

FIBRE FILTRATION PRINCIPLES & FILTRATION VARIABLES

FIBRE FILTRATION PRINCIPLES

Pore size of the filter is the most important consideration when choosing a cartridge. Pore size is dependent on the following:

FIBRE DIAMETER

As fibre diameter decreases, mean pore size decreases. In other words, in order to get a finer filter, use thinner fibres.

POROSITY

Porosity is the ratio of the void volume to the total volume of a filter medium. Porosity can be decreased by winding a cartridge more tightly. Decreasing the porosity decreases the mean pore size and makes the filter finer. However, decreasing the porosity also increases the resistance to flow of the cartridge, consequently increasing the overall ΔP .

THICKNESS OF THE FILTER MEDIA

As filter medium becomes thicker, mean pore size decreases and as layers of medium are added to a cartridge, the pores become smaller. However, as with the case with porosity, adding layers to the medium increases the resistance to flow and, consequently, the overall ΔP .

*NOTE: DESIGNING A FIBROUS FILTER IS A JUGGLING ACT BETWEEN FIBRE DIAMETER, POROSITY AND THICKNESS OF FILTER MEDIUM.

FILTRATION VARIABLES

Filtration performance (life and efficiency) varies as operating conditions change. The guidelines described below are a basic outline of how operating conditions affect filter life and efficiency.

EFFECT ON EFFICIENCY

1. **Flow Rate** - High flow rates are detrimental to adsorptive retention mechanisms and, hence, decrease efficiency. This effect is more dramatic in wound cartridges and at higher micron ratings. Conversely a decrease in flow rates increases efficiency by enhancing adsorptive retention and

the ability to form a filter cake. Some evidence suggests that optimum efficiency occurs around 0.5 to 0.75 GPM/12 ft for pleated media.

2. **Differential Pressure** - In order to maintain a constant flow rate through a filter as it plugs with contaminant, more fluid must flow throughout the progressively smaller unplugged portions of the cartridge. This increases differential pressure and decreases efficiency.

*NOTE: IF THE DIFFERENTIAL PRESSURE IS ALLOWED TO EXCEED THE MANUFACTURER'S RECOMMENDED MAXIMUM, TYPICALLY 35 PSID, BOTH THE LIFE AND EFFICIENCY OF THE CARTRIDGE MAY BE COMPROMISED.

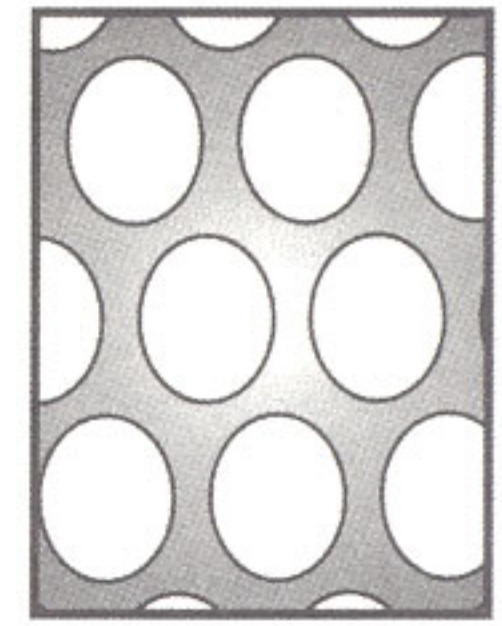
3. **Viscosity** - Increasing viscosity increases the hydrodynamic drag of the fluid and also increases the differential pressure required to push the liquid through the filter. Increasing the viscous drag is detrimental to adsorptive retention, consequently decreasing filter efficiency.

4. **Contaminant** - The relationship of particle size distribution to pore size determines the degree of surface versus depth filtration.

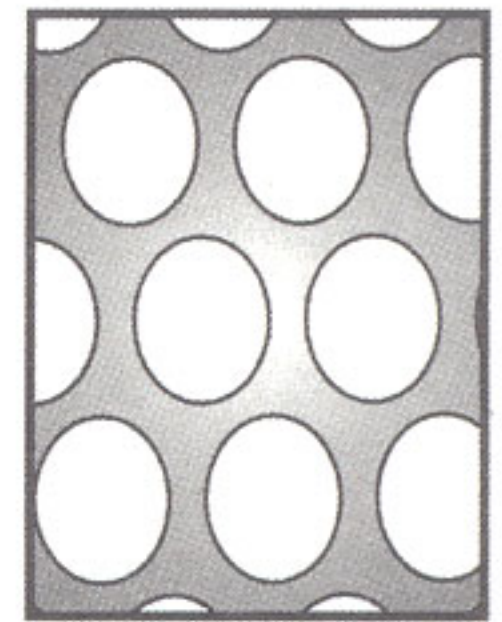
5. **Flow Conditions** - Cartridge filters are designed for use under steady flow conditions. Pulsating flow can disrupt a filter cake and/or dislodge particles that were adsorptively or even mechanically retained. Excessive pulsing can also cause structural damage to the filter.

6. **Compatibility** - Fluids that are not compatible with a filter can have various detrimental effects on filtration efficiency. Incompatibility can cause filter media to swell, become brittle, dissolve, shrink and separate from end seals and release fibres. The filter may become seriously weakened.

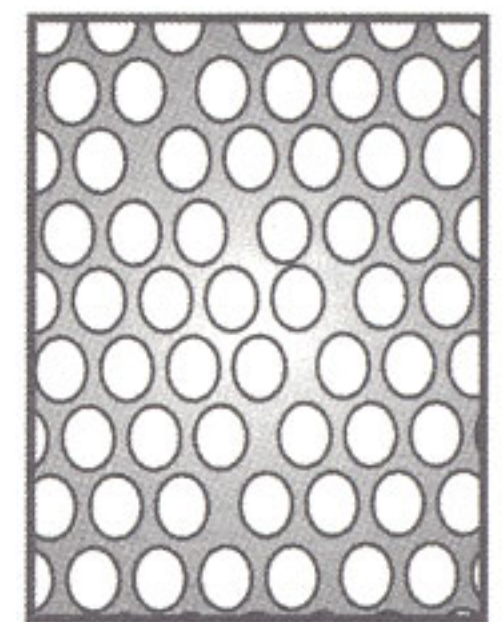
7. **Area** - Increasing filter area while keeping the flow rate constant reduces the flux or flow density (flow rate per unit area) and, therefore, increases filter efficiency.



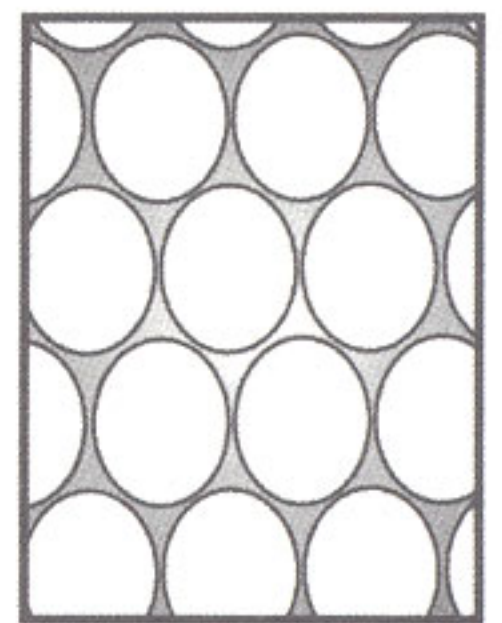
PORE SIZE



HIGHER POROSITY



PORE SIZE



LOWER POROSITY:
MORE FLOW RESISTANCE

