Check your hydraulic system!

The hydraulic system is used with intensifiers and is the driving force of the intensifier to do its job of compressing water into high pressure water for cutting with a high pressure stream.

The hydraulic pump is driven by an electric motor which must be rotating in the proper direction (most always rotating counterclockwise as you face the back of the pump). The hydraulic pump must also have access to an uninterrupted supply of oil at the proper flow rate. If the oil supply is not sufficient or absent, the pump can experience cavitation (mixing air with oil causing improper lubrication and possible damage to the hydraulic pump).

The most common type of hydraulic pump used on Flow machines are axial piston (pistons and cylinders are parallel to the main drive shaft). On older pumps, Flow had used radial piston pumps (action of pistons in and out of cylinders move toward and away from drive shaft). These types of hydraulic pumps used by Flow are usually Rexroth brand which can come as a single 4 cubic inch pump or in a tandem configuration (one pump behind, or inline with the front pump). These pumps can be ordered with or without the gear pump on back for cooling loop systems. 2.8 cubic inch Rexroth pumps are also used on pumps with motors of 30h.p. and below. Parker pumps (usually a teal green color but sometimes in black) are also used. Parker pumps do not come in a tandem setup and also come in 4 and 2 cubic inch models.

Both of these types of pumps are usually used on open loop style systems on Flow machines (in open loop systems, the return side of the system is not pressurized). In other words in the open loop systems, used oil after performing its task, goes directly through a return filter and into the reservoir.

Finally, Denison pumps are used in pumps with closed hydraulic systems such as the 25X models. These pumps are run in a closed loop (pressurized return side) and should be maintained by experienced hydraulic personnel.

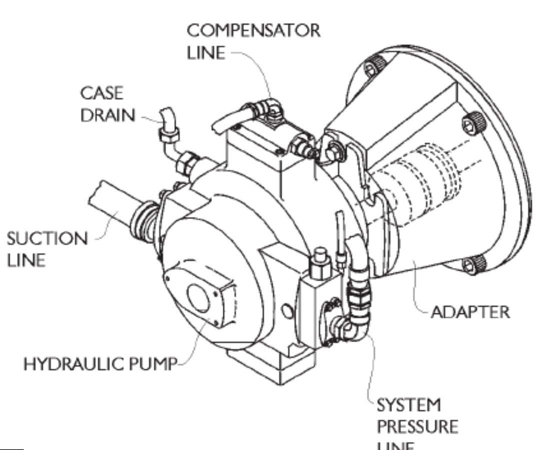

Fig. 1

This is an example of a radial piston pump manufactured by Bosch. It shows the **SUCTION LINE** which draws oil from the reservoir. Axial piston pumps are set up the same way. The **SYSTEM PRESSURE** line puts forth the volume of oil necessary to operate the hydraulic system on the intensifier pump. The **CASE DRAIN** line allows the flow of residual or bypass oil from the pump case to the reservoir. The **COMPENSATOR** line will be used to control the volume of output oil via the **SYSTEM PRESSURE** line to operate the hydraulic system on the intensifier pump. The **ADAPTER** couples the **HYDRAULIC PUMP** to the electric motor. Also note the motor and pump shaft are coupled together usually with a 3 piece coupler assembly.

To explain the operation of the system further, axial piston pumps use a swash plate to compress pistons into the cylinders to pump out oil. The radial piston pumps use a ring. Both will move when back pressure is put to the volume of oil coming from the COMPENSATOR of the hydraulic pump. The action of adding back pressure or resistance to the oil coming from the COMPENSATOR circuit will cause the swash plate or ring to move more, the more the resistance is put on the COMPENSATOR circuit. Enough resistance will be put on the COMPENSATOR circuit to cause the hydraulic pump to achieve full system pressure. Here is a basic example of an axial piston pump.**

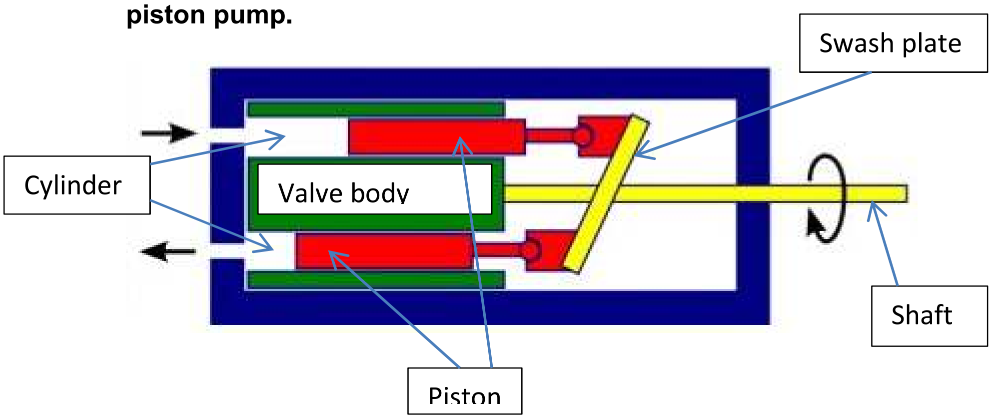

fig. 2

The swash plate pivots at the bottom and can either be moved back by applying resistance to the compensator circuit or moved forward by applying little or no resistance to the compensator circuit. We see here that the swash plate is moved back allowing the piston at the top to open and allow the cylinder to fill with oil. When the top piston rotates to the bottom position, the piston is forced back into the cylinder causing it to expel hydraulic oil out through the outlet port or system pressure line. There are usually 7 pistons and cylinders in the valve body on this type of pump.

Here is a basic example of the radial piston pump;

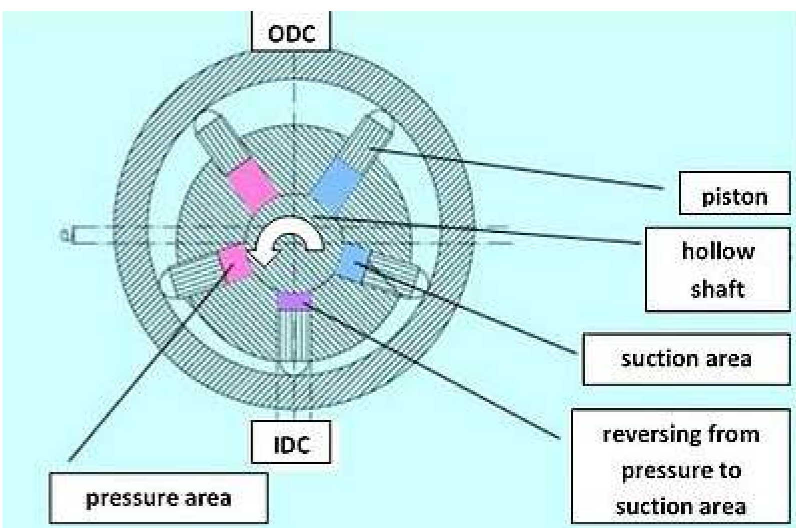

fig. 3

Here we see the ring that has been offset to the shaft allowing the pistons to come out more from the cylinders at the top of the rotation to take in oil. When the piston rotates to the bottom, the piston is forced into the cylinder, expelling oil out through the outlet port or system pressure line.

General components in the hydraulic system include fig. 5, relief valves (and the electronic version; the proportional valve), shift valves fig. 4, (used in directing oil to shift intensifiers), hydraulic pumps fig. 1-2-3. fig. 5, relief valves used as safety valves, flow control valves, check valves and cartridge style valves to pass or stop hydraulic oil from entering a system i.e. the cartridge valve that allows hydraulic oil to shut the bleed down valve.

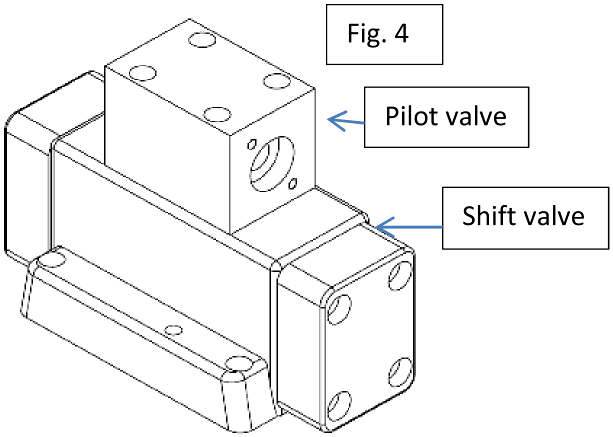

Fig. 4

Oil comes into the shift valve from the manifold which is directed by actuating the pilot valve, down through the proper ports in the shift valve. In the same action, oil is directed to one side of the piston (biscuit) in the intensifier which pushes the piston (biscuit) to the other side. At that time the oil used to push the piston (biscuit) before this stroke, is allowed to go up to the pilot valve which directs the oil down through the proper port in the shift valve and out to tank (reservoir).

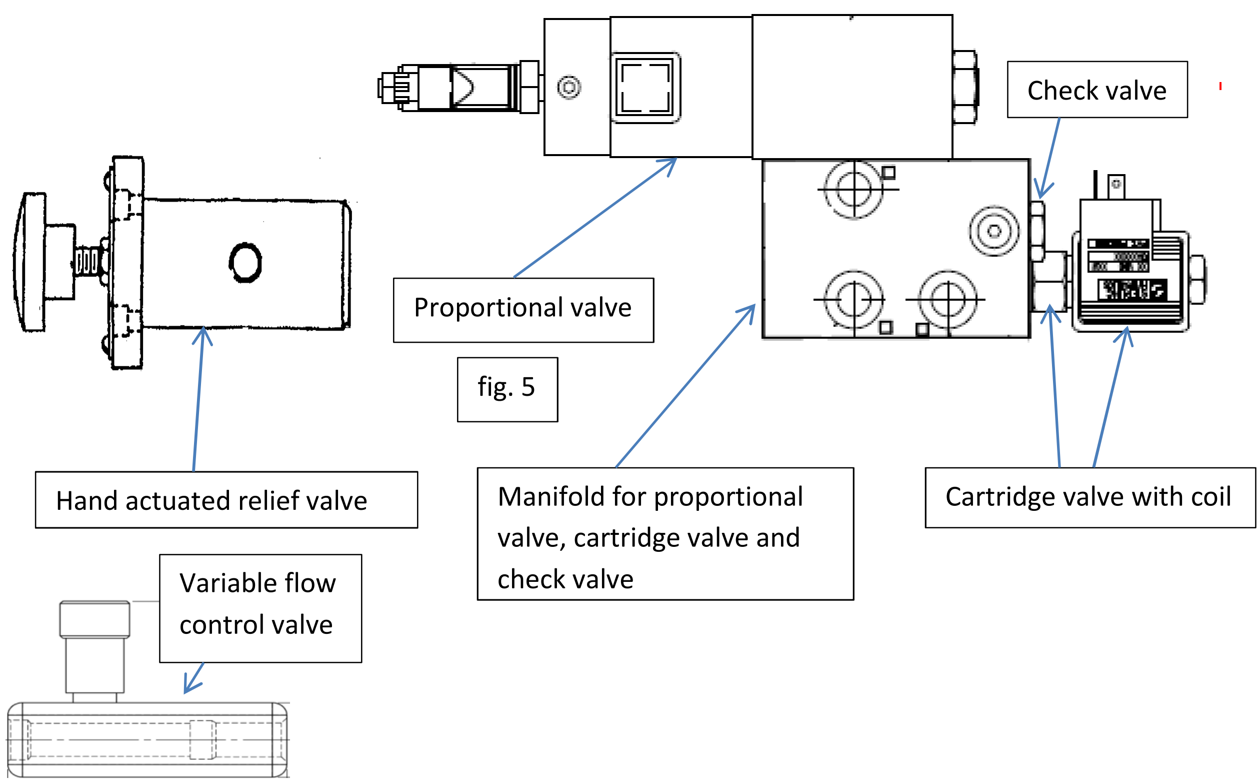

fig. 5

The other parts of the hydraulic system include the reservoir that holds the oil for the hydraulic pump fig. 1-2-3, to use and return to, manifolds fig. 5 and hoses for transmitting hydraulic fluid from component to component in the hydraulic system.

Condition of the oil is critical and should be checked every shift before running the waterjet. The recommendation of Flow international is to change the oil and filters in the reservoir at least once a year from running the pump minimally up to 40 hours per week (or if bad hydraulic oil is detected i.e. burned look or smell, milky, foamy or particulates floating in it). Oil should be changed at least twice a year for more than 40 hour a week operation and possibly 3 times a year or more for around the clock operation of the waterjet.

Having the correct oil and filters on hand for your waterjet is recommended for any failure that could happen. You should have all data about your machine regarding oil and filters and where they go.

When changing oil, always inspect filters, oil and bottom of reservoir for any foreign matter or anything else out of the ordinary. Your oil can tell you a lot about your machine if you look hard enough.

Make sure your oil is maintained at a certain set temperature as much as possible. 105 degrees is the recommendation (chillers may render the temperature lower). This temperature is easy on the seals that come in contact with the oil. Also, it can become an indicator of some failure in the system (higher than normal temperature).

If needed, read the “Check your cooling system” document to go over the part of the system that cools the oil. If you have high oil temperature, it could be a problem in the hydraulic system or a problem in the cooling system set to cool an efficiently operating hydraulic system.

Sometimes starting a pump up after cooling down and feeling all components in the hydraulic system to find out which one gets hot first can help detect problem components.

Have indicators such as a thermometer in sight to monitor the hydraulic system at all times.

Give the hydraulic system time to warm up after starting up from being cold.