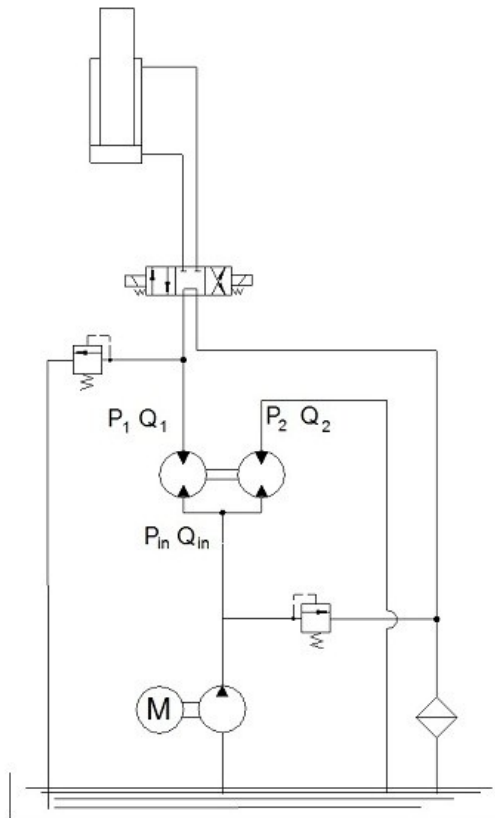


## FLOW DIVIDER USED AS PRESSURE AMPLIFIER



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

$$P_{in} Q_{in} = P_1 Q_1 + P_2 Q_2 + K$$

P is the pressure, Q is the Flow Rate and K is a coefficient that correspond 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 follows:

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

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 frictions, the ratio between in and out pressure is inversely proportional to the ratio of the flow rates.

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

By choosing the correct displacements between the available ones, it is possible to have different ratios on the flow rates that can bring to the required 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.

It's extremely important to keep in mind that the maximal working pressures 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 displacements (as indicated in our catalogues)

#### EXAMPLE 1

Let's consider to have approximately 10 liters as inlet at 100 bars and to wish 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 the theoretical pressure becomes:

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

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

#### EXAMPLE 2

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

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. Knowing that the flow rate Q is equal to the displacement multiplied by the revolutions per minute (RMP), we shall determinate the flow rate ratio with the following approach:

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

This means that the theoretical pressure becomes:

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

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

By correctly choosing the displacements it is possible to find the solution that fits better the specific requirements.