Small System Conversions

Small system hydraulic units are used extensively for stand alone equipment, such as small lift systems, jacking systems, powered booms and cranes, shredders, compactors, conveyors, crushers, and stacking and retrieval systems just to name a few. These open loop systems constitute the vast majority of stand alone units in use today. They are traditionally sized as systems of 10 USG reservoirs or less, system flows of less than 5 gpm, and pressures less than 2000 psi. They usually are not designed for extended continuous use and will quickly overheat if run too long as per the equipment manufacturer's operating instructions. These systems quite often are subjected to some of the most extreme ambient conditions. Most often these systems are designed as single function systems powering a single cylinder or motor. Because of the functional simplicity, these systems are designed and constructed of common and inexpensive components that function adequately when used with traditional petroleum based mineral oils or readily available vegetable oils. Therefore, components are usually chosen by the OEM not only based on their performance with traditional hydraulic fluids, but for the low price these components command.

Commonly the small system's major components is a pump, usually a small positive displacement gear pump, a pressure relief valve, a directional control valve, either a motor or cylinder, a small integral reservoir, a return filter of some kind, and a prime mover (AC or DC electric motor or a direct drive engine). The most serious challenge to converting from traditional hydraulic fluids to synthetics is the materials used in the components. Gear pump, motors, and cylinders can be made of a wide variety of materials, including non-anodized aluminum. If the synthetic fluid is a water glycol then it can't be used with non-anodized components. There are also some elastomer materials that are incompatible with glycols. Paper material return filters are also not recommended for use with glycols. Therefore, prior to converting it is imperative to check with the power unit OEM and/or a qualified fluid power professional to determine the suitability of the components' use with water glycol fluids.

After the compatibility issues are resolved and the system components are deemed to be unaffected by water glycols, then the conversion procedures and process is quite simple. Basically, it is draining the system and replacing it with the synthetic fluid. The following is advised to successfully complete the conversion:

<u>Draining the System</u>

1. **Insure that power is disconnected and remains disconnected while doing the conversion.**
2. **Drain the old fluid as per the OEM's instructions. It may require the use of a fluid transfer pump, either manual or electric. Insure that the old fluid is transferred into an appropriate approved container and that it is stored in an area that is designated for storage of hazardous waste fluids.**
3. **Remove the return filter and discard in accordance with hazardous waste disposal.**

4. **If the pump or motors have a case drain plug, open and drain oil from the component cases. After draining, replace the case drain plugs and tighten to the OEM's torque specifications.**
5. **Disconnect all hoses, tubes and piping to drain fluid from transfer lines.**

System Setup

1. **Replace any fluid transfer lines needing repair. This is also a good time to repair or replace any other system components that need to be changed.**
2. **Reconnect all lines. Prior to reconnection it is recommended to mechanically clean lines with a pneumatically powered "pig", which clean any residual oil or material contaminants from the lines.**
3. **Replace return filter with a new return filter with the appropriate media for water glycol fluids.**
4. **Fill the reservoir to the recommended OEM level for operation.**
5. **If pump and motor cases have filler plugs, remove plugs and fill cases and reinstall the case plugs with fluid. Tighten to OEM's torque limits.**

System Activation

1. **Back off the system pressure relief valve all the way to a no load position.**
2. **Maintaining the system in a no load condition start the pump motor/driver for 20 seconds to charge the pump and pump discharge line.**
3. **Start the pump and begin tightening the pressure relief valve until the bypass pressure is achieved.**
4. **Run the system over the pressure relief for 1 minute.**
5. **Start the pump and open directional control valve to activate rotary and/or linear actuators. Run for 1 minute to fully charge the system and check the pressure relief valve and adjust as necessary.**
6. **Let the unit remain static for 5 minutes and check for connection leaks.**
7. **If the reservoir has a site gauge check the fluid level and how much residual oil that has accumulated on the surface of the reservoir fluid. If the accumulated oil is more than 3/16 of an inch, vacuum off the oil or siphon the oil off. Oil will continue to accumulate during system operation until all oil is purged.**
8. **After 5 minutes start the unit and begin bleeding procedures bleeding the system of air until it is thoroughly bled. Do not run the system longer than 5 minutes at a time. Rule of thumb: Run for 5 minutes, rest for 5 minutes.**
9. **Once the air is successfully bled from the system the actuators should not be spongy in the case of cylinders and motors should run smoothly without "jerkiness" or hesitation. The pump should run smoothly without making popping sounds or surges.**

The system is now ready to be put back into service. After system has run for 10 operating hours, change the return filters and check the reservoir levels and oil accumulation. The fluid color should be as new fluid. If the fluid appears pasty or has white lumps in it discontinue use and drain and replace the fluid after trouble shooting the problem. If the system has non-anodized aluminum and the fluid

appears soapy or pasty, then drain the fluid and look for the aluminum component and replace or return the system to traditional hydraulic fluid. The presence of white lumps in the fluid is an indication that non-deionized water has ingressed into the system. Change the fluid and replace with clean water glycol and return filters. Troubleshoot and find where the water is coming from and correct the problem.

Place the unit on a routine maintenance schedule. Generally with such small systems when the fluid becomes chemically unbalanced rather than correct the viscosity or pH, most users simply change out with new fluid.