

# HYDRAULICS THEORY OF OPERATION

## Theory

The eHydro hydraulic system receives its supply from the power steering return line. This oil is pumped through an oil cooling radiator in front of the main radiator. A cooler bypass relief valve monitors pressure drop across the radiator. If the pressure drop across the radiator is equal or greater than **300-900 kPa (45-130 psi)** the radiator bypass opens. This allows oil flow to go around the radiator and on to the hydrostatic transmission.

The oil then passes through a screw on filter. The filtered oil is regulated to a pressure of **1200 kPa (175 psi)** for the hydrostatic transmission. The flow that goes through the pressure regulator relief is returned to sump.

The charge pressure oil that is regulated to **1200 kPa (175 psi)** travels to the hydraulic system for main PTO, mid PTO, and MFWD through port M3; the transmission proportional solenoid valves; and the hydraulic pump and motor make-up oil line.

The proportional valves, one for forward and one for reverse, control the oil going to the servo control of the hydraulic pump. The proportional valves are controlled by the electronic logic controller. See controller theory in the Electrical section.

The hydraulic pump is connected directly to the engine and is rotating any time the engine is running. The swash plate of the hydraulic pump is servo controlled and remains flat unless one of the proportional valves opens and the servo rotates the plate. When the swash plate rotates, oil is pumped through the transmission to rotate the hydraulic motor. Oil is pumped either direction through the transmission depending on which direction the hydraulic pump swash plate is rotated. The direction of the oil flow controls the direction of motor rotation.

Only the side of the pump and motor circuit loop that the pump is sending oil into has high pressure. The other side of the circuit loop provides a return route for the hydraulic motor oil and supply oil for the hydraulic pump. If the low pressure side falls below **1200 kPa (175 psi)** the check valve opens and charge pressure oil enters the circuit to make-up any lost oil.

The system relief valves open if the hydraulic pump pressure exceeds **38500 kPa (5585 psi)** on the motor drive side of the circuit.

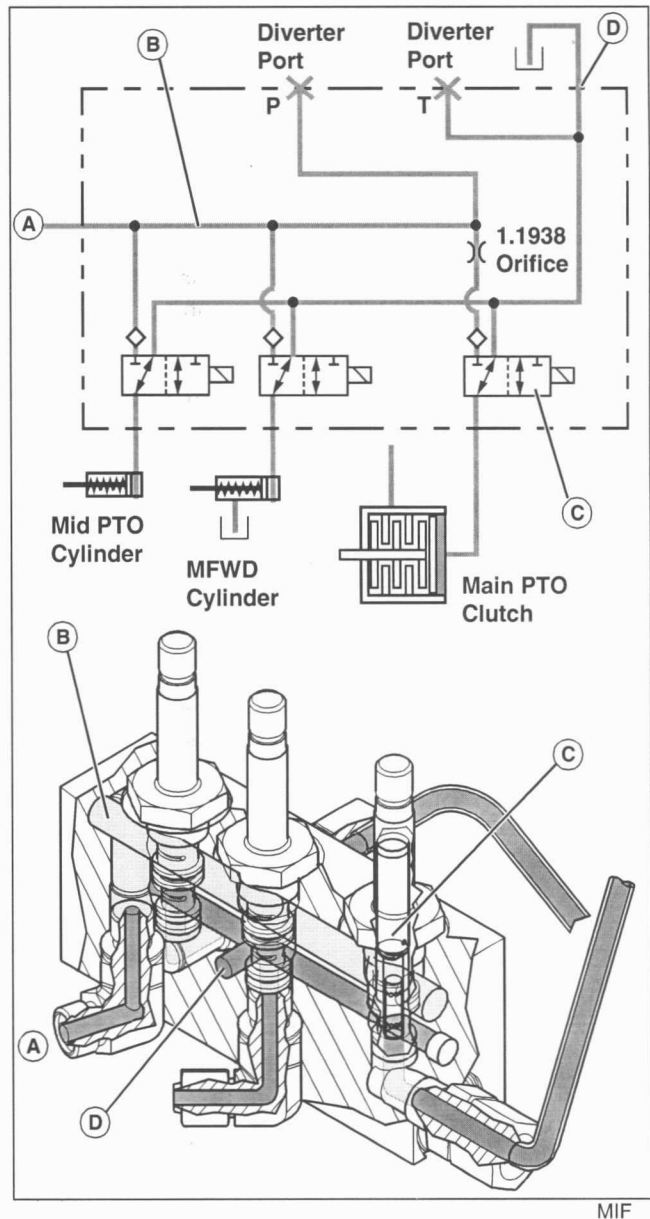
The M1 and M2 pressure ports provide locations that may be used for checking the charge pressure of **1200 kPa (175 psi)** and the motor drive pressure of **38500 kPa (5585 psi)**. The higher drive pressure and lower charge pressure will be at the opposite ports when the machine is in reverse as compared to the pressures when the machine is in forward.

## PTO and MFWD Hydraulic Operation

### Function:

To supply necessary hydraulic oil to the main PTO clutch, MFWD cylinder, and mid-PTO cylinder for actuation of these functions.

### Theory of Operation:

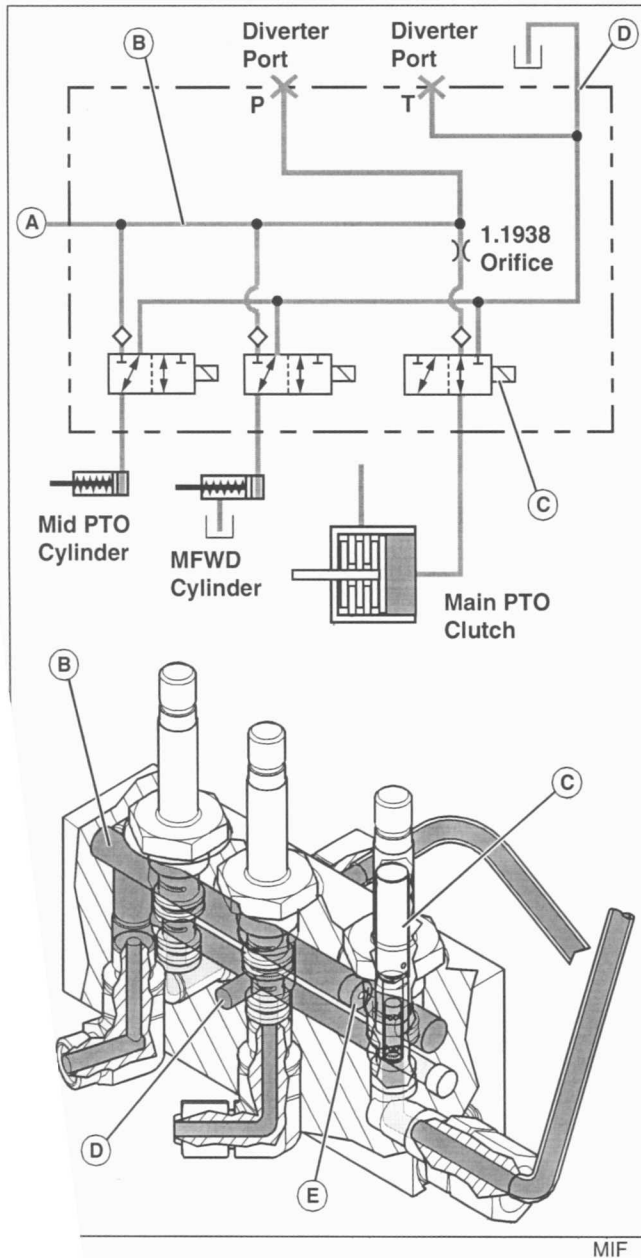


The component hydraulic system receives its regulated oil supply (A) from either the clutch cover on the ePowrReverser and SST or from the transmission M3 port on the eHydro. The supply goes into the solenoid valve manifold (B). When the mid-PTO, MFWD or main PTO is activated, a valve cartridge opens and the supply oil flows to the component cylinder. The oil then activates the cylinder.

## THEORY OF OPERATION

The hydraulic oil (A) is supplied to the valve regulated to **1200 kPa (175 psi)** on eHydro models and **1100 kPa (160 psi)** on SST and ePowrReverser models. This pressure is supplied to all of the valve cartridges by the manifold (B).

The valves are normally in the off position and are set to sump the hydraulic oil from the systems. The valve cartridges (C) are spring loaded and oil pressure in the mid PTO cylinder, MFWD cylinder and main PTO clutch is relieved to sump (D).



When the operator engages one of the systems (main PTO, MFWD, or Mid PTO), the coil for that valve cartridge is energized. This valve cartridge (C) moves up to the open position, allowing the regulated oil to flow through the valve and to the cylinder.

When the main PTO (shown above) is activated, solenoid (C) valve cartridge opens. The supply oil through an orifice (E) before going through the valve cartridge and onto the clutch. The orifice modulates how fast the PTO clutch is engaged. See "Main PTO Clutch Operation" on page 742.

### Main PTO Clutch Operation

#### Function:

The PTO clutch provides a means for disengaging the output shaft from the engine. The PTO brake is provided to positively stop the rotation of the PTO system when the PTO clutch is disengaged. The PTO clutch and PTO brake work simultaneously. Both the mid and rear PTO are affected by the operation of the PTO clutch and PTO brake.

The rear PTO shaft is engaged directly from the clutch. The mid PTO gears are driven by gears engaged to the rear PTO. The mid PTO gears are only engaged when they are shifted into gear. They are shifted into gear when the main PTO solenoid located in the solenoid valve manifold is activated.

#### Theory:

The PTO clutch (A) is engaged or disengaged by the operator through an electrical switch. The PTO brake (B) is automatically spring applied when the PTO clutch is disengaged. The PTO brake is a spring loaded multi-plate wet brake and is normally engaged, preventing the PTO clutch shaft (C) from rotating. The PTO clutch is a multi-plate wet clutch and is normally disengaged.

When the operator pulls the PTO switch to the on position, the hydraulic control valve is activated and supplies hydraulic pressure to activate the PTO clutch. The oil has to flow through an orifice. The orifice restricts the initial flow and pressure. The restriction modulates how fast the PTO clutch is engaged.

The PTO clutch piston is moved forward by the hydraulic pressure. As the piston (D) moves forward, the spring pressure applied to the brake by the piston, through the four pins (E), is removed and disengages the brake. At the same time, the piston is applying pressure to the PTO clutch pack and engaging the PTO clutch. The pressure applied to the clutch pack locks the plates (splined to the clutch basket (F)), to the friction plates (locked to the clutch hub (G)). Power is transferred from the input shaft to the clutch hub, through the friction plates and separator plates to the clutch basket, and finally to the PTO drive shaft.

A locking tab on the outside of the brake housing allows the PTO drive shaft to rotate approximately 300°, which, in turn, allows the PTO stub shaft to rotate approximately 63° to aid in aligning the splines of an attachment drive shaft during hook-up.