Diagnosing Hydraulic Problems with a Cee-Jay Tool Cutter

There are two types of hydraulic problems, either with flow or with pressure.

Pressure problems can have the following symptoms:
1. system is not developing enough pressure
2. actuators not moving or moving slowly
3. valves are acting erratically
4. leaks occurring

Pressure problems usually originate from incorrectly set or malfunctioning valves, actuators, or pumps.

Flow problems may have the following symptoms:
5. system is slow to build pressure
6. actuators not moving or moving slowly
7. valves getting too hot
8. valves not shifting or shifting hard
9. hoses jumping, banging noises, and leaks

Diagnosing these problems takes a systematic approach of narrowing down the possible causes until just a few are reached. This is done by a series of tests.

Testing.
The first step in diagnosing pressure or flow problems is to verify the correct adjustment all of the valves. The pressure gauge is located on the aluminum hi/lo block at the end of a Chris Cutter or HDS power unit and is directly attached to the pump on a M50.

1. Verify the system pressure is set correctly.
    a. Deadhead the top jaw all of the way down. Did the pressure gauge reach the correct setting and stay there? 2400-2500psi for late model Chris Cutters. 2400-2700psi for HDS. 2000psi for M50 and early model Chris Cutters made by Chris Jenkins.
    b. Deadhead the top jaw all of the way up. The pressure gauge should read the same pressures as listed in the step above.
    c. Put the lock/unlock lever in the detent position. The inbound table should raise up and the pressure gauge should read 650-750psi.
    d. Pull the lock/unlock lever towards the inbound side. The pressure gauge should read 400-500psi.
2. Note the current state of the hydraulic system and write it down. This may indicate sources of the hydraulic problems.
    a. Are there any severe leaks? This may be points of dirt ingression.
    b. Is the hydraulic fluid viewable in the tank sight glass? If not the fluid is not at the appropriate level.
    c. Is the hydraulic fluid dirty? Looking at the sight glass does it have a yellow translucent color typical of clean motor oil or is it brown like coffee?

    d. While running and warmed up, is the filter dirt indicator stuck up? If you cannot make the red indicator go down by pushing the reset button, the filter has problems passing the oil through it efficiently.
    e. Is there any noticeable damage to any of the hydraulic components? Does it look like any valves have been struck or broken off and repaired? Noticeable gouges, scratches, unusual abrasion and dents are all indicators that components may have been hit very hard by stone or machinery.
    f. Does the machine look generally well maintained? Duck tape and binding wire holding parts on, oil soaked dirt under the power unit and control valves, severely worn hose casings, loose top jaw guides, dirty and worn teeth are all indicators that a cutter is not properly maintained. This may be due to improper maintenance training, low mechanic skills, or no regular maintenance at all.
3. Attempt to readjust any valves if the pressures are not correct. If you are unable to adjust a valve, note it and move on to the remaining valves.
    a. On a three cylinder Chris Cutter the top jaw pressures are set by 5 different valves and takes some practice on how to determine where each of them is set. As you watch the pressure gauge when the top jaw is lowered and deadheaded, it will jump twice. The first and smallest jumps should occur around 800-900psi. This is when the counter-balance valve on the hi/lo block dumps the large volume pump gear back to tank. The second jump is when the sequence valve on the cutter begins to power the outer cylinders. This occurs around 1200psi. Do the deadheading sequence several times so you will learn to watch the pressure gauge and see when the valves are changing.
        i. First set turn the relief valve on the operator control valve all of the way in. Turn the relief valve on the hi/lo block all of the way out. While deadheading the top jaw down, turn the hi/lo relief valve in until it is 100psi above the desired system operating pressure as outlined in step 1a. Lock the jam nut to secure the set screw.
        ii. Second, as you deadhead the top jaw down, turn the operator control valve relief outwards until you finally see the pressure gauge start to come down. Adjust this valve to the desired operating pressure outlined in step 1a.
        iii. Third, on sequence manifold, turn the counterbalance valve screw all of the way in, then back it out about ¼ to ½ turn and lock the jam nut. This valve simply dumps excess oil from the sequence manifold and top jaw cylinders.
        iv. Forth, on the sequence manifold, adjust the sequence valve to actuate at 1200psi. Do this by deadheading the top jaw downwards, then adjusting the set screw. The pressure gauge needle will climb up, drop down and continue to climb to the system pressure. This happens fast, but the maximum pressure the needle reaches before it drops and starts climbing again is the pressure the sequence valve is set at.

v. The last valve to adjust is the counter-balance valve located on the hi/lo block on the power unit. This valve dumps the high volume gear from the pump back to tank at a set pressure. You need a clamp on style ammeter to adjust this valve correctly. Attach this meter around the bottom wires going to the motor in the pump starter panel. Read what the full-load amp (FLA) rating of the motor is off the motor nameplate. It should be listed directly under the voltage being used. For 25hp motors the FLA should be 56amps for 240volts and 28amps for 480volts). Read the ammeter as the top jaw is raised and lowered. Adjust the counter-balance valve so the ammeter reads close to the motor FLA and no more than 15% of the motor FLA rating (64A for 240V and 32A for 480V). Note: adjust a counter-balance valve in to decrease the pressure setting and turn out to increase. This is opposite of the relief valves.

b. For HDS and single cylinder Chris Cutters and older sequence valve Chris Cutters, do the above steps i, ii, and v only. Additionally, the sequence valve in the older Chris Cutters have a spring on the left side that is adjusted by adding washers or shims. This would be equivalent and done in the same fashion as step iv above.
c. For M50s, steps i and ii will need to be done only. The equivalent to the counterbalance valve in step v is located on the pump and is factory preset to 650psi. If adjustment is required, remove the hex cap on the side of the pump to access the set screw and adjust as necessary.
d. On every cutter there are two relief valves to set for the locking and unlocking of the teeth. They are both located directly above the operator control valve where they are screwed into an aluminum manifold which is called the lock/unlock block. Each valve has a different pressure range and setting.
    i. The relief valve on the left side of the lock/unlock block is labeled RDDA LDN for M50s and RDFA LBN for everything else. It controls the pressure for the inbound table cylinders, the veneer gage cylinder extend, unlocking of the cam and teeth, and finally the extending of the teeth. This valve should be set at 650 to 750psi for all cutters. Adjust this valve by pushing the second operator control lever into the detent position and leaving it there. The inbound table should go up and all of the teeth should extend to their maximum. Adjust the set screw on the valve until the pressure gauge reads the appropriate pressure.
    ii. The relief valve on the right side of the lock/unlock block is labeled RDDA LEN for M50s and RDFA LEN for everything else. It controls the pressure for the cam lock position and retracting of the veneer gages. It can be adjusted by holding the second lever of the operator control valve back in the tooth lock position and turning the valve set screw until the pressure gauge reads 400-500psi.

e. On every cutter there is a flow control valve that determines the rate of which oil can escape from the tooth piston chambers. On newer cutters it typically has a black adjustment knob and is located on the lock/unlock manifold. It is labeled NFDC KAN on M50s and NFFC KGN on all other cutter models. On older cutters this valve will be attached separately to the lock unlock block and will look like a water spigot valve. Turning this valve knob in will close the flow making it harder for the oil to escape the tooth piston chambers. This makes it harder to push the teeth in. We use this setting for harder stone. In opposite fashion, we turn this valve out to allow the oil to escape easily. This will allow the teeth to be pushed in relatively easy and should be used for softer stone. Never turn this valve in all of the way.

4. Upon successful adjustment of the valves, the cutter hydraulics should be working correctly and the symptoms experienced should have gone away. If this is not the case, then more diagnosis will need to be done. Below is a list of reasons you may not have been able to adjust a particular valve to the correct pressure setting:
    a. Damaged valve due to contamination. Look at hydraulic oil sight glass and filter to see if the oil is excessively dirty. The valve may be cleaned using a cleaner or solvent friendly to buna-N or nitrile rubber, rinsed with water, dried and put back in to see if it works again.
    b. Damaged valve due to excessive heat. If the oil in the system reaches extremely high temperatures the seals in the valves may fail. Molten or misshaped seals, seals that have extruded into gaps, and discoloration of any parts indicate too high of temperatures around that valve. If this relief valve if it is being opened all of the time it can get extremely hot in a short amount of time. Replace this valve in the event of any of these symptoms and look for a reason this valve is open all of the time. It could be that it is set lower than the operator control relief valve which it shouldn't be. This is a safety valve and should not be opened at all if the cutter is working properly.
    c. Accidental damage to valve due to being struck by objects. In a quarry there are many heavy objects that may fall on or strike the valve. Obvious signs may be dents, gouges, and scratches on the valve body. Not-so obvious signs include parts that look newer than the rest of the valve, mushroomed or damaged set screw and thread, or a bent mounting plate that it is bolted to. In any case the valve is suspect to internal damage as well and may not function properly. Removal, inspection, and replacement may be necessary.
    d. Rusty, dirty, or damaged threading on the valve adjusting screw. This may not allow you to turn the screw pass a certain point, fooling you into thinking the valve is turned all of the way in or out when it is not. A thread file and wire brush will help straighten and clean the threads.
    e. Blown seals. If the internal seals of the valve are not working properly, fluid may be able to escape from one port to another. Inspect the seals and replace if any damage or deformation found.

f. Internal wear. When disassembled you may find that some parts may have portions eroded away from high pressure oil running across the part. Though this is rare, aluminum bodies are more susceptible to this type of failure than cast iron or steel. Other forms of wear are the typical sliding of two parts across each other to the extent that they do not function properly. In any case replacement with be necessary.
g. Improperly working valve. Through all inspection and testing you cannot figure out why a valve is not working properly. Stop beating your head and replace it anyway.