CLARK

BASIC HYDRAULIC TROUBLESHOOTING MANUAL

NO. 9042

INDEX

CLARK

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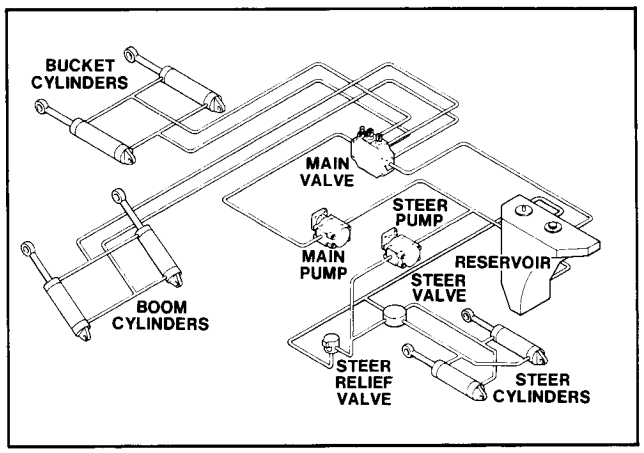
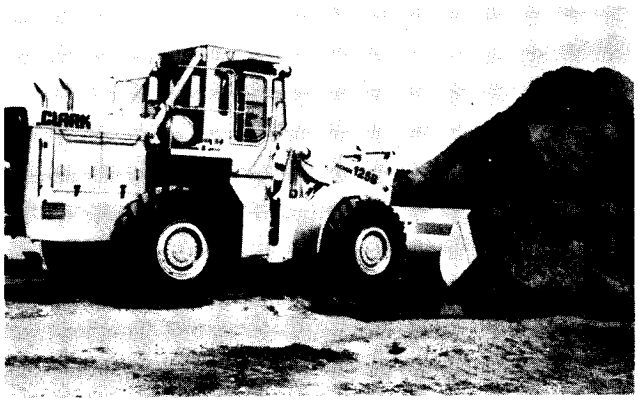
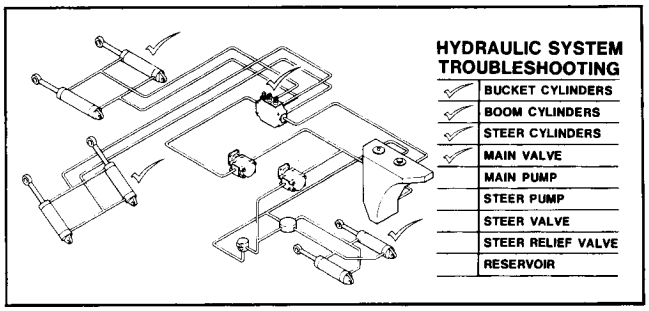


This is intended to be a guide to locating problems in a hydraulic system. To cover *all* of the causes and remedies would be impossible but let's cover the most common and remember to look for the obvious first.



Be sure there is a problem with the hydraulic system.

It's possible that a different operator has been placed on the machine or the machine has been moved from one operation to another and is now being required to work beyond its rated capacity. This simple check can save a lot of time looking for a problem that doesn't exist.

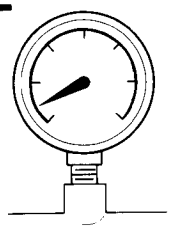


If you're satisfied that the problem is hydraulic and not improper application, no matter what the problem is, there are a few basic troubleshooting steps which should be followed every time a machine is being serviced.

THE BASIC RULES FOR ALL TROUBLESHOOTING ARE.....

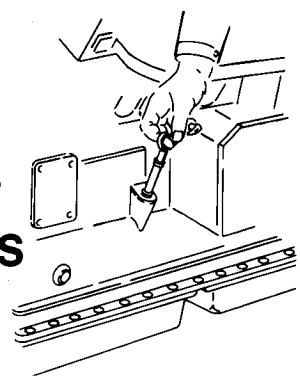
1

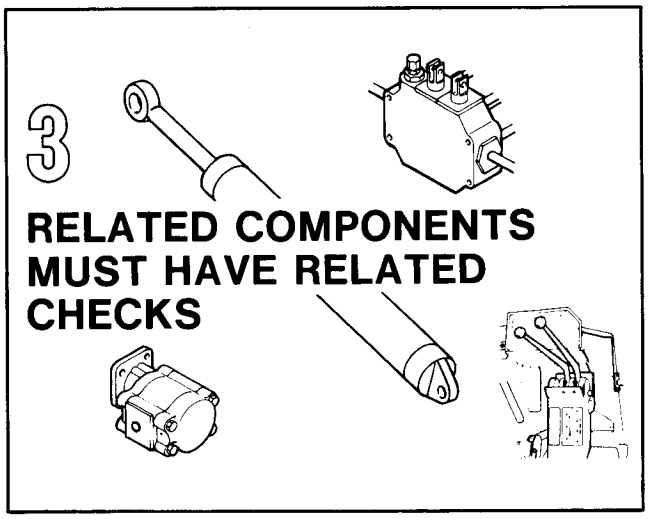
NEVER ASSUME ANYTHING



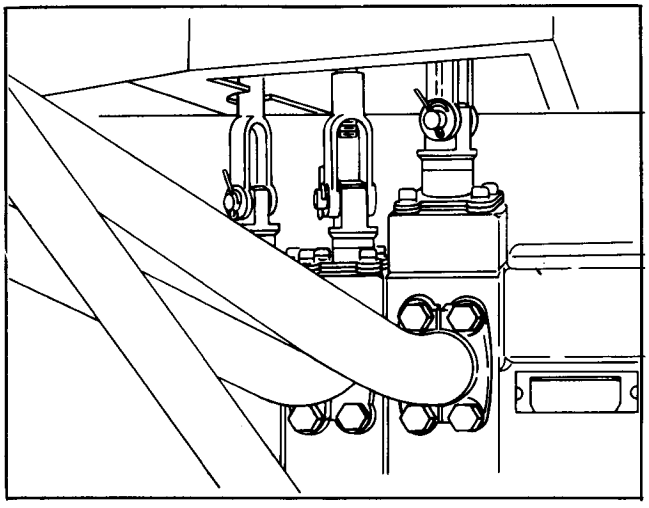
2

CHECK THE EASIEST POSSIBILITIES FIRST



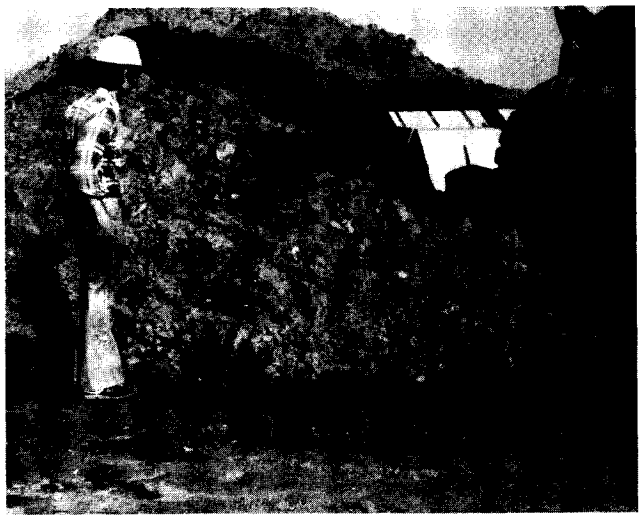


With these in mind then, the first step is: CHECK THE OIL LEVEL. No oil....No hydraulics.

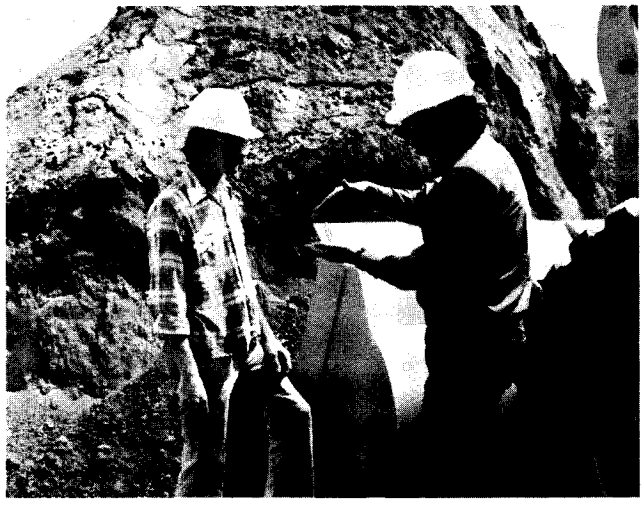


THEN A VISUAL CHECK . Start with the control linkage to make sure it's operating properly.

Then walk around and look for obvious leaks in the hoses, connections or cylinders and for pinched or damaged tubing.

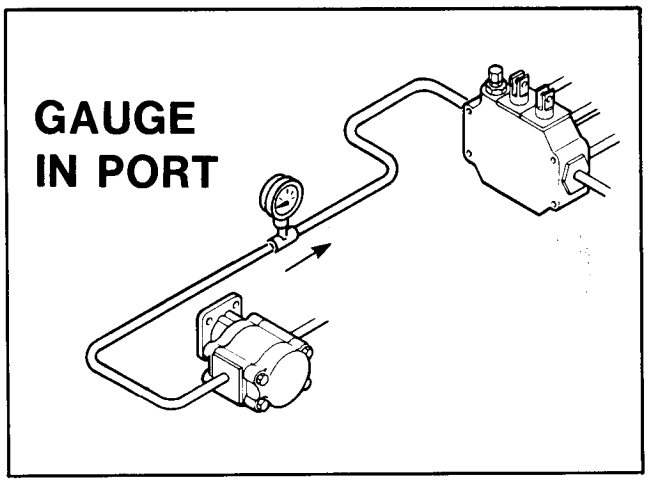


CHECK THE OPERATION OF THE MACHINE. Is the machine doing the job it was designed for? Don't expect it to do more.... or accept it doing less.

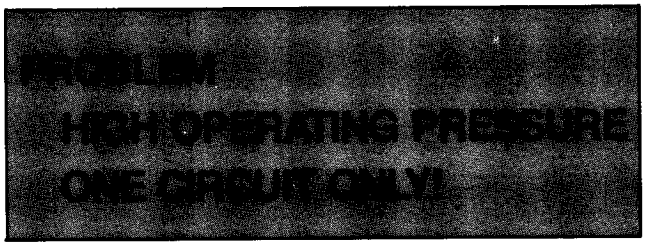


Does the operator's complaint check out? Get as much detail on the symptoms as you can.

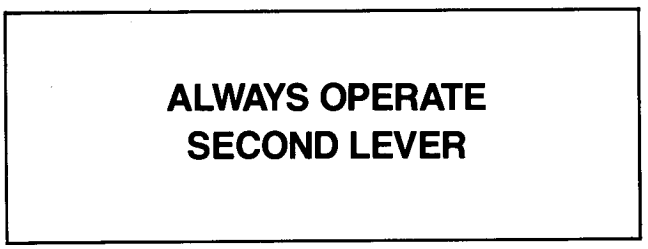
Are the hydraulics slow, do they chatter or do they lack power?

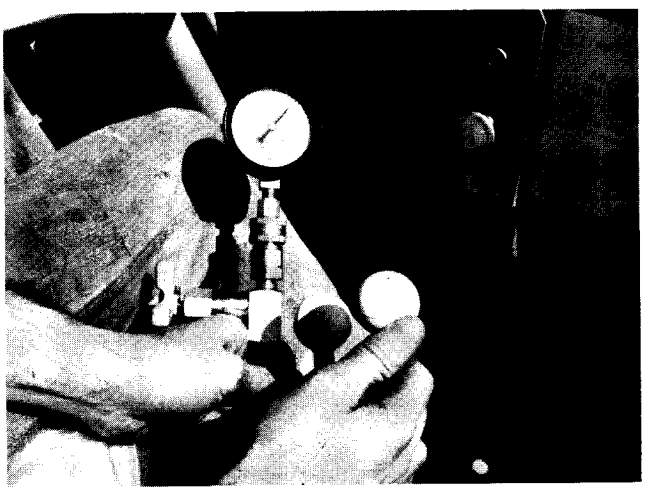


If at this point you are satisfied that there is a problem in the hydraulic system, INSTALL A PRESSURE GAUGE INTO THE SYSTEM BETWEEN THE PUMP AND THE VALVE.

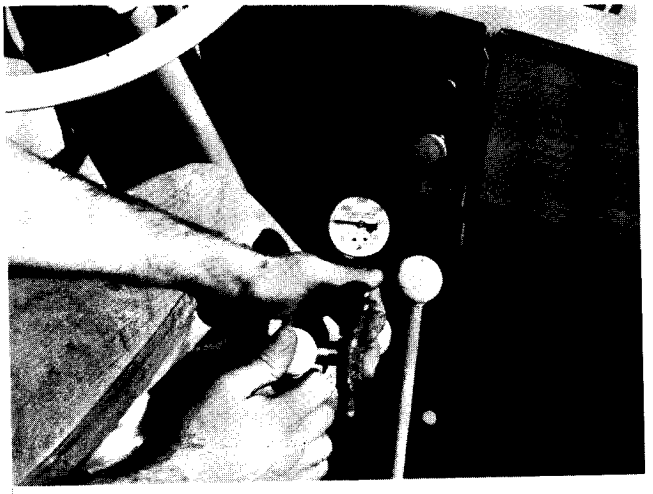


With a gauge installed, operate the control valve. In this case, the pressure goes to relief without a load against the cylinder.

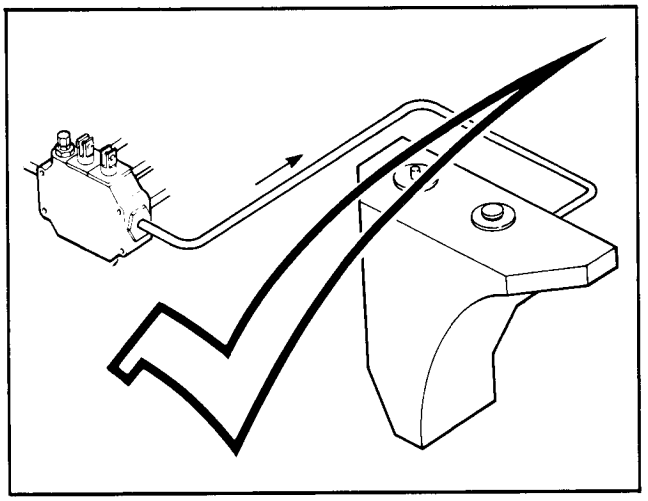




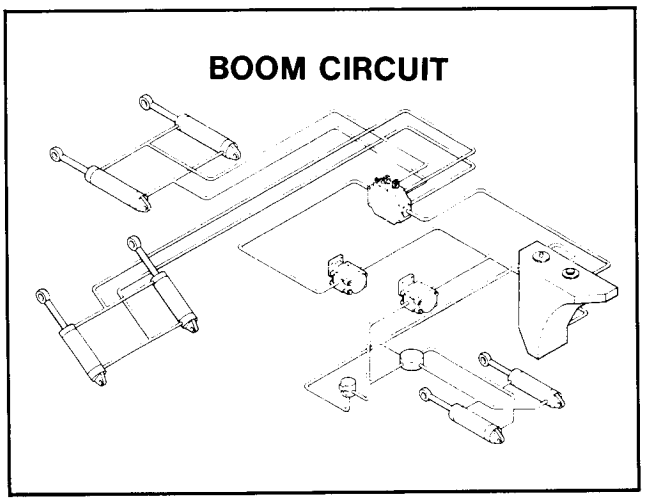
As an example, if you're working on a tractor shovel and the boom lever is operated, high pressure is shown on the gauge....



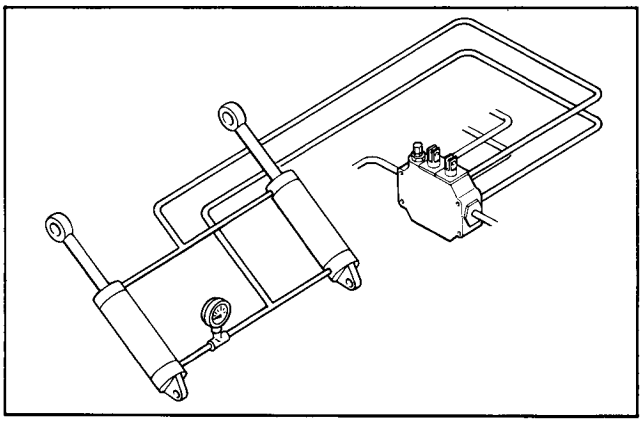
pull the bucket lever. If the pressure drops back to normal operating pressure....you have cut your troubleshooting by about 50% just by moving a lever.



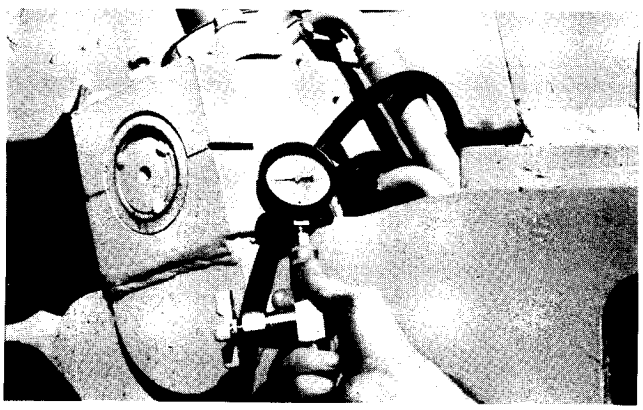
With normal operating pressure in the bucket circuit, you have eliminated the possibility of the problem being in the return line from the control valve to the hydraulic tank and most likely the control valve itself.



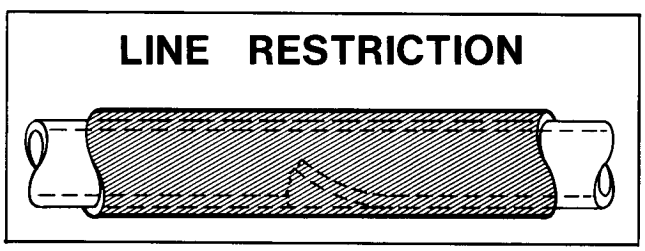
Now the problem is narrowed to the boom circuit.



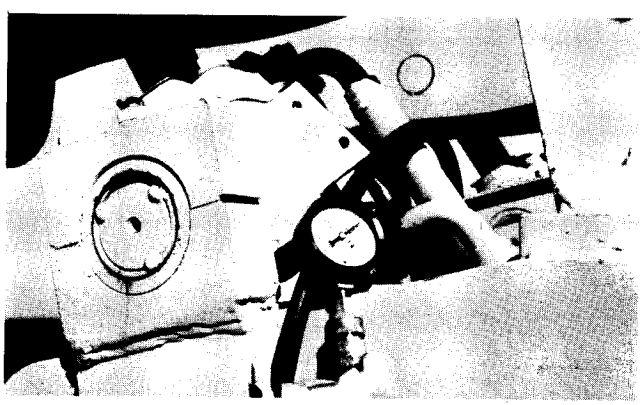
The next step in tracking the problem would be to install a pressure test block and gauge at the base end of the cylinder and engage the lever.



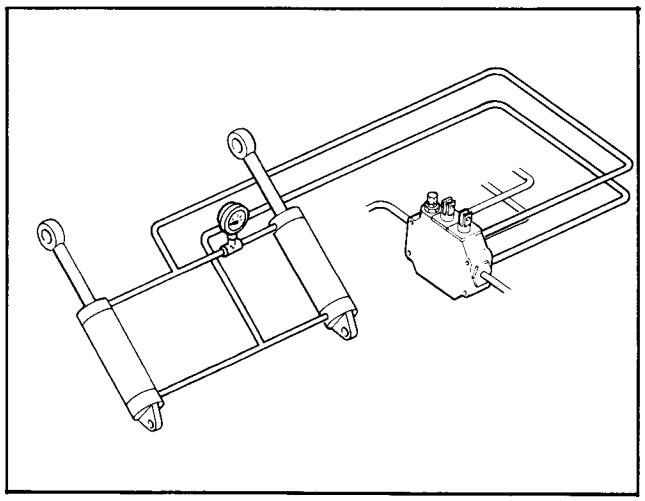
If the pressure reading at the base of the cylinder is normal operating pressure....



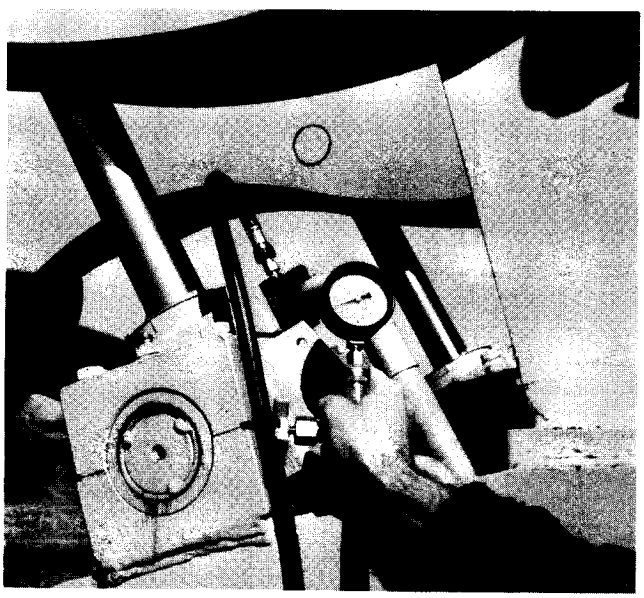
the restriction is in the line or control valve.



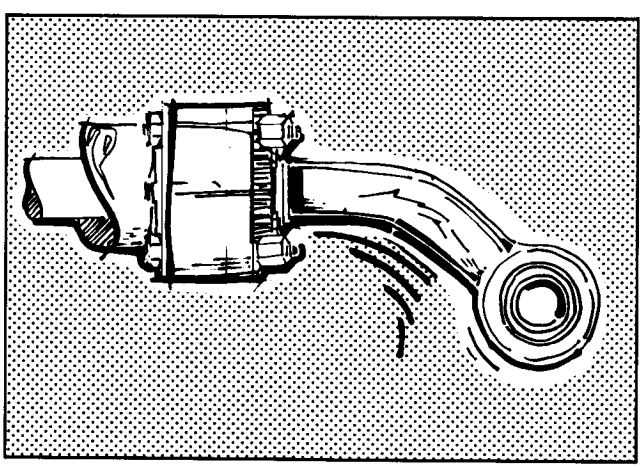
If the pressure reading at the base of the cylinder is relief....



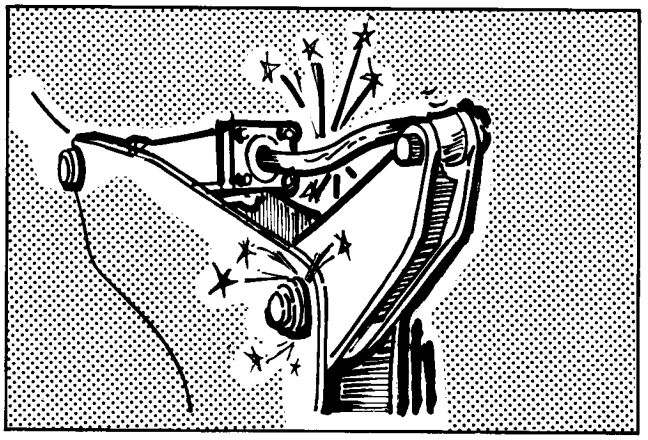
it will be necessary to move the gauge block to the rod end of the cylinder.



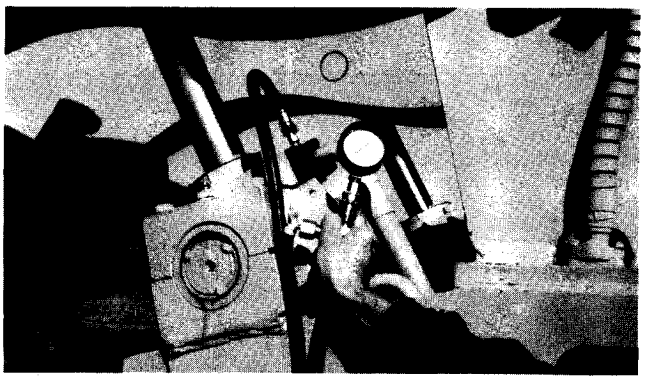
If the pressure at the rod end of the cylinder is low, the problem is IN the cylinder.



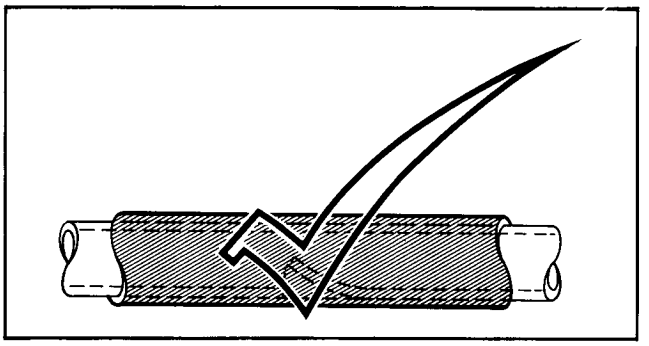
Before you do any further hydraulic checks, look for a bent rod.



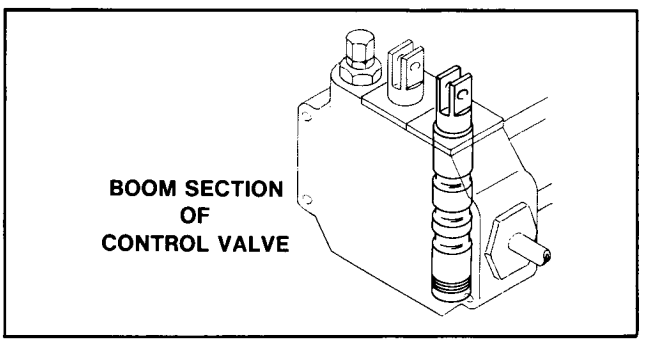
Don't forget that pins, bushings or linkage may be binding and causing the high pressures in the hydraulic system.



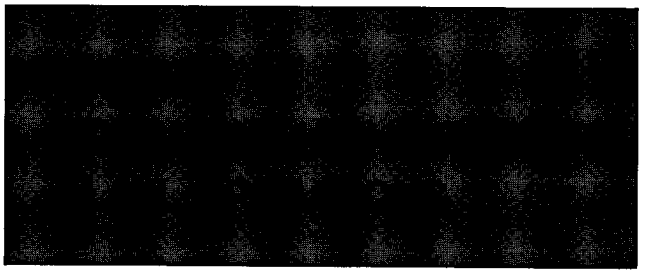
If the pressure is still high at the rod end of the cylinder, check the line back to the control valve.

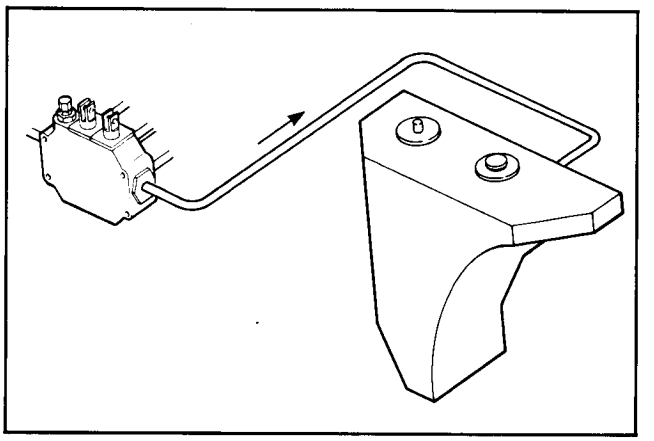


If there is no blockage in the line....

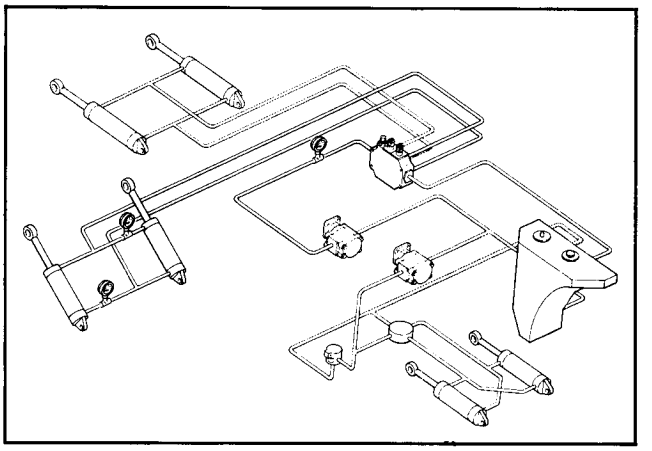


the problem must be in the boom section of the control valve.

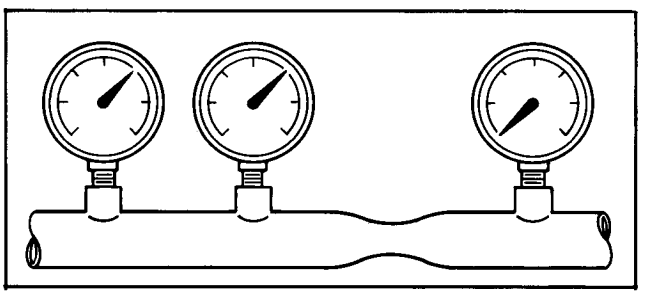




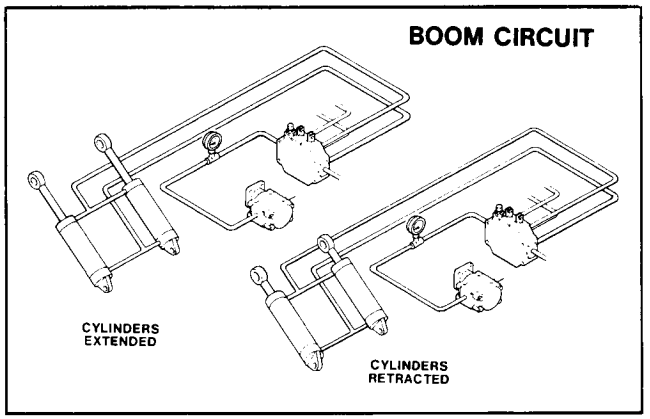
In this case, you should look for something which will cause restriction to flow in the return circuit of the valve, the return line to tank or the tank itself.



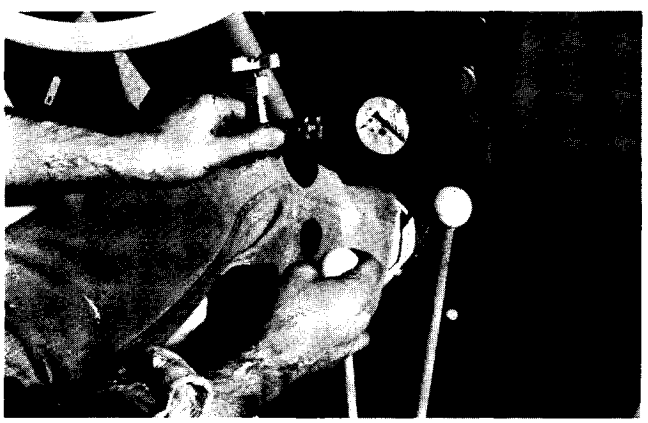
Let's summarize the general troubleshooting procedures when dealing with HIGH OPERATING PRESSURES. Install pressure gauges in the system following the oil flow until a gauge indicates normal or low pressure.



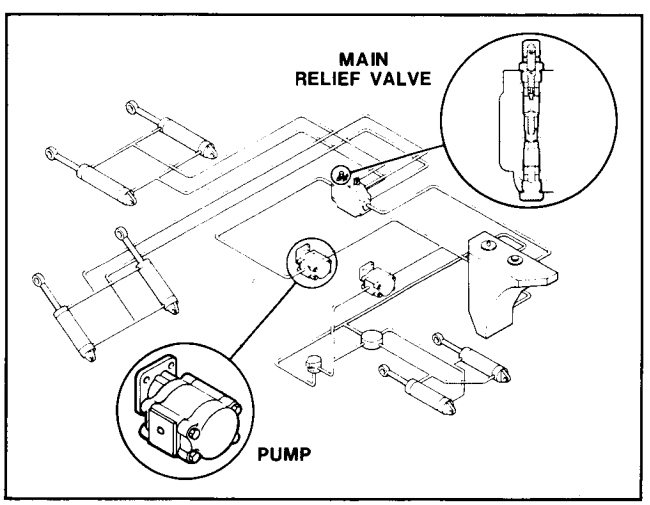
The blockage must be located between the last high pressure and first low or normal pressure gauge reading.



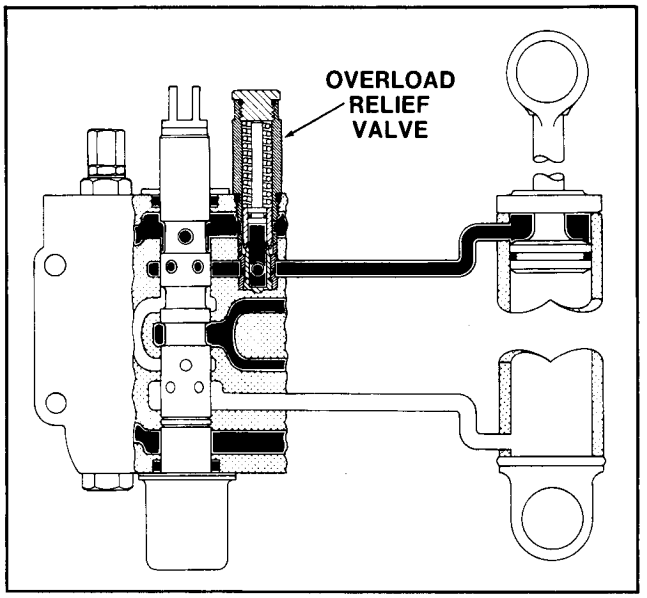
The cylinders for one circuit have been bottomed out in both directions and relief pressure cannot be reached.



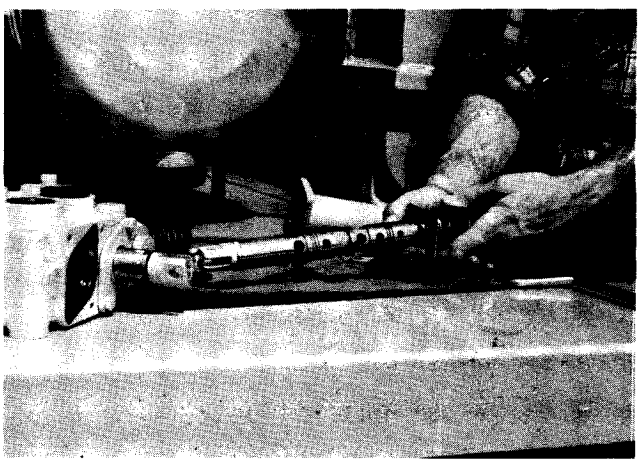
When the second lever is operated, the pressure goes immediately to main relief with the cylinder bottomed out.



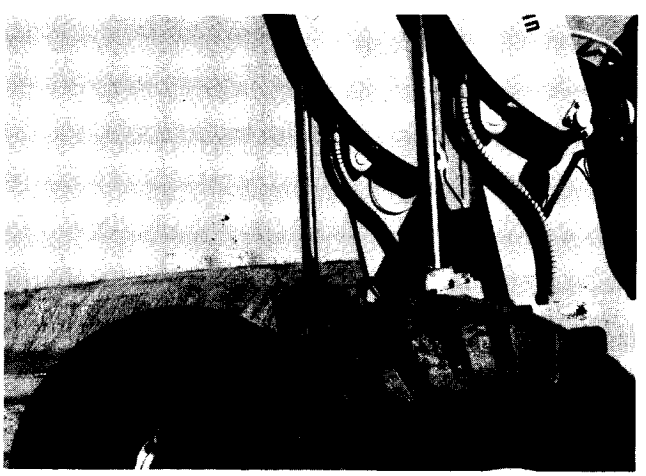
By moving the second lever, you have eliminated the possibility of the pump or the main relief valve being the problem.



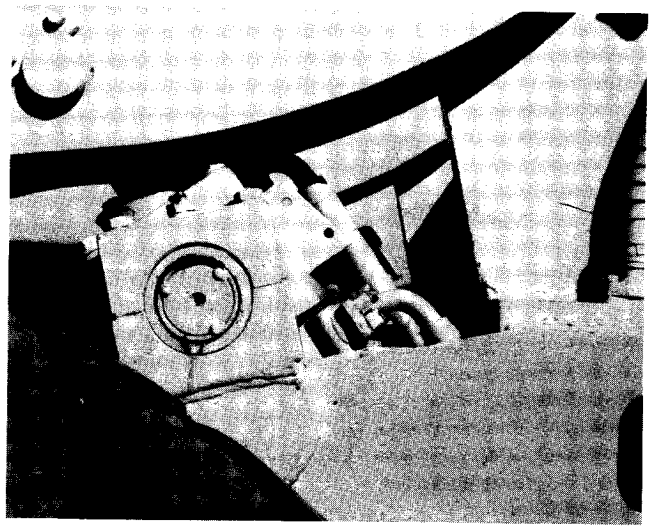
By checking the pressure in both the base end and rod end of the cylinders, you have eliminated the possibility of an overload relief valve being the problem.



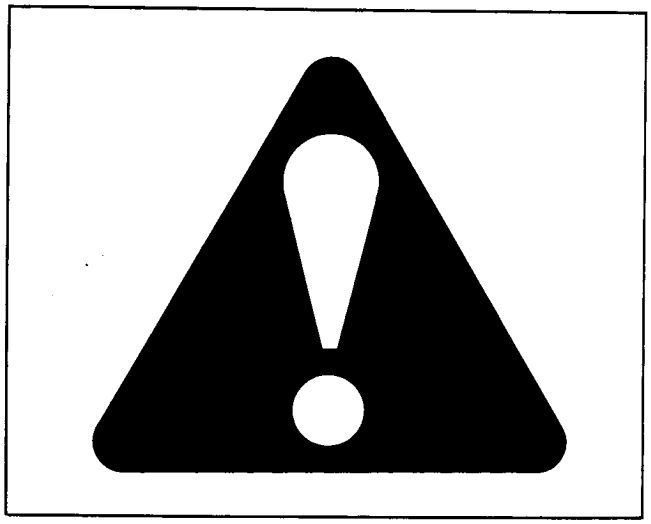
It is also very unlikely that the control valve has leakage, as both ends of the spool would have to wear evenly.



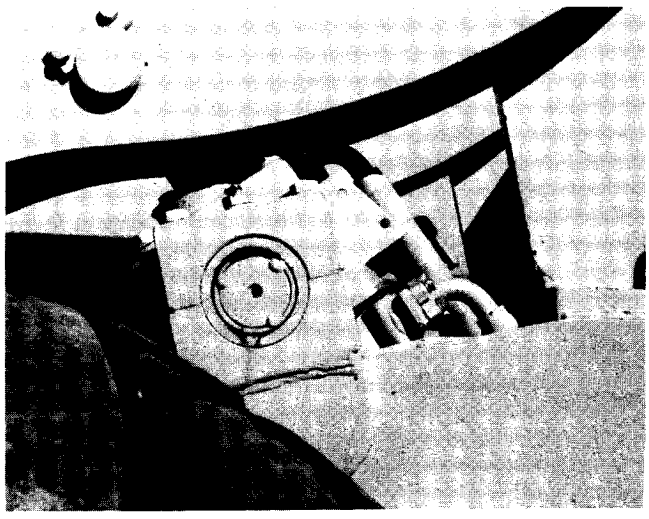
This brings you to the cylinders, which are the most likely cause of the problem.



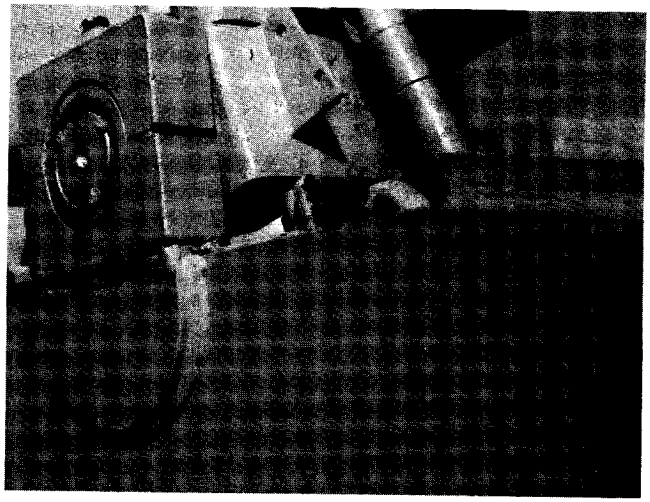
To check a cylinder, move it all the way to the end of its stroke.



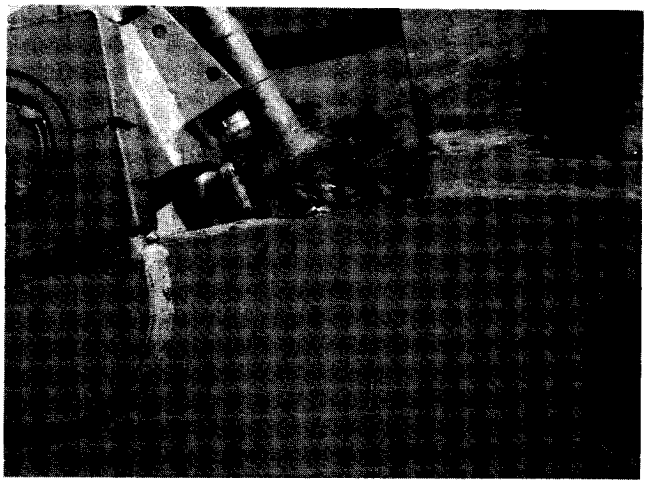
Always move the cylinder in the direction that leaves it in the safest possible position to work on....(Remember, failure to follow these instructions could cause personal injury.)



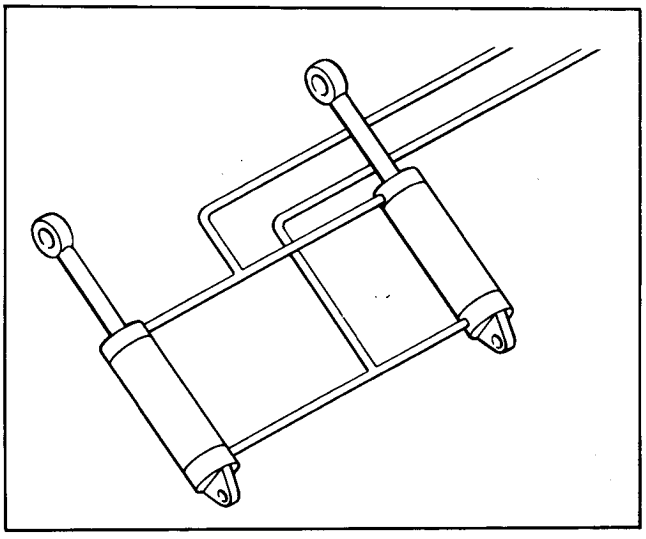
which means the boom cylinders should be all the way DOWN....not up.



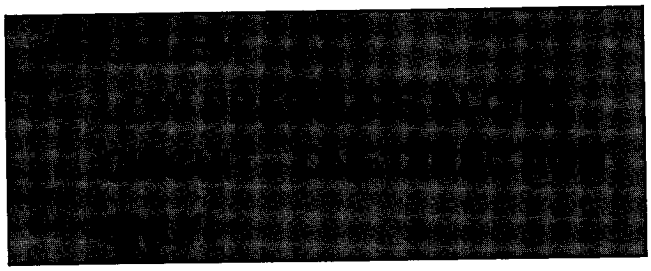
Remove the line from the end where the piston is located and cap it.



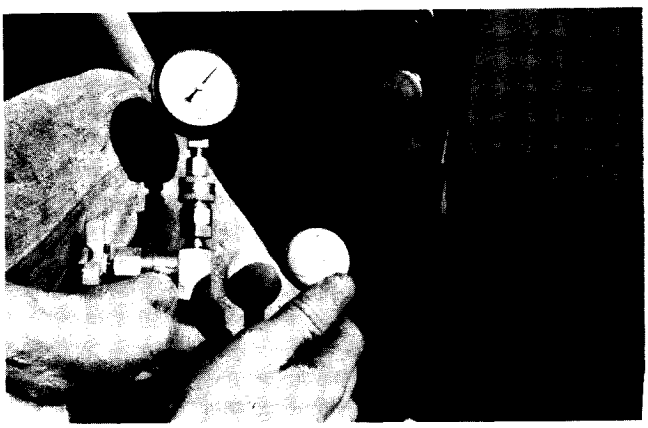
Pressurize the opposite end of the cylinder and if oil pours from the open port of the cylinder, the cylinder has excessive leakage.



If two cylinders are connected together, then repeat the procedure with the second cylinder.

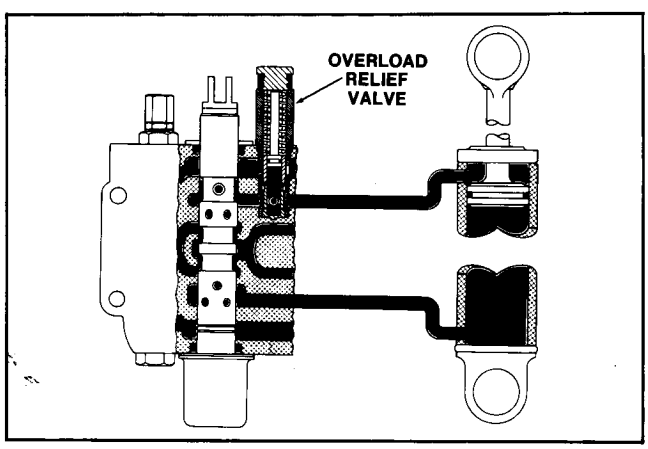


Operate the lever in one direction, main relief pressure cannot be obtained....

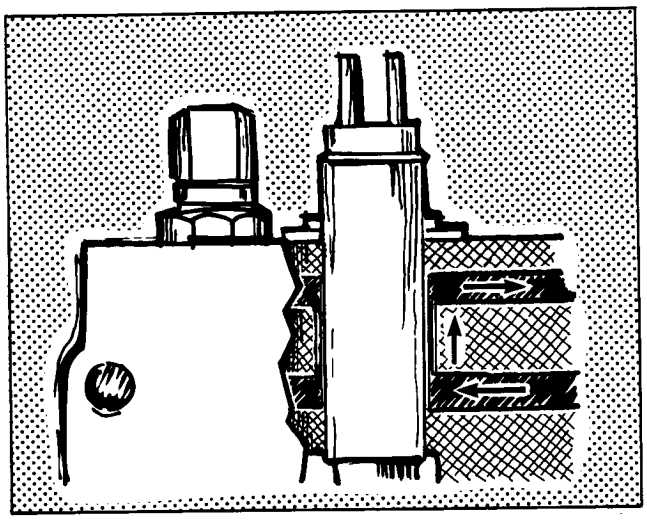


but operating in the opposite direction, main relief pressure is obtained. Other circuits operate correctly in both directions.

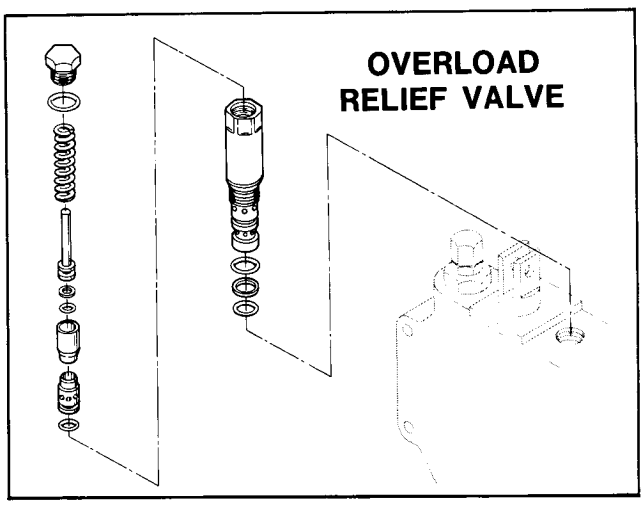
Two things can cause this problem....



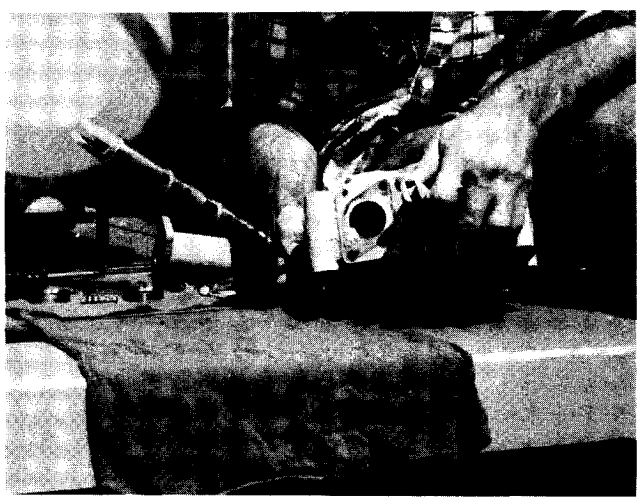
The overload relief valve....



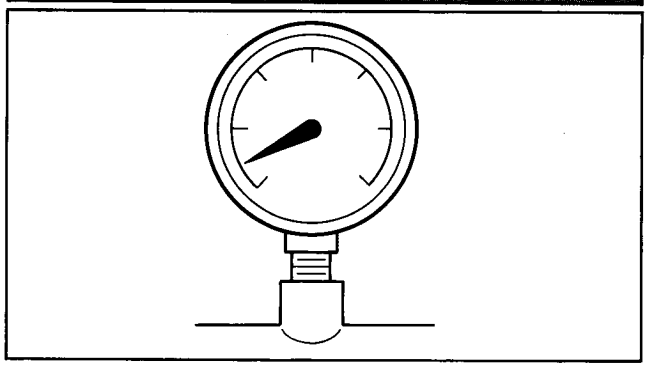
or there is valve spool leakage.

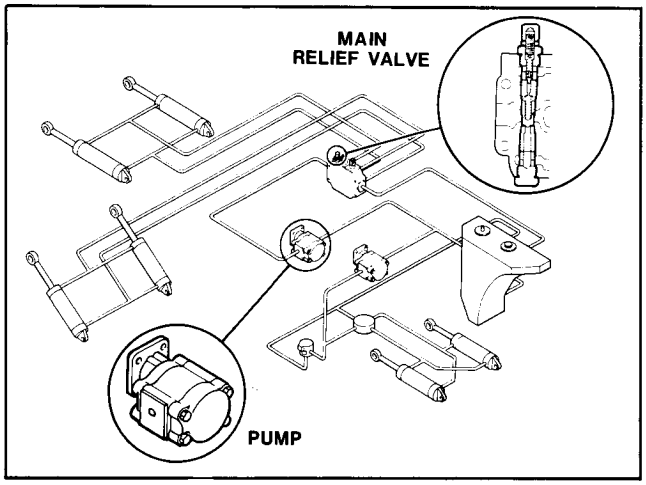


To determine which one is the problem, remove the overload relief valve and check the poppets, springs and seats etc. If there is nothing damaged in the overload relief valve and the pressure cannot be adjusted....



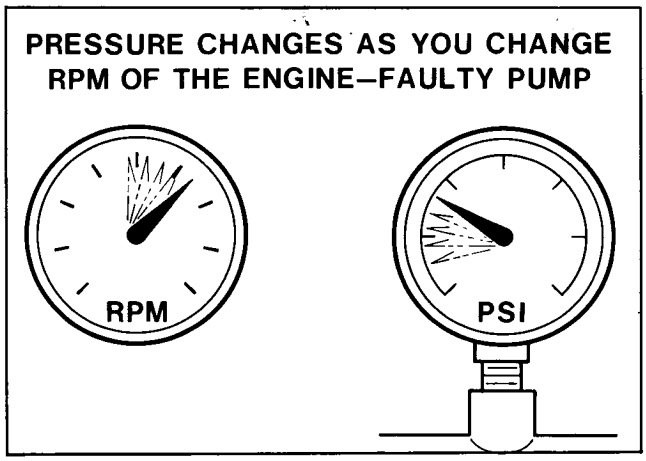
inspect the valve spool and housing. If either the valve spool or housing is damaged, the valve assembly will probably have to be replaced.



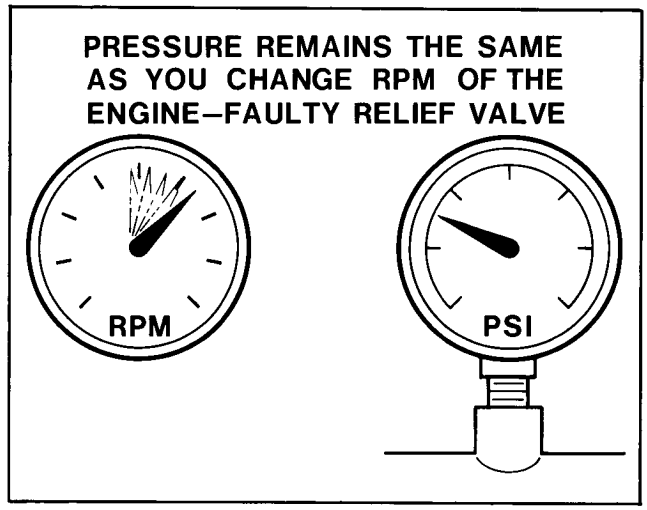


The two most likely causes of this would be....the main relief valve....or the pump. How do you separate these two? Well, if the machine is equipped with a two stage, pilot operated relief valve....

we can get an indication of which is bad by sitting in the operator's seat and changing the R.P.M.s of the engine.

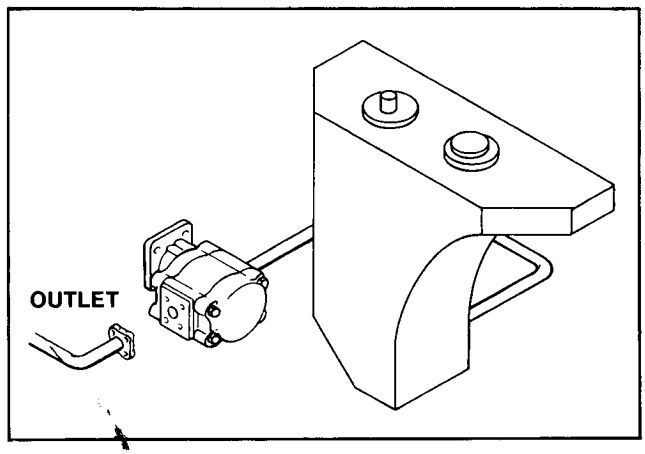


If the pressure changes as you change the R.P.M. of the engine, it's a good indication that the pump is faulty. Not a guarantee....just an indication.

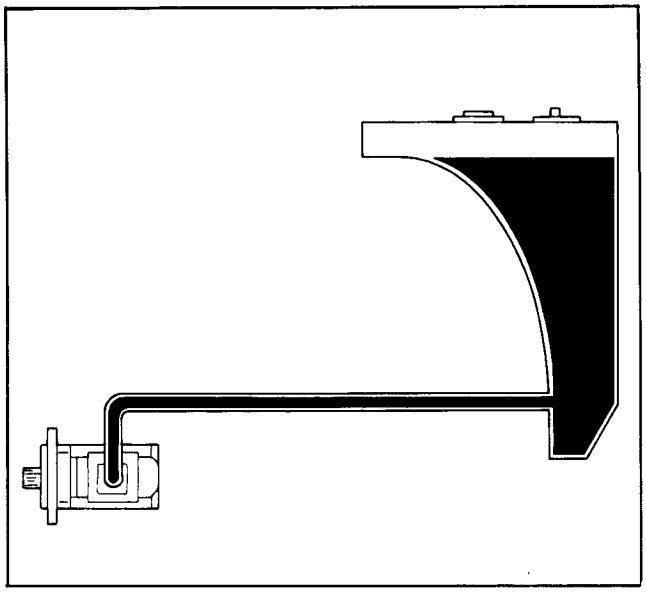


If the pressure remains the same as you change the R.P.M. of the engine, it's an indication that the relief valve is faulty.

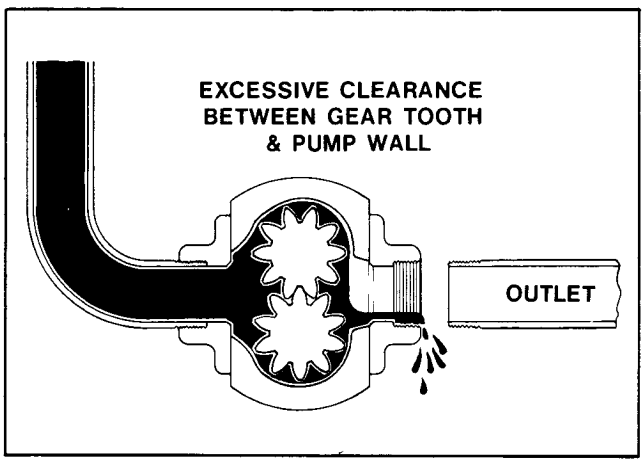
If this check indicates a faulty pump, a further inspection of the pump is required. The only correct or 100% sure method of checking a pump is with a flow meter.



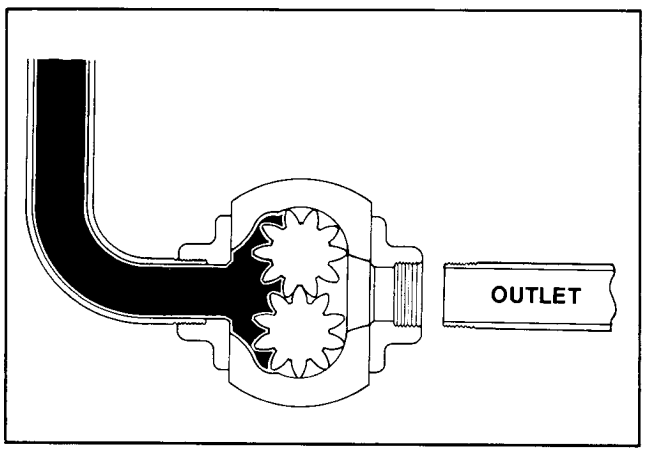
In some systems, it is possible to get an indication of pump wear by removing the outlet line of the pump.



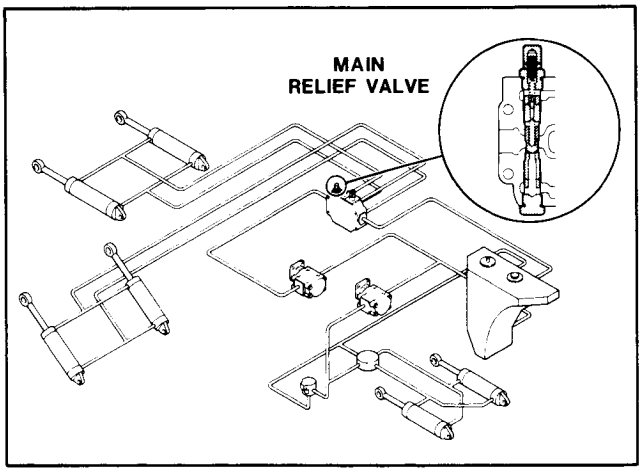
In order for this to be a valid check, the system must either have a pressurized reservoir or the oil level must be higher than the inlet of the pump.



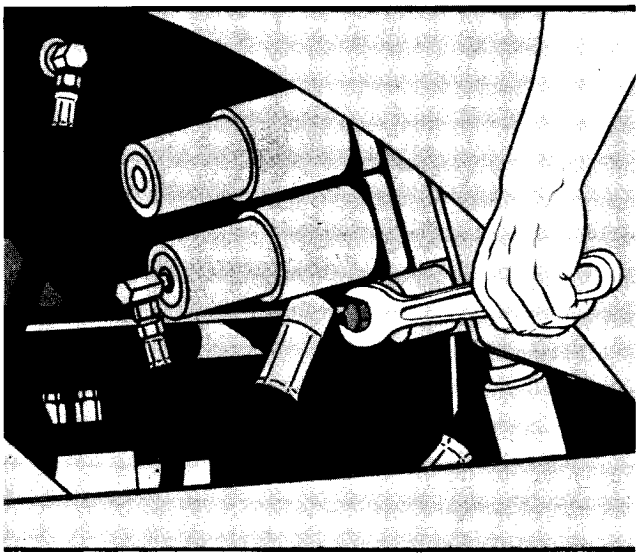
If the pump is bad, oil will flow around the gears and out of the port.



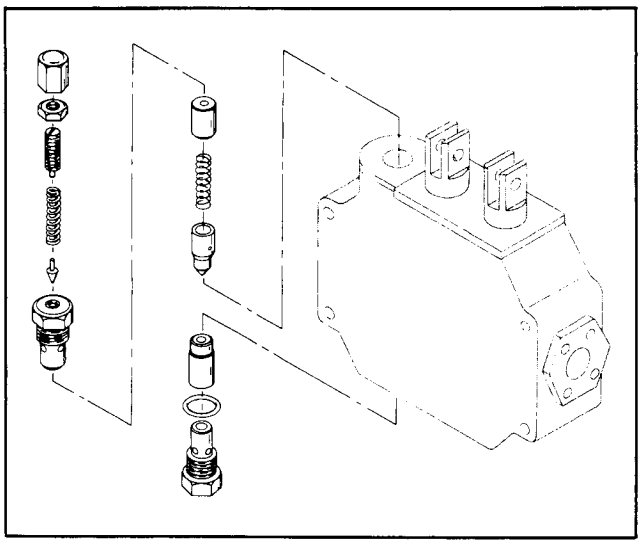
If the pump is good, it will act as a check valve and stop the oil flow. With a good pump, you should have only a slight trickle of oil from the outlet port.



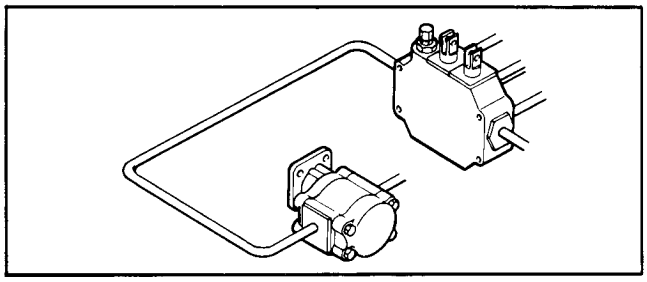
If the pressure stays constant when you rev the engine, the problem may be in the relief valve.



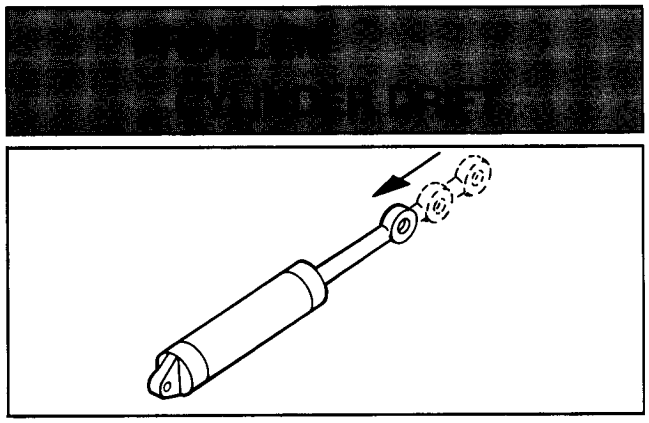
Try adjusting it to the proper pressure.



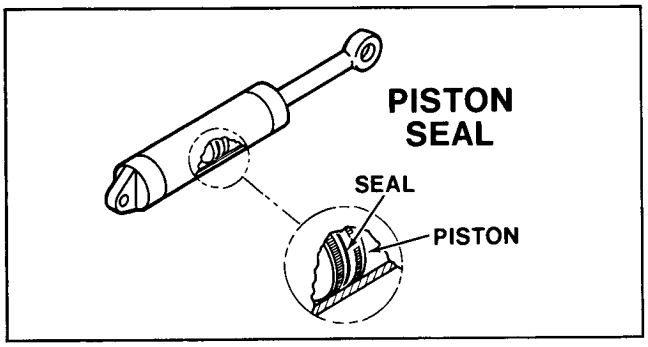
If proper relief pressure cannot be obtained, the relief valve should be removed and inspected for broken springs, bad seats, blown "O" rings, etc.



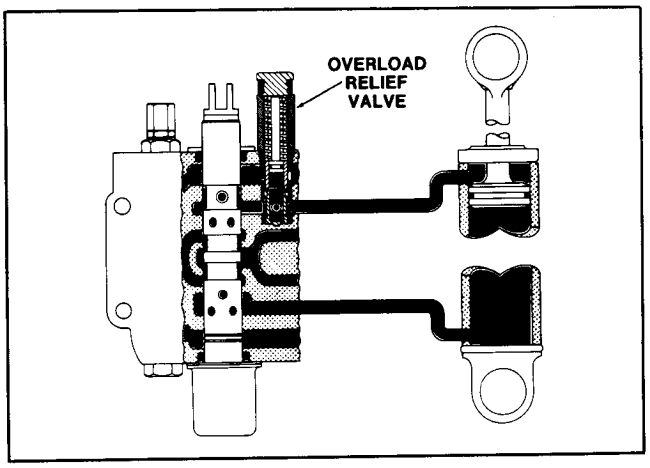
If the relief valve seems to be in correct working condition, the decision must be made whether to check the pump next....or the internal components of the valve.



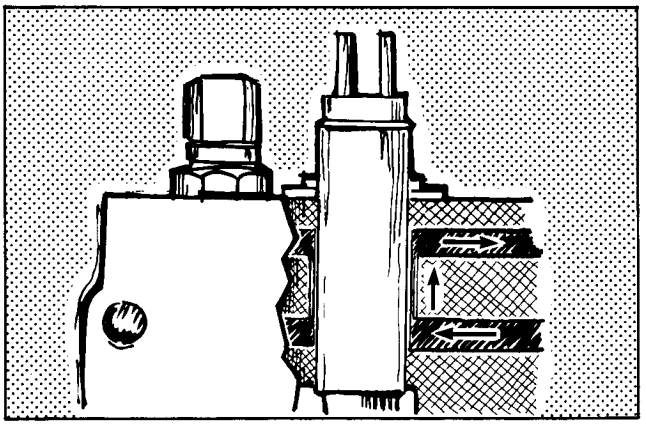
There are only three areas in the hydraulic system which will allow cylinder driftage. They are....



Piston seal leakage....



Overload relief valve leakage....

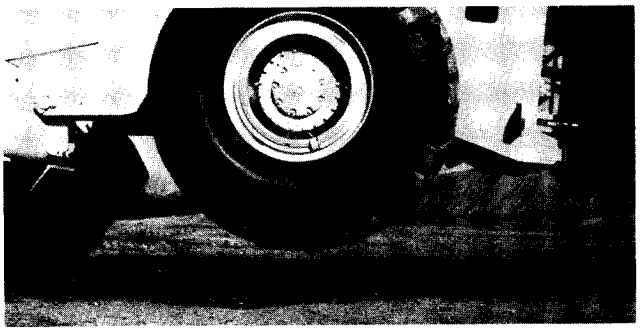


and valve spool leakage.

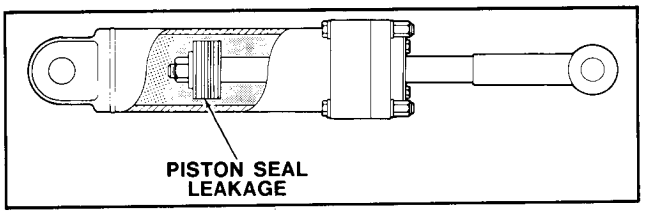
SEPARATE .....

- PISTON SEAL
- OVERLOAD RELIEF
- VALVE SPOOL

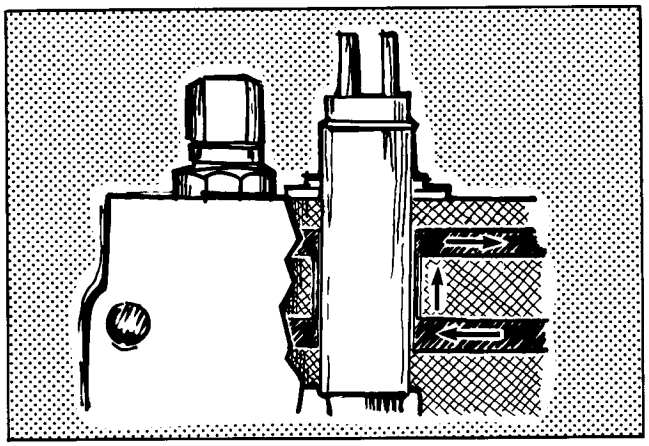
Now to separate which of these possibilities is causing the problem, where possible, pressurize the cylinder in the opposite direction.



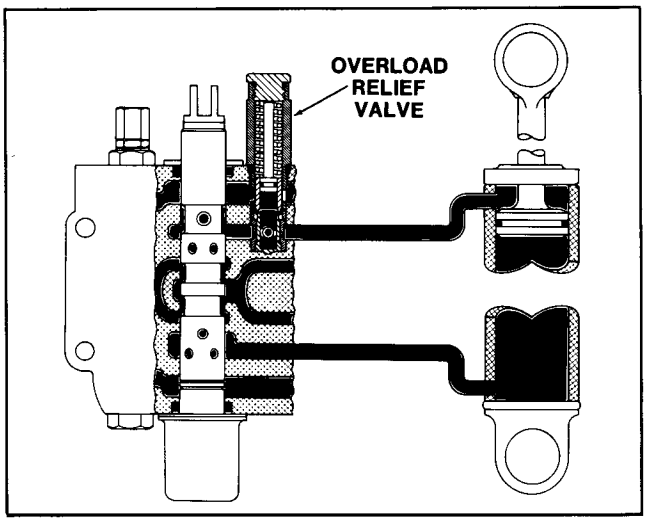
Pick the front end of the machine off the ground. Allow the lever to return to neutral. This will provide external force from the ground onto the cylinders in the opposite direction.



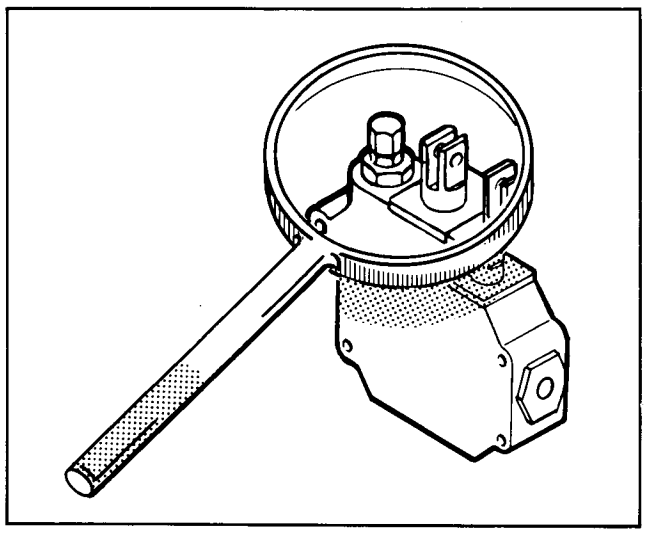
If the machine drifts back to the ground, the most likely problem is leakage by the cylinder piston seal and a cylinder leakage test should be performed to determine which cylinder is faulty.



If the cylinder does not drift in both directions, it narrows the choice to spool leakage....

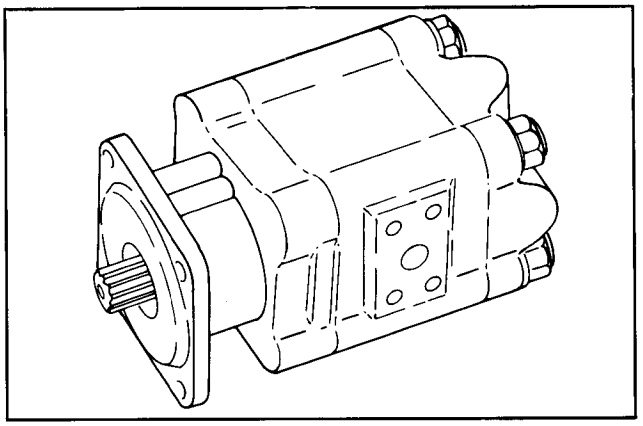


or the overload relief valve. The most likely of the two is the overload relief valve and it should be checked by removing it for inspection and readjustment.

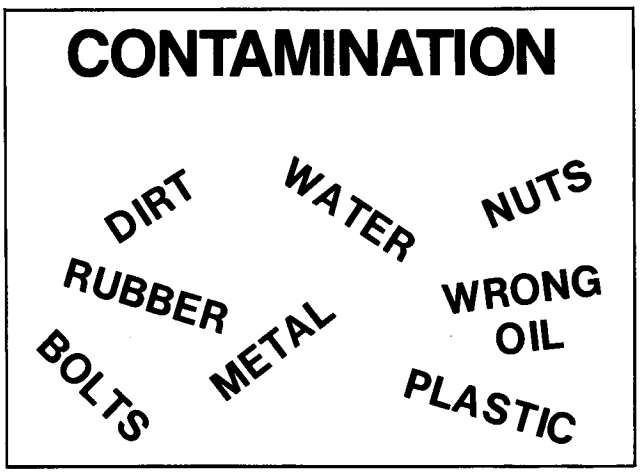


If this does not correct the problem, check the valve spools and valve body for signs of damage. Repair or replace the valve as necessary.

PUMP FAILURE



What should be done when it has been determined that the problem is in the pump? There are five basic reasons for pump failures.



Contamination can be dirt, metal, water, the wrong oil or anything which is in the system that shouldn't be there.

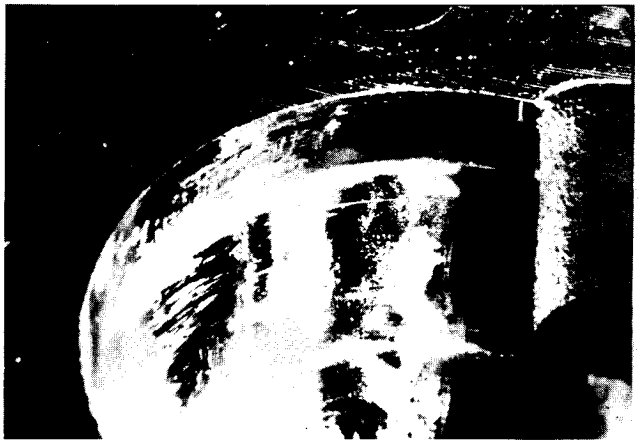
To identify a pump that has failed from contamination, you'll find score or scratch marks in the pump wall, gears and end plates. It may also look as if someone has used a fine hone on the pump parts.

CAUSES OF
CONTAMINATION

- IMPROPER SERVICE PROCEDURES
- PREVIOUS FAILURE
- POOR SYSTEM SEALS

CAVITATION OR AERATION

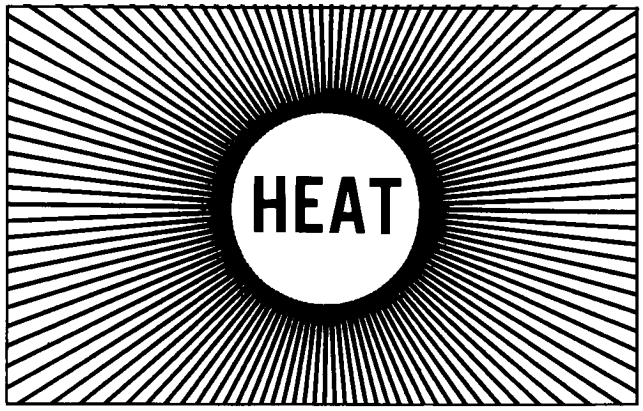
The second cause for pump failure is cavitation or aeration ....which is defined as air in the oil or a lack of oil in the system.



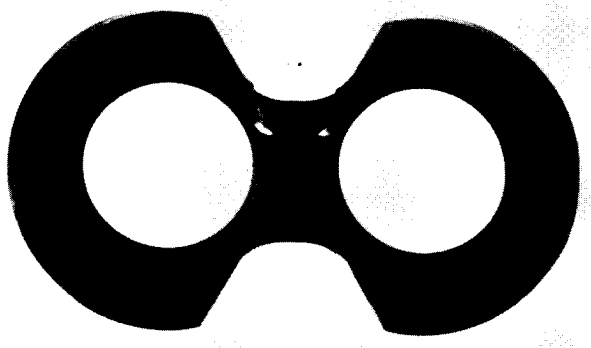
The identification of a pump that has failed from cavitation or aeration is pit marks in the pump wall, gears or end plates.

CAUSES OF
CAVITATION OR AERATION

- LOW OIL LEVEL
- WRONG OIL
- LEAKING SUCTION HOSE
- PUMP SHAFT SEALS



The third is a real killer....HEAT.



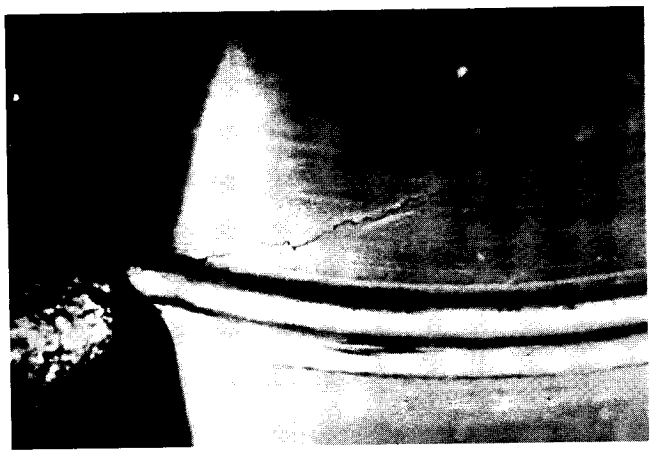
A pump which has failed from heat shows discoloration of the gears, pump wall, end plates and also hardening or deterioration of seals or "O" rings.

CAUSES OF
HEAT

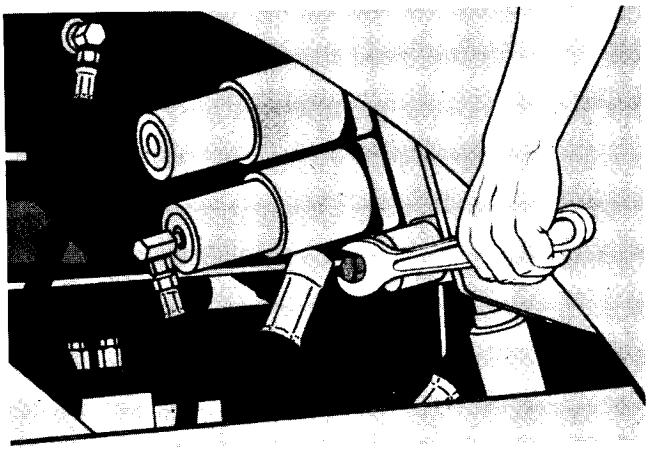
- LOW OIL LEVEL
- OVERLOADING MACHINE
- LEAKING CYLINDER PISTON SEALS
- INCORRECT RELIEF VALVE SETTING

In general, any oil by-passing the seals or spools.

HIGH PRESSURE

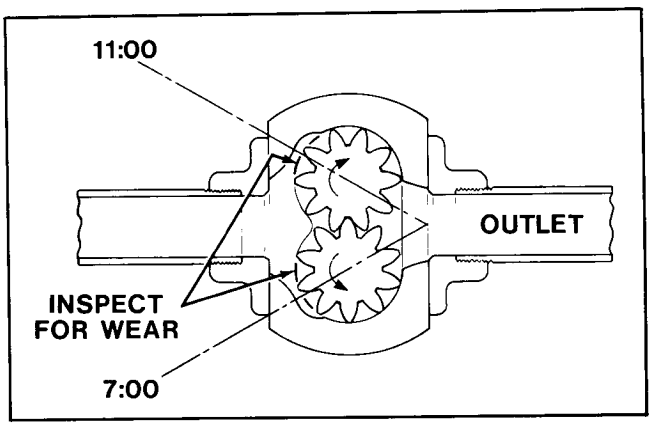


This failure is identified by cracks in the pump body and/or broken pump components.



The causes of a high pressure problem could be an improper adjustment of the relief valve or a faulty relief valve.

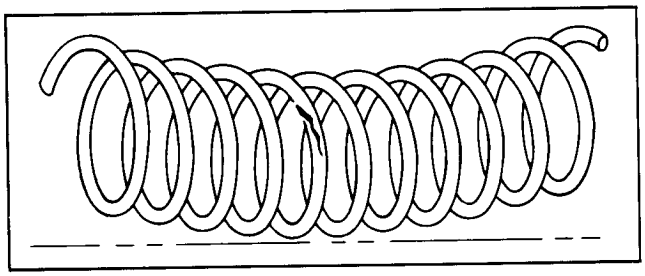
NORMAL WEAR



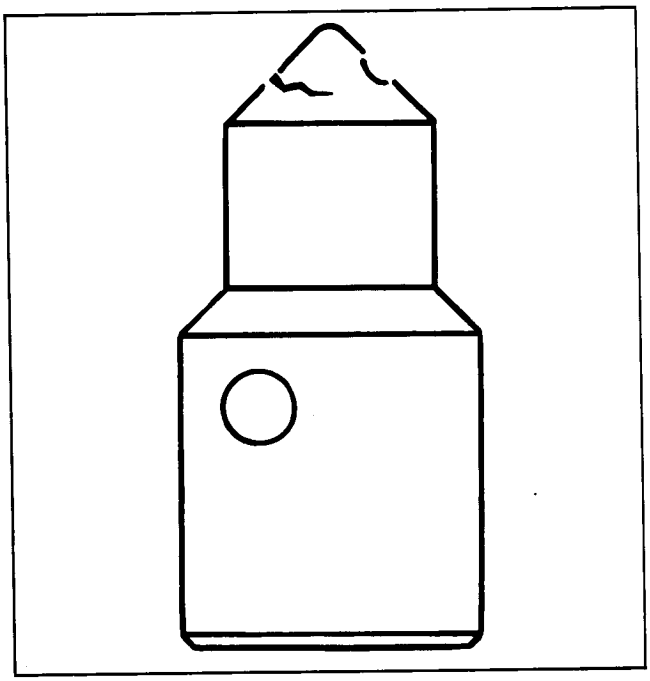
It won't have tell-tale traces of discoloration, cracks or broken components, so your check will have to be made at the 7:00 and 11:00 positions to inspect the clearance between the gears and pump walls.

[illegible]

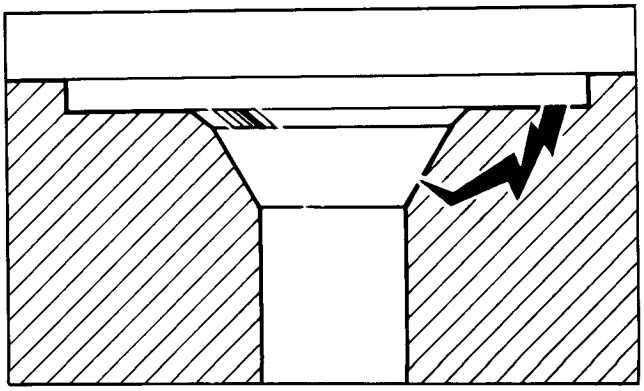
If a relief valve fails to maintain the correct pressure setting, any of the following things could have caused the failure.



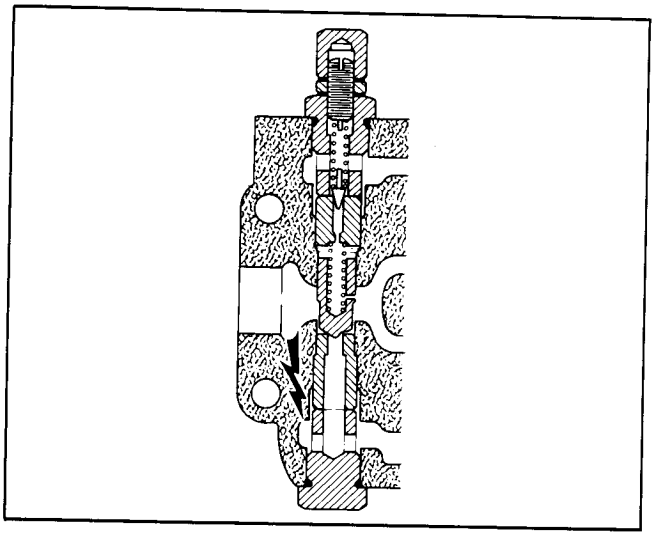
A spring that has been weakened due to heat or broken.



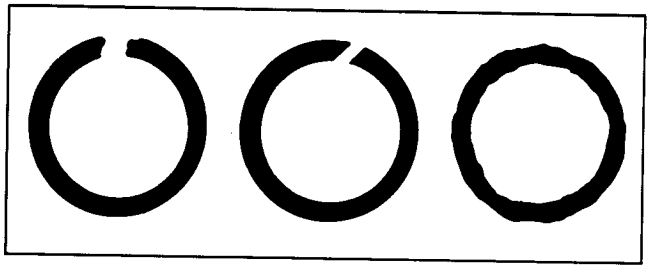
A poppet that has become scored, cracked, warped or worn.



Or a poppet seat that is scored, cracked, warped or worn.



The body could also be cracked, warped or worn.

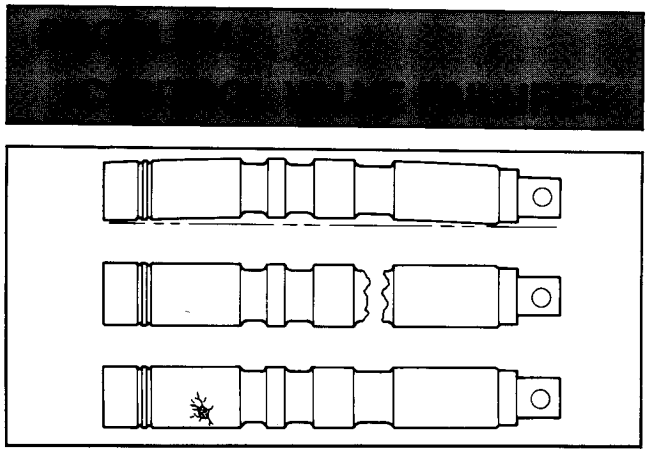


The "O" rings may be split, cut or burnt.

CAUSES OF
RELIEF VALVE FAILURES

- CONTAMINATION
- HEAT
- IMPROPER INSTALLATION
- NORMAL WEAR

Now, when control valves lose control....it could be:

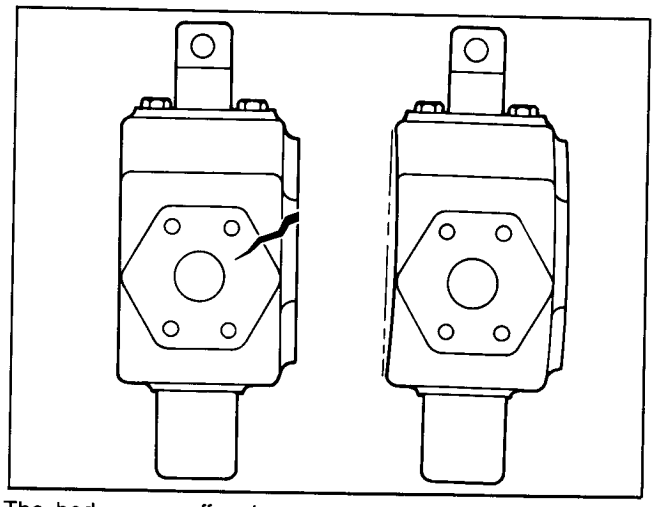


the spools are scored, broken, worn or binding.

LEAKING SEALS

- CUT
- WORN

When seals leak, it's because they are either cut or worn.



The body may suffer damage such as cracks, warping or wear.

Check valves could be malfunctioning because they are:

CHECK VALVES

- BINDING
- SCORED
- WORN
- WARPED

SPRING & DETENTS

- BINDING
- RUSTED
- WORN

The possible causes for any of these problems in the control valve could be....
contamination in the oil....
excessive heat in the system....
the improper installation of components....
the overtightening of mounting bolts....
high pressure
and normal wear.

CYLINDER FAILURE

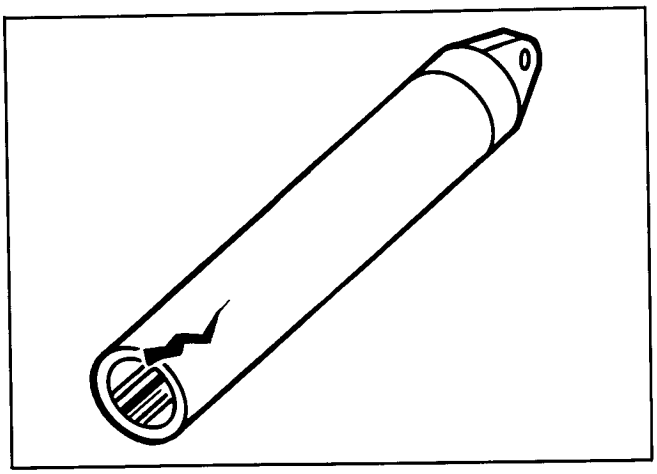
Cylinders can have problems, such as....

PISTON SEALS

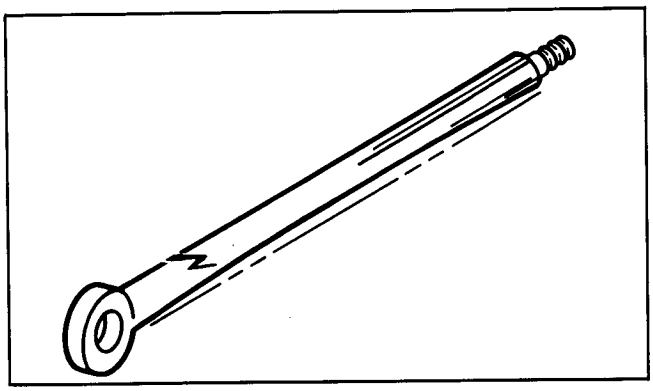
- CUT
- SCORED
- BLOWN
- BURNT

ROD SEALS

- CUT
- SCORED
- BLOWN
- BURNT



The cylinder tube could be scored or cracked.



The rod itself could also be scored, bent or cracked.

the possible causes for damage to cylinders are
contamination of the oil....
excessive heat....
the improper installation of components....
high pressure
hitting obstructions
and normal wear.

BASIC HYDRAULIC SYSTEM TROUBLESHOOTING.... JUST A MATTER OF A GOOD, SYSTEMATIC PROCESS OF ELIMINATION.