FLUID POWER
Design Data Sheet

Revised Sheet 48 - Womack Design Data File

TROUBLESHOOTING TIPS FOR HYDRAULIC PUMPS

The pump is probably the component most subject to wear in a hydraulic system, and the one most likely to cause a sudden or gradual failure in the system.

Pump trouble is usually characterized by increased noise, increased heat, erratic operation of cylinders, difficulty or inability to develop full output, decreased speed of cylinders or hydraulic motors, or failure of the system to work at all.

One of the following problems will most likely be the cause if any of the above symptoms appear, if they are indeed caused by the pump.

Pump Cavitation

Cavitation is the inability of a pump to draw in a full charge of oil. When a pump starts to cavitate its noise level increases, and it may become extremely hot around the shaft and front bearing. Other symptoms of pump cavitation are erratic movement of cylinders, difficulty in building up full pressure, and a milky appearance of the oil. If cavitation is suspected, check these points:

a. Check condition of pump suction strainer. Clean it even if it does not look dirty. Use a solvent then blow dry with an air hose. Varnish deposited in the wire mesh may be restricting the oil flow but may be almost invisible. If you find varnish deposits on internal surfaces of pumps or valves, the system is operating at too high a temperature. A heat exchanger should be added.

b. Check for restricted or clogged pump inlet plumbing. If hoses are used, be sure they are not collapsed. Only those hoses designed for vacuum should be used in the pump inlet. They have an internal wire spiral to prevent collapse.

c. Be sure the air breather on top of the reservoir is not clogged with lint or dirt. On systems where the air volume above the oil is relatively small, the pump could cavitate during its extension stroke if the breather became clogged.

d. Oil viscosity could "be too high for the particular pump. Some pumps cannot pick up the prime on heavy oil or will run in a partially cavitated condition.

Cold weather start-up is particularly damaging to a pump. Running a pump for several hours in a cavitated condition until the oil warms up can greatly shorten its life. On equipment operating outdoors use an oil not only of the recommended viscosity but also with as high as possible viscosity index. This minimizes the viscosity change from cold to hot oil operation and reduces cavitation on a cold start-up.

e. Check suction strainer size. Be sure that original strainer has not been replaced with one of smaller size. Increasing its size, where possible, may help on some systems where the original size selection may have been marginal.

f. The use of high quality oil may reduce formation of varnish and sludge.

g. Determine recommended speed of pump. Check pulley and gear ratios. Be sure the original electric motor has not been replaced with one which runs at a higher speed.

h. Be sure pump has not been replaced with one which delivers a higher flow which might overload the suction strainer. Increase suction strainer size if necessary.

Air Leaking Into the System

Air which is in a new system, just assembled, will purge itself after a short time. The system should first be cycled for perhaps 15 minutes to 30 minutes without trying to build more than very low pressure. Entrapped air will dissolve in the oil, a little at a time, and be carried into the reservoir, from where it will escape. This process can be accelerated, of course, by bleeding air from high points in the plumbing, and especially at cylinder ports.

Air which comes into the system from air leaks will cause the oil to have a milky appearance a short time after the system is started, but the oil will usually clear up a bout an hour after shutdown. To find where air is entering the system, check out these points:

a. Be sure the oil reserve is filled to Its normal level, and that the pump intake is well below the minimum oil level. The NFPA reservoir specifications call for the highest point on the suction strainer to be at least 3 inches below minimum oil level.

Check the oil level when all cylinders are extended to be sure it is not below the "Low" mark on the gauge. However, do not overfill the reservoir when cylinders are extended; it may overflow when the cylinders are retracted.

b. Air may be entering around the pump shaft seal. Gear and vane pumps which are pulling suction oil from a reservoir located below them, will have a slight vacuum behind the shaft seal. When this seal becomes badly worn, air may enter through the worn seal. Piston pumps usually have a small positive pressure, up to 15 PSI, behind the shaft seal. Air is unlikely to enter these pumps through the seal.

c. Check all plumbing and joints in the pump inlet line, especially unions. Check for leaks in hoses used in· the inlet line. One easy way to check for plumbing leaks is to pour oil over a suspected leak. If the pump noise diminishes, you have found your leak.

Check also around the inlet port. Screwing a tapered pipe fitting into a straight thread port will damage the thread, causing a permanent air leak which it is difficult or impossible to repair.

d. Air may be entering through the rod seal of a cylinder. This can happen on cylinders mounted with the rod up, and which are not properly counterbalanced. On the downstroke, the gravity load may cause a partial vacuum to appear in the rod end of the cylinder. Cylinder seals are not usually

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designed to seal air out, so even a good seal can leak under these conditions.

e. Be sure the main tank return line discharges well below the minimum oil level and not on top of the oil. On new designs it is helpful to increase the diameter of the tank return line for a few feet before it discharges. This causes oil velocity to decrease, reducing turbulence inside the reservoir.

Water Leaking Into the System

Water leaking into the system will cause the oil to have a milky appearance while the system is running, but the oil will usually clear up a short time after the system is shut down as water settles to the bottom of the reservoir. Water may enter into the system in these, possibly other ways:

a. A leak in a shell and tube heat exchanger may allow water to mix with the oil.

b. Condensation on the inside walls of the reservoir. This is almost unavoidable on systems operating in an environment where the ambient temperature changes from daytime to nighttime. The proper solution is to daily tap off a small quantity of fluid from the bottom of the reservoir through the drain valve. Since water settles to the bottom, it will drain off before oil starts coming out.

c. Be sure that any tubing or piping which carries cooling water inside the air space of the reservoir enters and leaves below the oil level, so water cannot condense on it.

Oil Leakage Around the Pump

a. Leakage Around the Shaft. On some pumps (piston pumps or those pumps operating with an overhead reservoir), there may be a slight pressure behind the shaft seal. As the seal becomes well worn, external leakage may appear. This will usually be more pronounced while the pump is running, and may disappear while the pump is stopped.

Other pumps such as the gear and vane type, usually run with a slight vacuum behind the seal. Leakage may only occur after the pump has been stopped.

Prematurely worn shaft seals may be caused by excessive oil temperature. At temperatures of 200°F and higher, rubber seals have a very short life.

Abrasives in the oil may wear seals out quickly, and will also produce circumferential scoring of the shaft in the seal area. If abrasives are present, they will settle out of a sample drawn from the reservoir if it is allowed to stand an hour or so. Check all points where abrasives can enter. The most common entry point is through the air breather on the reservoir. To solve this problem, seal the reservoir air tight and maintain 1 or 2 PSI (no more) on top of the oil.

b. Leakage Around a Pump Port. Sometimes leakage at these ports is caused from screwing a taper pipe thread fitting into a straight thread port. Once the threads have been damaged there is no easy way to repair the pump.

Check tightness of fittings in the ports. If dryseal pipe threads are used, there should be no need to use a pipe thread sealant. Beware of screwing taper pipe threads too tightly into a pump body casting. This may cause the casting to crack.

c. If leakage is from a small crack in the body casting, this most likely has been caused either by screwing a pipe fitting in too tightly, or from operating the pump in a system where either the relief valve is set too high, or where high transient pressure spikes are generated as a result of shocks. It is possible that the casting may originally have been defective but this has rarely turned out to be the problem.

Pump Delivering Too Little or No Flow

a. Shaft turning in wrong direction. Shut down immediately. Reversed leads on a 3-phase motor are the commonest cause for wrong rotation. Pumps must be run in the direction marked on their nameplate or case.

b. Intake Clogged. Check suction strainer for dirt, and check for collapsed intake hoses.

c. Low oil level in the reservoir.

d. Stuck vanes, valves, or pistons, either from varnish in the oil or from rust or corrosion. Varnish indicates the system is running too hot. Rust or corrosion may mean water is getting into the oil.

e. Oil too thin, either from wrong choice of oil or from thinning out at high temperature. A system with this problem may operate normally the first few hours after startup, then gradually slow down as the oil gets overheated.

f. Mechanical Trouble. Check for broken shaft or coupling, sheared key or pin, etc.

g. Pump running too slow. Most pumps deliver a flow at all speeds, proportional to RPM. But some vane pumps which depend on centrifugal force to extend the vanes, will deliver little or no flow at slow speeds such as engine idle RPM.

h. If the driving motor has been replaced, make sure it is the correct speed for the pump.

Pump Noise Has Recently Increased

a. Cavitation of pump inlet.

b. Air leaking into the system from low oil or other cause.

c. Mechanical noise caused by loose or worn coupling, loose set screws, badly worn internal parts, etc.

d. System may be running too hot.

e. Pump may be running too fast.

Short Pump Life

a. Operation of pump above catalog pressure rating, especially if pump must maintain this pressure for a high percentage of total running time.

b. Oil of wrong viscosity or of poor quality.

c. Operating the oil at excessively high temperatures.

d. Inadequate filtering.

e. Failure to keep suction strainer clean.

f. Misalignment of pump shaft with driving motor or engine. **Note:** When replacing a foot mounted pump, leave the bracket and replace only the pump and the new pump will not have to be re-aligned with the driving source.

g. Air or water may be leaking into the system.

h. Running the pump too fast or too slow.

i. Inlet cavitation from other causes.

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