Symptoms of Common Hydraulic Problems and Their Root Causes

by Brendan Casey

Proactive maintenance emphasizes the routine detection and correction of root cause conditions that would otherwise lead to equipment failure. In the case of hydraulic systems, there are three easily detectable symptoms that give early warning of root cause conditions. These symptoms are abnormal noise, high fluid temperature and slow operation.

Abnormal Noise

Abnormal noise in hydraulic systems is often caused by aeration or cavitation. Aeration occurs when air contaminates the hydraulic fluid. Air in the hydraulic fluid makes an alarming banging or knocking noise when it compresses and decompresses, as it circulates through the system. Other symptoms include foaming of the fluid and erratic actuator movement. Aeration accelerates degradation of the fluid and causes damage to system components through loss of lubrication, overheating and burning of seals.

Air usually enters the hydraulic system through the pump's inlet. For this reason, it is important to make sure pump intake lines are in good condition and all clamps and fittings are tight. Flexible intake lines can become porous with age; therefore, replace old or suspect intake lines. If the fluid level in the reservoir is low, a vortex can develop, allowing air to enter the pump intake. Check the fluid level in the reservoir, and if low, fill to the correct level. In some systems, air can enter the pump through its shaft seal. Check the condition of the pump shaft seal and if it is leaking, replace it.

Cavitation occurs when the volume of fluid demanded by any part of a hydraulic circuit exceeds the volume of fluid being supplied. This causes the absolute pressure in that part of the circuit to fall below the vapor pressure of the hydraulic fluid. This results in the formation of vapor cavities within the fluid, which implode when compressed, causing a characteristic knocking noise.

The consequences of cavitation in a hydraulic system can be serious. Cavitation causes metal erosion, which damages hydraulic components and contaminates the fluid. In extreme cases, cavitation can cause mechanical failure of system components.

While cavitation can occur just about anywhere within a hydraulic circuit, it commonly occurs at the pump. A clogged inlet strainer or restricted intake line will cause the fluid in the intake line to vaporize. If the pump has an inlet strainer or filter, it is important for it not to become clogged. If a gate-type isolation valve is fitted to the intake line, it must be fully open. This type of isolation device is prone to vibrating closed. The intake line between the reservoir and pump should not be restricted. Flexible intake lines are prone to collapsing with age; therefore, replace old or suspect intake lines.

High Fluid Temperature

Fluid temperatures above 180°F (82°C) can damage seals and accelerate degradation of the fluid. This means that the operation of any hydraulic system at temperatures above 180°F is detrimental and should be avoided. Fluid temperature is too high when viscosity falls below the optimum value for the system's components. The temperature at which this occurs is dependent on the viscosity grade of the fluid in the system and can be well below 180°F.

High fluid temperature can be caused by anything that either reduces the system's capacity to dissipate heat or increases its heat load. Hydraulic systems dissipate heat through the reservoir. Therefore, the reservoir fluid level should be monitored and maintained at the correct level. Check that there are no obstructions to airflow around the reservoir, such as a build up of dirt or debris.

It is important to inspect the heat exchanger and ensure that the core is not blocked. The ability of the heat exchanger to dissipate heat is dependent on the flow rate of both the hydraulic fluid and the cooling air or water circulating through the exchanger. Therefore, check the performance of all cooling circuit components and replace as necessary.

When fluid moves from an area of high pressure to an area of low pressure without performing useful work (pressure drop), heat is generated. This means that any component that has abnormal internal leakage will increase the heat load on the system. This could be anything from a cylinder that is leaking high-pressure fluid past its piston seal, to an incorrectly adjusted relief valve. Identify and change-out any heat-generating components.

Air generates heat when compressed. This means that aeration increases the heat load on the hydraulic system. As already explained, cavitation is the formation of vapor cavities within the fluid. These cavities generate heat when compressed. Like aeration, cavitation increases heat load. Therefore, inspect the system for possible causes of aeration and cavitation.

In addition to damaging seals and reducing the service life of the hydraulic fluid, high fluid temperature can cause damage to system components through inadequate lubrication as a result of excessive thinning of the oil film (low viscosity). To prevent damage caused by high fluid temperature, a fluid temperature alarm should be installed in the system and all high temperature indications investigated and rectified immediately.

Slow Operation

A reduction in machine performance is often the first indication that there is something wrong with a hydraulic system. This usually manifests itself in longer cycle times or slow operation. It is important to remember that in a hydraulic system, flow determines actuator speed and response. Therefore, a loss of speed indicates a loss of flow.

Flow can escape from a hydraulic circuit through external or internal leakage. External leakage such as a burst hose is usually obvious and therefore easy to find. Internal leakage can occur in the pump, valves or actuators, and unless you are gifted with X-ray vision, is more difficult to isolate.

As previously noted, where there is internal leakage there is a pressure drop, and where there is a pressure drop heat is generated. This makes an infrared thermometer a useful tool for identifying components with abnormal internal leakage. However, temperature measurement is not always conclusive in isolating internal leakage and in these cases the use of a hydraulic flow-tester will be required.

The influence of internal leakage on heat load means that slow operation and high fluid temperature often appear together. This can be a vicious circle. When fluid temperature increases, viscosity decreases. When viscosity decreases, internal leakage increases. When internal leakage increases, heat load increases, resulting in a further increase in fluid temperature and so the cycle continues.

Proactively monitoring noise, fluid temperature and cycle times is an effective way to detect conditions that can lead to costly component failures and unscheduled downtime of hydraulic equipment. In most cases, informed observation is all that is required.

About the Author

Brendan Casey has more than 15 years experience in the maintenance, repair and overhaul of mobile and industrial hydraulic equipment. For more information on increasing the uptime and reducing the operating cost of your hydraulic equipment, visit his Web site: www.InsiderSecretsToHydraulics.com