently.

In establishing the selection criteria of a feed pump system it is necessary to take these variable flow and pressure conditions into consideration. Other system variables that can have an effect on the pump and on the operation of the filter press system are: Erosion, Corrosion, Chemical Resistance, Large Foreign Material, Shear and Temperature.

At the start of filter press feed cycle, the feed system must provide the correct filling velocity at low pressure to ensure even distribution of solids between the chambers. and through the length of the filter press plate pack. There is no common rule to size a filter press feed pump. It is all a dependent upon individual applications and the dewatering character of what is the product pumped into the press. A slow or too high initial fill rate may result in uneven distribution of the feed solids, which will cause uneven cake formation in the individual filter press chamber.

The resulting unequal pressure distribution within an individual filter press chamber or from chamber-to-chamber this can cause severe loading on individual plates, leading to plate deformation and damage. For a typical municipal or industrial application, a feed system that completes the initial feed cycle within 5 to 10 minutes under consideration of a system pressure of 30 to 40 psig is optimal.
After the initial fill period, as the cake is formed, the resistance to filtration increases, resulting in the need for higher pressure to feed the press. During this period, the filter press feed system should provide a relatively constant high sludge feed rate at increasing pressure until the maximum design pressure is reached. In addition, a high sludge feed rate will minimize the filter cycle time. When the system pressure reaches the design set point, the sludge feed rate will decrease to maintain a constant system pressure. A uniform, variable sludge feed pressure flow is required during this stage of the operation.

A feed pump is sized based on the capacity/filtration area of the filter press with consideration of the type of slurry and the conditioning schema. The best pump selection would not shear the flock and the affect the particle size.

The end of the filter cycle sees the sludge feed rate decreasing very slowly over time until a minimum sludge feed rate is attained. This slowly decreased rate to a minimum flow is extremely important because a low sludge feed rate is essential in achieving a high solids loading in the filter cake.

For feeding a standard recessed chamber (fixed volume) filter press, a Positive Displacement Pump will produce the best results especially when the sludge is organically conditioned prior to the pump. For Membrane (variable volume) presses other pumps (centrifugal) can be used since the ultimate dewatering is done by the squeeze system.

For liquid-solid separation in filter presses, slurries can be fed with a force up to 100 psig (low pressure – 7 bar) or 225 psig (high pressure -15 bar). The typical filtration cycle is characterized by temporal variations in flow rate pressure and solids-loading.

For optimum filtration results, it is of the utmost importance that the feed systems used are capable of adapting themselves to provide the maximum possible filtration rate.

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There are number of ways to determine the **End of Cycle**. When the Filter cake is fully developed the filtrate flow rate will have reached a point at which the reduction in filtrate flow is too low that the rate appears almost constant. In practice, this rate will become low that would not be practical to run the press (0.16 gpm/ft\(^5\) of filtration area (0.65 liters/min/m\(^5\)). If the sludge is consistent in characteristic and % solids, time can determine the end of cycle. It is always best to have two parameters to determine the end of cycle if time is used the pressure should be considered as well. Flow can be used by measuring the filtrate flow using a flowmeter or a weir tank.

To Size for pump GPM you can use the following for typical municipal or industrial application:

- No. of Chambers x plate filtration area
- 0.1 of filtration area could be the GPM required
- Or it could be filing the press in 5-6 minutes
- Press capacity x 7.4 ÷ 5 or 6 minutes.
- Filling the press in 6 minutes

There are applications when 1.5 to 2.5 m/sec or much higher rate could be based on the size of the feed eye of the filter plate. Consult your filter press or filter plate manufacturer for the proper feed rate if you have special application. Testing will take the “what if game” out of the picture.

**Note:** You have to consider the line loss and location of pump in respect to the press and source of sludge

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To learn more about our filter facts (*Filter Press Book of Eli*), our service please call or email Phone (610)400-7255 email: alex@elicompanyllc.com or yazdjer@gmail.com