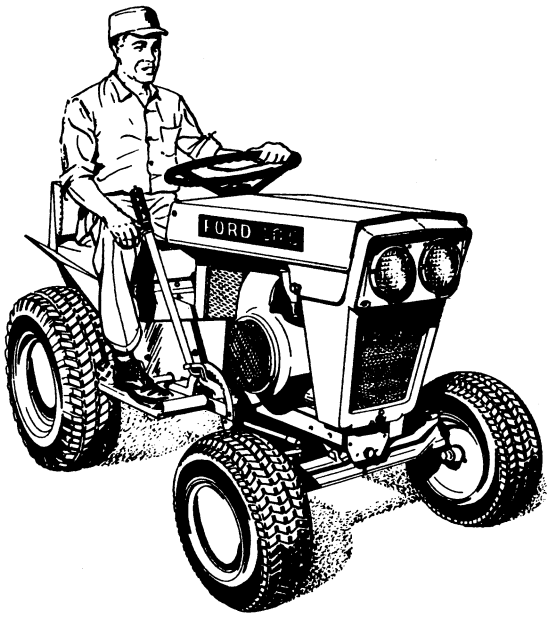
FORD

FORD LAWN AND GARDEN TRACTOR

HYDROSTATIC TRANSMISSION

PRELIMINARY SERVICE INFORMATION



FORD TRACTOR DIVISION

TRACTOR AND IMPLEMENT OPERATIONS (U.S.)

FORD MOTOR COMPANY

Reprinted

FOREWORD

THIS MANUAL CONTAINS PRELIMINARY SERVICE PROCEDURES FOR THE HYDROSTATIC TRANSMISSION USED WITH THE FORD LAWN AND GARDEN TRACTOR. INFORMATION IS PROVIDED ON REMOVAL AND INSTALLATION, TESTS AND ADJUSTMENTS, AND SERVICING EXTERNALLY ACCESSIBLE COMPONENTS. THE HYDROSTATIC TRANSMISSION REPAIR MANUAL, COVERING THE COMPLETE DISASSEMBLY, INSPECTION AND REPAIR, TESTS, AND ADJUSTMENTS OF THE HYDROSTATIC TRANSMISSION, IS BEING PREPARED FOR PUBLICATION.

KEEP THIS MANUAL, ALONG WITH YOUR OTHER SERVICE MATERIAL, AVAILABLE FOR READY REFERENCE.

SERVICE DEPARTMENT
FORD TRACTOR DIVISION
FORD MOTOR COMPANY

CONTENTS

MAINTENANCE AND ADJUSTMENTS

During the initial start up or after a short period of running time, it may be necessary to make a few minor adjustments to the belts and linkages. The Hydrogear transmission cannot be adjusted.

DRIVE BELT AND CLUTCH-BRAKE ASSEMBLY

Before adjusting the drive belt and clutch-brake assembly, refer to figures 1 and 2. Check the dimensions shown. ("A" and "B").

Since adjustment of the clutch setting affects adjustment of the brake setting and vise versa, it will be necessary to check both settings after adjustment of one, making necessary adjustments to the other, as required. It is emphasized that optimum dimensions, as given here, must both conform to these instructions.

Refer to figure 1 and note dimension "A" which is measured with clutch-brake pedal in the UP (Clutch engaged) position. Dimension "A" must be 1-7/8" to 2-1/8" as measured between the inner surface of the belt. This dimension can be measured with the belt guard in place.

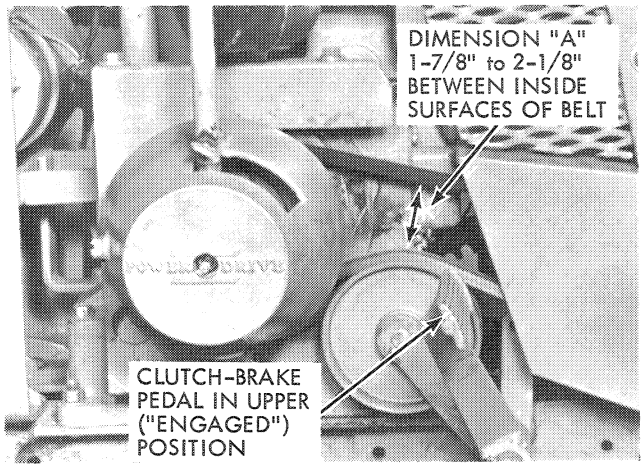


Figure 1

If dimension "A" is LESS THAN 1-7/8", belt life will be shortened. If dimension "A" is MORE THAN 2-1/8", belt will not properly disengage when pedal is pushed down.

To INCREASE dimension "A", loosen the engine mounting bolts and move engine FORWARD. To DECREASE dimension "A", loosen engine mounting bolts and move engine REARWARD. After adjustment, it is essential that engine mounting bolts be securely retightened.

Refer to figure 2 and note dimension "B", which is measured with clutch-brake pedal pushed firmly downward and locked in this setting by tightening the parking brake knob clockwise. The distance from the flange of the idler pulley to the lower edge of the frame must be 1" to 1-1/4". This dimension can be measured with the belt guard in place. If adjustment is required, it will be necessary to remove the belt guard.

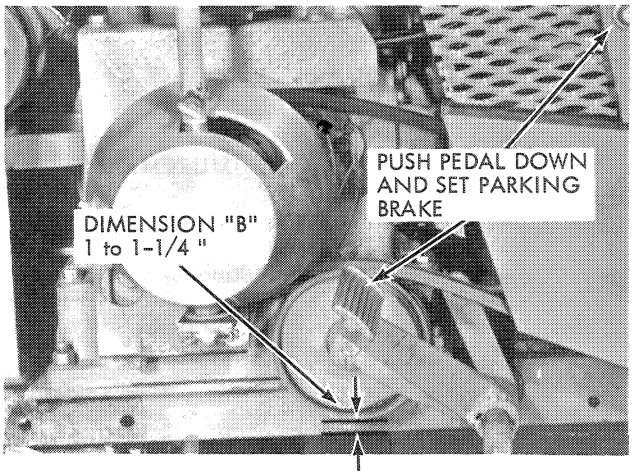


Figure 2

If dimension "B" is LESS THAN 1", the brake may not hold properly. If MORE THAN 1-1/4", brake may drag during operation or lock before the clutch is fully engaged.

To change dimension "B", it is necessary to shorten or lengthen the travel of the brake rod.

1. Remove rear guard over drive belt by removing the two acorn nuts and one slotted-head screw. (Fig. 3).

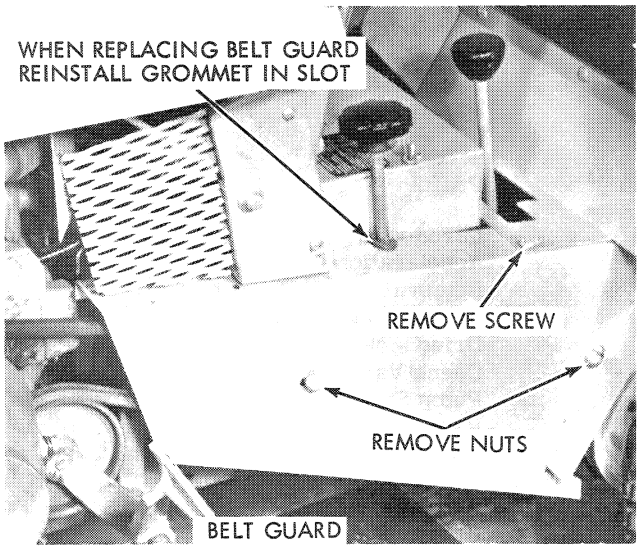


Figure 3

NOTE

When replacing guard, take care to reinstall rubber parking brake rod grommet in slot on upper surface of belt guard as shown in figure 3.

2. Refer to figure 4 and remove the hairpin cotter.

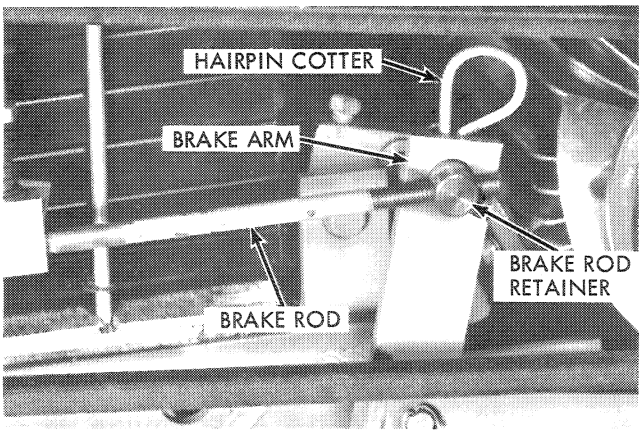


Figure 4

3. Pull the brake rod retainer from the brake arm as shown in figure 5.

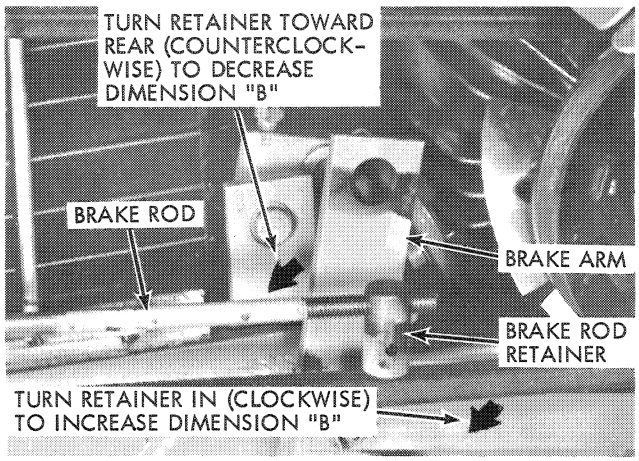


Figure 5

4. Turn the brake rod retainer CLOCKWISE to increase dimension and counter-clockwise to decrease dimension, (as viewed from rear end of brake rod) and reinstall brake rod retainer in brake arm. Check dimension "B" and continue adjustment if necessary until dimension "B" measures between 1" and 1-1/4".

5. When dimension "B" is correct, reinstall the brake rod retainer in the brake arm and reinstall the hairpin cotter through the hole in the end of the brake rod retainer.

TRACTION DRIVE BELT REPLACEMENT AND ADJUSTMENT

1. Remove the left foot rest from the tractor.

2. Remove the rear belt guard by removing the two acorn nuts from the side and the slot head screw from the top of the belt guard. (Fig. 3).

3. Remove the power drive control handle by loosening the thumb screw that secures it to the power drive assembly.

4. Remove the thumb screw from the power drive housing support bracket and rotate the power drive housing and support bracket to separate the two parts.

5. Remove the front belt guard from around the engine drive pulley by removing three hex head screws; two screws from on top and one screw from the bottom of the guard.

6. Fully depress the clutch-brake pedal and lock the parking brake securely to hold the pedal down.

7. Raise the tractor seat and loosen the two hex head screws fastening the upper belt retainer (Fig. 6) to the seat assembly.

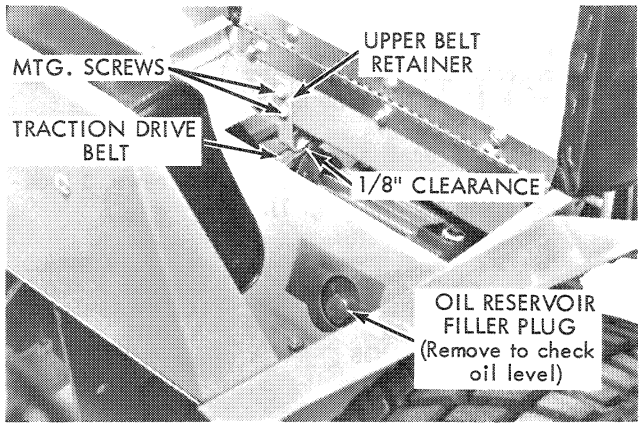


Figure 6

8. Remove the traction drive belt from around the transmission input pulley; then remove it from the engine drive pulley.

9. Replace the traction drive belt with the type of belt specified in the parts list.

10. After the belt has been properly positioned on the pulleys, release the parking brake. Adjust the upper belt retainer so the lowest point of the retainer is approximately 1/8" above the belt.

    Tighten the two hex head screws to lock the adjustment.

11. After installing the new belt, it will be necessary to readjust the traction drive belt and clutch-brake assembly by following the instructions outlined under "Drive Belt and Clutch-Brake Assembly. See page 4.

12. Reinstall parts previously removed by reversing the procedures given here.

IMPORTANT

When reinstalling the rear belt guard, make certain that the grommet around the rod of the parking brake is properly fitted into the slot on the belt guard.

CONTROL LEVER ADJUSTMENT

When the control lever is in the neutral position and the tractor moves in either direction while the engine is running and the clutch is engaged, the control lever linkage may require adjusting.

NOTE

The tractor may tend to move slightly if the oil in the transmission is cold. Make certain that the oil in the transmission is warm before determining if the linkage or transmission requires adjusting. Allow 10 - 15 minutes for oil warm-up.

To adjust the Control Lever Linkage:

1. Release the belt tension from the transmission pulley by depressing the clutch-brake pedal and applying the parking brake securely.

2. Remove the Drive - No Drive knob from the Hydrogear control shaft by loosening the set screw on the side of the knob.

3. Remove the seat apron and the seat from the tractor by removing 5 slot head screws, 3 lockwashers and 3 nuts. (Fig. 7).

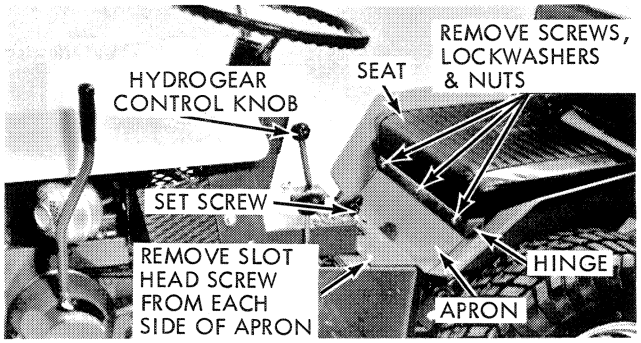


Figure 7

4. Remove the hairpin cotter from the ball joint rod and the bushing from the control arm. (Fig. 8). Slide the ball joint out of the control arm.

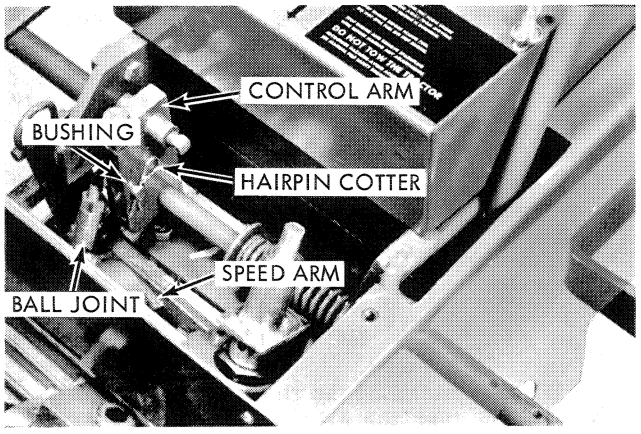


Figure 8

5. Locate the neutral position of the speed arm, Figure 8, by moving the arm up and down until you hear a "clicking" sound and feel the arm lock.

6. To insure that the speed arm is in neutral the engine must be started and the clutch engaged. Before starting the engine make sure that the ball joint is clear of the transmission pulley. Temporarily replace the seat on the tractor.

WARNING

DO NOT ATTEMPT TO ADJUST THE SPEED ARM WHILE THE ENGINE IS RUNNING! KEEP HANDS AWAY FROM ALL MOVING PARTS.

7. Loosen the nut on the ball joint and adjust the length of the ball joint rod as follows: If the tractor moves forward when the control lever was in neutral, increase the length of the rod; decrease the length of the rod if the tractor moved backward. Move the control lever to the neutral position. Turn the rod in or out of the ball joint until the end of the rod lines up with the center of the hole in the control arm.

NOTE

DO NOT move the speed arm out of neutral when adjusting the length of the rod. Insert the end of the rod through the hole and reinstall the bushing over the end of the rod and into the hole in the control arm. If the bushing does not line up with the hole, readjust the length of the rod until the bushing can be inserted into the hole.

8. After adjusting the length of the rod, reinstall the hairpin cotter and tighten the nut securely on the ball joint.

9. To assure that the adjustment is correct start the engine and operate the tractor. If the tractor moves when the control lever is in neutral, repeat the linkage adjustment, step 7.

10. After completing the adjustment reinstall parts previously removed by reversing the procedure given here.

DESCRIPTION OF HYDROGEAR

The Hydrogear Transmission is a transmission that transmits power by flow and pressure of oil.

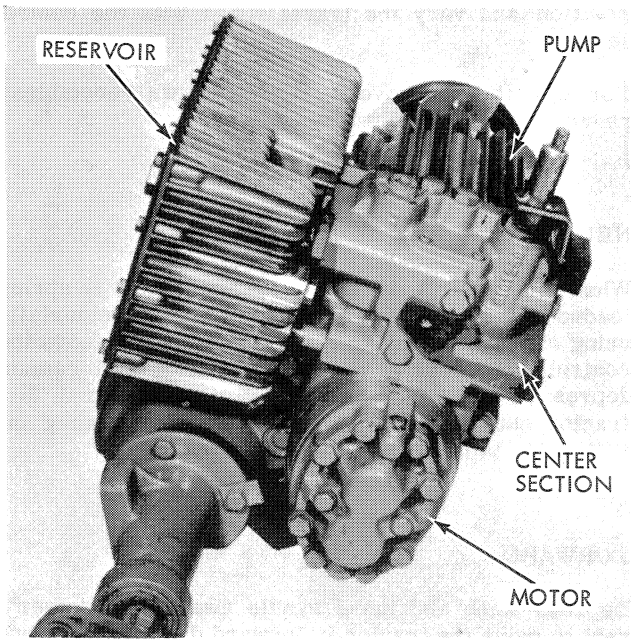


Figure 9

The transmission consists of three main components - a pump, a motor, and a center section.

PUMP (See Fig. 9).

The pump, which is identified as a variable displacement, reversing swashplate axial piston type pump, is the key in controlling the operation of the Hydrogear transmission and the tractor.

MOTOR (See Fig. 9).

The motor, which is a fixed displacement gear motor accepts the flow from the pump.

CENTER SECTION (See Fig. 9).

The center section houses all the internal porting and valves for the unit.

OPERATION

CIRCUIT (See colored diagram of Hydrogear Transmission Circuit)

PUMP

With the tractor engine running and the drive belt engaged, the input drive shaft to the pump is driven. Coupled to the shaft inside the pump is a cylinder block which houses nine (9) pistons. With the engine running and the control lever in neutral the pistons are all in the same plane, therefore, no oil is pumped and the tractor does not move.

When the operator moves the control handle from neutral, the swashplate is tilted. This produces a certain stroke to the pistons which in turn produce a certain flow and this flow is transmitted to the motor. Varying the position of the control handle directly varies the tilt of the swashplate and consequently, the flow produced by the pump.

MOTOR

The motor is a fixed displacement unit, and will accept a constant volume of oil through it in any revolution. The greater the volume of oil pumped to it, the faster the motor must turn.

The oil pumped to the motor is under high pressure. This pressure is dependent upon the load applied to the tractor. One of the gears has the output drive shaft keyed to it. As gears rotate, the output shaft rotates.

After accepting the oil under high pressure, the oil flows around the outside of the gears and enters the low pressure side of the circuit, and is returned through the center section to the pump to be pumped out under high pressure again.

CENTER SECTION

CHARGE PUMP

The center section houses the charge pump which is mechanically splined to the pump shaft. When the shaft is driven the charge pump rotates supplying oil for lubrication, cooling, and replenishing the circuit. The oil is drawn from the reservoir.

CHECK VALVES

Check valves are located on each side of the channeling and will allow make-up oil from reservoir to enter the low pressure side of the circuit from the charge pump.

CHARGE RELIEF VALVE

A charge relief valve is located in the charge circuit of the Hydrogear to establish a pressure of the make up oil at 75 - 110 psi. Oil used for internal lubrication and cooling is supplied by the charge circuit.

ACCELERATION CONTROL & RELIEF VALVES

Two additional valves in the circuit are called Acceleration Control and Relief Valves. All hydraulic systems must be protected from excessively high pressures, therefore high pressure relief valves must be provided. If the load applied to the tractor is too great, the transmission will create pressure up to the preset relief level. The relief valves will open thus protecting the transmission and tractor from possible damage.

Incorporated with the high pressure relief valve is the acceleration control valve. When the control lever is in neutral, oil is under low pressure throughout the circuit. If the control lever is advanced rapidly, the pressure on one side of the circuit increases and the cone in the high pressure valve lifts, bleeding some of the high pressure oil to the low pressure side of the circuit, thus limiting the acceleration rate.

As the tractor continues to accelerate at a normal rate, high pressure oil flowing through a metering plug assembly forces the upper piston against the spring, increasing the spring force on the relief valve cone thus returning it to its seat.

The valve is now a high pressure relief valve and will remain in this position until the control lever position is changed. Thus, it is, in effect, a variable rate relief valve.

DRIVE - NO DRIVE VALVE

The drive - no drive valve is a manual bypass valve which permits the tractor to be moved without hydraulic lock. The tractor should never be manually moved faster than a walking pace.

RESERVOIR AND FILTER

The Hydrogear Transmission uses a closed loop circuit and is a sealed transmission. Oil used for lubrication and cooling are returned to the reservoir for future use. Oil drawn from the reservoir into the circuit by the charge pump replaces the lubricating oil, thus maintaining a full circuit at all times.

Located in the reservoir is a filter to trap and remove material held in suspension in the oil. If oil is allowed to become contaminated, it must go through the reservoir and Hydrogear before going through the filter. Care should always be taken when checking the oil level in the reservoir to keep all dirt out.

START-UP

Before starting the tractor engine, make sure that the control lever is in neutral. This will keep starting torque to a minimum and insure the safety of the operator.

The tractor speed is dependent upon throttle setting and location of the directional control lever.

For most forward movement applications, it is better to have the throttle setting at 3/4 to full position and vary the travel speed with the control lever.

For operation in reverse direction, we recommend reduced throttle settings.

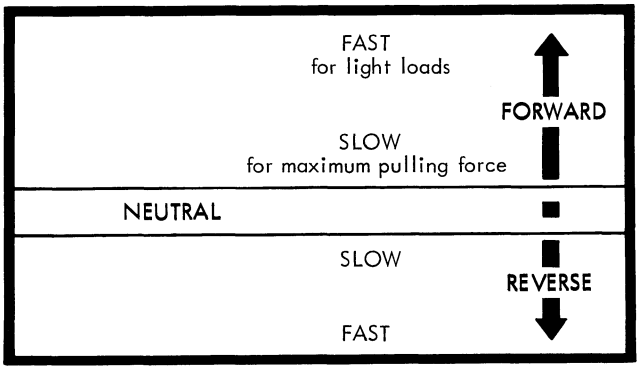


Figure 10

NEUTRAL

When the control lever is in neutral, it is spring loaded to a detent to prevent it from accidentally being moved. The knob must be depressed to move the control lever out of neutral. The knob will remain depressed until the lever is returned to neutral. The tractor should not move with the engine running and with lever in neutral.

FORWARD

Depress knob and move handle away from driver's seat to move the tractor in forward direction. Ground speed will depend on the engine speed and distance the control lever is from neutral. Moving the control lever toward neutral decreases the ground speed of the tractor.

REVERSE

Depress knob and move handle towards the driver's seat to move the tractor in reverse direction. Ground speed will depend on the engine speed and distance the control lever is from neutral. Moving the control lever toward neutral decreases the ground speed of the tractor.

STOPPING AND SHUTTLING THE TRACTOR

To stop the tractor, move the control lever to the neutral position. When shuttling the tractor from forward to reverse, or reverse to forward, slowly move the control lever to the neutral position to first stop tractor motion and then move the lever past the neutral notch to change tractor direction.

NOTE

In the case of an emergency, the movement of the tractor can be stopped by depressing the clutch brake pedal, or turning off the ignition key.

PARKING

Move the control lever to the neutral notch to stop the tractor, depress the clutch brake pedal and lock the parking brake securely. Stop the engine and remove the ignition key.

REPAIRS

INTRODUCTION

The Hydrogear transmission is a sealed unit. When the unit is serviced in any manner, it is to be thoroughly cleaned before any work is begun. Dirt is the biggest enemy of hydraulic units. The unit was sealed as it came from the factory. Any dirt that enters the unit is due to human error. Do not clean unit or surrounding area with paint thinner or acetone or other solvent that may harm "O" rings, gaskets, paint, etc. Steam cleaning is preferable.

ACCELERATION CONTROL AND RELIEF VALVE

The acceleration relief valves are placed in the circuit to protect from over pressure circuit damage, and to aid in limiting vehicle acceleration to a safe rate. With the control lever in neutral, oil is under low pressure throughout the circuit. When the control lever is advanced rapidly, the circuit pressure increases and the cone in the high pressure side of the circuit lifts, bleeding some of the high pressure

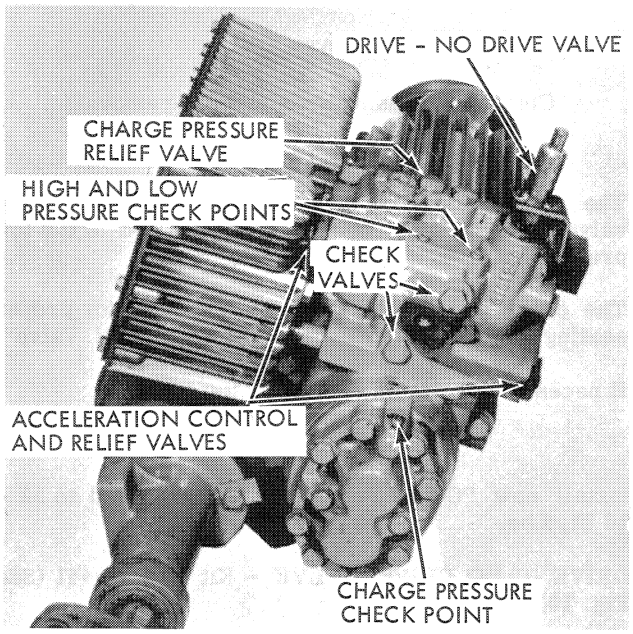


Figure 11

oil to the low pressure side of the circuit, thus limiting vehicle acceleration. As the vehicle continues to accelerate at a safe rate, high pressure oil passing through the metering plug assembly forces the piston down and the cone is returned to its seat.

The valve is now a high pressure relief valve and will remain in this position until the control lever is changed.

NOTE

If the forward acceleration valve must be inspected or changed, the reservoir must be removed. See page 13.

REMOVAL OF ACCELERATION CONTROL AND RELIEF VALVE

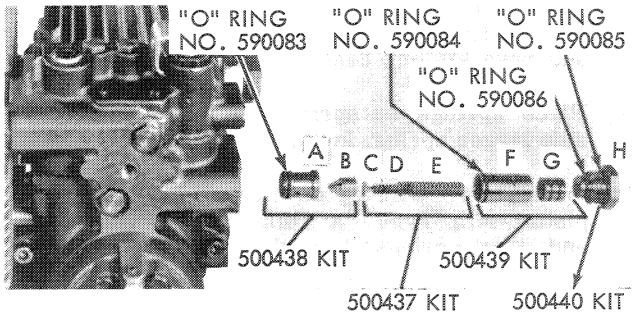


Figure 12

NOTE

Clean surrounding area prior to disassembly.

Metering Plug Assembly and "O" Rings - Kit No. 500440

The metering plug assembly is the 1-3/16" Hex Head Body located in the cast center section. Item H.

Remove assembly from center section, clean thoroughly and check the assembly for visual damage. The assembly consists of the housing, pipe plug spring seat, spring, metering ball, roll pin and two (2) "O" rings.

If any of these parts, excluding "O" rings, are damaged, or the assembly, when shaken, rattles, it is advisable to replace the entire assembly and install new "O" rings.

Piston and Sleeve Assembly with "O" Rings - Kit No. 500439

Remove piston, item G, and its sleeve, item F, and inspect for scoring or sticky operation by sliding back and forth in its bore. If either part has a damaged surface and rework would inhibit its function, both must be replaced.

Spring and Seat Assembly - Kit No. 500437

Remove the two springs, items E and D. Remove spring seat, item C. Check the springs for breaks or warpage. Inspect the seat for any nicks or roughness that could cause leakage.

Cone and Seat Assembly - Kit No. 500438

Remove the cone, item B. To remove the seat, item A, it is necessary to overcome the "O" ring resistance on seat and the housing. Inserting a stiff wire hook into porting hole in cone seat may aid in removing. The cone should exhibit a shiny unbroken circle of contact approximately 5/32" from the apex. If valve seat or cone is damaged, replace cone and seat as a kit.

Reassembly of Acceleration Control and Relief Valve

1. Replace all "O" Rings.
2. Lightly coat all parts with Type "A" Automatic Transmission Fluid during reassembly.

3. Install new "O" rings on seat. Oil the cone, seat and center section and push cone against cone seat and push kit into center section. (Kit No. 500438)

4. Place springs on spring seat, small spring inside larger spring. Install in cone. (Kit No. 500437)

5. Install new "O" ring on sleeve. Coat sleeve and piston with Type "A" oil. Insert piston (Open end over springs) into sleeve. (Kit No. 500439)

6. Install new "O" rings on metering plug assembly and install into center section. (Kit No. 500400)

7. Torque to 65 - 70 Ft. Lbs.

CHARGE RELIEF VALVE - Kit No. 500435

NOTE

Clean surrounding area prior to removal.

The charge relief valve is a spring loaded poppet and seat arrangement.

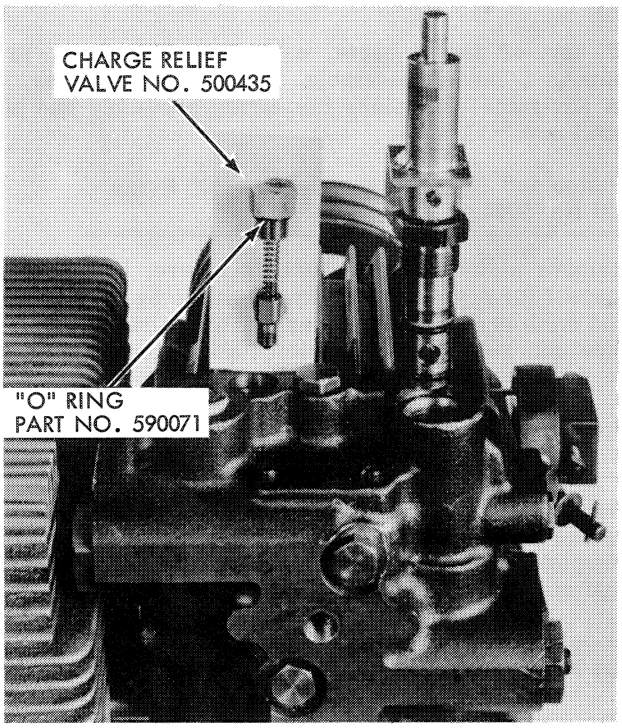


Figure 13

Erosion or non-conformity will cause valve to leak, so charge pressure cannot be developed. Remove and check the poppet for uniformity of sealing pattern approximately 5/32" from the apex.

If the pattern is broken due to misalignment of poppet to its seat, coin the seat, check with blueing. If necessary, install new charge relief valve kit. Install new "O" ring and torque Hex Head 22 - 26 Ft. Lbs.

CHECK VALVE - Kit No. 500436 (See Fig. 14)

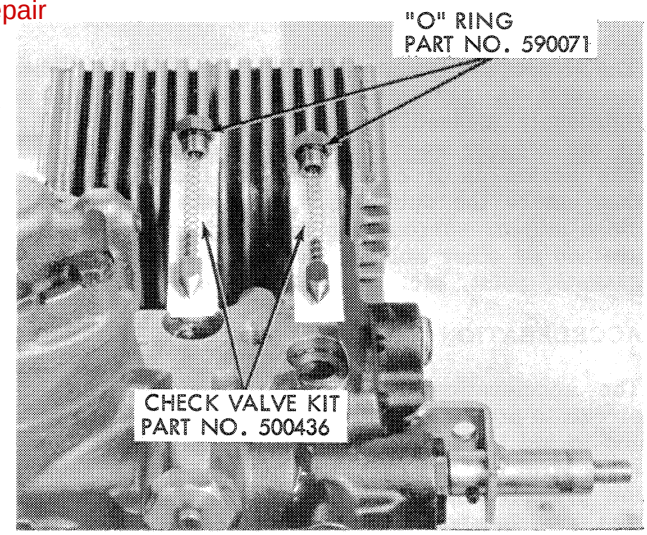


Figure 14

NOTE

Clean surrounding area prior to removal.

The check valves are spring loaded cone to seat valves which allow charge oil to be fed to the low pressure side of the circuit.

The cones and seats should be inspected for proper seating as described under "Charge Relief Valve".

If necessary, install new kit or kits.

Install new "O" rings and torque Hex Head to 22 - 26 Ft. Lbs.

DRIVE - NO DRIVE VALVE - Kit No. 500441 (See Fig. 15)

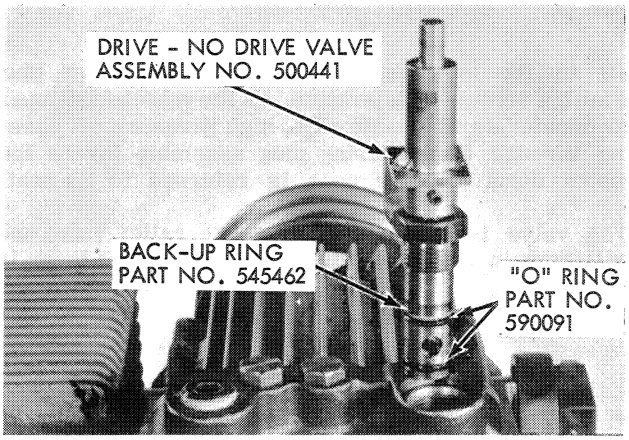


Figure 15