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## AIA: Control System Retrofits Make Old Presses Better Than New

Control system retrofits can save manufacturers up to 50 percent of the cost of a new machine.

Most older hydraulic machines, especially press equipment, use limit switches and pressure limiters to control two-position hydraulic valves. These valves are often called "bang-bang" valves because of the shock and noise that result from the coarse back-and-forth cylinder operation. Adapting these machines so that they can manufacture new products requires adjusting pressure limits with knobs and moving the physical location of the limit switches. This takes time and operator skill.

With the marketplace moving to low-volume production, machine changeover times and the variability of operator skills and accuracy can become limiting factors. In addition, companies can't afford to waste material while they adjust their processes. Machine tuning also becomes harder as the machine ages. Old equipment is typically worn from years of use, making precise adjustments harder to accomplish.

Is there hope for these old machines? Absolutely. Hydraulic machines make particularly good candidates for control system retrofits, which can save the owner up to 50 percent over the cost of a new machine. They can also provide a better product.

A case in point is the upgrade of a line of powder metal presses for the Hydraulic Press Div. of Alpha Lehigh (Alpha, NJ). Concept Systems Inc. (Albany, OR), a control systems integrator, retrofitted these presses.

Powder metal presses form complex, molded metal parts with uniform density throughout a varying cross-section. The presses can handle a range of different powder materials. Uniform material transfer is key to powder press operation. Multiple hydraulic cylinders and pistons are typically used to form a mold cavity. A mixture of metal powder and binders is pushed into the cavity. It is then compressed by the cylinders into the required shape. After compression, the part is baked to achieve the hardness of the final product. Using this method to produce parts allows manufacturers to avoid the expensive machining step that was traditionally used to make small metal parts.

Presses are good examples of complex force-position control applications that benefit from a combination of PLC-based control and event-step control executed by a special-purpose motion controller. The PLC and motion controller are tightly integrated, with the motion controller executing complex motion steps under instruction from the PLC. This simplifies PLC programming and allows the programmer to use the motion controller for



sequences requiring tight coordination or that require tight status monitoring so operating modes can be adjusted quickly.

In the upgraded press control system, the motion controller controls each hydraulic axis through a proportional servo valve, allowing the system to smoothly accelerate and decelerate. Position feedback is provided via magnetostrictive displacement transducers (MDTs). Analog transducers installed in the cylinders as part of the retrofit operation provide hydraulic pressure feedback. These transducers interface directly to the motion controller to support precise closed-loop control of the compression process. Unlike limit switches and pressure release valves that activate only when the limit has been reached, the new transducers provide progressive information throughout a move operation.

The motion controller (an RMC100 model) was supplied by Delta Computer Systems Inc. (Vancouver, WA). This controller samples data from the transducers every 10 to 20 milliseconds, enabling it to produce complex, smooth motion profiles. The transducers also allow the controller to slow the actuators gracefully before changing direction.

With fully programmable motion control capability, the speed of powder loading into the mold cavity can be varied, as can the powder compaction pressure.

Alpha Lehigh has added a sophisticated new application. This application involves moving the compression cylinder up and down rapidly to “fluff” the powder to improve the end product. This action would be impossible using the machine’s old bang-bang valve control system. The new control system supports press parameter tuning using a graphical interface.

Besides configuring and operating the press differently for different product “recipes,” the control system must also deal with the variability from one batch of powder to the next. Environmental variability, such as changes in temperature and humidity, can affect the quality of the process. This variability is managed by tight, closed-loop process control.

Because the motion controller can be connected to a factory network, the new control system enables automated tracking of product quality data. Process data is fed to other computer systems at the plant level for statistical process control.

The development, maintenance and operation of production recipes are facilitated through a new operator screen interface, implemented by Concept Systems. Once the machine operator selects a particular recipe, the PLC automatically configures the press to support it. Through complete control of all process variables, machine changeover times are greatly reduced, and operational accuracy is improved. This has improved product consistency and quality, and increased machine throughput.

Preliminary data since the control system retrofit suggest that a 50 percent increase in production throughput is possible with the new control system. Production part quality has also improved. Before the control system retrofit, machine operators used to perform time-consuming inspections on 100 percent of the machine’s output to weed out defects. Now, the quality of parts is consistently high enough that the parts can be sent to the next operation without additional inspections.

Machine vendors are quick to suggest that new machines are more efficient and can provide higher throughput. However, machine owners are wise to consider a new option, made possible by the continuous improvement of electronic control systems. By employing this strategy, some machine owners have been able to obtain the same or higher productivity of brand new machines at half the capital cost?or even less.

For more information on motion control systems, call Delta Computer Systems at 360-254-5435 or visit [www.deltacompsys.com](http://www.deltacompsys.com).



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