TECHnotes

by John Dignan

Hints for Healthy Hydraulics

Understanding the anatomy of fluid systems helps you keep your equipment in circulation

Hydraulics could be termed the lifeblood of today's fertilizer and crop protection dealership equipment.

Spreader trucks, liquid rigs, tenders and so-on use hydraulic components to deliver fertilizer, run liquid pumps, control boom position, run augers and a host of other applications. Many post application sprayers use hydraulic circuits to provide power to the wheel motors rather than the traditional gear/mechanical drive systems.

Becoming familiar with hydraulic system components or just refreshing your memory may help you keep your hydraulics healthy and your equipment in circulation. That should save you time—and dollars—in a new application year. Troubleshooting or maintaining hydraulics should be simpler with a solid understanding of components and how they work. Back to basics. The diagram at the top of page 41 shows a simple hydraulic circuit. It consists of a pump that pulls fluid from a reservoir and delivers the fluid to a hydraulic device such as a motor. The pump delivers a certain number of gallons per minute at set revolutions per minute; the motor rotates at a certain speed based on the fluid flow through it. The fluid then leaves the motor and returns to the reservoir.

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Probably the most important factor to keep in mind when working with a basic hydraulic system is the relationship between hydraulic "flow" and "pressure". Flow is what makes things happen, say, the movement of a motor or cylinder, while pressure is the result of "load".

In a perfect hydraulic system, there is no pressure. But work done by the various hydraulic components creates pressure. A standard spinner type dry-box that operates at 200 or 300 pounds of pressure when empty may approach 2,000 pounds of pressure when the rig is fully loaded.

Looking at characteristics of various components will put things more into perspective.

Pumps deliver a certain "flow per minute" when operated at a certain speed and are capable of delivering that flow specification under a pressure load. Most pump specifications are based on 1,000 revolutions per minute (rpm). A 10 gallon per minute (gpm) pump delivers 10 gallons per minute at 1,000 rpm The same pump will deliver 30 gallons per minute at 3,000 rpm, typically under a pressure load of 2,500 to 3,000 pounds.

The hydraulic reservoir tank must provide both storage and cooling for the hydraulic system. The suction and return lines should be placed so that the fluid continually turns over or cycles to provide maximum cooling.

Motors will operate at a speed based on the number of gallons of

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hydraulic fluid flowing through it. They will be capable of delivering a certain torque and will operate at a maximum specified pressure.

A **cylinder** operating speed is based on the fluid flow. The higher the flow in gallons per minute, the faster the cylinder will operate. Operating pressure increases as the load increases.

Flow dividers control the direction and amount of flow in a hydraulic circuit. Some flow dividers, called "priority flow dividers" pull a fixed amount of hydraulic fluid from the system, possibly 2 to 3 gpm for operating boom control cylinders.

Pressure relief valves are like fuses, set to blow if the pressure is too high. In most cases the valve bypasses fluid if the operating pressure of the system is exceeded.

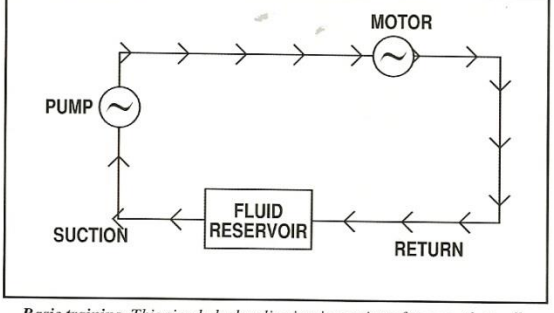
The bottom diagram shows fluid flow through a typical hydraulic circuit, the basic dry-box. The point here is, "The *flow of fluid in a hydraulic circuit always equals the output of the hydraulic pump.*"

The diagram shows a pump delivering 30 gpm at its operating rpm. The spinner control valve and spinner motors make up one hydraulic circuit while the web control valve and motor make up another circuit. Notice the distribution of flow throughout the circuits.

The spinner circuit is first in line to receive the available 30 gallons per minute from the pump. The spinner speed is set using the spinner control valve. A rate of 15 gallons per minute provides proper operating speed of the spinner motors and comes through the CF or control flow port of the spinner control valve.

The other 15 gpm of hydraulic oil escapes out of the EX or exhaust port of the control valve. Whatever flow comes into the valve must exit either the control flow or exhaust flow ports.

BASIC HYDRAULIC CIRCUIT



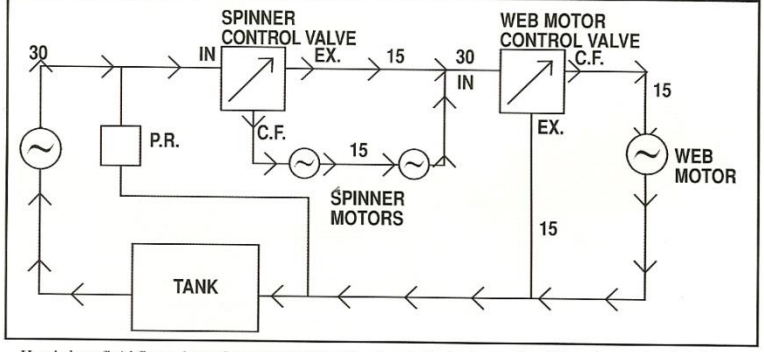
Basic training. *This simple hydraulic circuit consists of a pump that pulls fluid from a reservoir and delivers the fluid to a hydraulic device such as a motor. The fluid then leaves the motor and returns to the reservoir.*

The fluid flows through the spinner motors and combines with the exhaust fluid from the control valve bringing the circuit fluid flow back to the pump's 30 gallons per minute. The combined fluid flow is now made available to run the web drive motor circuit.

The web control valve is probably a motor controlled type, allowing an electronic control system to automatically adjust the web motor speed, maintaining a constant application rate.

When it comes to maintaining and troubleshooting existing hydraulic equipment, you rely on the manufacturer for advice to properly size and adjust the components. Motors, pumps, pressure relief valves and other components can be cross-referenced when replaced if an exact replacement is not readily available.

DRY BOX HYDRAULICS



Here's how fluid flows through a typical hydraulic circuit, the basic dry-box. The spinner circuit is first in line to receive the available 30 gallons per minute from the pump. A rate of 15 gallons per minute provides proper operating speed of the spinner motors and comes through the CF or control flow port of the spinner control valve. The other 15 gpm of hydraulic oil escapes out of the EX or exhaust port of the control valve. Whatever flow comes into the valve must exit either the control flow or exhaust flow ports. The fluid flows through the spinner motors and combines with the exhaust fluid from the control valve bringing the circuit fluid flow back to the pump's 30 gallons per minute to run the web drive motor circuit.

The same flow principles apply here. The flow output of a hydraulic circuit will always equal the input. Pressures will vary throughout the system, especially where the dry box load changes.

The importance of properly replacing components cannot be overstated. If your system was designed for 30 gpm of hydraulic flow you will probably run into trouble if you oversize

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