Paper Mill Achieves Zero Valve Failure Rate Over 12-Year Period

Longevity of Equipment Proves the Value of a Clean-Filtration System

By Sean Insalaco

When contamination causes a hydraulic system to fail, companies often lose $5,000 to $13,000 per hour in downtime as valves, pumps and other equipment are replaced. And those figures do not include the cost of repairs and replacements — both to hydraulic components and manufacturing equipment or work in progress damaged by the shutdown.

In contrast, proper filtration systems and procedures can avoid such costly downtime and potential equipment damage. Such steps, while relatively simple, are often overlooked or given inadequate attention. The result is lost time, lost productivity and sometimes lost equipment or materials.

The key to avoiding these problems is the design, implementation and maintenance of a clean-system approach to hydraulic maintenance. There are several different designs for a filtration system. This article examines one of the best available configurations and looks at the results proper filtration has generated for a major paper mill in the southeastern United States.

System Design

Moog Inc. recommends that mills maintain, at a minimum, ISO 4406 14/11 cleanliness level on all hydraulic systems. This level enables equipment to be used continuously for at least 9,000 to 10,000 hours — or approximately 15 months of "round-the-clock" usage. The next level of filtration, ISO 13/10, enables the user to further extend intervals between service to over 30,000 hours.

To achieve the minimum ISO 14/11 rating, Moog recommends a scheme consisting of five filters: off-line, pressure line, return line, air vent and make-up oil transfer. This is shown in the accompanying schematic.

- The off-line, or kidney-loop filter, requires a recirculation pump and a three-micron filter. The pump and filter should be sized to circulate the volume of fluid in the reservoir at least four to six times per hour. This loop removes most of the contamination from the system.
- The second filter, for the pressure line, is a 15-micron non-bypassing point-of-usage filter in the high-pressure line. This filter acts as a "last chance" filter to catch any contamination generated by a deteriorating pump.
- The third filter, in the return line, is a three-micron filter. This filter removes any contamination that was introduced into the system from the device that actuates the load.
- The fourth filter, on the air vent for the reservoir, prevents the introduction of airborne particulates during reservoir level changes. Moog recommends using a three-micron filter on the air vent.
- The last filter, on the transfer cart, prevents the introduction of contaminants in new oil. New oil is not clean oil and should be filtered to three microns before putting it in the sump.

When one Moog customer, a brass mill, underwent an extensive program of updating its total hydraulic fluid system, the annual repair rate for servo and proportional valves dropped dramatically from 200 units per year to five per year. Lower repair costs alone resulted in annual savings of more than $75,000, which does not include the countless hours of system downtime that have been avoided.

One Plant's Experience

A paper mill in Arkansas adopted a clean-system approach for a calendering line when the plant opened in 1987. Almost 12 years later, the plant has never experienced a valve failure, and it took more than seven years for a pump to fail.

A total of 36 valves on the calendering line have been operating since the plant began operations, according to Jim Vandever of Air-Draulics, which sold Moog valves to the plant. "They're in their 12th year of operation, and they've never changed or cleaned or done anything with the valves," he said. "That ought to be a world's record."

The calendering line consists of two machines with two rollers per machine. There are nine Moog valves on each of the rollers. The key to the long life of the valves, not to mention the pumps in the system, is the placement of a two-micron filter, manufactured by Pall Corp., in front of each roller. The plant uses filters to keep the oil clean, but they can also provide an indication of problems somewhere else on the line.

The filters have saved the plant from two major problems that would have caused severe damage, possibly on every piece of equipment on the line — pumps as well as valves. In one situation, the head of a piston broke off and contaminated the system with brass metal. Another time, a metal pin came out of a roller, generating metal particles. If the filters had not been there, those particles would have ruined the valves and forced the plant to replace the pumps in the system as well. Thanks to proper filtration, the plant's record for replacing pumps is almost as good as its record for replacing valves. The first pump was replaced after seven years of continuous operation, and some pumps are the originals.

Filter elements cost about $500. That replacement cost is minimal, considering that contamination from large particles could mean replacement of all the valves on a machine. With valves costing up to $4,000 each, the bill could run $72,000.

Filter elements, in addition to costing less than valves, are relatively simple and quick to replace compared with replacing a valve. Also, plant managers might determine that contamination has damaged a valve somewhere in the system, but they might not be sure which valve or valves need to be replaced. Finding the damaged valve can be a difficult and time-consuming process.

Conclusions

The Arkansas paper mill incorporates all three elements of a successful filtration program — design, implementation and ongoing maintenance. The results are both extraordinary and financially significant.

By adopting a clean-system approach to hydraulic system maintenance, other companies may not get 12 years of life from their valves, but they will probably enjoy longer valve life, lower repair costs, less system downtime and interrupted production schedules, greater productivity and fewer headaches.

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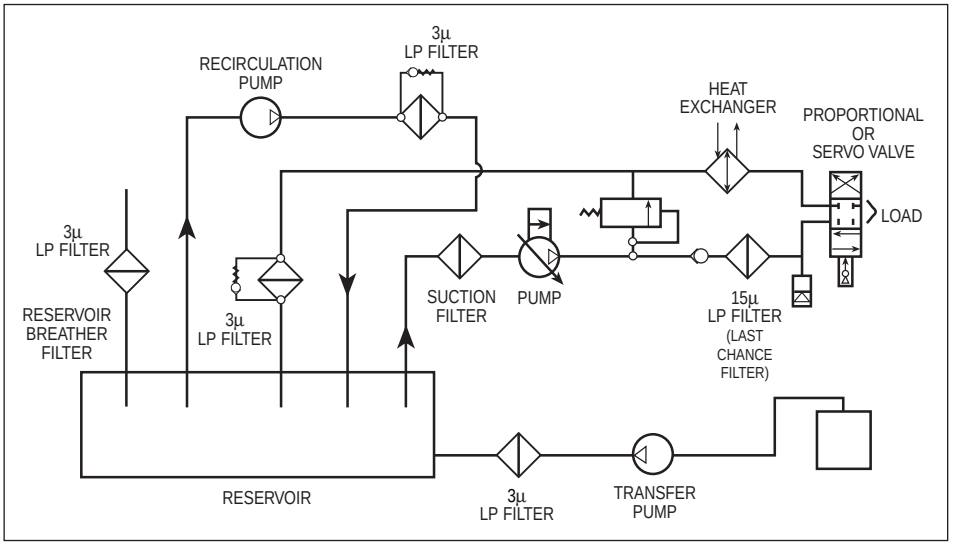

Typical Filtration Schematic