Filter Aid Filtration

Filtration is the separation of solids from liquids by forcing the liquid to flow through a porous medium and depositing the solids on the medium. A filter aid (finely divided material added to the liquid to be filtered) helps control flow and solids removal. The septum, usually screen or cloth, serves principally as a support for the cake. The filter aid forms a porous layer on the septum and becomes the filtering medium that traps the solids and prevents them from blinding the septum. Filter aid filtration is mechanical, not chemical in nature. Irregularly shaped particles interlace and overlay leaving 85 to 95 % voids or open spaces—billions of microscopically fine interstices between the filter aid particles. The size of these openings is so minute that the unwanted solids are strained from the liquid. The vast number of openings compensates for their small size resulting in fast flowrates and brilliant clarity.

Good filter aids are light in weight and chemically inert. They form high porosity filter cakes that permit high initial liquid flow, provide pore spaces to trap and contain the filterable solids and leave a high percentage of channels remaining open for flow. Particle size distribution is tailored to permit precoating on coarse wire and yet give the desired flow rate and clarity. Dicalite diatomite, perlite and cellulose filter aids meet these criteria. They are available in a variety of grades to suit the solids removal requirement of any application.

Pressure Filtration

General Operating Notes

The filter septum serves principally as the support for the filter aid cake. The size of the opening should be fine enough to retain the filter aid particles and allow a firm cake to be formed quickly while at the same time giving a minimum resistance to flow. The material must withstand chemical, pressure and temperature conditions existing during filtration. The two most widely used septa are metal and cloth. The most common metal screen is 24 x 110 Dutch Weave.

Precoat

In most cases, the first step is formation of the precoat, a thin layer (1.5 to 3.0 mm or 1/16 - 1/8 inch) that protects the septum and ensures clarity by stopping the solids at the surface. Careful selection of the precoat filter aid grade allows the fastest possible flow yet traps the solids. A slurry is made from filtered liquid, or sometimes water, and filter aid. The concentration should be low as possible, 0.5 % is typical. Agitation in the precoat tank should be sufficient to keep the filter aid in suspension. Excessive agitation for extended time may break down the particles. Filter aids should be added at 500 to 1200 g/m² (10 - 25 lbs/100 ft²) of filter area. The precoat is formed by recirculating the filter aid slurry through the filter. The coarser particles deposit themselves first on the screen followed by smaller ones. Precoating rate of 40 litre/m²/min. (1 GPM/ft²) is normal. Much lower rates are used with higher viscosity liquids. There should be at least 0.07 kg/cm² (1 psi) differential pressure during the precoat process. Precoating liquor should clear up within 10 to 15 minutes.

Bodyfeed

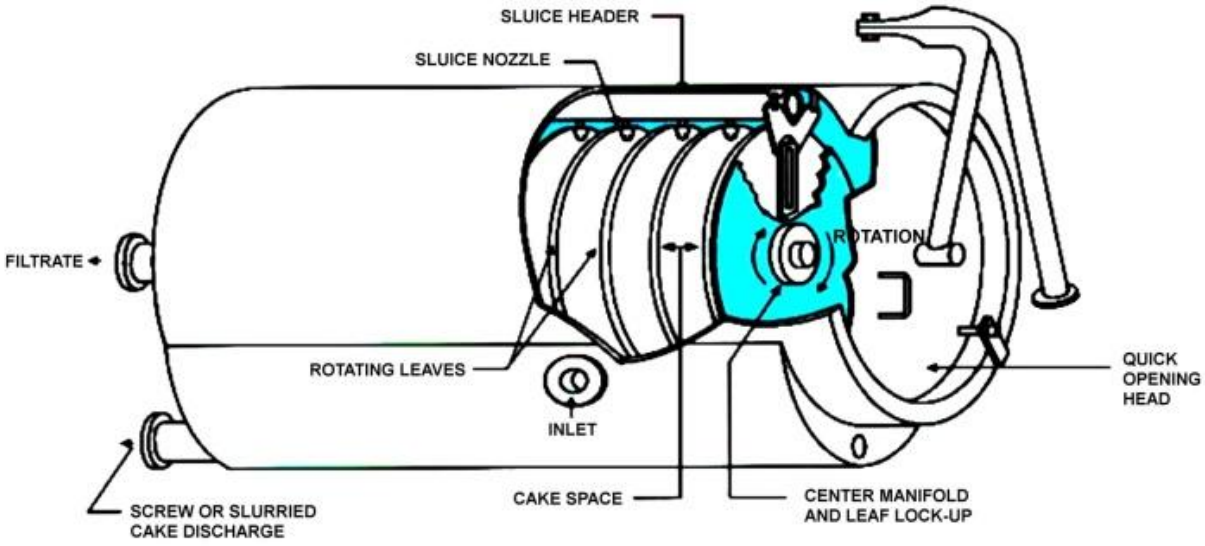
Addition of filter aid to the liquid to be filtered is referred to as bodyfeed. The type and grade as well as quantity to be added is vitally important to obtain the highest filtration flowrate consistent with the clarification required. Filter aid dosage varies with the solids content and other variables specific to each application. In general, a dosage of ½ of the percent solids by weight is close. Bodyfeed can be added directly to the tank of liquid to be filtered, or dosed from a slurry tank into the filter inlet.

Grade Selection

Clarity is the most important measure of efficiency in filter aid filtration. Selection of the particular type and grade of filter aid having the correct particle size and distribution is a major factor. Other considerations include the quantity of filter aid to be used, flowrate needed to meet plant production schedules, equipment limitations and general filtration conditions. All of these can best be resolved by tests using the actual liquid involved.

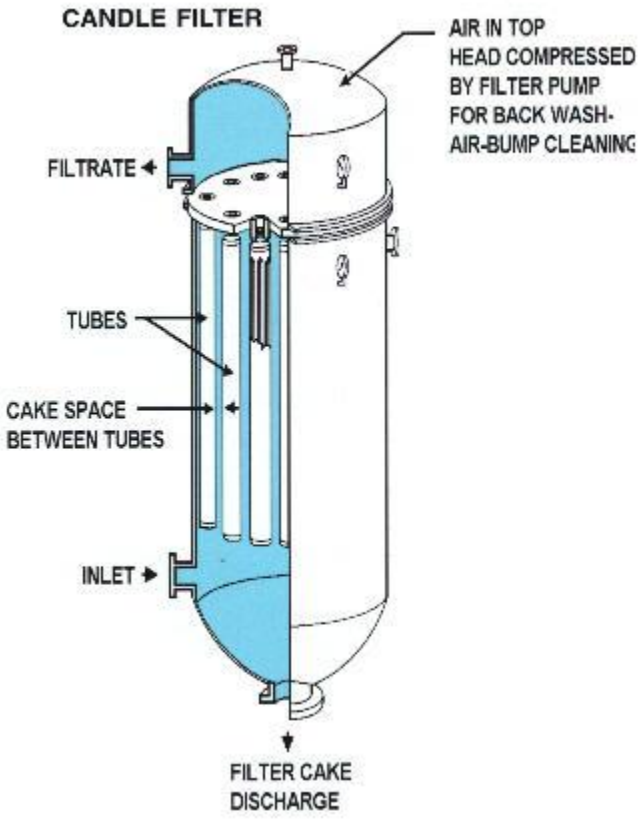
Pressure Filters

HORIZONTAL TANK ROTATING LEAF
AUTOMATIC JET SPRAY CLEANING FILTER



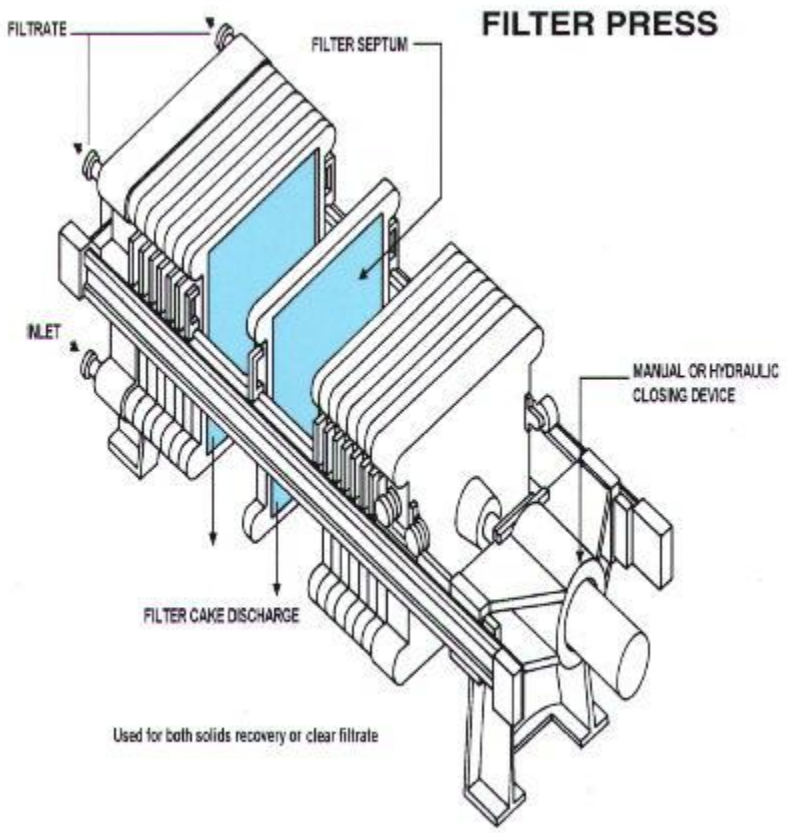
The leaves rotate during cleaning but are stationary during filtration. For wet discharge, the leaves rotate past a sluice nozzle. For dry discharge, the leaves rotate past scraper blades. The released cake is then evacuated by a screw conveyor.

TUBE OR CANDLE FILTER



The tube filter is a vertical tank filter with tubes suspended from a tube sheet. Filter cake is formed on the outside of the tube and filtrate flows up through the tube into the head and out. The tubes are cleaned by high rate backwashing often assisted by a hydraulic "pump".

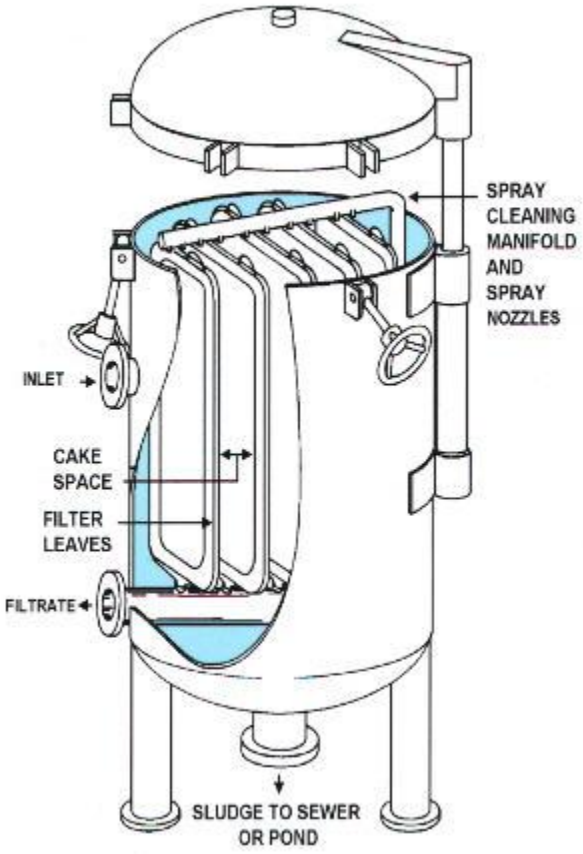
FILTER PRESS



The filter press has numerous versions. The illustration shows one with caulked-in metal septa with recessed cake space. Other types have flush plates dressed with paper or cloth separated by open frames where the cake is formed. The presses may be automated.

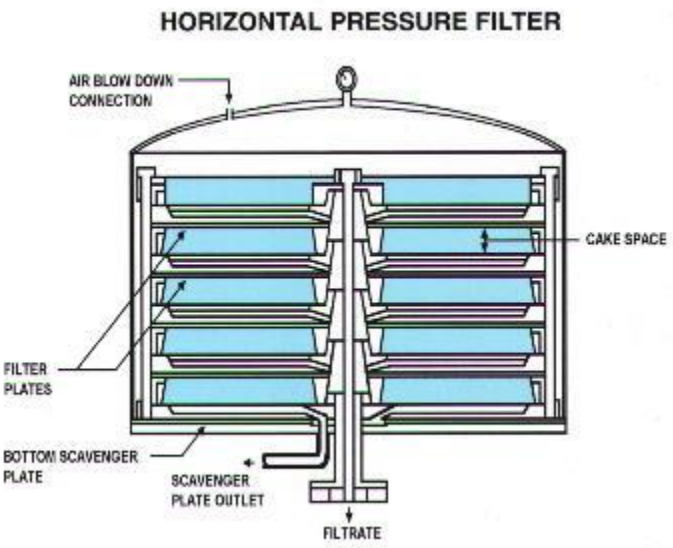
Some operate up to 250 psi (18 atm). The filter is used where dry cake discharge is required and in systems where no dangerous or toxic fumes exist.

VERTICAL TANK - VERTICAL LEAF FILTER



This filter has small floor space requirements, but must have sufficient head room for removal of the leaves. It has a high ratio of filter area to filter shell volume. It can be made as a wet discharge sluicing filter (as shown) or as a dry cake discharge filter with leaf vibrators.

HORIZONTAL PLATE FILTER



Filtration takes place only from the top of the plate in this filter so that even with intermittent operation, the cake remains in place. In the filter shown, the leaf assembly is cleaned and dressed (usually with paper) outside of the filter. In other variations, the cake may be discharged by means of a rotating sluice or may be spun off by centrifugal force by rapidly rotating the leaves.

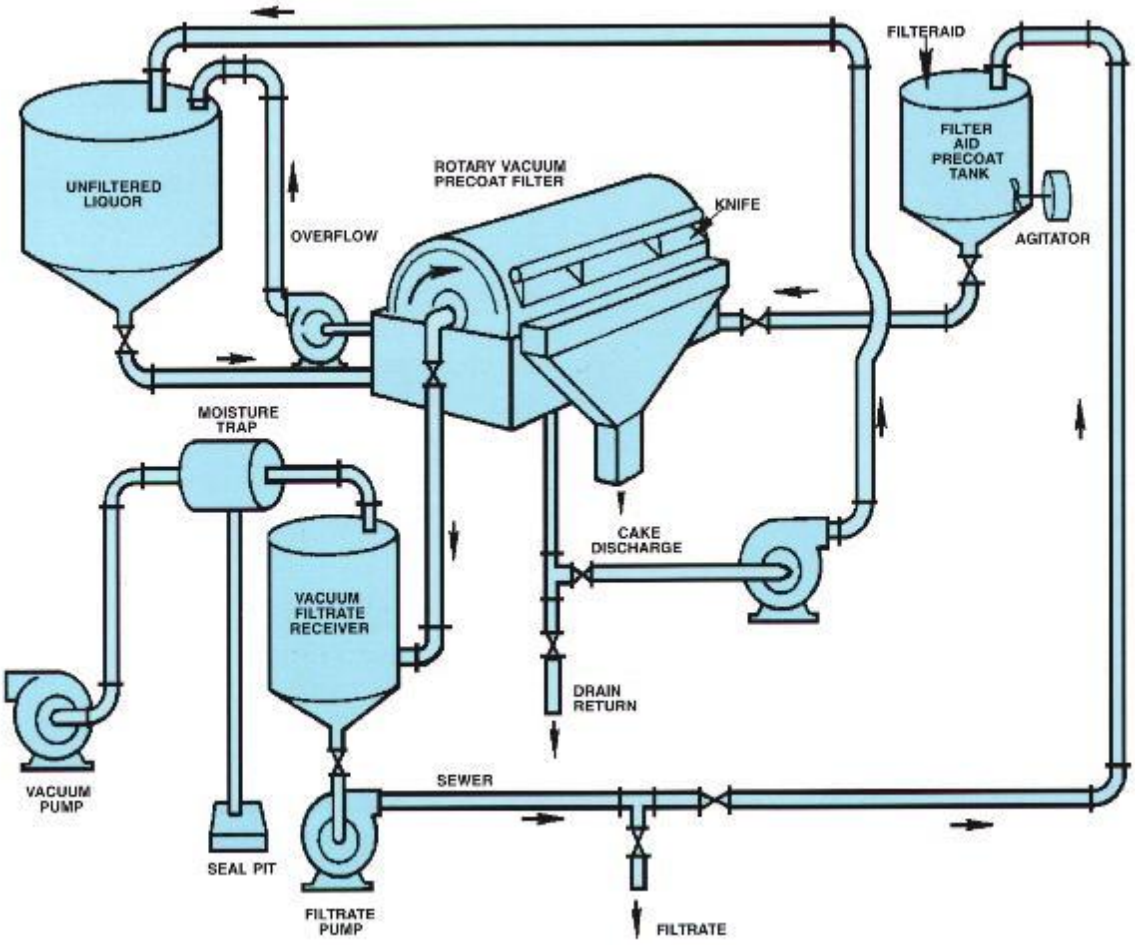
Rotary Vacuum Precoat

Rotary Vacuum Precoat Filters are typically used for thick, difficult to filter liquids or when the solids content is high. The precoat is formed on a drum with a cloth or metal-septum by recirculating a 2 - 5 % filter aid slurry. A 5 to 10 cm (2 - 4 inch) cake can be applied in an hour or less. Too rapid precoating rate and too high filter aid concentration can cause excessive cake cracking. The septum should be kept clean, as it can be a source of cake cracking and non-uniform thickness.

During the operating cycle, the process liquid passes through the cake leaving the solids on the precoat surface. A mechanically operated knife blade continuously shaves off the filterable solids and leaves a clean filtering surface. Selection of the proper depth of cut depends mostly on the nature and quantity of the solids. Cycle lengths vary from 8 to 24 hours typically, depending on depth of cut and cake thickness.

Flowrates are, for the most part, dictated by the filter aid solids and liquor viscosity. Common drum speeds range from 1 to 1/5 revolutions per minute. The optimum grade and type of filter aids is the grade which will maintain the solids on the surface of the cake. Optimum clarity occurs when solids are retained at the precoat surface. Dicalite personnel are available to aid in this selection. Laboratory filtrations are a no risk method for investigating this and all other filtration variables.

Dicalite perlite filter aids show superior performance in rotary vacuum filtration, with proven advantages in filter aid usage and resistance to cake cracking.



Notes

Permeability Flowrate (PFRv)

The constant volume filtration flowrate is measured by the permeability method (S.T.M. Nr. I-9). This relative value gives an idea of the filtration speed. It is the fundamental characteristic which differentiates one filter aid grade from another when the particles are formed into a filter bed or cake. Permeability is related to particle size distribution.

Permeability Cake Density (PCD)

The wet cake density is also measured by the permeability method (S.T.M. Nr. I-9). This value gives the wet cake density in lbs/ft^3 ($x16 \approx kg/m^3$). Perlite filter aids form lower density cakes than diatomite filter aids of comparable permeabilities. Densities of Dicalite perlite filter aids are controlled at a level found to be optimum for most effective performance.

Float

The float is measured by S.T.M. Nr. O-4. This value gives the amount of floating particles in ml/20g.