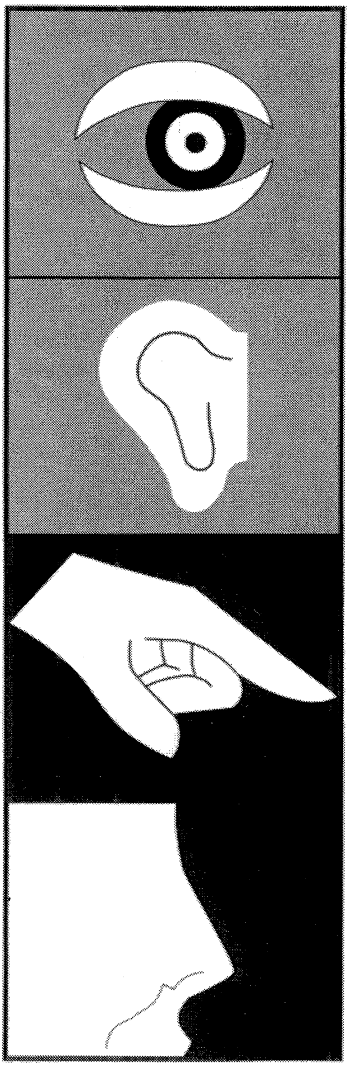
HOW TO
troubleshoot hydraulic systems by using your senses



Sight

Hearing

Touch

Smell

SIGHT

One good way to forestall problems with a hydraulic system is to periodically look over your equipment. Watch for any signs of leakage—a wet machine or hose, oil stains, low levels in the reservoir. It's a good idea to look at the reservoir regularly, not just to check the fluid level but to actually examine the fluid. If the oil in the reservoir has a milky appearance it is probably saturated with air or water. In either case, your hydraulic system is in for trouble.

To continue your visual tour take a look at the fluid conductors in the system. Watch for hose lines that are abrading or for lines that are too short when pressurized. These are conditions that can lead to a premature failure of the hose. You should also watch for kinked or flattened lines because a kink will restrict flow and in the case of a pump supply line could ruin a pump. Naturally you should check the hydraulic gauges to make sure the system pressures are within the designed limits.

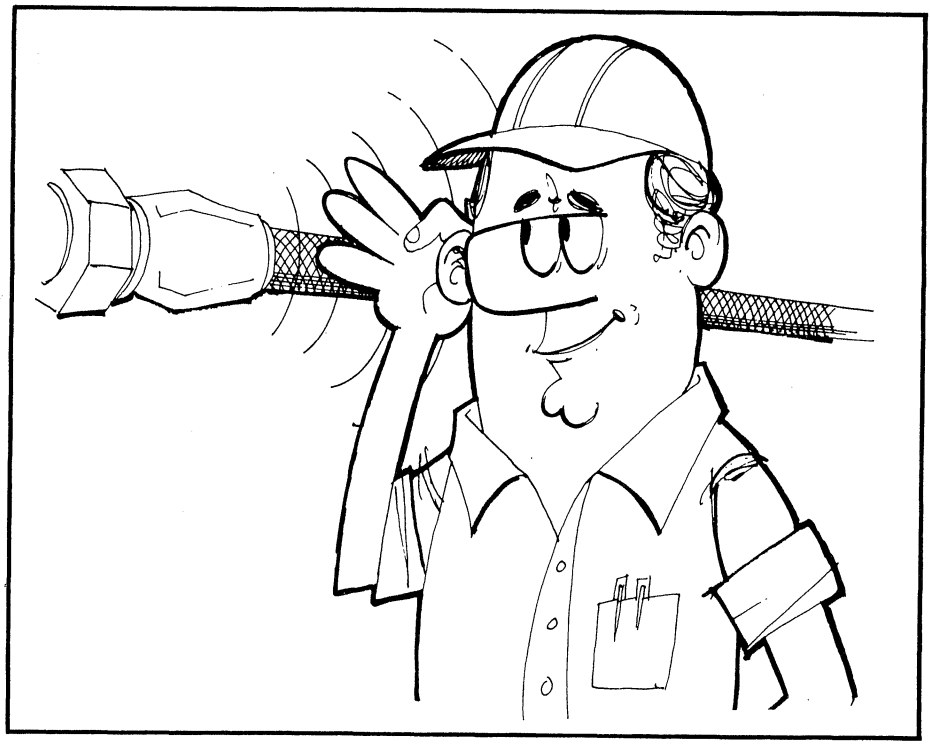
Observe the action of the hydraulic cylinders. If the movement is jerky or erratic something is wrong. It may be air in the system or a bent cylinder rod.

Most important of all, make sure there is sufficient oil in the hydraulic reservoir after the complete system is charged and the cylinders are extended. Follow the manufacturer's recommendations on the fluid level as well as on the type of fluid to use.

HEARING

A good troubleshooter will listen for unusual sounds coming from a hydraulic system. The loud, shot-like, sound that you hear when a tap is closed quickly is called "water hammer." This is caused by the sudden stoppage of moving liquid. The hydraulic surge created by this condition increases with the speed at which the liquid is moving. A pressure surge may go as high as four times the normal working pressure. This can cause great physical damage to fluid conductors and other components in a system. A shock-wave travels at the speed of sound in hydraulic fluid, and normal hydraulic gaûges will not record these fast transient pressure surges.

The main function of a hydraulic pump is to move liquids against comparatively high resistance. When the supply of fluid is insufficient to meet the demands of a pump, the pump goes into a state of hydraulic shock described as cavitation. When this occurs the injured pump emits a most unusual sound. If there is no back pressure it sounds as if you were pumping marbles, and you can hear them rattling. When back pressure is present the pump emits a shrill whine that will have you holding your ears. Unusual sound anywhere in a hydraulic system bears investigation by a fluid power mechanic.



TOUCH

When you put your hand on a hydraulic pump and wish you hadn't because it's hot, the pump is trying to tell you something. When the maximum temperature of a hydraulic system exceeds 150°F. several malfunctions occur. Oxidation is accelerated. Tests have shown that, below 135°F., oil oxidizes very slowly. The rate of oxidation approximately doubles for every 18°F. increase in temperature. It is estimated that the working life of most oil is decreased by 50% for every 15°F. rise in temperature above 140°F. Oxidation causes sludge to form, reduces clearances, causes corrosion and creates more heat, thus establishing a vicious cycle.

Just because the hydraulic reservoir is not hot does not mean there is no heat problem. A good troubleshooter will feel the fluid conductors in various parts of the system to make sure there are no "hot spots." If any part of a hydraulic system is unusually hot you can be sure there is a problem developing.

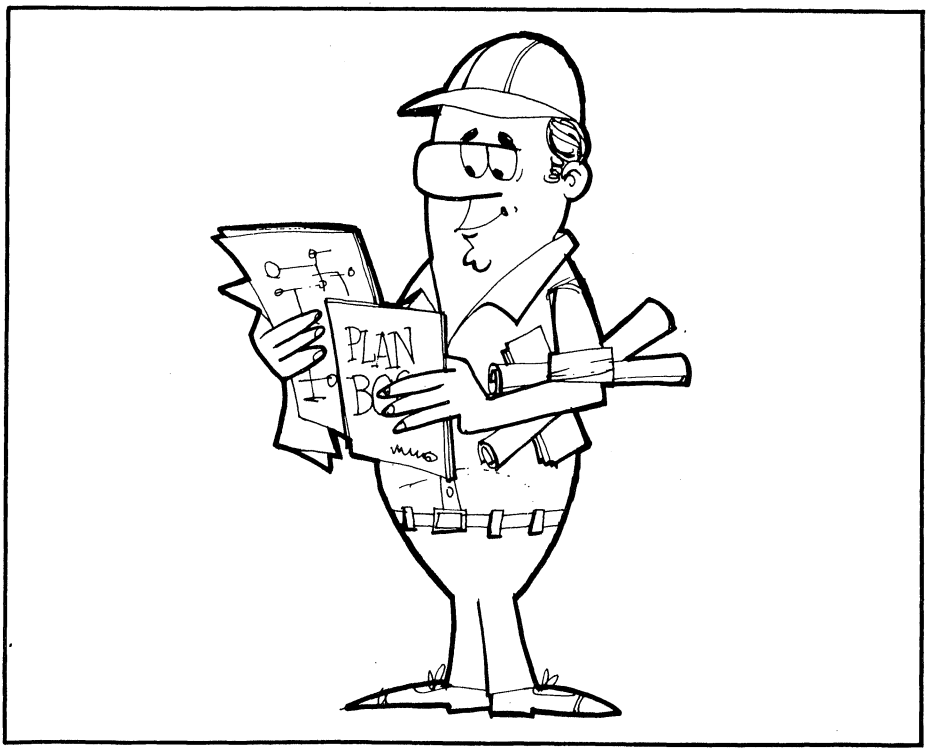
Remember, high heat can be very damaging to a fluid power system and should not be tolerated.

Another extremely damaging condition encountered in a hydraulic system is high frequency vibration. You can feel these vibrations with your hand by touching steel fluid conductors. This condition has been known to break weldments and other components and should be corrected. You can also "see" this condition by placing an ordinary tumbler of water on a steel tube and watching the surface conditions. When the water pops off the surface the condition is serious enough to warrant further investigation and correction.

SMELL

When hydraulic oil is saturated with air, or when a hydraulic pump is cavitating, the air bubbles in the system go from a subpressure condition (vacuum) to a high pressure condition in a fraction of a second which generates a great deal of heat. In fact, it has been estimated that a pocket of air in a hydraulic system may reach temperatures in excess of 2000°F. This is hot enough to scorch surrounding oil and a good troubleshooter can smell this "burned" oil in the reservoir.

When any of these abnormal conditions are present, a good troubleshooter will follow-up. Any factor known to him that could cause the irregularity must be checked out. Nothing should be overlooked. He should obtain a drawing of the system and a specification sheet from the manufacturer so that he knows the system. Although he may have to use pressure gauges, surface pyrometers, flow gauges, vacuum gauges, and oscilloscopes in order to ferret out the problem, the most important tools that he has are his God-given senses, and the finest computer ever made—his brain.



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