

# **AUTOMATIC TRANSMISSION REPAIR MANUAL**

**SUNDSTRAND HYDROSTATIC SYSTEMS  
Hydrogear & Piston - Piston, 1965-1982**



# **WHEEL HORSE**

## **lawn & garden tractors**

Part No. 492-4206  
(Formerly A-1391, 803402)

# SUPPLEMENTAL INFORMATION

## INTRODUCTION

The following information will assist you with troubleshooting, assembly, and repair information, in light of changes made and experience gained since this manual was first published in 1974. It also contains special service information for 1978-82 model year Sundstrand units.

## SERVICE AND REPAIR PARTS

- **Hydrogear Conversions** - Many hydrogear units (1966 to mid-1973) have been converted to the serviceable piston-piston transmission. Refer to the photos in this manual to identify the transmission in a particular tractor.
- **Complete Transmissions** - Complete replacement transmission assemblies are no longer available. Independent outside rebuilding service may be available. Refer to the latest issue of Service Bulletin 437 for information.
- **Repair Parts** - Use this manual to determine replacement part numbers for 1965 to mid-1973 hydrogear units (Pages 54-56) and mid-1973 to 1977 piston-piston units (Pages 60-62). Be sure to check parts price list to determine if all parts needed are still available before ordering parts.

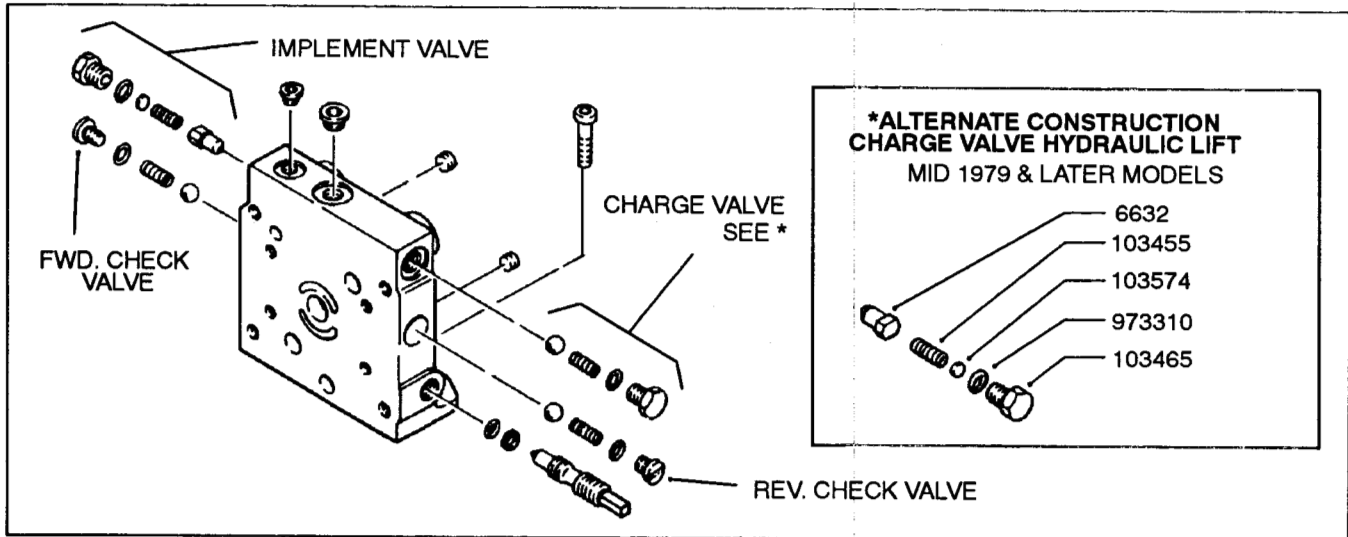
Piston-piston part numbers for 1978-82 model year tractors are contained in the particular tractor parts manual.

- **D-Series Adjustments** - Transmission control linkage adjustments described in this manual for 1975 models are appropriate for 1976-77 models. 1978-82 linkage adjustments are covered in the 1978-79 B,C,D- Series Service Manual, P/N 810063R1.
- **D-Series Driven Coupling Preload and Pump Alignment** - Refer to Service Bulletins 217 and 305 for special service information.

## CONSTRUCTION CHANGES, 1978 AND LATER

- Sundstrand units on 1978 and later tractors differ from earlier units in that the motor shaft extends through the cover plate, for the mounting of a parking brake drum. Motor repair operations described in this manual still apply, except that the motor cover plate oil seal should be replaced during the repair process.

- Part-way through the 1979 model year, the charge pressure relief valve on hydraulic lift models was changed from ball-type to cone-type. Both constructions are illustrated below, with part numbers given for the cone-type valve system.



## SERVICE NOTES

- **Oil** - The recommended transmission oil is SAE 10W-30 or SAE 10W-40 engine oil. **IMPORTANT:** All 1972 and prior, and some 1973 models use automatic transmission fluid (Dexron II). Determine type of oil in these units - Do Not Mix engine oil and automatic transmission fluid. Units may have been changed to engine oil during prior overhauls. To convert to engine oil, the entire system - transmission, transaxle, hoses, hydraulic lift valve - must be totally cleaned of transmission fluid.
- **Pressure Checks** - Keep in mind an "unsealed" condition anywhere in the transmission will cause a low-or-no charge pressure condition. Troubleshooting charts and the lack of charge pressure seem to point to the pump section as the source of the problem. Experience shows most "loss of pressure" conditions to be due to: sticking acceleration or forward/reverse check valves, charge pressure relief valves, or a problem in the motor section. Motor section problems are most commonly snap ring, special retaining ring, or spiraloc retaining ring failure, causing the motor cylinder block to lose its spring preload against the valve plate.
- **Contamination** - Where dirt or failed parts have circulated through the system, it is essential the entire system be disassembled and flushed clean - both transmission sections, the transaxle, hydraulic valve, and hoses or hydraulic manifold. Residual contamination will quickly destroy the repaired unit.

- **Valve Plates** - Note the difference between the pump and motor valve plates (Fig. 44). Ensure the correct valve plate is ordered when replacing, as the motor plate will fit in place of the pump plate, but will not function properly. Scratches in the brass surface of the plate that can be felt with a fingernail indicate an unserviceable valve plate. The cylinder block may also be unserviceable in this case.
- **Charge and Implement Valves** - Note the location of these valves, depending on whether the tractor has manual or hydraulic lift (Fig. 61). Using the appropriate valve parts in the correct hole permits setting up any piston-piston unit for either type of lift system.
- **Charge Pump** - Refer to the installation of the charge pump (Fig. 49). With the pump end cap positioned as shown, note that the dowel pin is down (nearest the sealing surface of the pump end cap). The charge pump can be put on upside-down, and will fail to function.

Also note that the charge pump needle bearing, Fig. 54, must protrude above the housing surface, to hold the valve plate in place. Use care to prevent accidentally pressing the dowel pin into the housing. Be sure the valve plate notch is over the dowel pin on assembly, or the valve plate will be ruined.

- **Control Shaft/Stub Shaft** - On 1978 and later transmissions, the longer control shaft is used on both sides of the pump housing (Fig. 57). Using a later transmission on an earlier tractor may require cutting a clearance hole in the tractor's sheet metal for the longer shaft.
- **Acceleration Valves** - Original equipment valves are different (Fig. 68) and must not be exchanged during repair. However, the forward valve is used as the service replacement part for both locations.

If an acceleration valve seems to be malfunctioning, ensure the metering plug hole is open (Fig. 70). If clogged, it will prevent the valve from closing. The hole is extremely small, and it may take a magnifying glass to see it.

- **Motor Section** - Note that the webbed section of motor housing must be "up" (Fig. 74), or motor will run opposite the intended direction.

#### Special Assembly Note

Ensure you use new retaining parts in the motor section (Items 23,70,73,74, Pages 61-62), to ensure the integrity of the cylinder block attachment to the motor shaft. On assembly, make absolutely sure the cylinder block is locked securely on the motor shaft. Be sure the notch in the valve plate is over the dowel pin in the motor end cap.

# FOREWORD

This service and repair manual has been compiled to provide authorized Wheel Horse service personnel with the proper procedures and techniques for servicing Wheel Horse automatic transmissions.

The following index lists all areas covered. It is advisable to read all of the introductory sections first to gain a proper understanding of the Wheel Horse automatic transmission.

The automatic transmission is a sophisticated piece of machinery. Maintain strict cleanliness control during all stages of service and repair. Even a small amount of dirt or other contamination can severely damage the system.

Although this manual deals primarily with the Sundstrand piston-piston type hydrostatic transmission, service and repair procedures for the older hydrogear type transmission have been included in a separate section .

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## PRINCIPLES OF OPERATION

(Refer to the Neutral, Forward & Reverse Schematic Diagrams, Figs. 1 (Pg. 6), 2 (Pg. 7), 3 (Pg. 8).

Power is transmitted from the engine through a flexible coupling or belt and pulley arrangement to the pump shaft (shown at left of diagrams). Rotation of the input shaft causes the main pump cylinder block and the charge pump to turn, initiating the power transmitting function. Oil from the reservoir is drawn by the charge pump through the inlet strainer and forced, by way of the check valves, into the low pressure lines. Oil introduced by the charge pump fills the area in back of the cylinder block pistons, holding them against their swash plates in both the pump and the motor.

When the pump swash plate is in neutral the pump cylinder block pistons do not move in and out. Thus, in neutral, no oil is being pumped from the variable displacement pump.

Low pressure oil from the charge pump fills the complete system, including the area around the acceleration valves. These valves are held open by the spring between them. The acceleration valves remain open until high pressure oil is introduced behind one of them. Which valve depends on the direction of rotation as determined by the position of the pump swash plate.

### RELIEF VALVES

Pressure from 70 to 150 PSI is controlled by the charge pressure relief valve. This exhausts the excess charge oil not needed to make up leakage to the oil filter and case reservoir. When an implement is used, the maximum charge pressure, from 550 to 700 PSI, is limited by the implement relief valve.

Some separated systems also incorporate a high pressure relief valve which serves to prolong the life of the hydrostatic unit. Located on the left side of the tractor above the transmission, this relief valve has been factory adjusted and will reset automatically if triggered.

### FORWARD TRAVEL

In forward position the pump variable swash plate tilts and, as the cylinder block continues to rotate, the pistons cross over a valving plate under low pressure and advance up the swash plate. This in turn pushes them into the block, forcing the oil from the block under high pressure. At the bottom of their stroke,

the pistons pass again to the low pressure side of the valving plate and are refilled by the charge pump with oil returning from the motor through the low pressure line. The high pressure oil (shown in black) closes the high pressure check valve and travels through internal passages to the inlet side of the piston motor.

In the motor, high pressure oil acting on the back of the piston forces the piston down the incline causing the block to rotate and turn the output shaft.

### REVERSE TRAVEL

When the control handle is moved to the reverse position, the pump variable swashplate is tilted in the opposite position which changes the direction of oil flow. The high and low pressure circuits interchange causing the motor to rotate in the opposite direction.

### ACCELERATION VALVES

The acceleration valves are placed in the circuit to limit 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, the circuit pressure increases, causing the oil on the high pressure side to bleed by the flats on the valve lands and into the low pressure side. This high pressure oil continues to bleed to the low pressure side, by-passing the piston motor and holding the acceleration rate to a safe level during the time it takes for the acceleration valve to close against its seat. The delay in closing the valve is due to the time it takes the high pressure oil to bleed through the small orifice in the acceleration valve metering plug and into the area behind the valve.

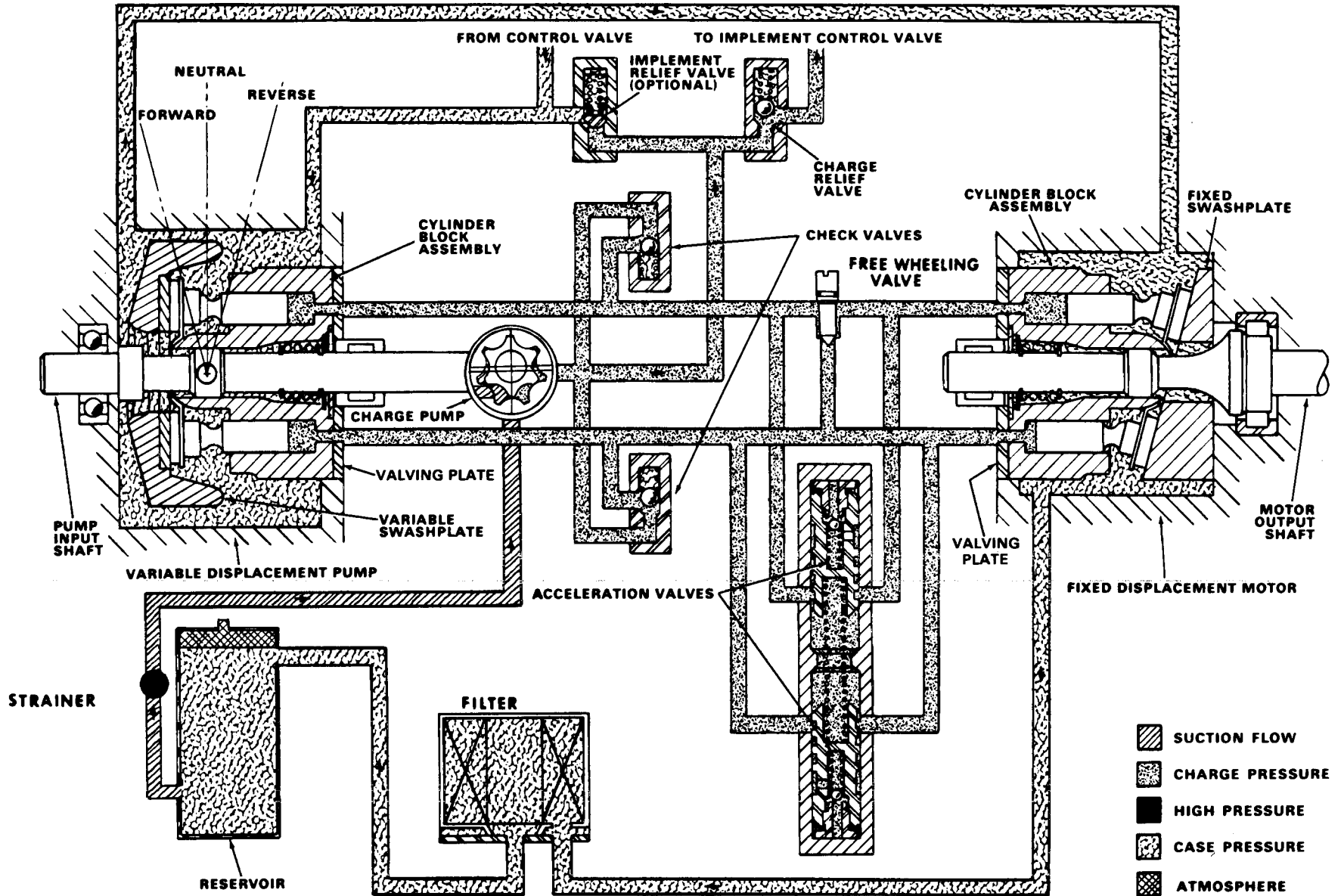
### PUSH VALVE

When open, the push or free wheeling valve allows the oil to by-pass or flow from one side of the main circuit to the other. When pushing, the motor becomes a pump forcing the oil through the open valve and to the other side of the motor. The direction of oil flow depends on the direction the unit is pushed.

**NOTE:** On "B" and "C" series tractors, and similar prior models, the hydrostatic pump and motor are bolted together as a single unit. For purposes of description we will refer to such a transmission system as a "standard system".

On "D" series tractors, and similar prior models, the pump and motor are separated incorporating a manifold between them. In this manual we refer to such a system as a "separated system".

VARIABLE PUMP-FIXED MOTOR CIRCUIT WITH ACCELERATION VALVES AND IMPLEMENT CIRCUIT



Piston - Piston Hydrostatic Transmission

NEUTRAL POSITION

FIG. 1.

VARIABLE PUMP-FIXED MOTOR CIRCUIT WITH ACCELERATION VALVES AND IMPLEMENT CIRCUIT

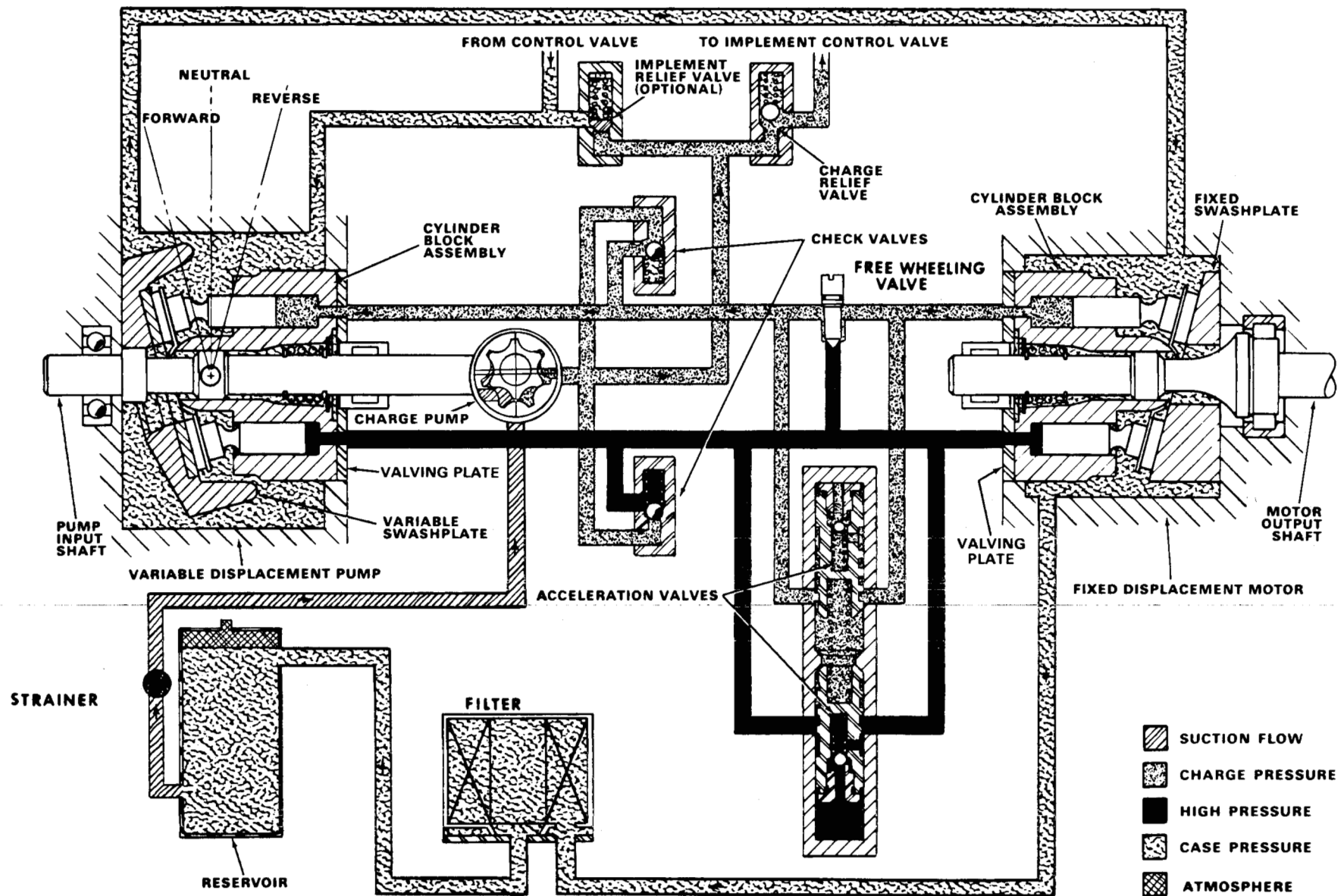
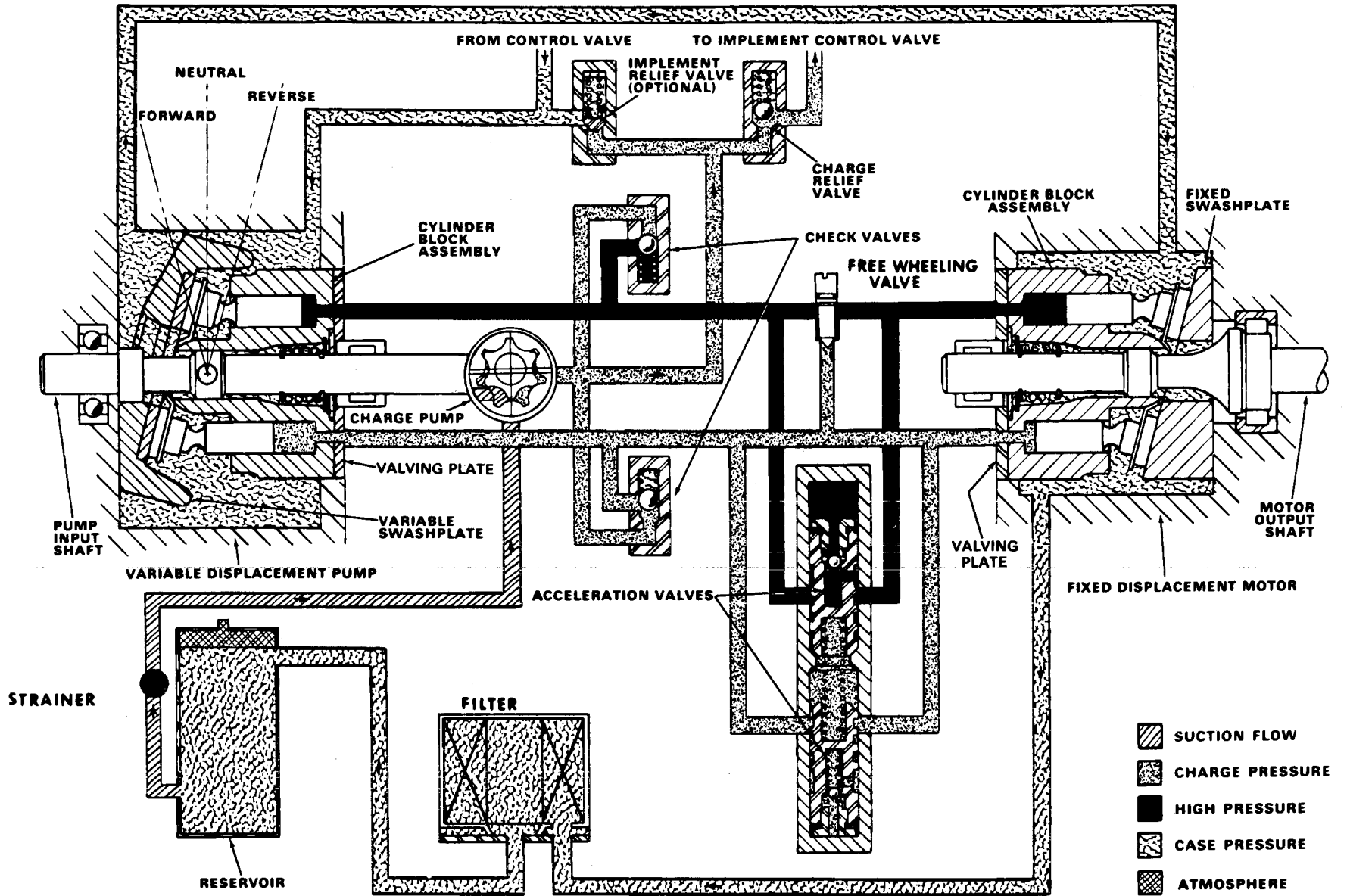


FIG. 2.

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Piston - Piston Hydrostatic Transmission  
FORWARD POSITION

VARIABLE PUMP-FIXED MOTOR CIRCUIT WITH ACCELERATION VALVES AND IMPLEMENT CIRCUIT



Piston - Piston Hydrostatic Transmission

REVERSE POSITION

## DIAGNOSIS

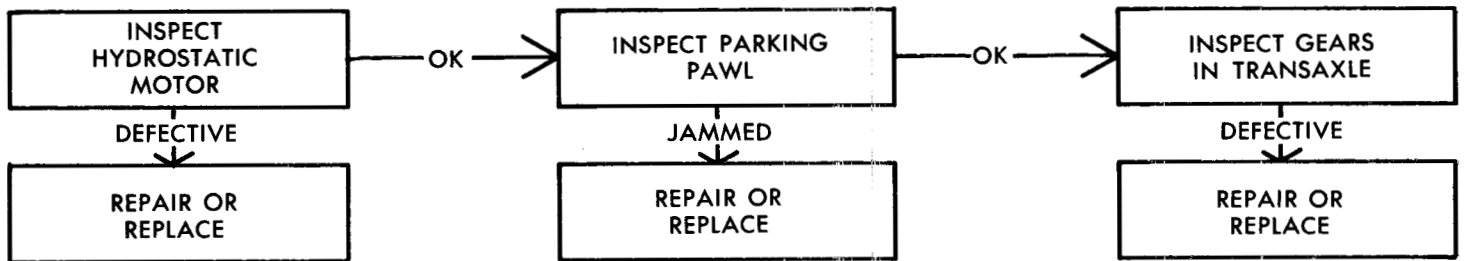
This trouble-shooting guide has been written to take into account both the most likely causes of service problems and the difficulty of checking certain parts of the system. To save time and expense, follow the sequence of steps as outlined in the trouble-shooting charts on the following pages. When the cause of the problem is found, repair or replace the parts involved.

**NOTE:** Whenever a problem occurs, always first check:

1. Transmission oil level.
2. Speed control linkage (page 19).
3. The push valve — make sure it is closed (page 5).

**SPECIAL SERVICE NOTE:** If the tractor drives in the wrong direction when the control lever is moved, the hydrostatic motor cover was incorrectly installed 180° off position by the supplier. Turn it to the correct position (see page 42, step 4).

### TRACTOR WILL NOT OPERATE IN EITHER DIRECTION. ENGINE BOGS DOWN OR STALLS.



#### SERVICE AREA

#### GENERAL INFORMATION

#### REMOVAL/REPLACEMENT

Hydrostatic motor

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Parking pawl

.....

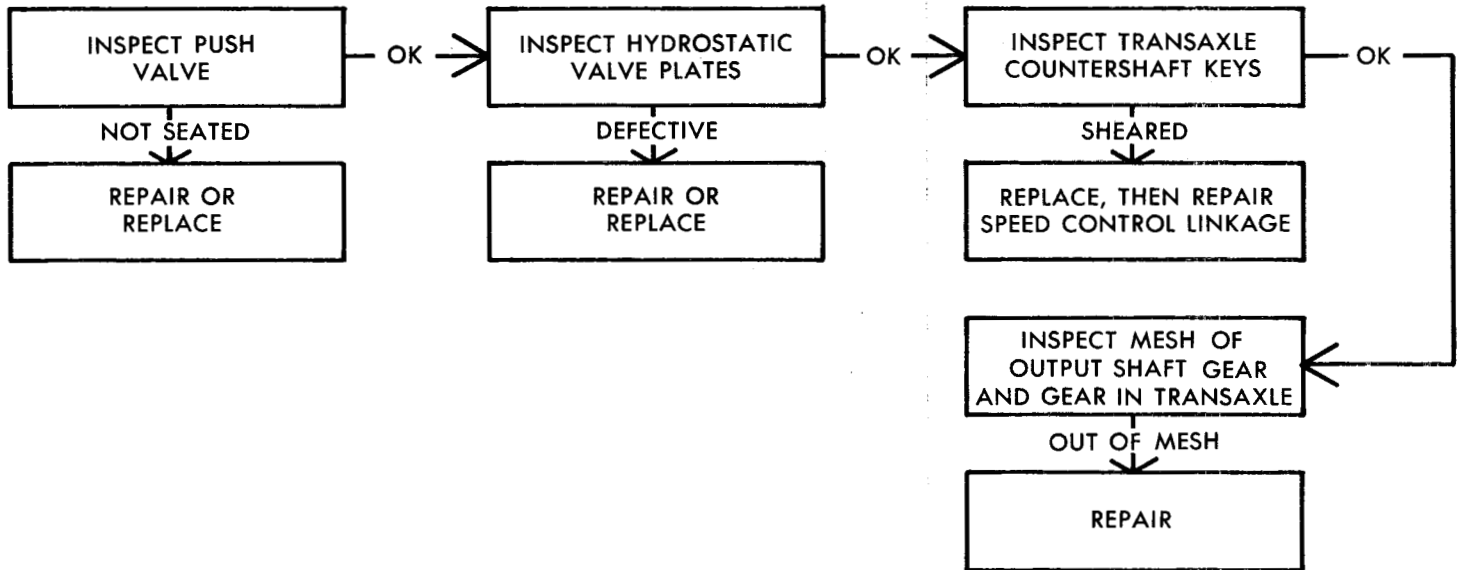
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Transaxle gears

.....

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**TRACTOR WILL NOT OPERATE IN EITHER DIRECTION.  
TRACTOR CAN BE PUSHED WITH PUSH VALVE CLOSED.**



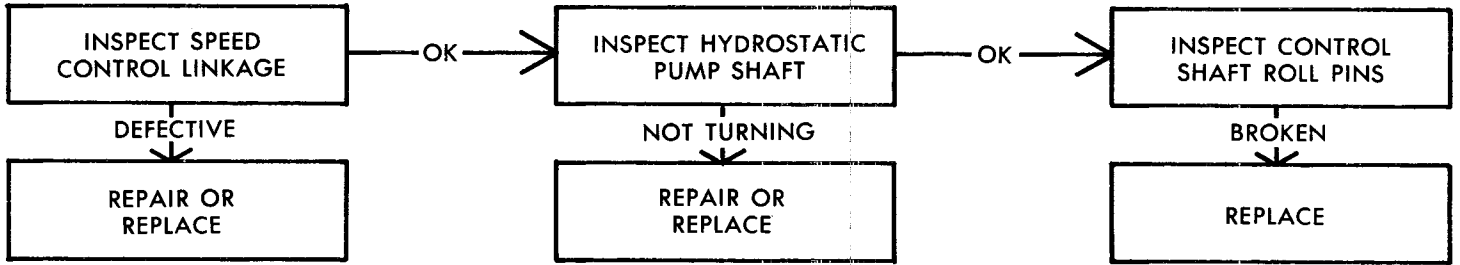
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**GENERAL INFORMATION**

**REMOVAL/REPLACEMENT**

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**TRACTOR WILL NOT OPERATE IN EITHER DIRECTION.  
TRACTOR CANNOT BE PUSHED WITH PUSH VALVE CLOSED.**



**SERVICE AREA**

**GENERAL INFORMATION**

**REMOVAL/REPLACEMENT**

Speed control linkage

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Pump shaft

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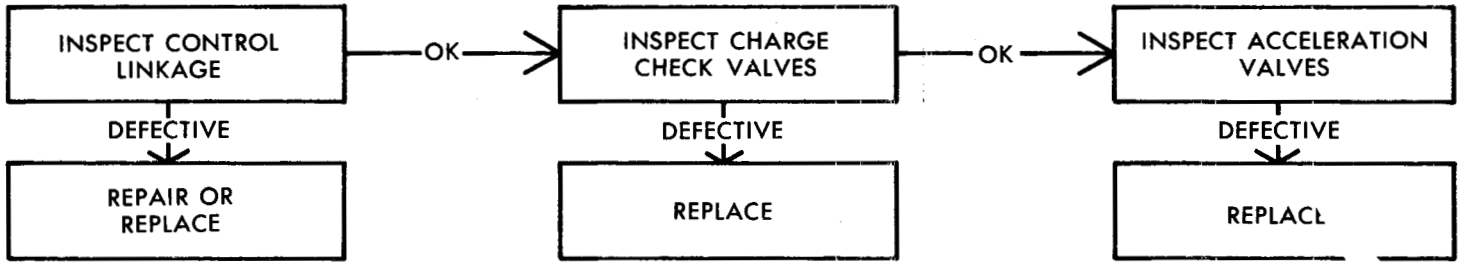
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Control shaft roll pins

.....

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**TRACTOR OPERATES IN ONE DIRECTION ONLY.**



**SERVICE AREA**

**GENERAL INFORMATION**

**REMOVAL/REPLACEMENT**

Speed control linkage

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.....

Charge check valves

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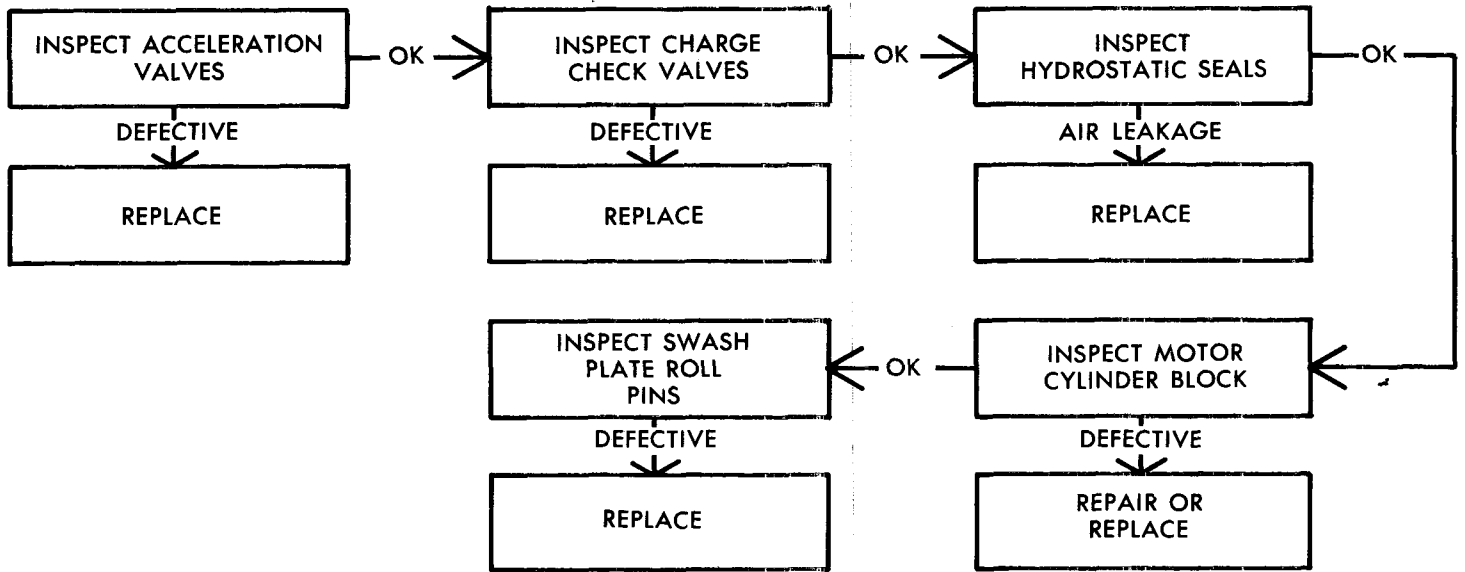
Acceleration valves

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**TRACTOR OPERATES ERRATICALLY.**



**SERVICE AREA**

**GENERAL INFORMATION**

**REMOVAL/REPLACEMENT**

Acceleration valves

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Charge check valves

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Seal rings, standard system

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Seal rings, separated system

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Shaft seals

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Page 37, 44

Motor cylinder block

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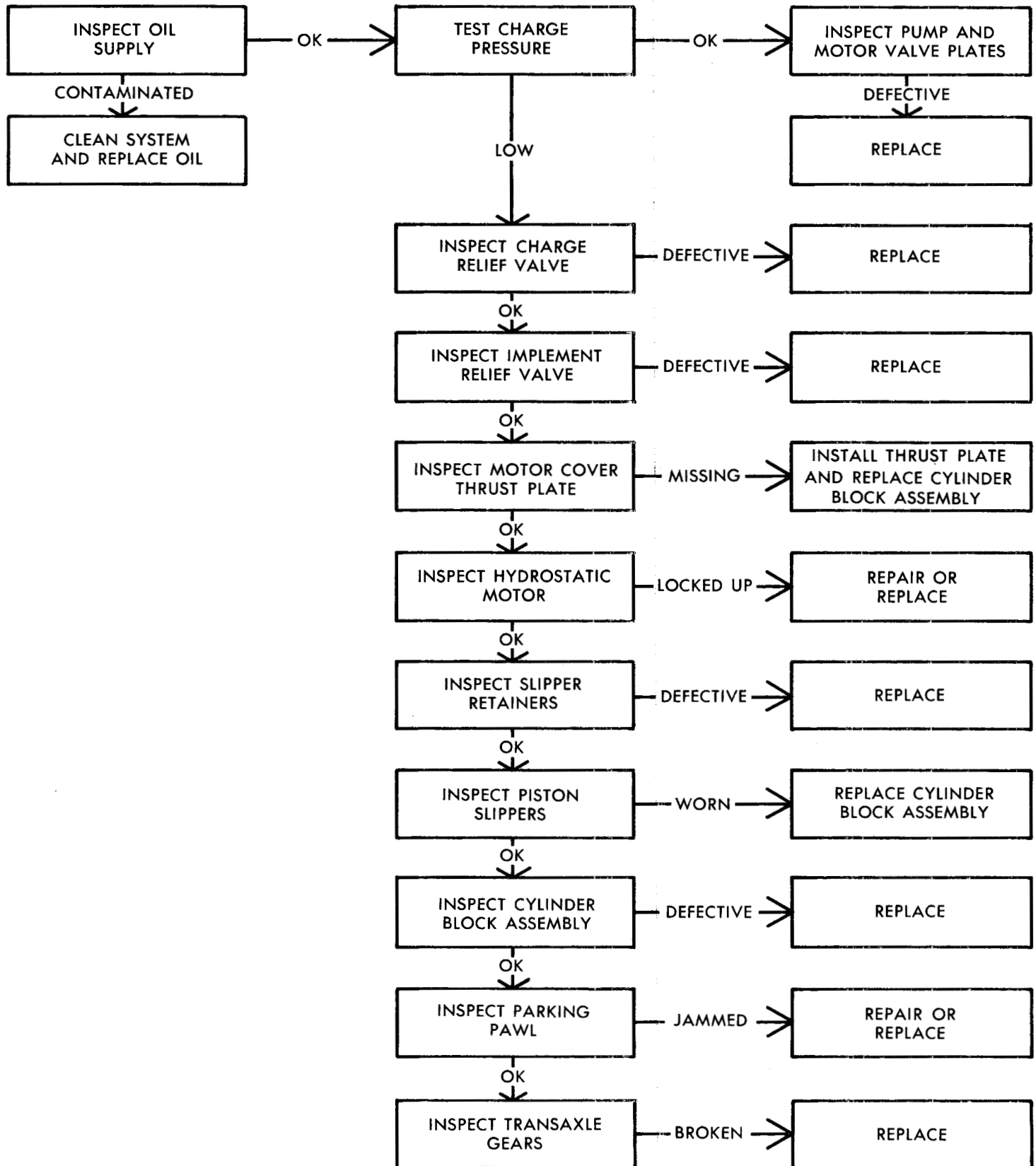
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Swash plate roll pins

.....

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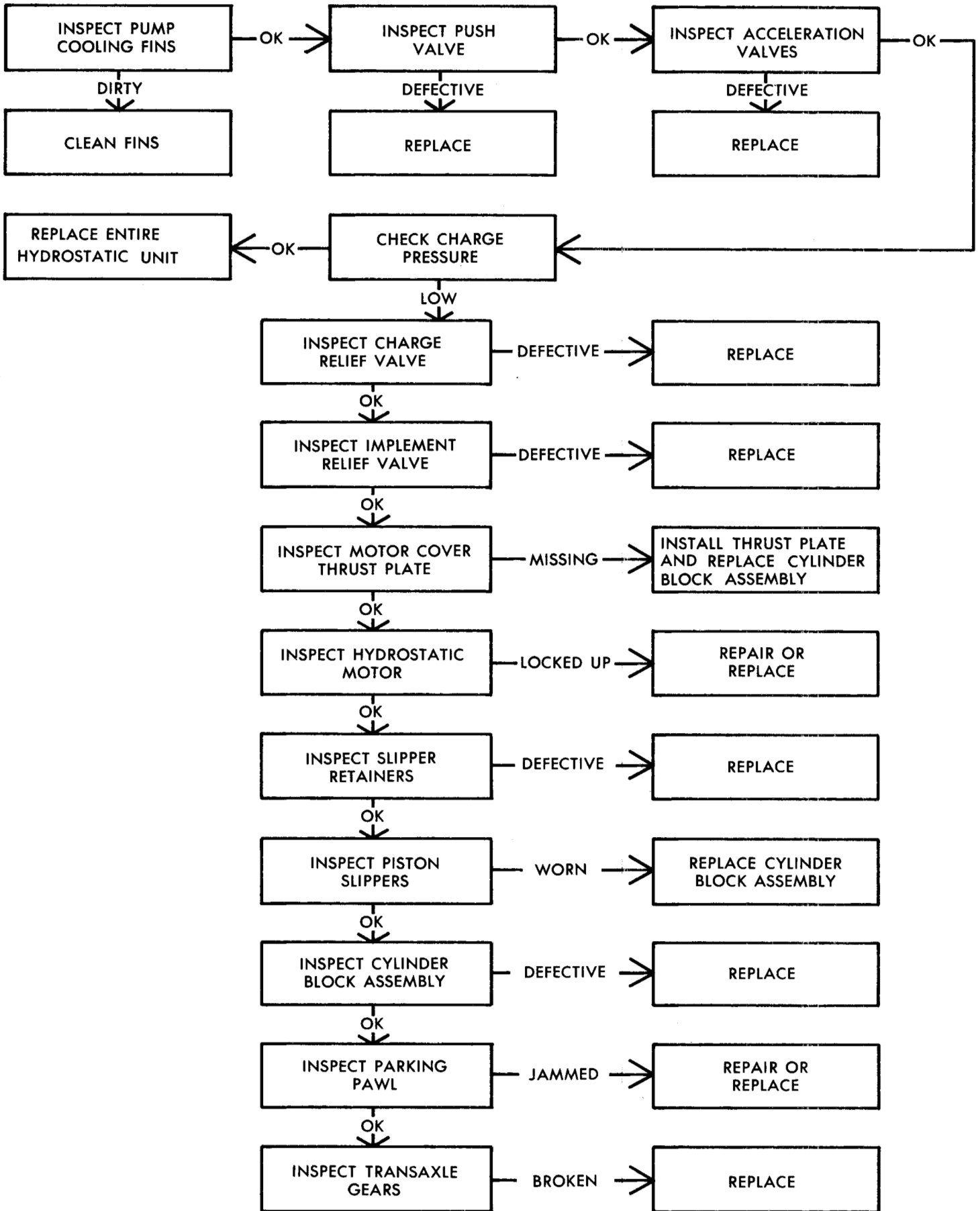
**TRACTOR OPERATES IN BOTH DIRECTIONS, BUT WITH LOSS OF POWER.  
CONDITION BECOMES WORSE AS TRANSMISSION BECOMES HOT.**



**SERVICE AREA****GENERAL INFORMATION****REMOVAL/REPLACEMENT**

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# TRANSMISSION OVERHEATING.



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## SPEED CONTROL LINKAGE AND ADJUSTMENTS – Standard System

### NEUTRAL ADJUSTMENT

Place the tractor on a level surface with the engine running. Depress the brake pedal. The tractor should not creep and the rear wheels should be effectively locked. Some creeping on slopes is normal and cannot be completely prevented.

If the tractor creeps on a level surface while in neutral, adjust as follows:

1. Block the rear wheels off the ground.
2. Remove the access plate located in front of the seat.
3. With an allen wrench, loosen the set screws in the arm (see Fig. 4).
4. Depress the brake pedal and keep it depressed.
5. Start the engine and disengage the parking brake. Insert a short screwdriver through the hole in the nylon cam and rotate the eccentric cam pin until the rear wheels stop turning. This usually occurs at a point midway between forward and backward wheel rotation.  
**NOTE:** The lobe on the eccentric pin must be up for proper operation.
6. Retighten the set screw in the arm and replace the access plate.



FIG. 4. Standard System Neutral Adjustment

### 1974 Models Only:

After neutral has been adjusted, check to see if the speed control rod is centered in the detent notch of the detent spring. This spring is located on the hood stand behind the belt guard. The spring incorporates slotted bolt holes so it may be adjusted as required to line up the neutral notch with the control rod.

## FRICITION ADJUSTMENT

The speed control lever is friction loaded to hold any selected speed in either direction. If the lever does not remain where it is set during operation, friction may be increased by releasing the lock nut and tightening the collar-friction adjustment (see Fig. 5). This adjustment is made at the front of the seat.

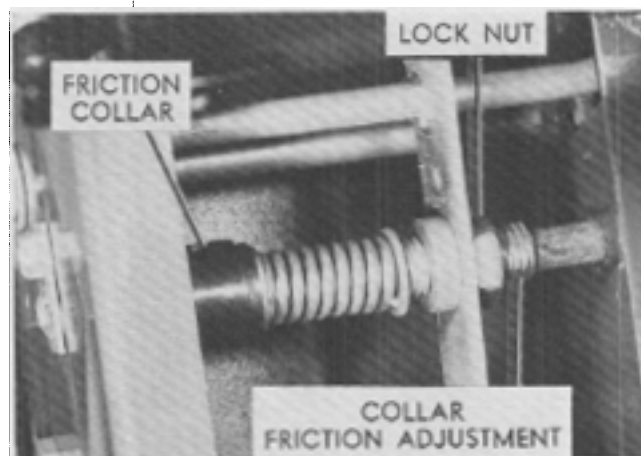


FIG. 5. Standard Control Lever Friction Adjustment

The proper amount of friction is obtained when approximately six pounds of force at the handle moves the control lever. Be sure to tighten the lock nut after proper tension is achieved. The friction collar is self lubricating and does not require lubrication.

## SPEED CONTROL LINKAGE AND ADJUSTMENTS – Separated System

### 1973 18 HP AUTOMATIC – NEUTRAL ADJUSTMENT

An access hole is provided in the right console panel for the neutral adjustment.

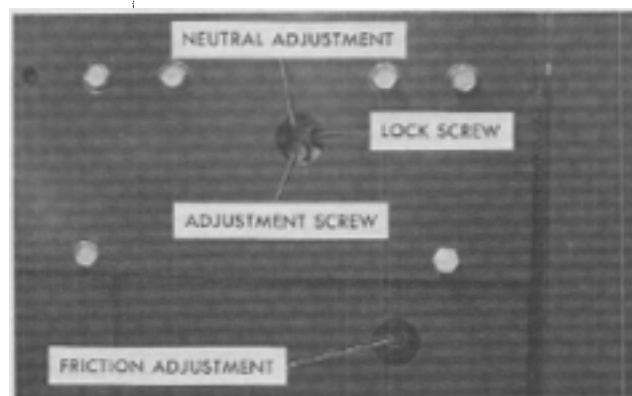


FIG. 6. 18 HP Automatic Adjustments

If the tractor creeps when in neutral, adjust as follows:

1. Block the rear wheels off the ground.
2. Loosen the lock screw holding the eccentric assembly (see Fig. 6).
3. Depress the brake pedal and keep it depressed during adjustment.
4. Start the engine and run at half throttle. Disengage the parking brake. Insert a screwdriver

# 1973 18 HP AUTOMATIC TRANSMISSION CONTROL LINKAGE

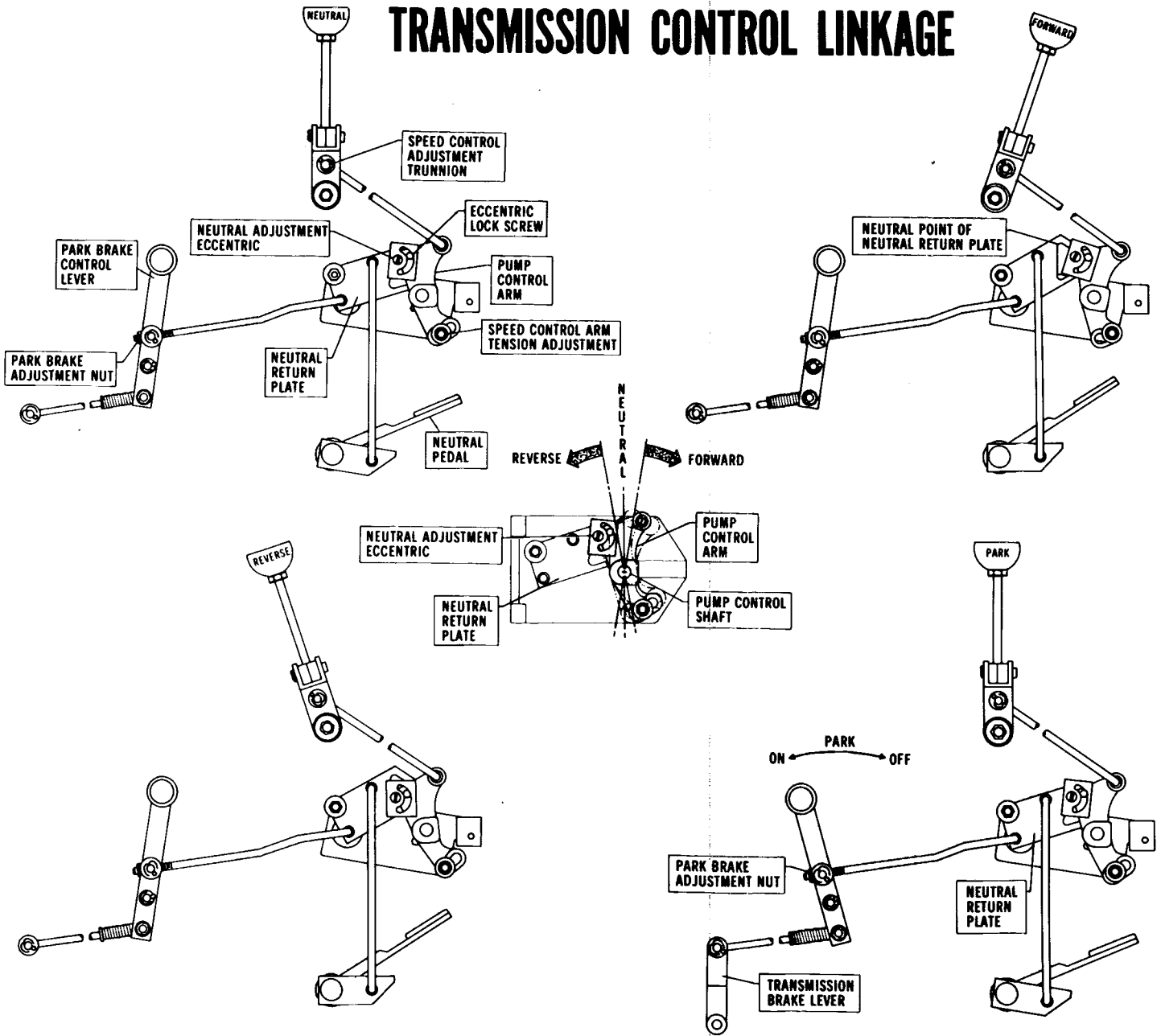


FIG. 7.

through the hole in the side panel and rotate the eccentric cam pin until the rear wheels stop. This usually occurs at a point midway between forward and backward wheel rotation. Retighten the lock screw holding the eccentric assembly.

To position the speed control lever at the neutral position of the console slot, depress the brake pedal and adjust the length of the shift rod arm by rotating it in its trunnion.

## FRICITION ADJUSTMENT

The speed control lever is friction loaded to hold selected speed in either direction. If the lever does not remain where it is set during operation, the friction may be increased by tightening the adjusting nut through the access hole located in the right panel (see Fig. 6). The proper amount of friction is obtained

when approximately 18 pounds of force at the handle moves the control lever.

## PARKING BRAKE ADJUSTMENT

1. With the engine shut off, press and release the brake pedal.
2. Engage the parking brake by placing the lever in the rear notch of the access plate.
3. Check the need for adjustment by moving the speed control lever back and forth to determine if the linkage can be moved from neutral toward either the forward or reverse positions.
4. If the speed control lever can be moved with little effort toward either position as described in step 3, shorten the length of the parking brake lever rod. This adjustment is made by turning the nut on the rear of the rod against the trunnion.

1974 "D" SERIES TRACTORS —  
NEUTRAL ADJUSTMENT

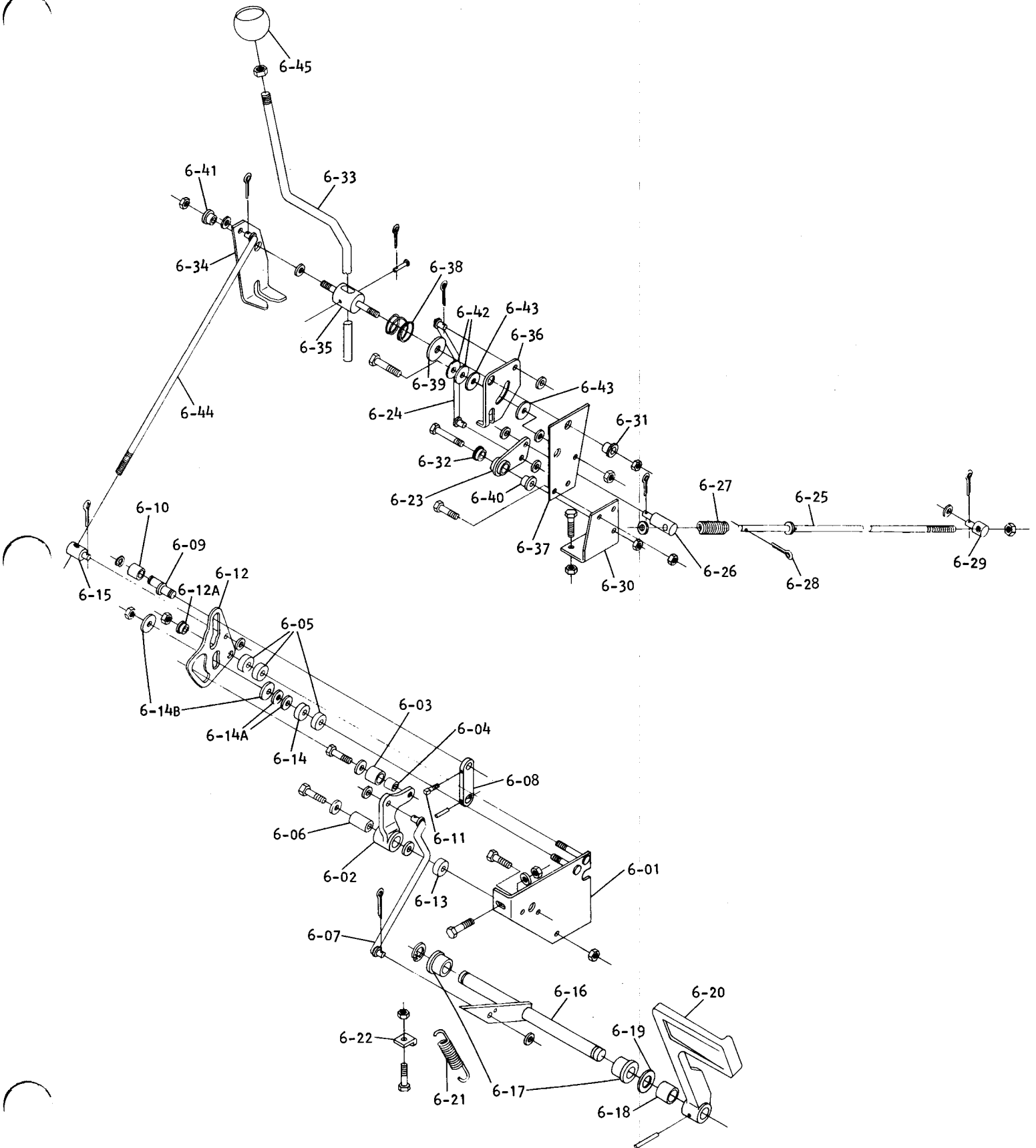


FIG. 8. Brake, Speed Control Linkage, 1974 "D" Series



5. If the parking brake lever is loose in the disengaged position, adjust the length of the transmission brake lever rod until there is little play left before it begins to engage.

### 1974 "D" SERIES TRACTORS — NEUTRAL ADJUSTMENT (FIG. 8)

1. Block the rear wheels off the ground.
2. Depress the brake pedal (item 6-20), and keep it depressed during adjustment.
3. Loosen the set screw (6-11). Start the engine and run it at half throttle.
4. Adjust the eccentric (6-09) until true neutral is reached. Check this by making certain the tires have stopped rotating. Be sure to check **both** tires. This usually occurs at a point midway between forward and backward wheel rotation.
5. Retighten the set screw.
6. Move the speed control lever into forward and reverse several times, depressing the pedal each time

to make sure of the neutral setting. Then make a final check of the adjustment at full throttle.

### LEVER POSITION ADJUSTMENT

If the speed control lever does not return to the neutral (center) position when the brake pedal is depressed, adjust as follows:

1. Remove the top cotter pin retaining the shift rod (6-44).
2. Rotate the shift rod (checking periodically) until the speed control lever is centered when the brake pedal is depressed.
3. Replace cotter pin and washer.

### FRICITION ADJUSTMENT — Speed Control Lever

A friction adjustment may be necessary on "D" series tractors if the speed control lever fails to maintain the selected speed.

1. Tighten the nut retaining the two friction washers (6-14B) on the speed control cam (6-12).

## 1974 D SERIES

# TRANSMISSION CONTROL LINKAGE

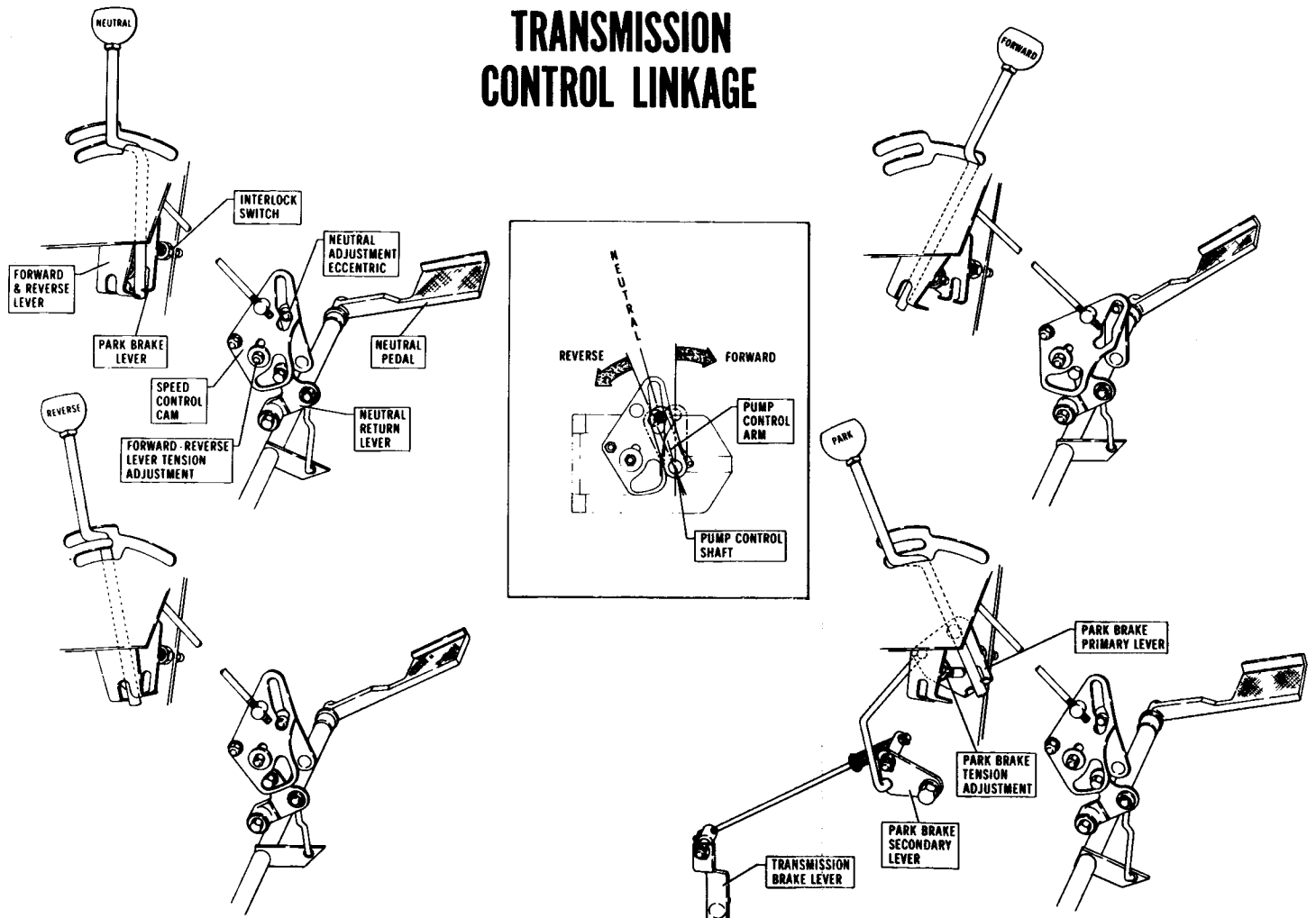


FIG. 9.

2. The proper adjustment is achieved when a pull of 24 to 28 lbs. is reached, measured near the top of the speed control lever.

### FRICION ADJUSTMENT — Parking Brake

A friction adjustment may be necessary to maintain the position of the parking brake control in the disengaged position.

1. Tighten the nut securing the two friction washers (6-43) at the parking brake lever (6-36). Try pushing the tractor both forward and reverse to make sure the parking pawl is fully engaged.

### PARKING BRAKE ADJUSTMENT

1. Engage the parking brake.
2. Adjust the trunnion (6-29) on the brake rod (6-25) until there is  $\frac{1}{8}$ " clearance between the washer and trunnion (6-26) at the other (front) end of the rod.
3. Tighten the lock nut at the adjusting trunnion (6-25).

### 1975 "D" SERIES TRACTORS — NEUTRAL ADJUSTMENT

An access hole is provided in the right console panel for the neutral adjustment.

If the tractor creeps when in neutral, adjust as follows:

1. Block the rear wheels off the ground.
2. Loosen the lock screw holding the eccentric assembly (Fig. 10).
3. Depress the brake pedal and keep it depressed during adjustment.

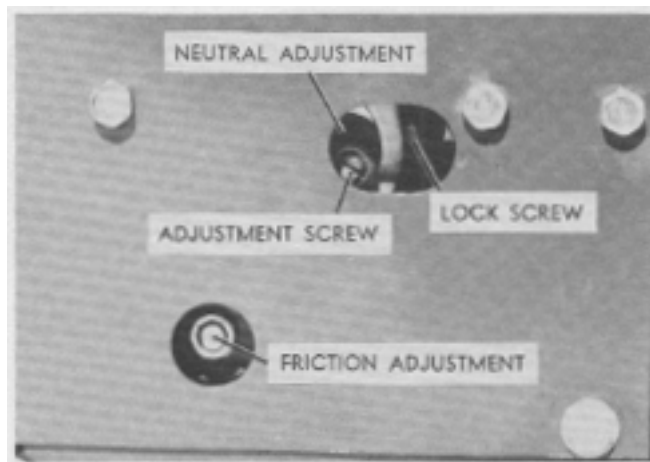


FIG. 10. Transmission Neutral & Speed Control Lever Tension Adjustment

4. Start the engine and run it at half throttle. Disengage the parking brake. Insert a screwdriver through the hole in the side panel and rotate the eccentric cam pin to a point midway between forward wheel rotation and backward wheel rotation. Retighten the lock screw holding the eccentric assembly.
5. Increase engine speed to full throttle. Move the speed control lever in both directions and return it to neutral with the pedal. Repeat several times. Recheck adjustment and readjust if required.

To position the speed control lever at the neutral position of the console slot, depress the brake pedal and adjust the length of the shift rod arm by rotating it in its trunnion.

### LEVER FRICTION ADJUSTMENT

The speed control lever is friction loaded to hold selected speed in either direction. If the lever does not remain where it is set during operation, the friction may be increased by tightening the adjusting nut through the access hole located in the right panel (Fig. 10). The proper amount of friction is obtained when approximately 18 pounds of force at the handle moves the control lever.

### PARKING BRAKE ADJUSTMENT

1. With the engine shut off, press and release the brake pedal.
2. Engage the parking brake by placing the lever in the top slot of the console panel.
3. Check the need for adjustment by moving the speed control lever back and forth to determine if the linkage can be moved from neutral toward either the forward or reverse positions.

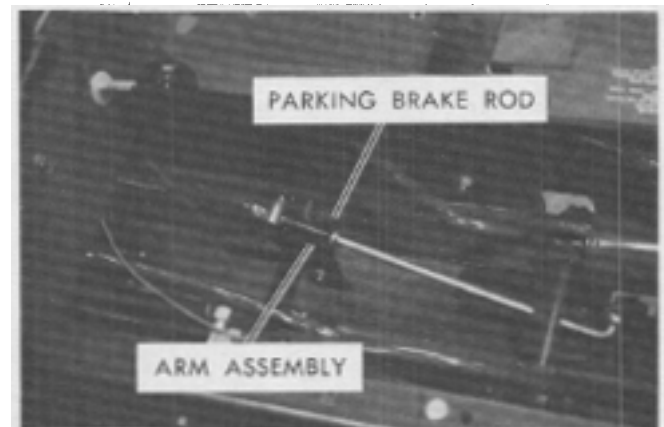


FIG. 11. Parking Brake Adjustment

4. If the speed control lever can be moved toward either position, shorten the length of the parking brake arm assembly rod (see Fig. 11) by turning the nut against the trunnion.

1975 D SERIES  
**TRANSMISSION  
 CONTROL LINKAGE**

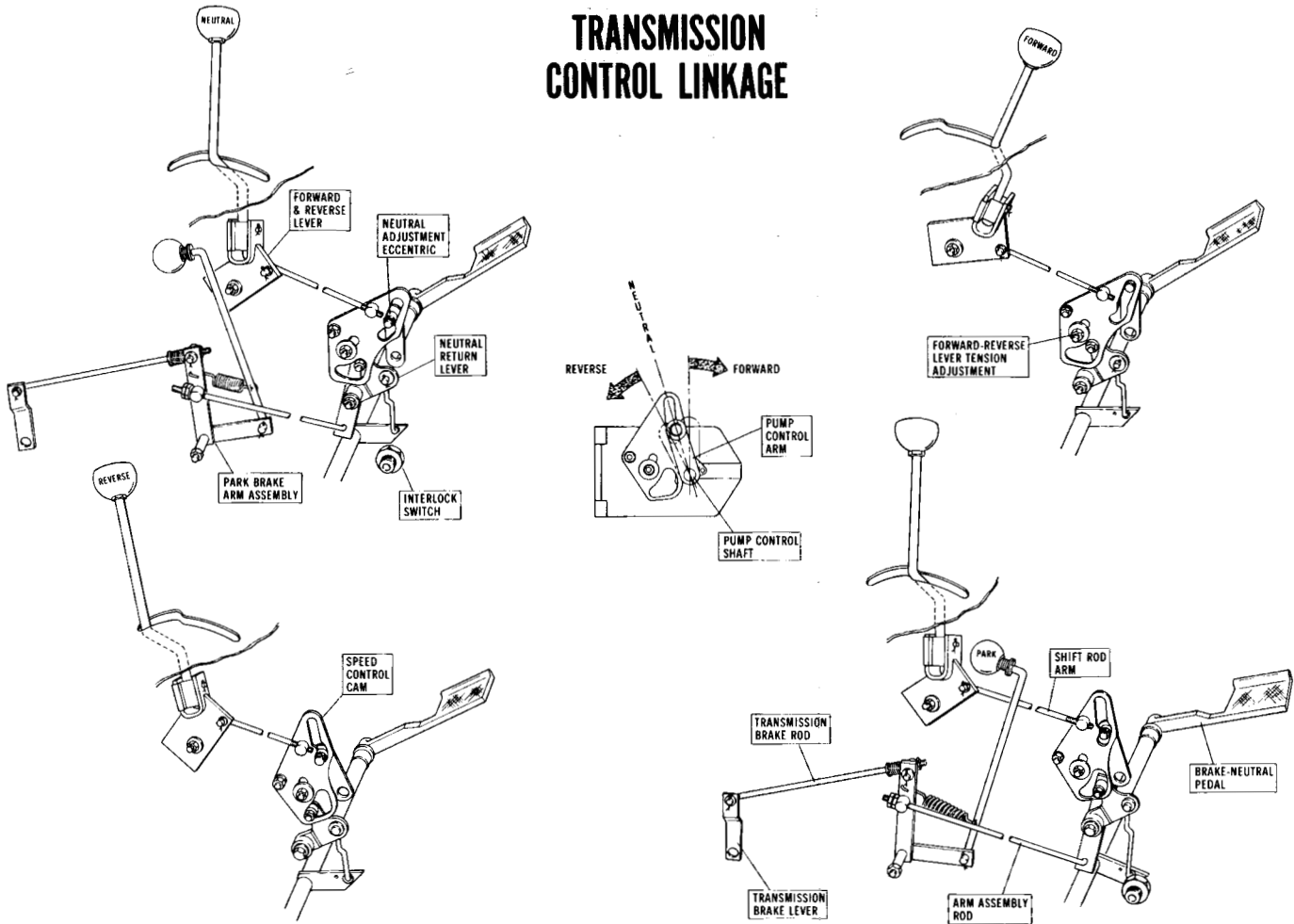


FIG. 12.

**PRESSURE TESTING**

Use a 0 to 1000 lb. gauge for all pressure testing.

Block the rear axle so the wheels are off the floor. All pressure testing should be performed at or near full throttle with the wheels turning. Turn the wheels by moving the speed control lever into forward or reverse.

**CHARGE PRESSURE TEST**

Charge pressure is an indication of transmission condition. Connect the pressure gauge as shown in Fig. 13 to the 1/4" pipe plug located between the implement hose ports. The alternate port (straight thread) just above this port may be used if it is more convenient.

With the engine running at 3/4 throttle the charge pressure should be 70 to 150 PSI. The pressure must never drop below 50 PSI under any condition. Always take pressure tests when the transmission oil is cold

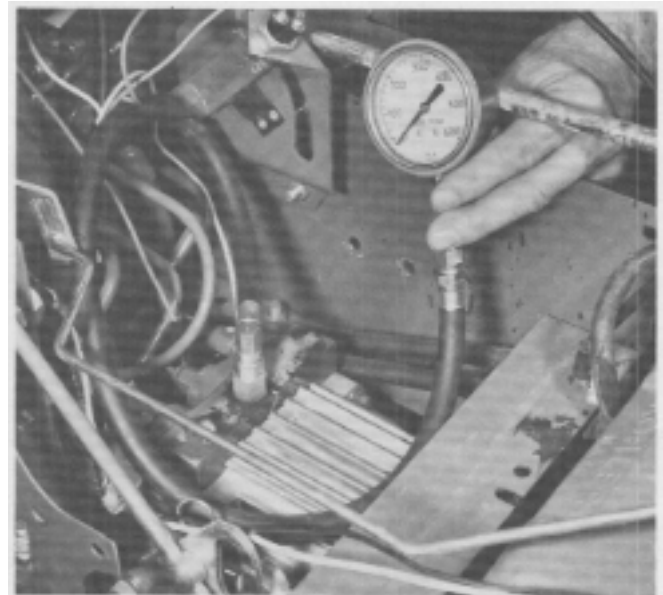
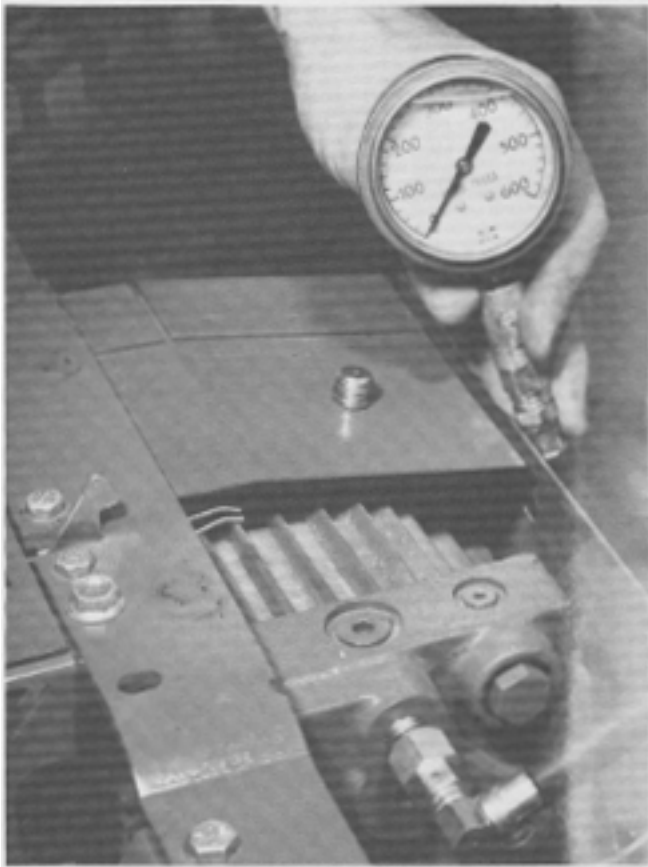


FIG. 13. Charge Pressure Test — Separated System

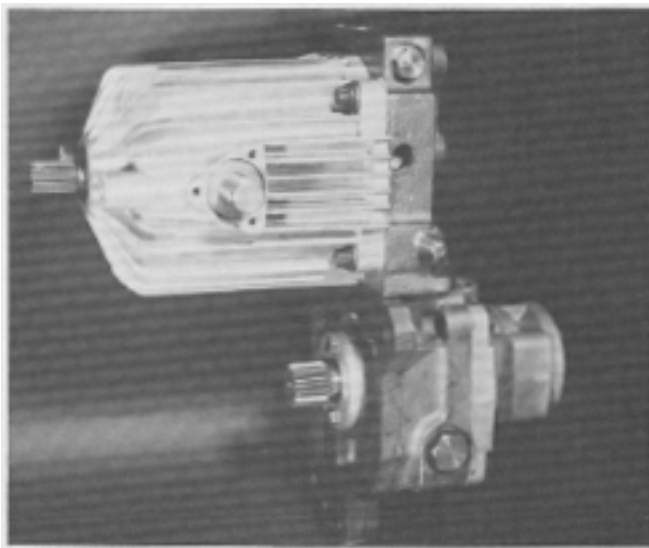
and again after the transmission has reached operating temperature. An appreciable drop in charge pressure as the temperature rises indicates internal leakage caused by worn parts resulting in loss of power.



**FIG. 14. Charge Pressure Test — Standard System IMPLEMENT PRESSURE TEST**

Use the same gauge hook up as Charge Pressure Test.

If the tractor is equipped with a hydraulic lift, implement pressure should be checked. Pressure should

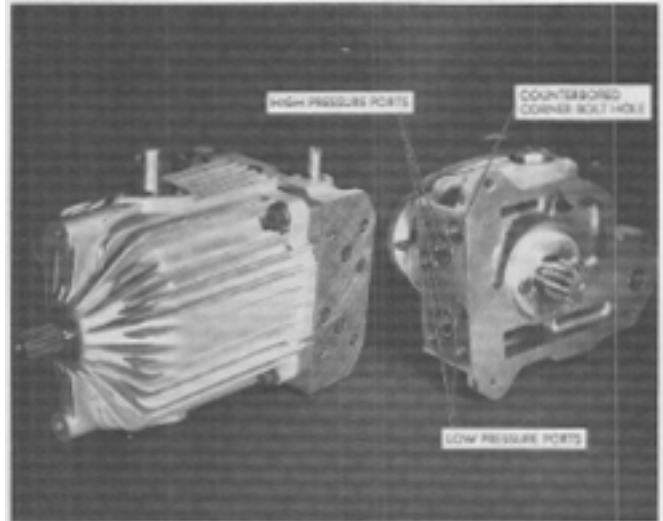


**FIG. 15. Hydrostatic Transmission — As installed in a Standard System**

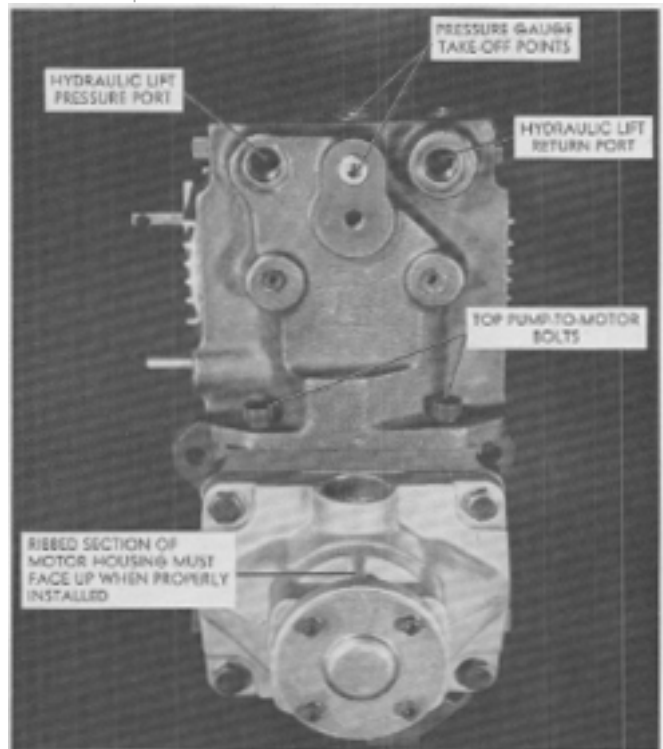
be 550 to 700 PSI when the piston has reached the end of its stroke.

## REPAIR PROCEDURES —

On "B" and "C" Series tractors and other standard system tractors, the hydrostatic pump and motor are bolted together as one unit. (Fig. 15). On the 1973 18 HP Automatic and all "D" Series tractors the pump and motor are separated to accommodate the design incorporating a manifold between the pump and motor.



**FIG. 16. Pump and Motor — Separated**



**FIG. 17.**

### Separation of Pump and Motor

The pump and motor may be separated so that new seal rings may be installed between the pump and the motor housings, and to facilitate overhaul. Four bolts

fasten the two units together. Two of the bolts are accessible from the top, and go down through the pump into the motor housing. The other two are accessible from the gasket side of the motor (where it attaches to the transaxle), and go up through the motor into the pump housing. Because "Allen" type screws are used, a  $\frac{5}{16}$  inch hex Allen wrench is required.

### Seal Ring Installation & Assembly of Pump to Motor

1. Place one small "O" ring in each of the two low pressure ports and one at the corner bolt hole that is counterbored to accept an "O" ring (see Fig. 18).

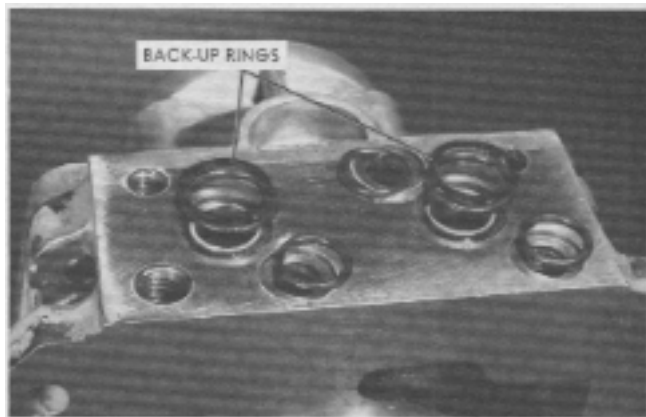


FIG. 18.

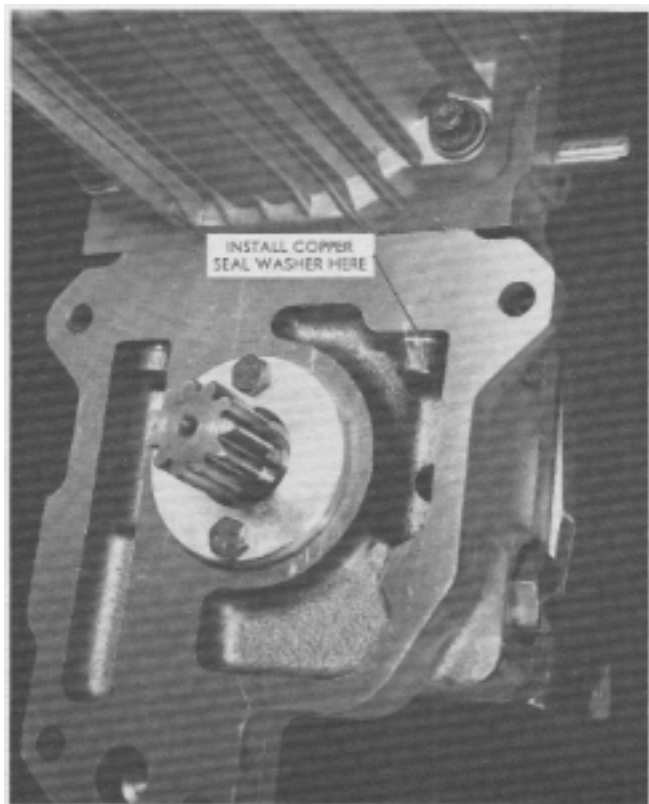


FIG. 19.

2. Place a large "O" ring in each of the two high pressure ports and then place a square section back-up ring on top of each of the large "O" rings, making sure they are centered exactly over the "O" rings (see Fig. 18).

3. Carefully mate the pump to motor using the bolts for alignment so the units will not have to be shifted once they are together. Shifting could disturb the seals and leaks may result.

4. Make sure the copper seal washer is placed under the head of the right side motor-to-pump-bolt (right side means as viewed looking at the motor and the transaxle gasket surface). Proper placement of this washer will assure that internal leaks will not occur in this area when the motor is bolted to the transaxle. (Fig. 19).

5. Tighten all four bolts evenly.

### REMOVAL OF HYDROSTATIC UNIT FROM A STANDARD SYSTEM

1. Remove the left rear wheel and tire assembly.
2. Remove the tractor seat, fender, and tool box assembly.
3. Remove the foot rest bracket.
4. Remove the belt guard and remove the drive belt from the transmission pulley.
5. Remove the access pump.
6. Remove the two bolts and nuts at the top of the assembly and the two cap screws on the bottom. Carefully remove the pump and motor assembly from the transaxle making sure the cam block pin disengages from the cam block. Remove the old gasket and all traces of dirt and oil.

### INSTALLATION OF HYDROSTATIC UNIT IN A STANDARD SYSTEM

1. Make sure the shipping plugs have been removed and that the motor to pump and pump to motor bolts are tight. Also make sure a copper washer is under the head of the front motor to pump bolt. (19).

2. Examine the motor to case mounting surfaces — clean as required and install a new gasket on the motor.

3. Place grease around the inside of the strainer flange and insert the strainer into the recess in the transaxle case. Make sure the grease holds the strainer in place; otherwise the strainer may slip down resulting in a cut gasket.

4. With the gasket in place, carefully install the pump and motor assembly on the transaxle making sure the cam block pin engages with the cam block so it will not damage the cam block and that the motor sits up flush against the transaxle. Secure the assembly at the top with the two  $\frac{3}{8}$ " case bolts and nuts and the two  $\frac{3}{8}$ " cap screws at the bottom. Tighten all four bolts evenly.

5. Install the access plate.

6. Install the drive belt on the transmission pulley and install the belt guard assembly.

7. Install the footrest bracket.

8. Install the tractor seat, fender and tool box assembly and retain with the four  $\frac{3}{8}$ " cap screws.

9. Install the left rear wheel and tire assembly.

10. Start tractor, test, and set the neutral adjustment as required.

## REMOVAL OF HYDROSTATIC UNIT FROM A SEPARATED SYSTEM

### MOTOR REMOVAL

1. Remove the nuts from the two bolts securing the top section of the motor to the transaxle. Remove the two  $\frac{1}{2}$ " and two  $\frac{3}{8}$ " cap screws that hold the manifold pad to the motor and tie up the manifold so it will clear the motor pad.
2. Jack the tractor up under the frame and remove the left rear wheel for working space. Place an oil drain pan under the motor and transaxle to catch oil as the motor is removed. To remove the motor, remove the top corner motor-to-case bolt nuts and the two lower motor-to-case cap screws which thread into the case.

### PUMP REMOVAL

1. To remove the hydrostatic pump, disconnect the head lamp wires and remove the hood, grille and shroud assemblies. Disconnect and remove the battery and disconnect the PTO rod trunnion from the clutch bar.
2. Disconnect the fuel and suction lines from the engine and the coil wire from the coil. Next, disconnect the throttle arm ball joint and the choke wire assembly from the carburetor and engine.
3. Disconnect the cable from the starter and remove the four  $\frac{1}{2}$ " bolts holding the engine to the frame.
4. Pull the engine straight forward until the coupling slides from the pump shaft spline.
5. It is not necessary to lift the engine from the frame. If, however, you would like to get it completely out of the way, disconnect the DC wire from the voltage regulator connector and the engine will be freed to move as desired.
6. Remove the right console panel, together with the battery supports.
7. Disconnect all three control rods. The upper forward rod is connected to the speed control lever linkage. The long rod coming up from the bottom is connected to the brake pedal shaft arm at the bottom. At the top it is connected to the neutral plate so that when the brake pedal is pushed down, the control shaft is brought to neutral, just as it is when operated by the speed control lever. On some models, a third rod at the rear connects the neutral plate and the parking brake lever.
8. Remove the four  $\frac{5}{16}$ " cap screws holding the front manifold pad to the pump pad. As the two rear screws have elastic stop nuts on the top, it will be necessary to hold them while removing the screws. An oil drain pan should be placed under this area, since there will be some oil loss.

Where an "Allen" type screw is used, a  $\frac{5}{16}$ " hex with a  $\frac{3}{8}$ " drive socket is recommended. If none is available, one can be fabricated by welding a piece of  $\frac{5}{16}$ " hex stock to a  $\frac{3}{8}$ " drive socket.

9. Disconnect the hydraulic lift tubes, located at the top of the pump, from their fittings. Discon-

nect the temperature sending unit wire. Remove the two  $\frac{5}{8}$ " bolts and nuts that hold the rear pump bracket to the steering gear support. After removing the bolt that attaches the front pump bracket to the left side panel, the pump and brackets may be removed. If a new pump is to be installed, carefully change the brackets and linkage from the old pump to the new pump.

## INSTALLATION OF HYDROSTATIC UNIT IN A SEPARATED SYSTEM

### PUMP INSTALLATION

Place a small amount of clean grease in the manifold plate seal ring recesses and on the seal rings themselves. Next, place a small o-ring in each of the low pressure port recesses and a large o-ring in each of the large high pressure port recesses. Then place a square section type back up ring over the top of each of the large o-rings, centering them as closely as possible.

To facilitate alignment of the pump to the manifold pad, fabricate two aligning pins by cutting the heads off two  $\frac{3}{8}$ -16 bolts to make two studs, each two inches long. Saw a screwdriver slot in the end and taper the ends as shown. Screw the aligning pins into the

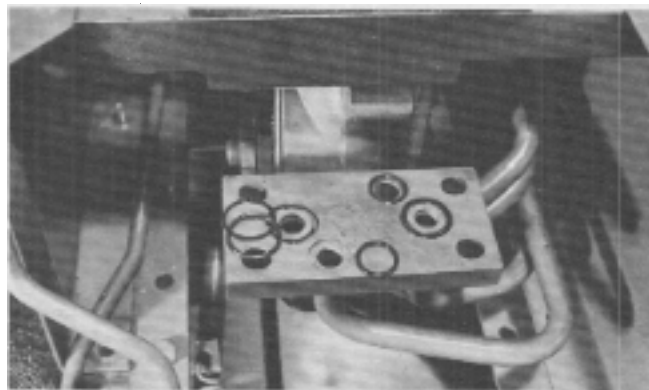


FIG. 20. O-ring Ports

two front threaded holes in the pump pad. Install the pump by placing it carefully in position. Insert the aligning pins into the front manifold holes as the pump is lowered into place.

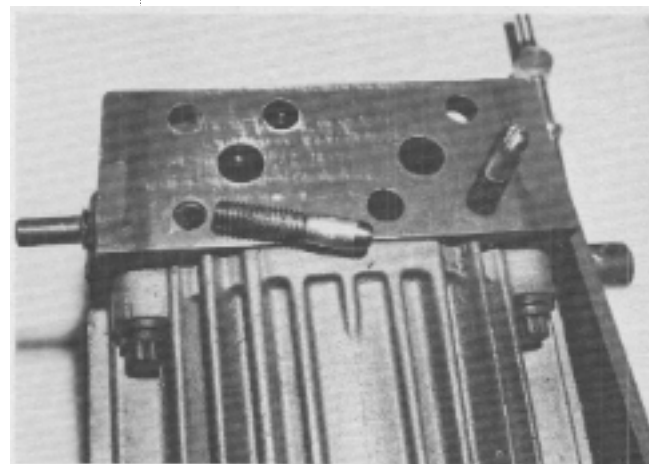
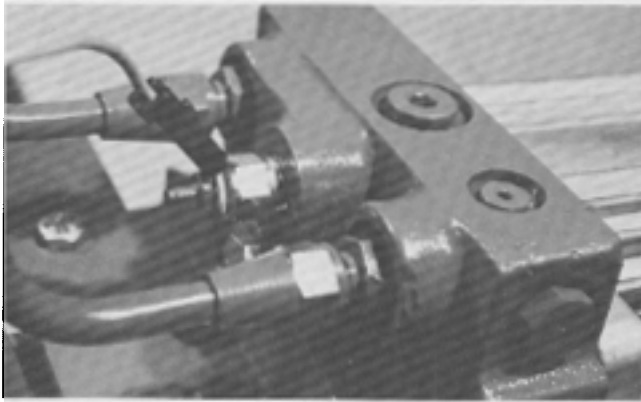


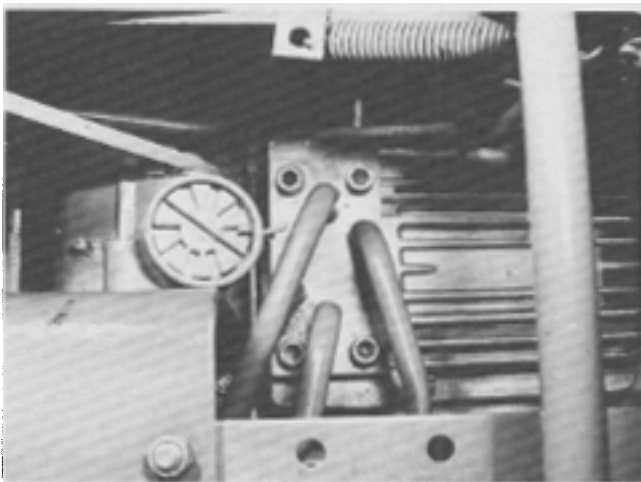
FIG. 21. Aligning Pins

Allow the pump bracket to rest on the steering gear brace. Install punches through the side panel holes and into the front bracket to hold the pump in position. Then, install the two  $\frac{3}{8}$ " bolts and nuts and secure the rear pump bracket to the steering gear brace. Now install the left panel to the front bracket bolt and nut. Connect the hydraulic tubes to the pump fittings. Connect the temperature indicator wire to the sending unit.

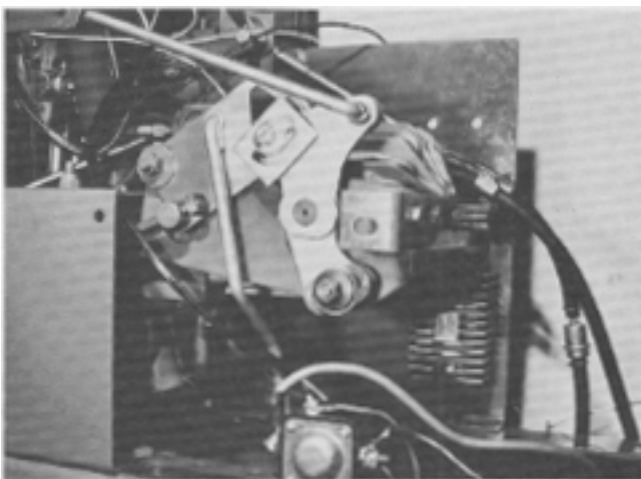


**FIG. 22. Temperature Sending Unit**

Install the two rear manifold-to-pump cap screws from underneath. Place the  $\frac{3}{8}$ " elastic stop nuts on top, but do not tighten at this time. Remove the two



**FIG. 23. Manifold Installed**

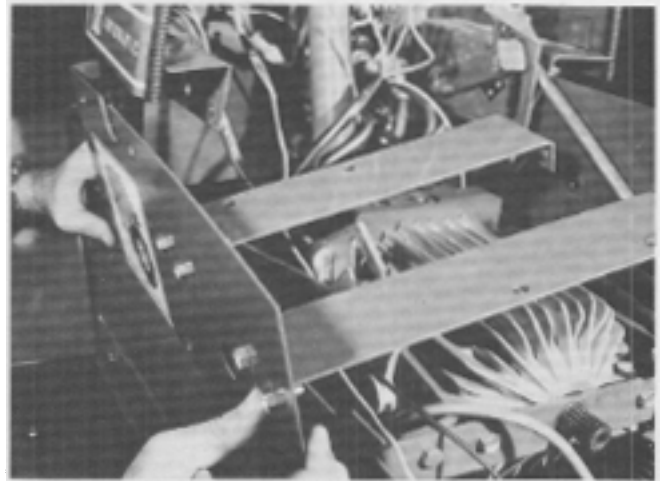


**FIG. 24. Control Rod Connections**

aligning studs and install the two front cap screws. Finally, tighten all four cap screws evenly.

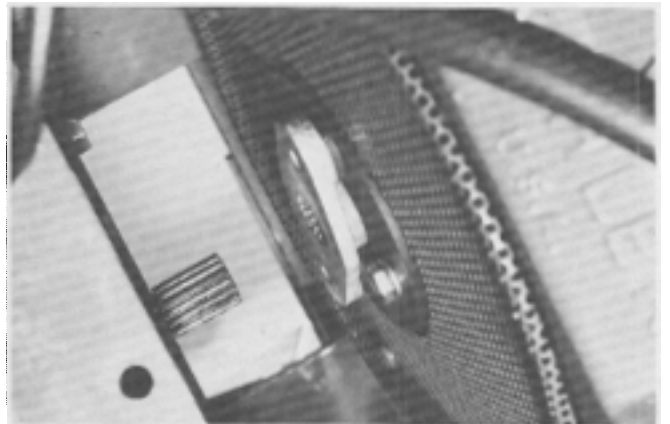
Connect the three control rods to their respective levers.

Install the right side panel and battery supports.



**FIG. 25. Side Panel Installation**

Lubricate the pump spline with "moly" grease and slide the engine carefully to the rear. Engage the pump spline with the pump coupling, center the engine on the pump shaft and bolt the engine securely to the frame. Connect engine controls as required and install and connect the battery. Install the grille shroud and hood. After checking the oil level, filling as required, test the unit for proper operation. It may be that if the neutral and tension adjustments were disturbed during the operation, they will require readjustment.

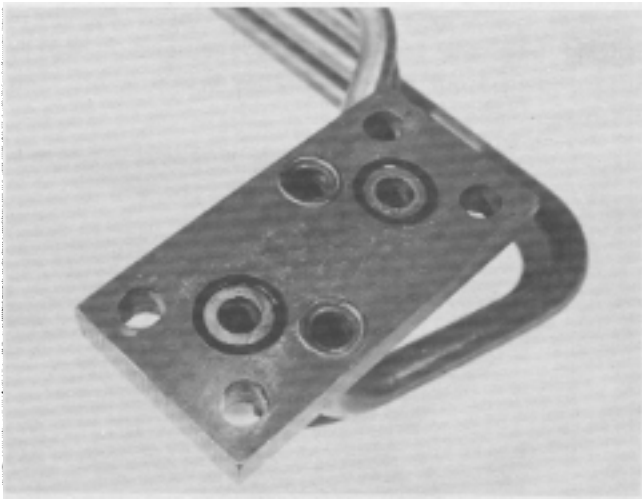


**FIG. 26. Pump Spline Engagement**

## MANIFOLD INSTALLATION

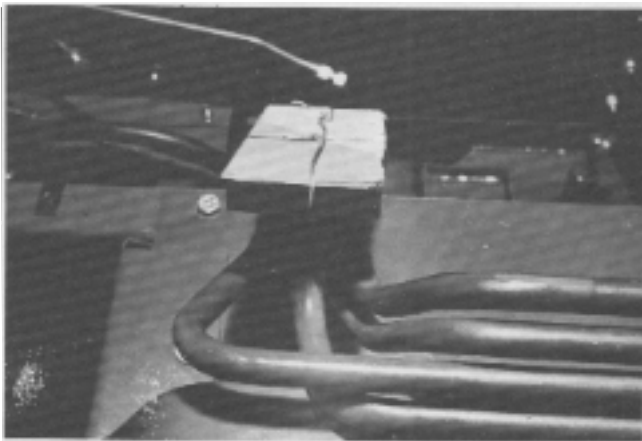
Install new seal rings on the front pad as follows:

Place a small amount of grease in the seal ring recesses and on the seal rings themselves. Place a small o-ring in each of the low pressure port recesses and a large o-ring in each of the high pressure port recesses. On top of each large o-ring place a square section type back up ring. Center it exactly on top of each of the o-rings.



**FIG. 27. Ring Installation**

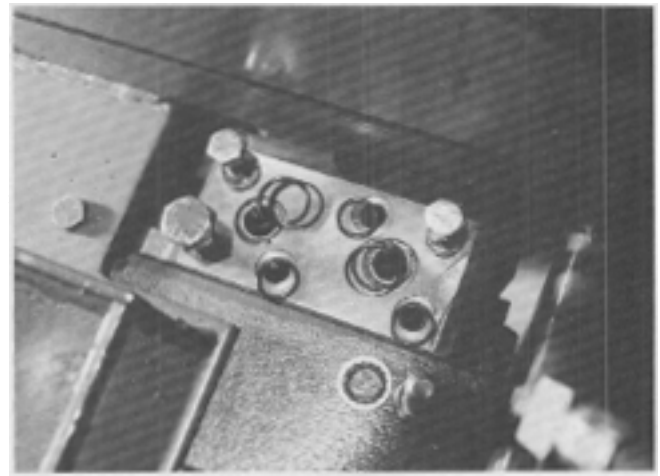
Place a protective cardboard cover over the seal rings to hold them in place and keep the area free from dirt during installation.



**FIG. 28. Protected Seal Rings**

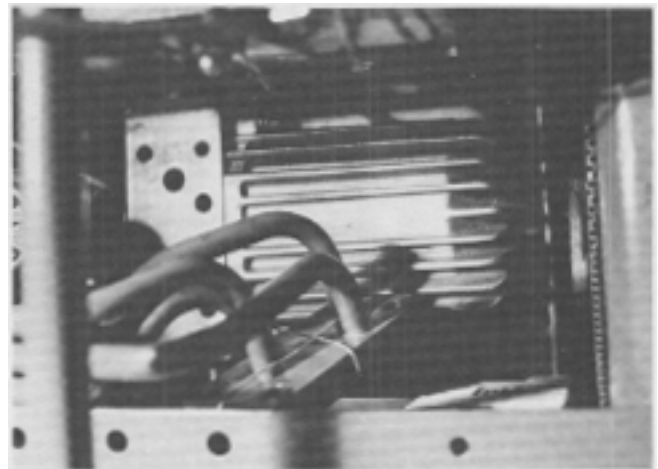
The following photograph shows the location of the seal rings and manifold attaching bolts at the hydraulic motor pad. **NOTE:** Two  $\frac{3}{8}$ " bolts and washers are at the left side of the pad and two  $\frac{1}{2}$ " bolts at the right side. Also note that the rear  $\frac{1}{2}$ " bolt does not use a washer. The front  $\frac{1}{2}$ " bolt, however, requires a special seal washer. Also, an o-ring is used at this corner between the manifold and the motor pad. These extra seals are required since this bolt goes down into a pressure area. If it is not sealed, there will be a major oil leak. Before installing seal rings, place a small amount of grease in each recess and on all seal rings. Place one small o-ring in each of the two low pressure ports and one at the right front bolthole recess. Place a large o-ring in each of the high pressure ports and then place a square section back up ring exactly over the top of each of the large o-rings. Make sure no dirt or foreign matter falls into this area while installing the manifold.

Prior to installing the manifold examine it carefully for cracks around the tubing welds and make sure the clamp prevents the tubes from flexing. If the tubes can be moved in the clamp, remove the clamps

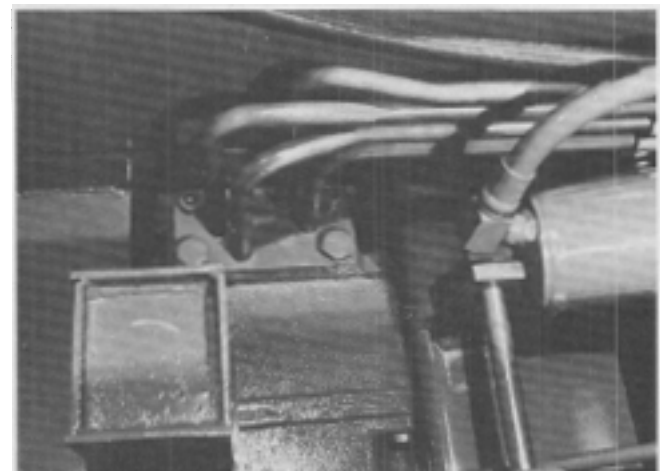


**FIG. 29. Ring and Bolt Locations**

and shape them as required to hold the tubes firmly. The following photograph shows the front of the manifold as it is inserted past the steering gear bracket turned to position it for attachment to the pump pad. Leave the protective cover on this pad while the rear of the manifold is being connected to the hydraulic motor.



**FIG. 30. Positioning the Manifold**

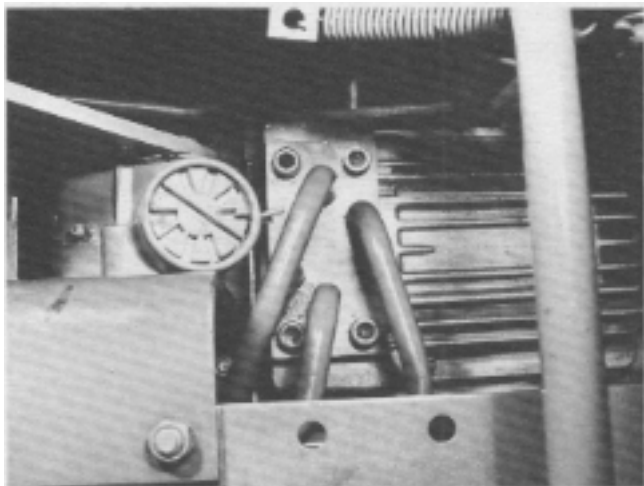


**FIG. 31. Rear Manifold Pad in Place**



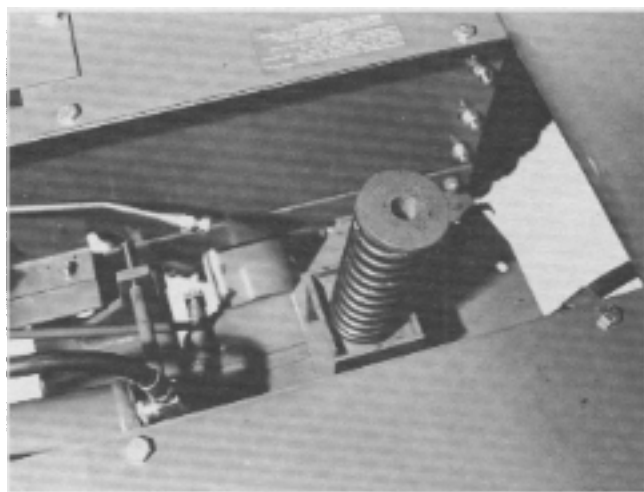
Carefully hold the manifold in place. Align the bolt holes in the manifold pad with the bolt holes in the motor and install all four bolts. Make sure that the special seal washer is under the head of the right front  $\frac{1}{2}$ " bolt. Do not completely tighten the bolts at this time. Just leave them snug so that the front of the manifold may be aligned without distorting the tubes.

Remove the protective cover from the front manifold pad and check to make sure all seal rings are in place. This can be done by flexing the tubes down just enough to feel if all the o-rings and back up rings are in place. Position the manifold pad so the bolt holes line up and install the two short front hex screws. Leave them loose at this time. Install the two longer bolts in the two rear holes, with the elastic stop nuts on top. Tighten all four bolts evenly, holding the nuts on the rear bolts as required. Now tighten all four of the rear manifold pad-to-motor bolts.



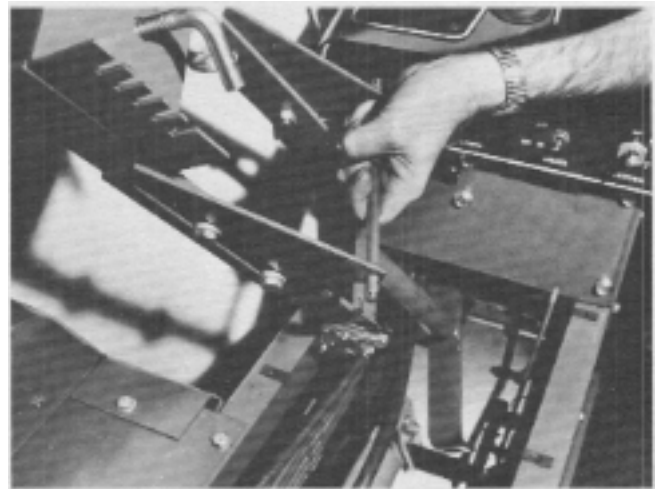
**FIG. 32. Manifold Installed**

Install the seat spring on its support and install the spring block on top of the spring.



**FIG. 33. Spring and Block**

Install the seat pivot assembly. Insert the front bracket from the top under the fuel and hydraulic hose and in front of the parking brake lever. Turn the assembly as needed.

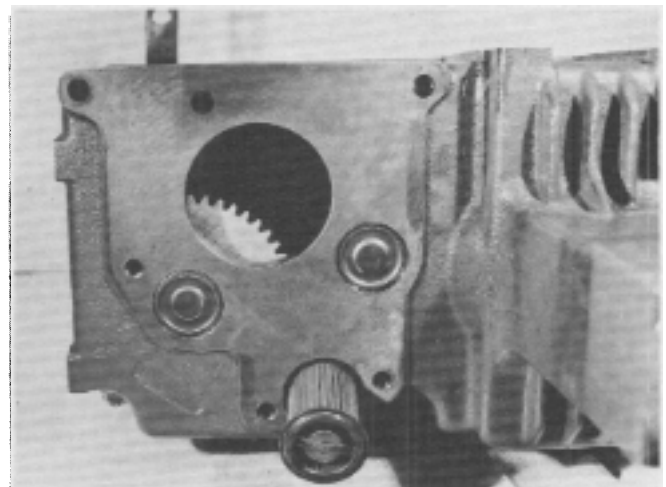


**FIG. 34. Seat Pivot Installation**

Line up the adjustment handle at the rear of the spring block. Hold the front of the pivot assembly to line it up with the holes in the frame and install the seat pivot rod. Retain with e-rings at each end. Install the seat stop bar with its rubber cushions and bolt it to the seat pivot bar. Using the nylon bushings and hairpin cotters, reinstall the seat assembly. Reinstall the access plate and the parking brake lever knob.

## MOTOR INSTALLATION

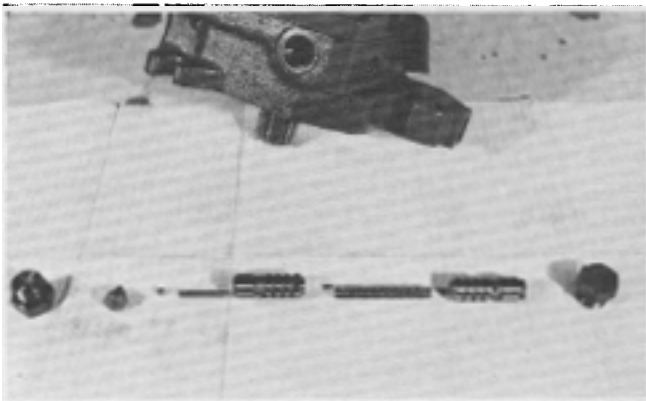
The following photograph of the transaxle shows the motor mounting area with the intake screen pulled out. The two cap screw holes on each side of the screen and the two top corner holes are for the four bolts which retain the motor to the case.



**FIG. 35. Motor Mounting Area**

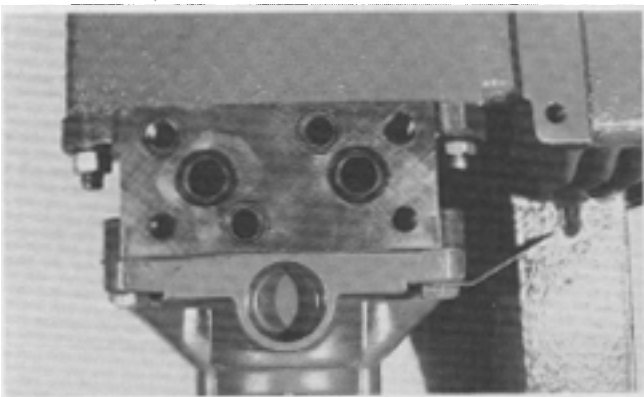
The following photograph shows the acceleration valves and related parts removed from the motor. The valve at the right is complete. The valve shown at the left has had the metering plug and ball and spring removed.

**NOTE:** Two valves with the spring between them and the two plugs with o-ring seals make up the complete acceleration valve assemblies. To install, place the spring in the end of one of the valves and install the valve and spring assembly in one end of the motor housing bore. Install the other valve in the opposite end. Make sure that the spring is seated in the bores of the valves and install the two plugs.



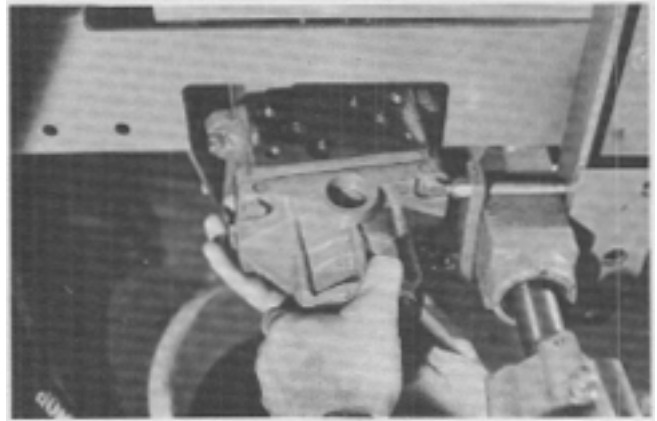
**FIG. 36. Acceleration Valves**

Install two small o-rings in the two low pressure ports. A third small o-ring is installed around the right front bolt hole, located at the top left corner of the following photograph. Center a square section back up ring on top of each of the large o-rings and install them in the two large high pressure ports. When properly installed the bottom of the back up rings will be just below the top of the recess.



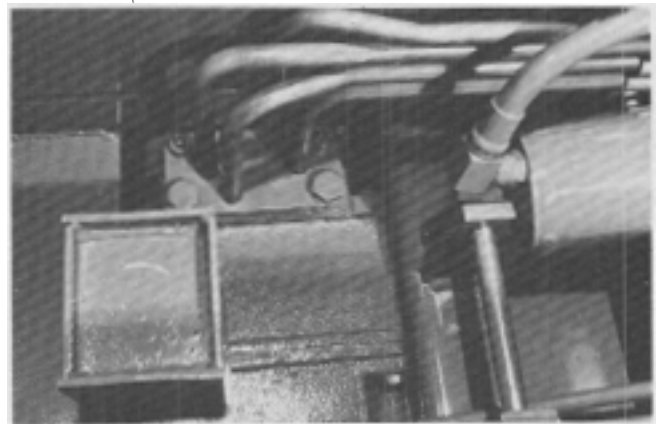
**FIG. 37. O-ring Installation**

Be very careful not to get dirt on the pad surface. To install the motor, line it up on the two top case bolts. Install the nuts on the two lower cap screws. **Always** use a new gasket.



**FIG. 38. Motor Installation**

After the motor has been secured to the transaxle check the seal rings to make sure they are in position. Next, release the back of the manifold if it was tied up during the motor removal. Line it up and install the two  $\frac{3}{8}$ " bolts and the two  $\frac{1}{2}$ " bolts. Make sure the special seal washer is under the head of the right front bolt.



**FIG. 39. Motor Installation Completed**