HIDRACAR S.A.

UNQUESTIONABLE BENEFITS OF INSTALLING A PULSATION DAMPENER AT THE DISCHARGE OF SINGLE-EFFECT DOSING PUMPS

As we have already seen, all single effect dosing pumps does not supply any flow during the filling or suction cycle of the pump. This means that at the end of such cycle, the pumping pressure has been reduced to “zero”. The liquid column inside the discharge pipe has stopped.

On starting the course of discharge or the exiting of the liquid from the pump, the liquid column must overcome:

a) The inertia of the mass of the liquid that has stopped.

b) The resistances that are generated in the circuit against the movement of the liquid. These resistances are:

I) Geometrical height.

II) Head loss.

CONSEQUENTLY, the pressure at the outlet of the pump goes from “zero” to a pressure generated by resistances *a* and *b*.

This variation of pressure, from “zero” to a maximum value, creates the following problems:

- Fatigue of the material of the pump mechanisms, piping, filters, flow meters, threaded or flanged couplings, etc…
- Vibrations that end up producing leaking of the liquid at the couplings.
- The impossibility of getting a precise reading of the flow meter.

All this shows how necessary is the installation of a pulsation dampener to avoid all the problems that have been exposed. As the dampener procures a more constant flow in the pipe, it is possible to calculate more accurately its section and it always results in a diameter reduction. This alone already redeems in part the extra cost assumed on installing the dampener.

Let’s see now how we can reduce to a certain extent the cost of the dampener.

As we already know, every time the size of the dampener must be calculated it is necessary to know the residual pulsation percentage that can be admitted or tolerated in the circuit. The final customer always tends to reduce this value when asked about, even though in most cases it is not necessary to adjust it to such tight values. In any case the pumping pressure must always be taken into account (it is not the same a wide percentage for a low pressure, say 6 bar than for a pressure of 200 bar or higher).

A simple illustration will make evident the reduction in the size of the dampener, just increasing slightly the percentage of residual pulsation (for a single piston pump):

If the pump head: 50 c.c.
The pumping pressure is: 6 bar
The initial residual pulsation is: +/- 4%
The size of the dampener will be:

$V_0 = (\partial V \times P_2) / 0.64 \times (P_2 - P_1) = (25 \times 6.24) / (0.64 \times 0.48) = 498.29$ c.c.
V_0 = Dampener size.
∂V = Volume of liquid the dampener will store and return = pump head / 2 (for single piston or membrane pumps)
$P_2 = 6 + (4 \times 6 / 100) = 6.24$ bar
$P_1 = 6 - (4 \times 6 / 100) = 5.76$ bar

<u>If we take a pulsation % of +/- 8%</u>

$P'_2 = 6 + (8 \times 6 / 100) = 6.48$ bar
$P'_1 = 6 - (8 \times 6 / 100) = 5.52$ bar
and $V'_0 = (25 \times 6.48) / (0.64 \times 0.96) = 258.68$ c.c.

We then see that if we change from a +/- 4% residual percentage to a +/- 8%, the size of the dampener has been reduced to approximately by half.

Pressures will fluctuate, with a 4%
+6.24; -5.76
and with a 8% residual pulsation
+6.48; -5.52
the fluctuation is just +/- 0.24 bar (difference between 6.48 – 6.24 = 0.24).

In a few words with a higher residual pulsation percentage (8%) the pressure fluctuation in the circuit is of just:
+6.48 bar; -5.52 bar (for a theoretical pumping pressure of 6 bar)

<u>FINAL SUMMARY</u>

In the single-effect dosing pump application, what is important is avoiding the fluctuation of the pump discharge pressure from “zero” to a maximum as it will eventually generate breakdowns in the circuit.

Therefore and unless the final customer wants to control with great precision the pressure fluctuation, ***HIDRACAR*** recommends, for these working pressure values (below 10 bar) to calculate the dampener size with a percentage of +/- 8% in order to avoid an important extra cost of the pump + dampener combination.

FEBRUARY 2019