

SIZING **HYDAC** FILTER ASSEMBLIES

To properly size and calculate the pressure drop across a filter for a particular application the following procedures should be strictly followed:

Assembly pressure drop (ΔP) is the sum of the ΔP across the filter housing plus the ΔP across the filter element. This simple formula is shown below:

$$\Delta P \text{ Filter Assembly} = \Delta P \text{ Housing} + \Delta P \text{ Element}$$

To calculate a filter assembly ΔP we must first know the specifics of the application.

To calculate the ΔP across the housing we must know the flow rate and specific gravity of the fluid we wish to filter. A chart is provided in each of the product brochures that provides a curve outlining the pressure drop across the housing assembly based upon the flow in gpm (gallons per minute). This data must then be adjusted if the specific gravity is at a lower or higher point than standard Hydraulic Fluid (0.86). The formula for calculation of the housing ΔP is shown as follows:

$$\Delta P \text{ Housing} = \Delta P \text{ Calculation (From Curve on Literature)} \times \frac{\text{Actual Specific Gravity}}{0.86}$$

To calculate the ΔP across the element additional information is required. This will include the **viscosity** of the fluid (at operating temperature), required **filtration rating in μm** (micron), **type of element** - (High collapse -BH3HC or Low collapse -BN3HC), and **K** (coefficient) factor from the attached conversion tables. With this information the following formula is used to calculate ΔP across the element. Again the specific gravity and viscosity (standard hydraulic fluid figured at a viscosity of 141 SSU - Saybolt Seconds) will change the ΔP .

$$\Delta P \text{ Clean Element} = \text{Flow Rate (gpm)} \times \text{Element K factor} \times \frac{\text{Actual Specific Gravity}}{0.86} \times \frac{\text{Actual Viscosity in SSU}}{141}$$

EXAMPLE #1 - an application with the following criteria would be sized as shown.

CONDITIONS:	Fluid - Hydraulic Oil	Flow Rate - 30 gpm
	Specific Gravity - 0.86	Max. Operating Pressure - 4,500 psi
	Viscosity - 141 SSU	Normal Operating Pressure - 4,000 psi
	Micron rating - 10µm	Bypass - YES (<i>Low collapse element</i>)

FILTER TYPE TO BE SIZED: HYDAC Model No. DF BN3HC 240 G 10 D 1.1

HOUSING:

$$\Delta P \text{ Housing} = \Delta P \text{ Calculation (From Curve on Literature)} \times \frac{\text{Actual Specific Gravity}}{0.86}$$

$$\Delta P \text{ Housing} = 4.0 \text{ psid} \times \frac{0.86}{0.86} = 4.0 \text{ psid}$$

ELEMENT:

$$\Delta P \text{ Clean Element} = \frac{\Delta P \text{ Calculation}}{\text{(Flow rate in gpm} \times K \text{ Factor)}} \times \frac{\text{Actual Specific Gravity}}{0.86} \times \frac{\text{Actual Viscosity}}{141 \text{ SSU}}$$

$$\Delta P \text{ Clean Element} = 30 \text{ gpm} \times 0.314924 \times \frac{0.86}{0.86} \times \frac{141 \text{ SSU}}{141 \text{ SSU}}$$

$$\Delta P \text{ Clean Element} = 9.44772 \times 1 \times 1 = 9.45 \text{ psid}$$

FILTER ASSEMBLY:

$$\Delta P \text{ Filter Assembly} = \Delta P \text{ Housing} + \Delta P \text{ Clean Element}$$

$$4.0 \text{ psid} + 9.45 \text{ psid} = 13.45 \text{ psid}$$

NOTE:

A change in the fluid can make a significant difference in the pressure drop across a filter assembly. Using the same criteria except changing only the specific gravity and viscosity of the fluid to be filtered will provide the following pressure drop. See following page for an example.

EXAMPLE #2 - an application with the following criteria would be sized as shown.

CONDITIONS:	Fluid - Hydraulic Oil	Flow Rate - 30 gpm
	Specific Gravity - 0.94	Max. Operating Pressure - 4,500 psi
	Viscosity - 200 SSU	Normal Operating Pressure - 4,000 psi
	Micron rating - 10µm	Bypass - YES (<i>Low collapse element</i>)

FILTER TYPE TO BE SIZED: HYDAC Model No. DF BN3HC 240 G 10 D 1.1 / 12 V-B6

HOUSING:

$$\Delta P \text{ Housing} = \Delta P \text{ Calculation (From Curve on Literature)} \times \frac{\text{Actual Specific Gravity}}{0.86}$$

$$\Delta P \text{ Housing} = 4.0 \text{ psid} \times \frac{0.94}{0.86} \text{ or } (1.093) = 4.37 \text{ psid}$$

ELEMENT:

$$\Delta P \text{ Clean Element} = \Delta P \text{ Calculation} \times \frac{\text{Actual Specific Gravity}}{0.86} \times \frac{\text{Actual Viscosity}}{141 \text{ SSU}}$$

*(Flow rate in gpm
x K Factor)*

$$\Delta P \text{ Clean Element} = 30 \text{ gpm} \times 0.314924 \times \frac{0.94}{0.86} \times \frac{200 \text{ SSU}}{141 \text{ SSU}}$$

$$\Delta P \text{ Clean Element} = 9.44772 \times 1.093 \times 1.42 = 14.663 \text{ psid}$$

FILTER ASSEMBLY:

$$\Delta P \text{ Filter Assembly} = \Delta P \text{ Housing} + \Delta P \text{ Clean Element}$$

$$4.37 \text{ psid} + 14.663 \text{ psid} = 19.033 \text{ psid}$$

NOTE:

A change in the fluid or a high vs. low collapse element can make a significant difference in the pressure drop across a filter assembly. Using the same criteria except changing the specific gravity and viscosity of the fluid to be filtered and the element to a high collapse will provide the following pressure drop. See following page for an example.

EXAMPLE #3 - an application with the following criteria would be sized as shown.

CONDITIONS: Fluid - Hydraulic Oil	Flow Rate - 30 gpm
Specific Gravity - 0.94	Max. Operating Pressure - 4,500 psi
Viscosity - 200 SSU	Normal Operating Pressure - 4,000 psi
Micron rating - 10µm	Bypass - NONE (<i>High collapse element</i>)

FILTER TYPE TO BE SIZED: HYDAC Model No. DF BH3HC 240 G 10 D 1.1 / 12 V

HOUSING:

$$\Delta P \text{ Housing} = \Delta P \text{ Calculation (From Curve on Literature)} \times \frac{\text{Actual Specific Gravity}}{0.86}$$

$$\Delta P \text{ Housing} = 4.0 \text{ psid} \times \frac{0.94}{0.86} \text{ or } (1.093) = 4.37 \text{ psid}$$

ELEMENT:

$$\Delta P \text{ Clean Element} = \frac{\Delta P \text{ Calculation}}{\text{(Flow rate in gpm} \times K \text{ Factor)}} \times \frac{\text{Actual Specific Gravity}}{0.86} \times \frac{\text{Actual Viscosity}}{141 \text{ SSU}}$$

$$\Delta P \text{ Clean Element} = 30 \text{ gpm} \times 0.314924 \times \frac{0.94}{0.86} \times \frac{200 \text{ SSU}}{141 \text{ SSU}}$$

$$\Delta P \text{ Clean Element} = 16.011 \times 1.093 \times 1.42 = 24.85 \text{ psid}$$

FILTER ASSEMBLY:

$$\Delta P \text{ Filter Assembly} = \Delta P \text{ Housing} + \Delta P \text{ Clean Element}$$

$$4.37 \text{ psid} + 24.85 \text{ psid} = 29.22 \text{ psid}$$