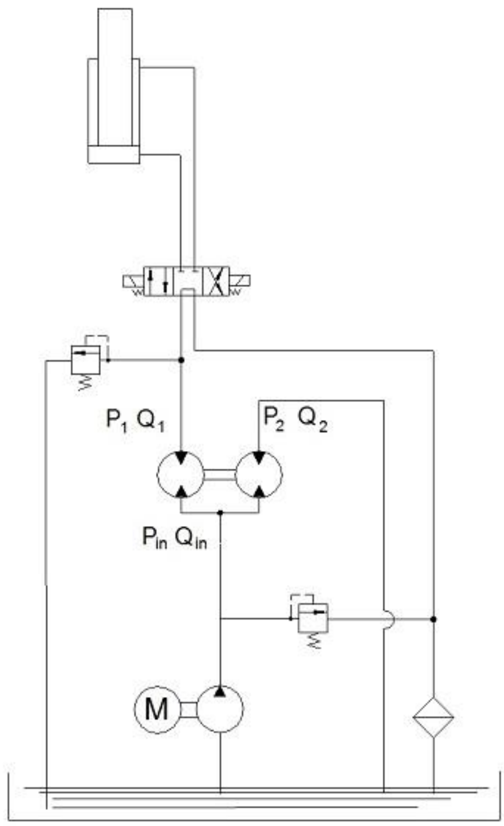
FLOW DIVIDER USED AS PRESSURE AMPLIFIER



We define using the schematization in the figure the following equation of energy balance:

$P_{in}Q_{in} = P_1Q_1 + P_2Q_2 + K$

P is the pressure, Q is the Flow Rate and K is a coefficient due to the loss of pressure caused by frictions.

If we consider initially K as irrelevant and we send the second outlet pressure to the tank ($P_2 = 0$), the formula can be simplified as follow:

$P_{in}Q_{in} = P_1Q_1$

In another way:

$\frac{P_{in}}{P_1} = \frac{Q_1}{Q_{in}}$

This means that except the K factor connected to the loss of pressure depending on the flow divider internal friction, the ratio between in and out pressure is inverse proportional to the ratio of the flow rates.

In a 2 sections flow divider with the same displacement, where $\frac{Q_1}{Q_{in}} = 0.5$, the output pressure became double.

By choosing the correct displacements between the elements, it is possible to have different ratio on the flow rate that can bring to the desired pressure increase, this result reached by sending a part of the flow to the tank.

K value is influenced by many factors (rotation speed, displacement, oil viscosity, etc.), to simplify the evaluation we shall consider it by decreasing 20-30 bars on the pressure improvement.

It's extremely important to keep in mind that the maximal pressure are not allowed to change and are still the same of the standard use. This means that **the pressure improvement can't overlap the values indicated as maximal** typical for the different displacement (as indicated in our catalogues)

EXAMPLE 1

Let's consider to have approximately 10 liters as inlet at 100 bars and to have the necessity to double the pressure.

If we consider to use a two elements flow divider, for example 2.2 cc x 2. By exactly dividing in two the flow rate we have:

$$\frac{P_{in}}{P_1} = \frac{Q_1}{Q_{in}} = 0.5$$

This means that in theory the pressure became:

$$P_1 = \frac{P_{in}}{0.5} = \frac{100}{0.5} = 200\ bar$$

If we now consider the loss of pressure, the final result should be to have 5 liters at 170 – 180 bar

EXAMPLE 2

Let's consider to have the same situation (approximately 10 liters) at 100 bar.

In this case we can consider to use a two elements flow divider with different displacements, for example 2.2 cc + 2.6 cc, and the biggest output is sent to the tank. By knowing that the flow rate Q is equal to the displacement multiplied by the revolution per minute (RMP), we shall determinate the flow rate ratio with the following approach:

$$\frac{P_{in}}{P_1} = \frac{2.2 * RPM}{(2.2 + 2.6) * RMP} = \frac{2.2}{4.8} \cong 0.45$$

This means that the pressure in theory became:

$$P_1 = \frac{P_{in}}{0.45} = \frac{100}{0.45} \cong 220\ bar$$

Naturally even the flow rate has the same proportion, so for this reason the result that we can expect, always considering a loss factor of 20-30 bar, is 4.5 liters (this value obtained by multiplying the total flow rate to the ratio) at 190 – 200 bar

By correctly choosing the flow rate is possible to find the solution that fits better the specific need.