

Volume 1
Issue 9

Variable Pre-charge
Systems:

- Optimize production rates
- Offer flexible machine set ups quickly
- Can be pre-programmed into machine PLC's

Use Variable Pre-charge System On:

- Variable load machines
- Metal forming equipment
- Tag Axles
- Suspensions



Variable Pre-Charge

By Paul Sakowicz

Have customers been asking for help designing or retrofitting machines; machines having a wider operating tonnage range *and* at the fastest possible cycle times?

If so, using a variable pre-charge accumulator system will economically help you achieve both goals.

A variable pre-charge system allows you to either increase or decrease the nitrogen pre-charge pressure, getting either more force or more speed from the actuator. Varying the force on stored oil volume optimizes the available pump flow, motor horsepower, and accumulator output for any part, thereby reducing cycle time for the widest range of parts.

For example, a metal stamping press may be designed from 18-gauge (0.048") to 10-gauge (0.135"). If only a pump and motor are used, you would have to size the pump for the maximum flow rate and the motor for the peak horsepower required for stamping the 10-gauge material. Correspondingly, often these types of systems use very large pumps, electric motors, and motor starters.

By using a variable pre-charge system, you essentially add a horsepower control (torque control) to your system, maximizing performance under all conditions. It also has an advantage over conventional pump horsepower control systems because there is a seamless

change from the high flow, low-pressure condition to the low flow, high-pressure condition allowing you to quickly stamp through the material.

How does it work? Using a two accumulator arrangement with piping attached to the gas end as shown in the drawing below, you can vary the pre-charge pressure using the hand pump to compress and increase the nitrogen gas pressure, thereby providing the minimum force necessary to stamp through thicker materials like the 10-gauge.

Conversely, when thinner materials like the 18-gauge are set up on the machine, you could bleed off oil through the needle valve to allow more oil volume to be stored into the accumulator; thereby increasing the volume of oil released to the actuator when a directional valve is shifted.

Each part to be run on a machine could be set up and tested to work at the optimal nitrogen pressure versus flow rate, providing the shortest possible cycle time on the machine for *every part run!*

Instead of a hand pump, you could also set up the circuit using an adjustable reducing valve, tee off the main hydraulic system, or an air/oil pump controlled with either a manual regulator or an I/P

regulator from the machine's PLC.

One final note about the above circuit. With two equivalent sized accumulators piped together on the gas end, you have a 50% adjustable range on your pre-charge pressure. With two 10 gallon accumulators at 1000 psi pre-charge, you can increase the pre-charge all the way up to 2000 psi with the hand pump, following the equation $P_{gas\ initial} * V_{gas\ initial} = P_{gas\ final} * V_{gas\ final}$. If you wanted to increase it more, you'd have to have a larger volume accumulator to be able to pump the pre-charge up to where you want it.

Where can a variable pre-charge system be used? Anywhere you have a variable load, like on metal forming equipment, tag axles, and suspensions.

