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A Hatton-Brown Publication

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Particleboard Press Retrofit Improves Output, Cuts Costs

January 2006

A major current trend in automation is for factories to retrofit control systems in order to make machines more productive and decrease lifecycle costs. A case in point is the upgrade of the control system of a hydraulic particleboard press at the Collins Products particleboard plant in Klamath Falls, Ore.

In the manufacturing process, a mixture of wood fiber particles and resin is formed onto large plates. The plates, sized for the finished particleboard panels, are then loaded into a 14-opening press, and compressed with large hydraulic rams until the fiber panels reach the correct density and thickness. The stack is held at the desired pressure for a predetermined period of time and then the pressure is released and the press opens to allow removal of the plates and compressed panels.

Collins' original press, built some 30 years ago, weighs 2 millions lbs. when fully loaded. The panel compression is accomplished by supplying hydraulic oil to four 35 in. rams. The press was fitted with a 5000 gallon reservoir and pumping system. All the pumps, totaling 1200 HP, ran constantly during press operation to ensure that adequate pressure and flow was available. The compression cycle was controlled by a PLC operating digital (open/closed, sometimes called "bang-bang") valves activated by solenoids under the control of a Siemens PLC. The system experienced a great deal of shock caused by switching such a high flow of oil on and off. This caused the pipes to shake and vibrate severely. Typically, maintenance repairs to pumps or leaking pipes needed to be made monthly due to the effects of system vibration.

In September 2004, the press was refitted with a complete new hydraulic system. The new system included a 10,000 gallon reservoir and six pairs of process pumps. The valves and piping are sized to pass fluid at a rate of approximately 25,000 gallons per minute when the press opens. Pressure is provided by one pair of "pressure" pumps, which handle fine-tuning of the press position and then holds the press at the desired position and five pairs of "volume" pumps that supply high volume fluid flow when it is required. In the effort to conserve energy, the "volume" pumps run only when the

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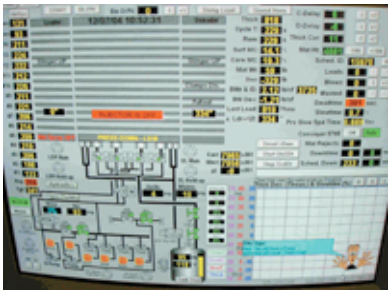
press is closing and are turned off for the remainder of the press cycle.

To smooth out the flow of hydraulic fluid in the system, Pacific Fluid Systems replaced the solenoid-controlled digital valves with proportional valves. To develop the new pump and valve control system, Collins Products called in Concept Systems Inc., an Albany, Ore. integrator with lots of experience in retrofitting new control systems into existing plants.

Concept Systems engineers reprogrammed the existing Siemens PLC to control the valves with analog output levels, and to control the hydraulic pumps individually. A byproduct of more active control of the pumps and valves was the ability to regulate the fiber press decompression process more closely and shave seconds off of the overall production cycle.

Collins' production managers estimated that each second that can be saved converts directly to increased production capacity for the press. The company's goal for the control system retrofit was to shave at least five seconds off the cycle, and Collins believes that this goal has been achieved. And while the old system used to shake and vibrate as the pipes carried the decompression fluid flow, the new system operates very smoothly, resulting in decreased maintenance costs.

Another area for cost savings is in power consumption by the hydraulic pumps. In the previous hydraulic system, as mentioned above, all of the hydraulic pumps ran continuously. Pacific Fluid Systems came up with the idea to operate each hydraulic pump independently. By turning the pumps on only when they are needed, it is possible to save a significant portion of the total power that used to be consumed by the pumps. The Energy Trust of Oregon, an independent nonprofit organization dedicated to energy efficiency and renewable energy development, was so interested in this idea that they agreed to fund part of the control system retrofit.



The previous control system implementation had a graphical operator interface that was based on software by Wonderware (Lake Forest, Calif.). The upgraded control system extends the use of Wonderware to allow the hydraulic pumps to be used interchangeably. If a pump fails, the system can continue to operate. The system also uses redundant MTS Temposonics magnetostrictive displacement transducers (MDTs) to measure the position of the hydraulic cylinders, ensuring continued operation if one MDT should fail.

Concept Systems' new control system design also provides improved diagnostics. The hydraulic valves provide LVDT signals that can be monitored to show how much the valves are open, providing confirmation of the valve's response to the control signals provided by the PLC. As part of a maintenance program, Concept also instrumented pump case drain flow meters to measure system leakage over time (an indicator of system wear). The pump operation and hydraulic fluid temperature are also monitored. All key status indicators are displayed on a PC screen by a Wonderware application. The PC is connected to the Siemens PLC via Ethernet.

Collins estimates that the productivity increases owing to the particleboard press retrofit have improved overall plant productivity by 1-2%, and cost savings stemming from the decreased consumption of electricity by the pumps has been calculated to be 57%. And whereas monthly repairs were required to keep the old system running, smoother operation due to the elimination of vibration sources has enabled the new system to be maintenance-free for the nine months that it has been in operation.

The quality of the machine's output has also been made consistently high. The old press sometimes had "blow out" problems when the press was almost closed. Now, with the new system, the speed of press closure can be smoothly ramped down to eliminate such problems. Other machine owners that have machines with old digital "bang-bang" hydraulic valves would do well to consider Collins' example.

This article was submitted by Concept Systems, Inc. For more information, please visit www.conceptsystemsinc.com.

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Published by
Hatton-Brown Publishers, Inc.