Flow through filter

The filters have a pressure drop given as function of standard flow, (slpm) at different system pressures: 30 , 60 and 90 psig. Before going further we define slpm units:

$$\text{slpm} := 1\,\frac{\text{L}\cdot\text{bar}}{\text{min}}$$

such that we can multiply an absolute volume rate by pressure to get the standard volume rate, e.g:.

$p_x := 10\text{bar}$ $\quad q_x := 1.0\text{lpm}$

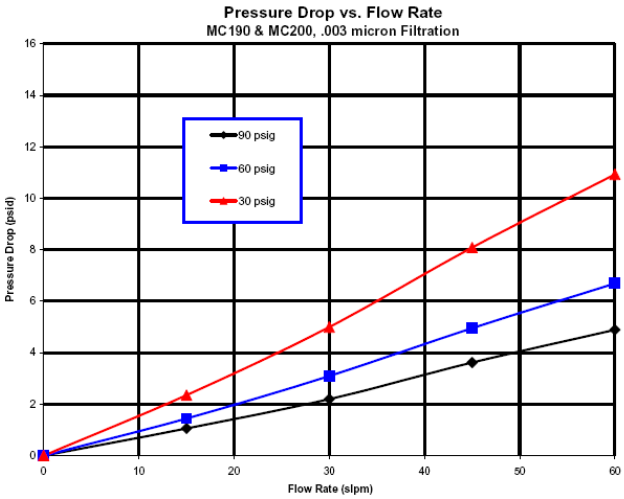
$sq_x := q_x \cdot p_x$ $\quad sq_x = 10\,\text{slpm}$

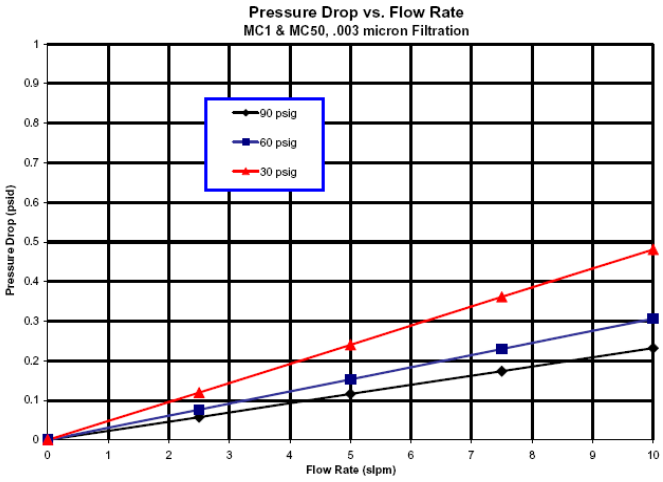
From filter datasheets (SAES MC50 and HP190), at 90 psig system pressure and at the nominal filter flow rate of 5 slpm we find a pressure drop of only:

$\Delta p_{hp190} := 0.3\text{psi}$ for the large hp190 filter @ 5 slpm nominal flow

and

$\Delta p_{mc50} := 0.03\text{psi}$ for the smaller MC50 filter @ 1.5 slpm nominal flow





This is at 90 psig; for 300 psig operation we have even less pressure drop through the filters, probably a factor of 3

Maximum standard flow rate for these filters (also from datasheet):

$sq_{max\_hp190} := 50\text{slpm}$

$sq_{max\_mc50} := 10\text{slpm}$

Pump (Pumpworks PW2070) flow rate is given in absolute volume rate, cfm (positive displacement pump):

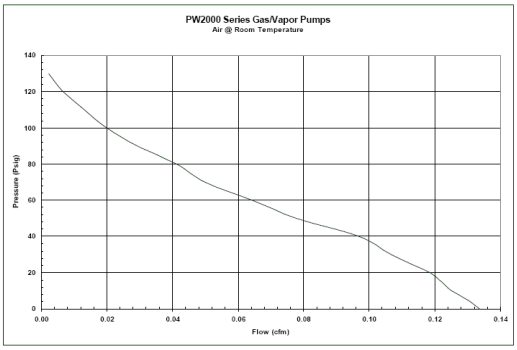


chart is essentially linear, with zero flow @ 130 psid and 0.14 cfm @ 0 psid so flow, as a function of pressure is:

$$q_{pw2070} := 0.14cfm - \frac{.14cfm}{130psi} \cdot \Delta p$$

so for our pump, operating at the filter (HP190) back pressure for nominal flow:

$$\Delta p := 0.30psi$$

$$q_{pw2070} := 0.14cfm - \frac{.14cfm}{130psi} \cdot \Delta p \quad q_{pw2070} = 0.14\,cfm$$

There is essentially no backpressure on the pump from either filter. Standard flow rate is:

$$^{s}q_{pw2070} := q_{pw2070} \cdot P_{MOP}$$

$$^{s}q_{pw2070} = 79\,slpm$$

this is much too high for either filter, especially the MC50 which, though smaller, has much less flow resistance and will see most of the flow; we will need to reduce either flow rate with the controller or add a flow restrictor if we are to avoid exceeding the maximum flow rate published.This immediately raises the question of how to balance the flow through the two filters (or is only one used at a time). Or, is it even important to balance the flow?