HYDRAULIC EQUIPMENT, TRACTORS
(WATERLOO)

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Powr-Trol is the name used by John Deere to identify the hydraulic power control systems built into the Waterloo line of tractors. It is used to apply power in the control of implements and attachments.

Powr-Trol provides the tractor with fast easy control of implements when they are used in combination with the tractor. The most common functions are control of working depth and raising the implement for transporting.

The Powr-Trol was developed to further the inherent desire of the tractor operator to do his work easier and faster. Original design along this line was a mechanical power lift introduced by John Deere in 1928. It was used mainly for raising and lowering cultivators. Its use was limited and there was undesirable interference with tractor clearance for certain crops.

In 1933 John Deere introduced the first hydraulic power lift. It was a self-contained unit mounted at the back of the tractor with an internal cylinder which operated the rockshafts. Power to move the piston in the cylinder was transmitted by oil under pressure from a gear-type pump driven by the power shaft.

This system was a distinct improvement over the mechanical power lift because it did not affect the clearance of the tractor and was not subject to mechanical troubles.

The one disadvantage, that of being unable to vary the stroke of the piston, was overcome by the introduction of the hydraulic power control (Powr-Trol) in 1945. With this unit the working depth of the implement could be varied as desired and in addition to this, provision was made for the use of a double acting remote cylinder.

Power from the Powr-Trol is delivered at two different points, from the rockshaft and from the remote cylinder. Power from the rockshaft is used to control cultivators, bedders and other integrally mounted implements. Power from the remote cylinder is used to control drawn type implements.

Original power lift and power control pumps were incorporated in the basic housing which serves as a cover for the final drive housing and were driven by the power shaft.

The pump on the Model "R" tractor is driven by the power shaft. It has the advantage of operating whenever the engine runs and the power shaft clutch is engaged.

With the introduction of the improved Model "AR" tractor in 1949 a new type pump was used. It was mounted on the governor housing and driven by the cam shaft gear. Engaged, it operates whenever the engine runs.

This type of pump is also used on the new Models "50" and "60" tractors and because of its versatility no doubt will be used on new tractors in the future.

To provide for continuous operating power control pumps for use on older tractors a new design pump is now furnished, which is mounted on the governor housing between the magneto or distributor and the governor housing. It can be engaged or disengaged at will.

The power lift pump used on the Model "H" tractor is also governor driven. However, no pro-
vision was made to disengage this pump so it always runs whenever the engine runs.

There are a variety of types of valve housings used with Waterloo hydraulic equipment.

The powr-Trol valve housing as used on the Models "50," "60" and "A," "B," and "G" tractors is a unit designed to control the operation of a single action rockshaft cylinder or the action of a double acting remote cylinder. This action can either be the full stroke of the piston or the movement of the piston can be varied to suit the operator. This provides for variable depth control of the implement.

Powr-Trol valve housings used on the Models "AR" and "R" tractors are basically the same as those used on the Models "50" and "60" tractors but due to the fact that they do not operate a rockshaft, the metering screw adjustment and the throttle valve adjustment are omitted.

Power lift valve housings used on Models "A," "B" and "G" tractors are for the control of a single action rockshaft cylinder. There is no provision for variable depth control. However, the installation of a selective control conversion does provide for variable depth control, and in addition, a single action remote cylinder may be used.

The valve housing used on the Model "H" in addition to the control valve mechanism, also incorporates the pump. This valve housing is used in conjunction with a remote cylinder only. This remote cylinder, however, is single acting.

Hydraulic equipment used on the Waterloo line of tractors is simple, rugged and requires very little attention except the ordinary day by day service as recommended in the Operator's Manual. It is well, however, that the service man be thoroughly versed in the theory of operation as well as in the accepted procedures for maintenance and overhaul.

The worst enemy of any hydraulic system is dirt. Therefore, cleanliness cannot be stressed too much. This applies not only during overhaul but in adding oil to the unit as well as when connecting or disconnecting the cylinder hoses. Particular care should be exercised with the unit and tools at overhaul time.

Keep It Clean!
The Powr-Trol is a hydraulic mechanism used to raise and lower implements. Drawn implements are operated through use of a remote cylinder. A serial number is located on the face of each valve housing. Changeover from rockshaft to remote cylinder is accomplished by changing adapter plugs.

The Powr-Trol main casting, mounted on the tractor final drive housing, contains the two rockshafts. At the front of the main casting is the rockshaft operating cylinder with piston and connecting rod. An oil pump supplies oil for operation. The valve housing contains all the operating valves, cams and levers and is the "heart" of the power control.

The remote cylinder is a separate component attached to the end of the Powr-Trol oil lines to convert the force of oil under pressure from the pump into useful work—that of raising and lowering implements, angling disks and many other jobs.

A small remote cylinder is used with the "B" tractor, a large one on the "G" and "R" and a medium sized one on the "A," "AR-AO," "50" and "60" tractors. The cylinder encloses a double-acting piston and the length of stroke is controlled by adjustable stops. The oil lines are so attached that the heavier load is handled by the end of the piston having the large effective area—the end opposite the piston rod.

POWR-TROL OPERATION

The control lever has five positions: NEUTRAL, SLOW RAISE, FAST RAISE, SLOW DROP and FAST DROP (Figure 20-10-2). The positions apply to both remote cylinder and rockshaft operation. The schematic drawings, Figures 20-10-3 through 20-10-8 show what happens inside the control housing at each lever position. The location of parts has been distorted for clarity.

NEUTRAL (Figure 20-10-3).

With the control lever in neutral position oil from the pump enters both sides of the operating valve. As the check valves are closed, the oil can only leave by the discharge ports which return it to the reservoir.
Inspect cam ratchet assembly “A” Figure 30-10-12 for wear or bind. Check cam ratchet spring for possible distortion or wear at the attaching points.

Inspect cam “B” for excessive wear or other damage.

Inspect cam latch “C” for wear at the surface that contacts the cam.

Inspect cam follower arm and roller “D.” Roller should be free to turn.

Inspect check valve “E” and relief valve “F.” They may be trued in a valve refacer.

Check cam follower, cam latch, check valve and throttle valve springs for distortion and possible wear.

**ASSEMBLY**

**Valve Guide.**

If valve guide has been removed drive in a new one with a brass drift as shown in Figure 30-10-13.

Drive guide in until it seats in the housing.

Check valve for free movement in the guide.

**Check Valve.**

Make sure valve and seat are clean. Oil valve face and stem. Install assembly and tighten plug assembly.

**Relief Valve.**

Install relief valve assembly using same care with cleanliness as was used with the check valve.

If no parts have been replaced use same amount of adjusting washers as came out. Otherwise it will be necessary to check the pressure and adjust.

**Cam Latch and Cam Follower.**

Install cam latch and cam follower. Make sure cotter pin is in shaft. Install pipe plug in shaft opening. Install cam latch and cam follower springs. Install by-pass valve.

**Cam Ratchet and Cam.**

Place a new cork seal in housing. Place cam ratchet assembly on end of shaft. Start cam on end of shaft making sure that ratchet pawl is on ratchet. Push shaft on into housing.

**Key Washer.**

Align keyway in control shaft with slot in ratchet control lever. Install key washer, bolt, and nut.

Align keyway in control shaft with slot in ratchet control lever. Install key washer, bolt, and nut.
INSPECTION AND REPAIR

End Cap.

Remove lock pin by driving out small pin which secures pin and spring. **NOTE**: Use same procedure in removing pin from both the end cap and piston rod yoke (Figure 60-5-5). Pin and spring should be replaced if damaged.

Inspect gasket and replace if damaged.

Concentric grooves on face of end cap should be clean and free from nicks and burrs.

Piston rod stop adjusting rods (Figure 60-5-6) are removed by removing nuts and lock washers. Damaged or bent rods should be thoroughly straightened or replaced with new ones.

Examine piston rod surface. If any burrs or scratches are found use a fine hone and remove them.

If piston rod is bent replace with new rod.

ASSEMBLY

Figure 60-5-9 will be found helpful in assembly. It is well to note that the later cylinder shown in Figure 60-5-9 differs somewhat from that shown in other illustrations.

Install front plug in housing and install Neoprene seal assembly (Figure 60-5-7) being sure the two flat ring surfaces are on the ends and all parts fit together properly. Sealing lips go toward the cylinder.

If no parts have been disturbed, replace same number of shims. With the piston rod and rod stop assembly in place, tighten the seal retainer. If any parts have been replaced, it is necessary to make the following adjustment on the seal retainer.

Install piston parts with exception of Neoprene rings. Now using a spring scale (Figure 60-5-8), deduct shims (.010" and 1/32") until with two cap screws tight, a pull of approximately 4 pounds will move the oiled piston rod through the V-seal.

When this adjustment is reached, replace rings on piston, tighten nut securely and lock with cotter pin.