SERFILCO CASE HISTORY

Let Supplemental Filtration Protect Your Hydraulic System and Save You Money Too!

by
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Over the years, I called on die casters, plastic injection molders, earth and construction equipment users, elevator service companies and others using hydraulic systems in an effort to sell them on the use of filtration to protect their equipment. The responses I received all sounded the same — *"Our systems are old. They leak a lot so we just replace the oil and put some absorbent around the machine." Others told me the systems were new and included filters in line on the machines so there was no need for anything further.* In between were those maintenance superintendents who replaced seals, pump packing or other sources of leakage to keep their machines running. (It should be noted that oil collected in pans from leakage can be treated for re-use because oil never wears out.)

First, let's establish that the object of the hydraulic system is to perform as intended at the time when it is needed, without interruption for service and without a total failure. Therefore, if possible, interrupted performance or downtime should be prevented. So, let's get down to basics.

A hydraulic system creates pressure by using a pump to force against a non-compressible liquid. Through a series of valves opening and closing, and without manual involvement, the hydraulic system is thus able to create the back and forth sliding movement of a shaft which, in turn, with cams, etc., is able to make another part of the equipment go up or down, open or close. We could say the hydraulic system works like the human body. For instance, it has a heart (pump) and lungs (breather) which allow the system to work. The pump, driven by a motor, is made with tight clearances to create the many pounds of pressure needed to perform the task (lift 1000 pounds, exceed 1000 pounds, and so forth).

What is the reason a hydraulic system doesn't function properly?

Most people might answer that the reasons are "too numerous to enumerate". However, a common reply very often involves contamination in the fluid. Therefore we ask, "How does a brand new system, flushed clean at the manufacturer's facility, and filled with new, clean fluid become contaminated? After all, isn't the fluid contained in a closed loop?" Yes, but …

Consider the pumps which we mentioned above. Such pumps involve gears and other close tolerance components which move against each other and are separated only by the thin film of fluid in the system. It can be expected that, over time of operation, the action of metal against metal will cause wear which results in small (micron and even sub-micron sized) particles that begin to circulate suspended in the fluid.

The breather, another source of contamination, allows atmospheric air (moist or dry), to enter the fluid reservoir to replace the fluid as it is being used to create the forward movement of the shaft. Then as the shaft makes its reverse movement, the fluid returns to the reservoir and the air is pushed out the breather. Doesn't this sound similar to the action of the human body? As we breathe, our nose protects our lungs from inhaling dust and other airborne contaminants, but if we smoke, we bring contaminants directly to the lungs. When we speak of contaminated air getting into our lungs, we are simply saying that it is virtually impossible to prevent some particles from getting in, as it is with the breather on the hydraulic system.

There is, of course, another source of contamination, that being the shaft. It is exposed out of the system when required to perform its forward operation. Then, when being returned in its reverse movement, it is wiped clean by a seal. Thus subjected to continuous abrasion, the seal will ultimately fail, causing fluid to leak out or abrasive particles to enter the recirculating fluid.

Therefore, all hydraulic systems include filters (sometimes referred to as strainers) installed in the circulating system of the fluid, and a filter is also installed in the breather for the same purpose. But alas, nothing is perfect.

Although the human body may be able to operate under adverse conditions for a limited or even an extended period, a hydraulic system subjected to on-going adverse conditions will simply continue to self-destruct. A pump will not replace the wear caused by contamination but rather will continue to wear more and more from the effect of the previously created particles.

What is the solution to the fluid contamination problem?

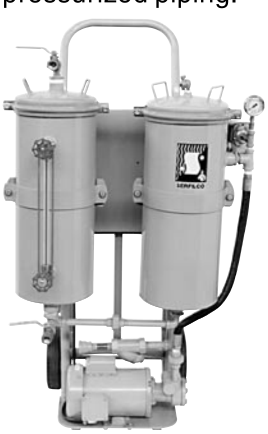
The logical answer to prevent wear and service downtime is to pick up the particles as quickly as possible from the recirculating hydraulic fluid. The problem therefore is to remove any particles in the pumps or valves which are finer than the thickness of the oil film, and most importantly, to do it before damage occurs.

Generally a well designed hydraulic system does include a myriad of filtration or other types of devices to pick up the damaging particles. The question is, "Will the means of filtration within the fluid system perform the needed 'cleansing' or would additional filtration capacity be desirable? Will more filtration (that is, the ability to remove particles) be worthwhile?" I believe the answer is yes. Needless to say, when continuous, uninterrupted reliability is expected, the cost of downtime will be the determining factor. Unquestionably in this scenario, more is definitely better.

Some will ask, "What flow rate, what particle size retention of the filter media and how much space will such a system occupy?" Answers will be arrived at mutually by the user and his equipment supplier.

PORTABLE FILTRATION

Some in maintenance will use a portable filtration system (one which contains its own pump, filter chamber, filter media and piping so that it can be moved from machine to machine and become integral to the fluid system through the use of quick disconnects) or they simply employ hoses inserted into the breather opening of the hydraulic reservoir. Others in maintenance may add a filter in a shunt system which provides additional filtration by processing a small quantity of fluid which can be diverted from the pressurized piping.



Portable filter system equipped with a large capacity filter chamber for removing solid contaminants from hydraulic oil and a coalescing chamber for removing water. Unit can be wheeled from machine to machine, as needed.

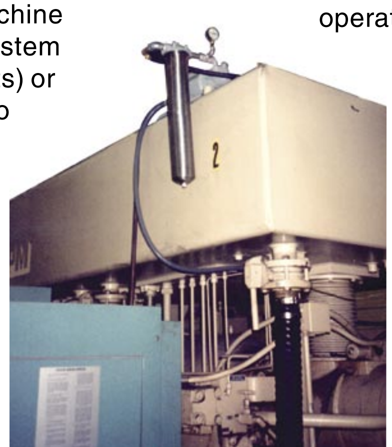
Finally, a system individually piped to the hydraulic reservoir may provide the best results. The pump can be energized independently so that it can achieve particle removal during periods of non-operation of the hydraulics. It may provide additional purification of the fluid from acid removing media, or moisture reduction, and, being independent, as the filter flow rate is reduced or back pressure in the filter is increased, it will not affect the performance of the hydraulic system.

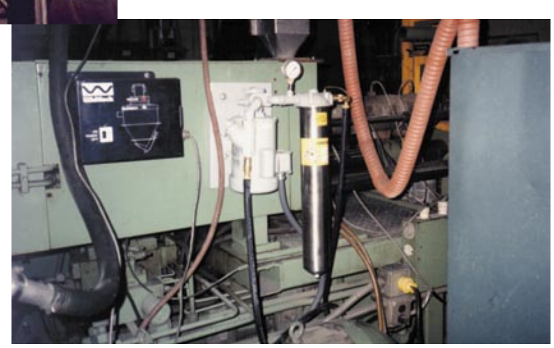
However, some users choose not to energize the hydraulic reservoir filtration systems independently but energize them only when the main motor starter of the machine starts the electrical motor that runs the hydraulic pump. This has two advantages. First, no one has to remember to turn on the filtration, so when the machine is running, the oil is being continuously filtered. Secondly, no one needs to remember to turn it off either.

PERMANENT DEDICATED FILTRATION

A supplemental filtration system permanently mounted to the machine and piped to the hydraulic reservoir may provide the answer to low maintenance, reliable, carefree operation. By tying the system to the motor start function of the machine, the oil reservoir is being filtered whenever the machine is "up". Piping the system with shut-off type quick disconnects at the filtration pump and the reservoir allow for easy maintenance access to both.

Additional oil filtration may benefit the machine operator in an unexpected way by relaying to the maintenance department the true importance of clean oil in the





The machine mount filter system is mounted directly on the hydraulically operated equipment. The top photo shows the filter assembly mounted at the top of a molding machine. The bottom photo shows the unit mounted on the side of a machine.

machine. When the "closed loop" hydraulic system of a machine must be "opened" for maintenance, personnel will surely take greater care to prevent contaminating the system.

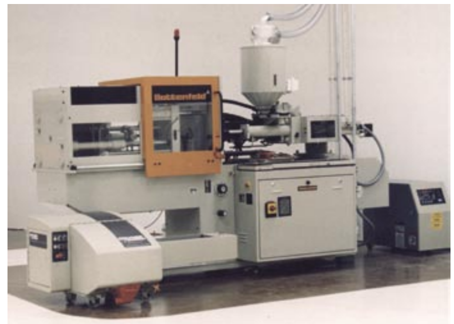
Monitoring and analysis in conjunction with supplemental filtration is the solution.

With today's sophisticated machine controllers, in combination with the personal computer, the machine operator can carefully monitor the actual hourly service life of the hydraulic oil and the frequency of filter cartridge changes. One injection molder reports that a preventive filtration maintenance program should include a cartridge change at 720 hour intervals, that is, actual time logged on the machine, or when the differential pressure between in and out on the filter chamber reaches 25 to 30 psig. He goes on to say that the filter system keeps his oil so clean, the pressure never reaches 30 psig, so he uses the 720 hour schedule to maintain his equipment.

When the filtration system is first installed, this interval should be cut in half and oil analysis should be performed frequently until a noticeable difference in the clarity of the fluid is detected. Using this procedure, the clarity of the oil can be monitored and the maintenance interval can gradually be increased until the 720 hour interval is reached.

Oil changes in the injection molding machine or other equipment incorporating a hydraulic system can become rare with an extensive program of regular oil analysis. It is a common misconception that hydraulic oils "break down" in service. While this is untrue, it is true that the anti-foam, rust, and oxidation inhibitors contained in premium grade hydraulic oils can be depleted at an accelerated rate if contaminants, such as particulate matter and water, are not routinely removed from the oil during up-time. Thus, coalescing systems with filtration capability would be an asset.

Today's sophisticated oil analysis instruments can monitor the level of the various additives and signal when more additives should be added. Thus one distinct advantage of this additional filtration, the considerable saving in the cost of the hydraulic oil, is achieved when downtime is bypassed because the oil doesn't need replacement. The history of one injection molder illustrates the benefits that can be derived from supplemental filtration and close monitoring of the condition of the hydraulic fluid:



Plastic injection molding machine typical of the type of equipment for which supplemental filtration of the hydraulic fluid can protect your equipment investment and save you money by reducing oil replacement requirements

The new general manager learned that his predecessor had replaced the hydraulic oil in all six injection molding machines four years earlier. This maintenance expense cost the company $4,312 (1,540 gallons @ $2.80 per gallon). This plant-wide oil replacement did little or nothing to minimize the nagging hydraulic breakdowns that constantly plagued the shop. In nearly every case, the breakdown, or poor and inconsistent machine performance, was traced back to contamination in the hydraulic system.

The plant budget again presented the opportunity to change the oil in all of the machines. Although the new general manager made a similar expenditure, he chose instead to buy filtration equipment rather than change the oil in each machine. As a result, each machine is equipped with a permanently mounted, external, 3 gpm filter unit. These filter units are wired and piped in place so that whenever the hydraulic system pump motor is running, the filter unit is also operating, constantly filtering the machine's hydraulic reservoir.

Prior to installing the filtration units, the general manager was tracking downtime events for the machines using the machine hour meters and a personal computer. He used the computer to monitor operational downtime with a numerical scale to predict future trouble which could be anticipated as the numbers increased. In this way, he was able to determine when downtime reached an unacceptable level. He then knew it was time to overhaul the machine or cause it to be taken out of service and replaced. He found that the six machines averaged a total of two hours of downtime per month for hydraulic problems.

During the first six months of operating the machines with the externally mounted filters, the benefits were noticeable. The downtime rate for hydraulic problems was cut in half. It was evident that major levels of contaminating particulate were being removed from the machine reservoirs. Throughout the next twelve months, the instances of hydraulic downtime continued to diminish, and the rate of hydraulic downtime leveled off at 18 minutes per month, or an 85% reduction from the original rate. In addition to eliminating the excessive downtime, the use of the filtration units enabled the general manager to eliminate entirely the costly budget item for oil replacement in the machines.

If you aren't already using supplemental filtration on your hydraulic system, and you don't already have your own computerized control system in place, ask your oil supplier to test your oil to indicate any level of contamination, then take appropriate steps with a supplier of filtration equipment. Put yourself in a position to predict and eliminate 1, 2, 3, or 4 malfunctions in your hydraulic systems. You'll maximize up-time, minimize downtime, and save a great deal of money in the process.

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