The range gear shift lever is located to the left of the operator's seat and controls high, low and mid-range gear ratios of the main transmission.

MAIN TRANSMISSION SHIFT LEVER — OVERHAUL

1. Remove the center steering shroud and the left side shroud panel.
2. Remove the lower snap ring (13), drive the pin (14) out of the universal joint and shaft, Figure 30.
3. Remove the lever bracket (4) from the steering column. Raise the linkage assembly and disconnect the universal joint from the lower lever shaft.
4. Using conventional repair procedures, overhaul the linkage assembly as required.

PART 5
TRANSMISSION SYSTEMS

Chapter 2
HYDROSTATIC TRANSMISSION — MODEL 1320-1520

A. DESCRIPTION AND OPERATION

The hydrostatic transmission consists of a variable displacement piston type hydraulic pump and a fixed displacement piston type motor assembly located in the engine clutch housing. The variable displacement pump is driven by the input shaft connected to the engine flywheel clutch. The pump supplies hydraulic power to the fixed displacement motor, which drives the three range transmission gearbox.

The hydrostatic unit, operated by a foot control pedal, can be advanced in forward-stopped or reverse, Figure 31.

The foot pedal automatically returns to neutral (stopped) position when it is released. The speed is controlled by varying the amount of movement of the pedal from the neutral positon.

The hydraulic unit with the three range gearbox provides a variable speed from 0-2.80 mph in low range, 0-5.28 mph in middle range and 0-11.22 mph in high range, on Model 1320.

On Model 1520 tractor, a variable speed from 0-3.08 mph in low range, 0-6.40 mph in middle range and 0-12.32 mph in high range can be achieved.

When a constant forward speed is desired on level terrain, shifting the speed control lever, Figure 31, to the "set" position will hold the foot pedal in a fixed position and permit the operator to remove his foot from the pedal. When the speed control lever is "released" the foot pedal automatically returns to neutral and the tractor stops.

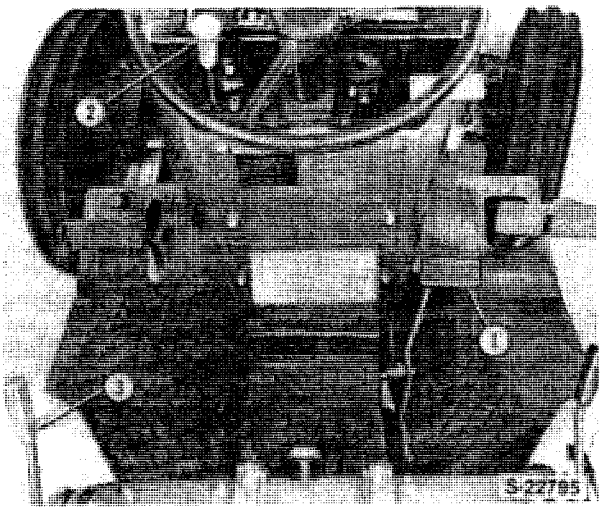


Figure 31
Hydrostatic Transmission

1. Foot Pedal Control
2. Speed Lock Lever
3. Shift Lever, Range Gear

NOTE: *The operator can depress the pedal further from the set position to travel at a faster speed momentarily. The pedal will return to the set position (and speed) when released. The speed control cannot be set in reverse.*

The hydrostatic unit utilizes the oil contained in the rear axle and transmission gearbox common reservoir compartment.

The hydrostatic system, Figure 32, consists of a inlet (suction) filter, hydrostatic transmission unit, oil cooler, final filter and connecting tubing.

PRINTED IN U.S.A.

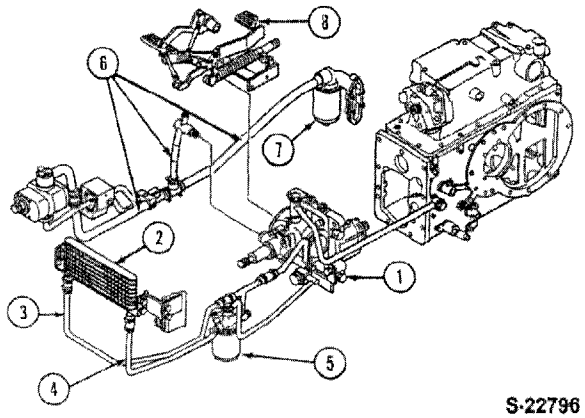


Figure 32
Hydrostatic Transmission – Hydraulic System

1. Hydrostatic Unit
2. Oil Cooler
3. Oil Line to Cooler
4. Oil Line From Cooler
5. Filter
6. Suction Tube
7. Suction Filter
8. Foot Pedal Control

The hydrostatic unit consists of a charge pump, variable displacement piston type pump, fixed displacement piston type motor, high pressure relief valve, two feed valves and neutral valve assemblies, and a charge pump relief valve, Figure 33.

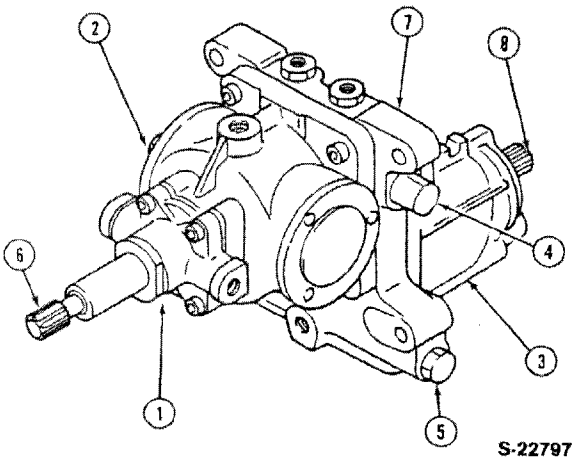


Figure 33
Hydrostatic Unit

1. Charge Pump
2. Piston Type Pump
3. Piston Type Motor
4. High Pressure Relief Valve
5. Feed Valve and Neutral Valve Assy. (2)
6. Input Shaft
7. PTO Drive
8. Transmission Drive

The input shaft, driven by the engine clutch, is splined to the variable displacement piston pump and extends out the rear side of the unit to drive the PTO shaft.

The charge pump, also driven by the input shaft, draws oil from the transmission sump and charges the hydrostatic system with oil under pressure at all times.

High pressure oil supplied by the piston pump drives the motor and powers the transmission assembly.

VARIABLE DISPLACEMENT PUMP – OPERATION

Reference – Figure 34

The pump cylinder block and pistons are splined to the input shaft and rotate with the shaft. In neutral position, the swash plate is in a vertical position and is at a right angle to the pistons and the pistons do not stroke.

When in the neutral position, the displacement in cylinders "A" and "B" are equal and no oil flows through the pump or motor.

When the swash plate is tilted at an angle, Figure 35, oil in the cylinder in position "A" is discharged out through the port in the valve plate as the cyinder is rotated to position "B."

Maximum oil flow is obtained when the swash plate is at the maximum tilt angle.

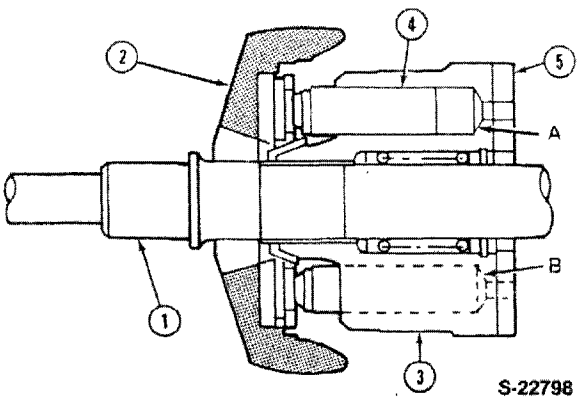


Figure 34
Hydrostatic Pump Operation – Neutral Position

1. Input Shaft
2. Variable Swash Plate
3. Cylinder Block
4. Pistons (4)
5. Valve Port Plate

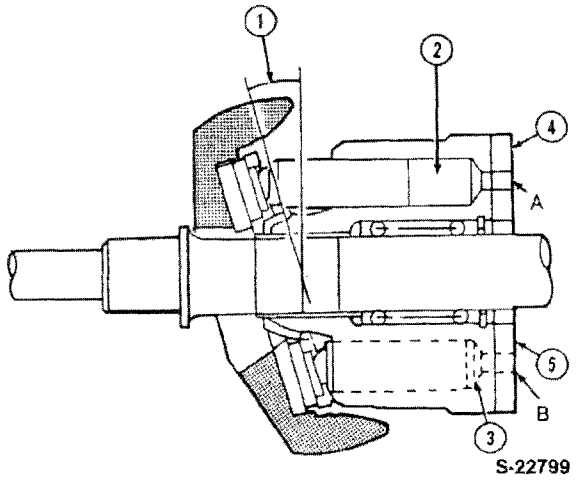


Figure 35
Hydrostatic Pump Operation — Forward Position

1. Swash Plate Angle
2. Suction Stroke
3. Discharge Stroke
4. Valve Port Plate
5. Valve Port

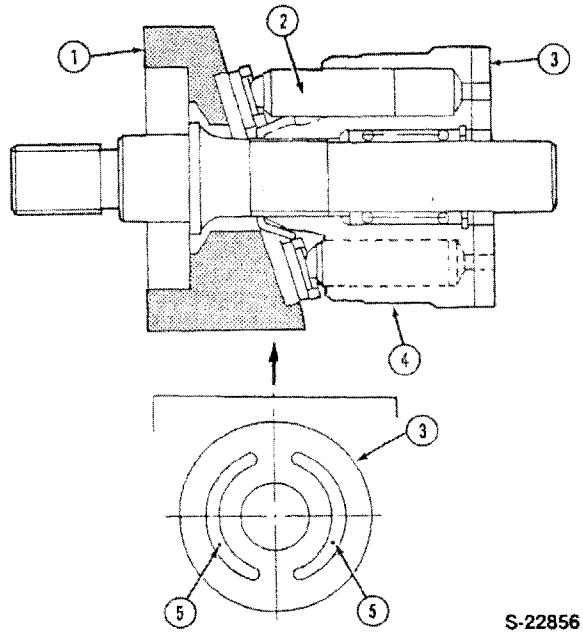


Figure 36
Hydrostatic Motor Operation

1. Fixed Angle Swash Plate
2. Pistons (9)
3. Valve Port Plate
4. Cylinder Block
5. Valve Ports

FIXED DISPLACEMENT MOTOR — OPERATION

Reference — Figure 36

Oil flow from the piston pump enters one of the ports in the valve plate of the motor and exerts a pressure against the end of the pistons in line with the port. Oil pressure on the pistons causes the cylinder block and pistons to rotate. A drive shaft splined to the motor cylinder block then drives the transmission gearbox.

OIL FLOW — NEUTRAL POSITION

Reference — Figure 37

Oil drawn from the transmission reservoir is pressurized by the rotor type charge pump. The oil flows from the charge pump through the cooler and filter to the feed valve and neutral valve assemblies and then returns to sump via the charge pump relief valve.

The charge pump relief valve maintains 61-81 psi pressure to the feed valves "A" and "B" at all times. Oil flow past the feed valves pressurizes the passages "A" and "B" and the pump and motor cylinder blocks.

Because of equal pressures in passages "A" and "B" the motor does not rotate.

The neutral valves are in a normally open position allowing oil flow past the feed valves to return to sump. The neutral valves set at 284 psi remain open until this pressure is exceeded.

OIL FLOW — FORWARD POSITION

Reference — Figure 38

When the foot pedal is shifted slightly forward, the pump swash plate is tilted at a slight angle and a small quantity of oil is discharged from the piston pump into passage "A." This small quantity of oil passes through the neutral valves and returns to sump while causing a slight pressure increase in the "A" circuit.

When the foot pedal is depressed further forward, increased oil flows from the piston pump, through passage "A." Pump pressure on the back side of feed valve 5, Figure 38, closes the feed valve and pressure increases on the neutral valve. At a pressure above 470 psi, the neutral valve closes the return to sump and all oil flow from pump passage "A" flows to the motor, and causes the motor to rotate.

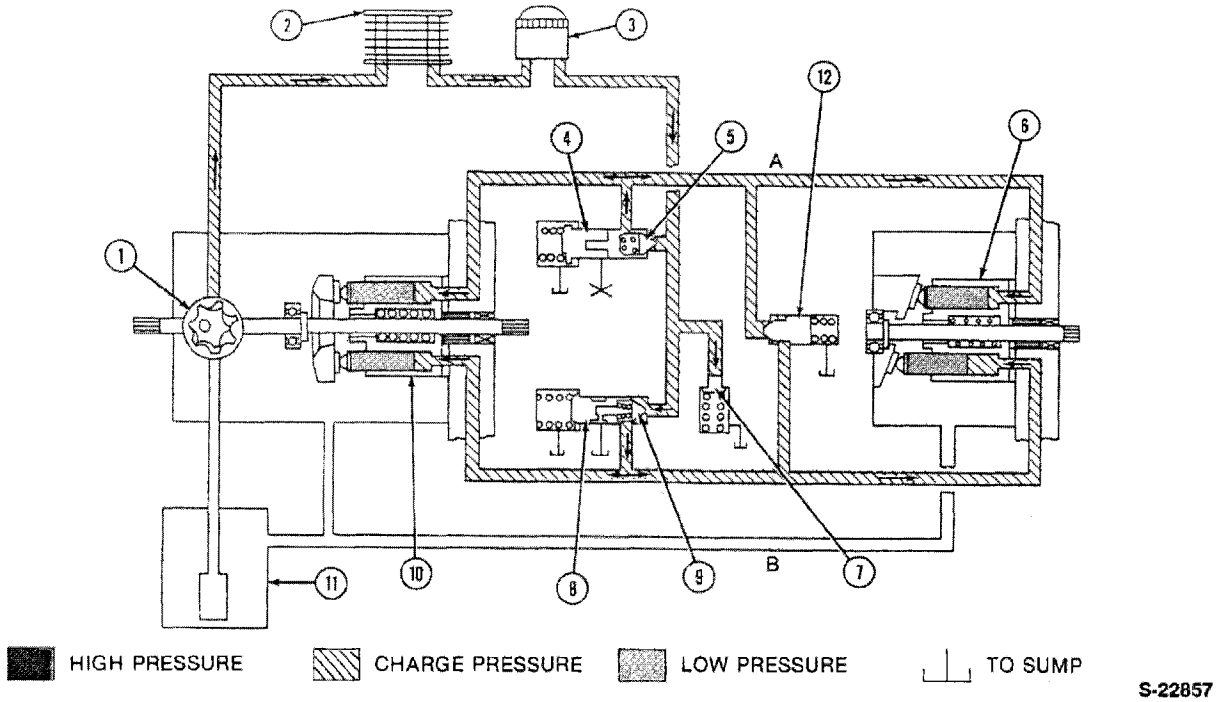


Figure 37
Oil Flow — Neutral Position

1. Charge Pump
2. Cooler
3. Filter
4. Neutral Valve
5. Feed Valve "A"
6. Hydrostatic Motor
7. Charge Pump Relief Valve
8. Neutral Valve
9. Feed Valve "B"
10. Hydrostatic Pump
11. Reservoir
12. High Pressure Relief Valve

Oil discharged from the motor in passage "B" flows back to the pump to complete the cycle.

When oil leakage in the system causes a drop in pressure on the suction passage "B," below 61-81 psi pressure setting, feed valve (8) opens and provides make-up oil from the charge pump.

Surplus oil from the charge pump is returned to sump via the charge pump relief valve (7).

OIL FLOW — REVERSE POSITION
Reference — Figure 39

When the foot pedal is depressed in the reverse position, oil flows from the piston pump into passage "B" to the motor. The neutral valve and feed valve (8) and (9), Figure 39, are closed due to pressure in passage "B." Oil pressure acting on the motor pistons causes the motor to rotate in the reverse direction. Oil discharged from the motor flows back through passage "A" to the pump.

B. OVERHAUL

REMOVAL

1. Drain the transmission oil.
2. Separate the tractor between the engine and clutch housing. See "Separating the Tractor," Part 12.

HYDROSTATIC UNIT — REMOVAL

1. Remove the two test port adaptors (1), Figure 40.
2. Disconnect the HST control rod (1), Figure 41.
3. Remove the clutch housing attaching bolts and remove the clutch housing, Figure 40.
4. Remove the hydrostatic unit retaining bolts and nuts and remove the hydrostatic unit from the transmission case, Figure 42.

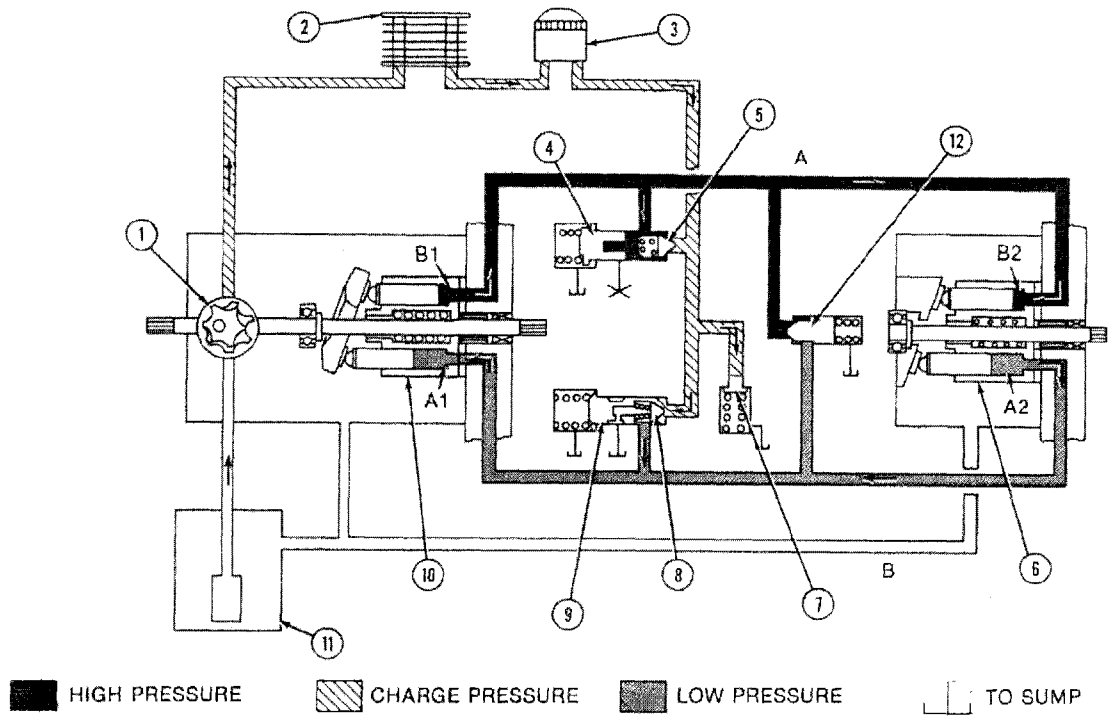


Figure 38
Oil Flow — Forward Position

1. Charge Pump
2. Cooler
3. Filter
4. Neutral Valve
5. Feed Valve "A"
6. Hydrostatic Motor
7. Charge Pump Relief Valve
8. Feed Valve "B"
9. Neutral Valve
10. Hydrostatic Pump
11. Reservoir
12. High Pressure Relief Valve

PRECAUTIONS BEFORE DISASSEMBLY

1. Be sure to thoroughly clean the tractor to remove all dirt and foreign matter from the unit.
2. Plug or cap all hydraulic line openings to prevent foreign particles from entering the system.
3. Drain the oil from the HST unit.
4. Maintain a clean work area so as to not contaminate or damage any of the precision surfaces of the HST components.
5. Handle the HST components with care so as to not scratch or otherwise cause damage to the parts.

HYDROSTATIC PUMP — DISASSEMBLY

1. Remove the four hexagon socket type bolts, Figure 43.
2. Raise the pump housing sufficiently to confirm the position of the valve port plate.

   NOTE: *The valve plate will adhere to either the pump cylinder block surface or to the port block surface. Exercise care in removing the pump to prevent the valve plate from inadvertently being dropped during disassembly.*
3. Remove valve plate, Figure 44.
4. Remove the pump cylinder block and piston assembly, Figure 45.
5. Remove the thrust plate from the swash plate. If it is hard to remove, use a hook type tool to remove the plate, Figure 46.

HYDROSTATIC MOTOR — DISASSEMBLY

1. Remove the four hexagon socket type bolts, Figure 47.

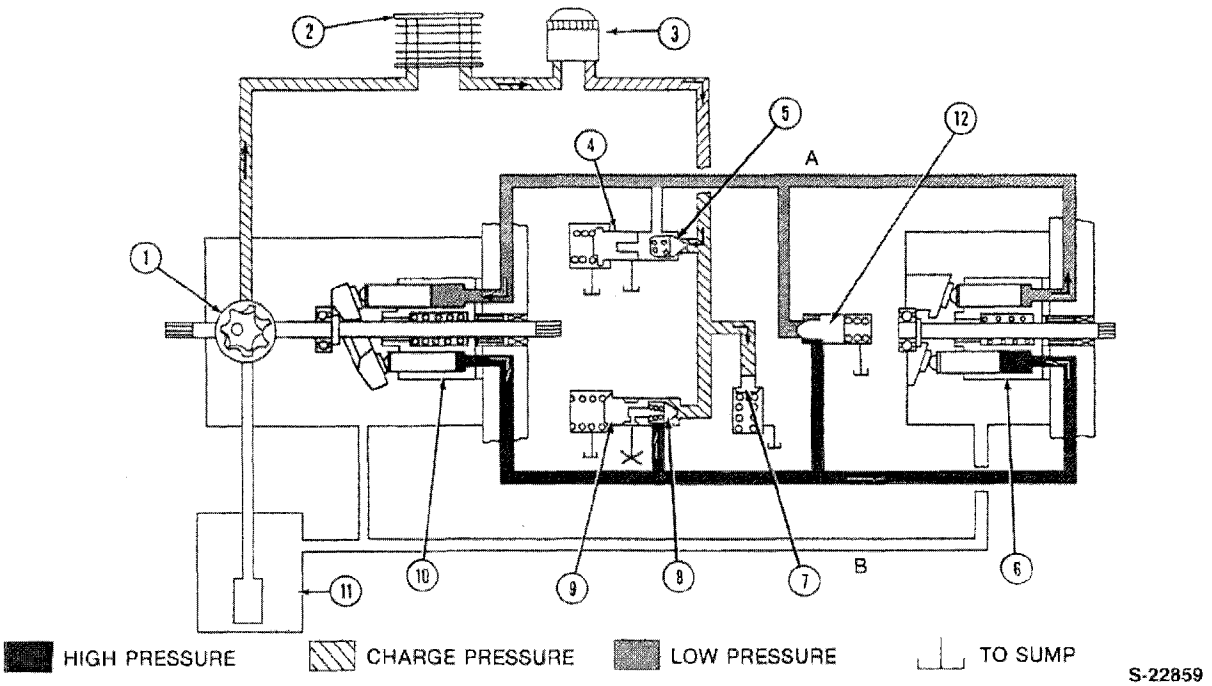


Figure 39
Oil Flow – Reverse Position

1. Charge Pump
2. Cooler
3. Filter
4. Neutral Valve
5. Feed Valve
6. Hydrostatic Motor
7. Charge Pump Relief Valve
8. Feed Valve
9. Neutral Valve
10. Hydrostatic Pump
11. Reservoir
12. High Pressure Relief Valve

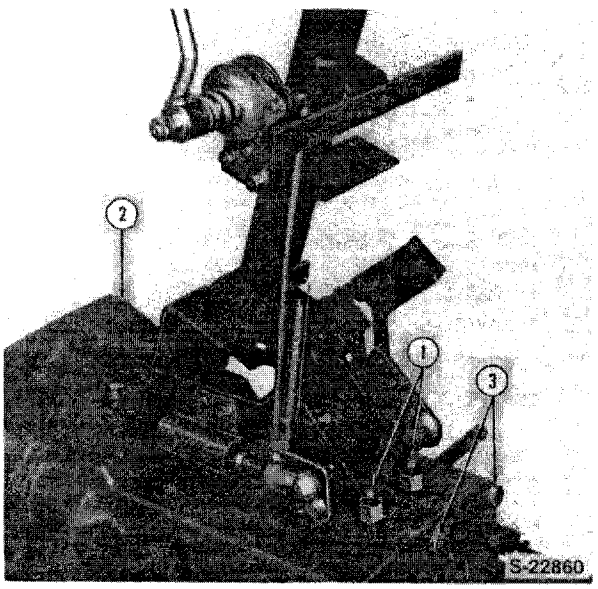


Figure 40
Clutch Housing Removal

1. Adaptors – Pressure Test Ports
2. Clutch Housing
3. Clutch Housing Attaching Bolts

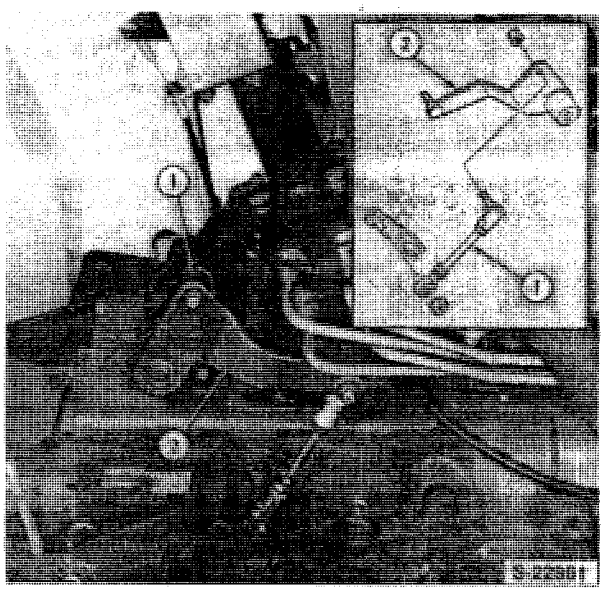


Figure 41
HST Control Rod Removal

1. Rod
2. Shift Link

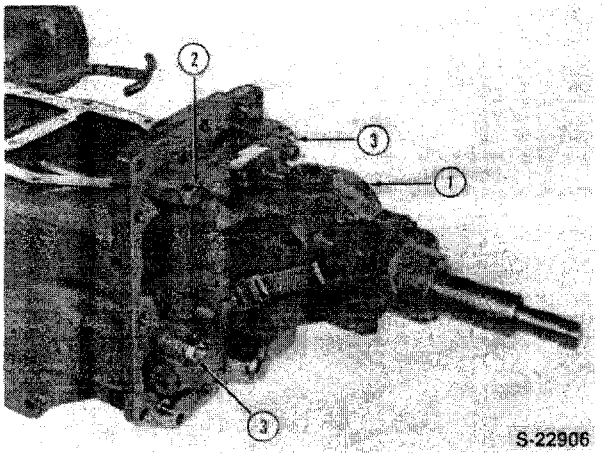


Figure 42
Hydrostatic Unit Removal

1. HST Unit
2. Bolts (2)
3. Stud Nuts (2)

2. Raise the motor housing sufficiently to confirm the location of the valve port plate.

   NOTE: *The valve plate will adhere to either the motor cylinder block surface or the port block surface. Exercise care in removing the pump to prevent the valve plate from inadvertently being dropped during disasembly.*

3. Remove the motor assembly and valve plate, Figure 48.

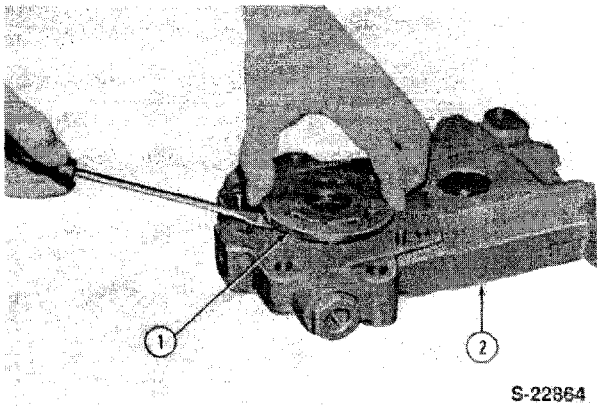


Figure 44
Valve Plate Removal

1. Valve Plate
2. Port Block

4. Remove the motor cylinder block and piston assembly, Figure 49.

5. Remove the thrust plate from the motor housing. If it is hard to remove, use a hook type tool to remove the plate as shown, Figure 46.

HYDROSTATIC MOTOR SHAFT – REMOVAL

1. Remove the three hexagon socket type bolts retaining the cover to the housing and remove the cover, Figure 50.

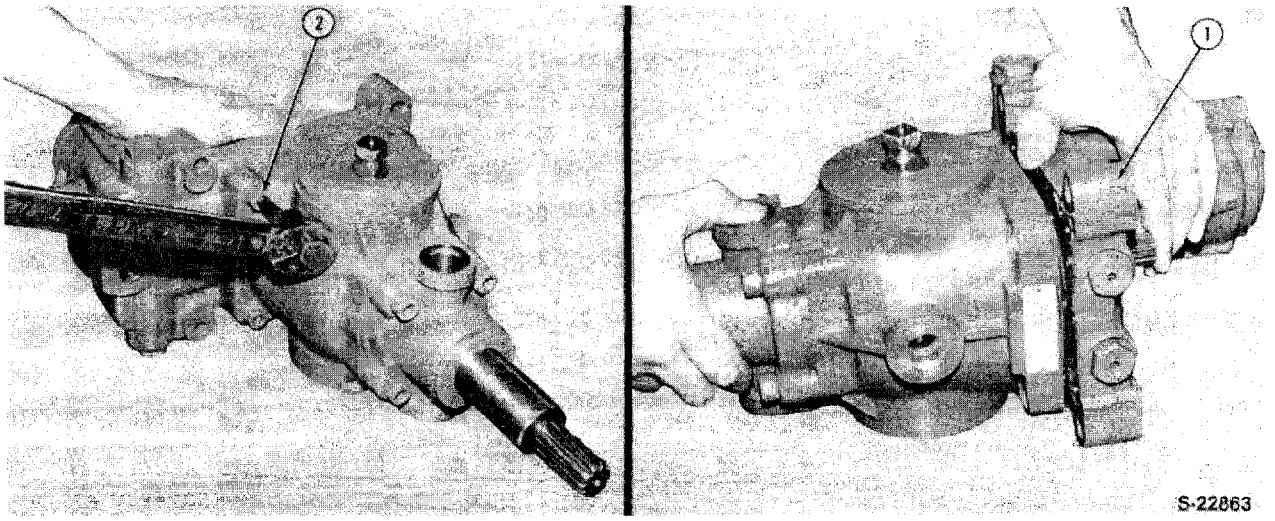


Figure 43
Hydrostatic Disassembly

1. Port Block
2. Socket Head Bolts (4)

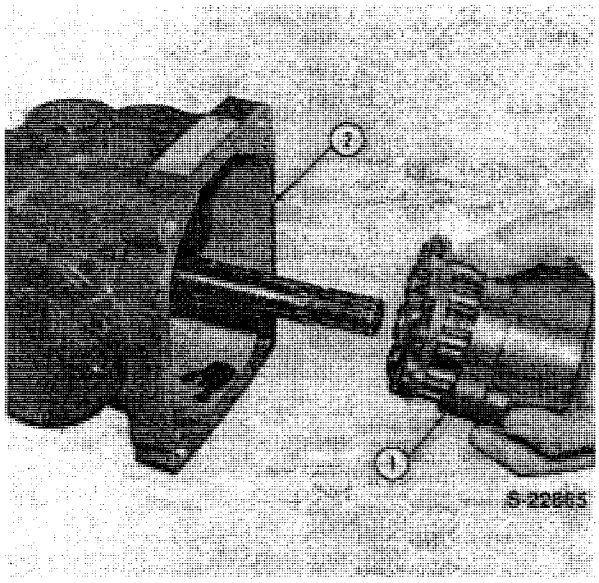


Figure 45
Cylinder Block Assembly – Disassembly
1. Cylinder Block (Pump) 2. Pump Housing

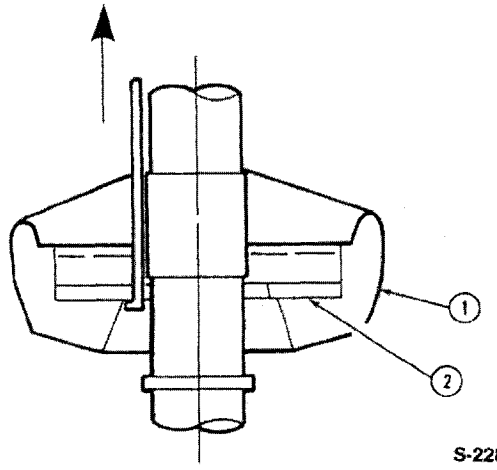


Figure 46
Thrust Plate Removal
1. Swash Plate 2. Thrust Plate

2. Using a soft hammer gently drive the shaft and bearing as an assembly out of the housing, Figure 51.

CHARGE PUMP – REMOVAL

1. Remove the throw-out bearing hub (2), Figure 52.

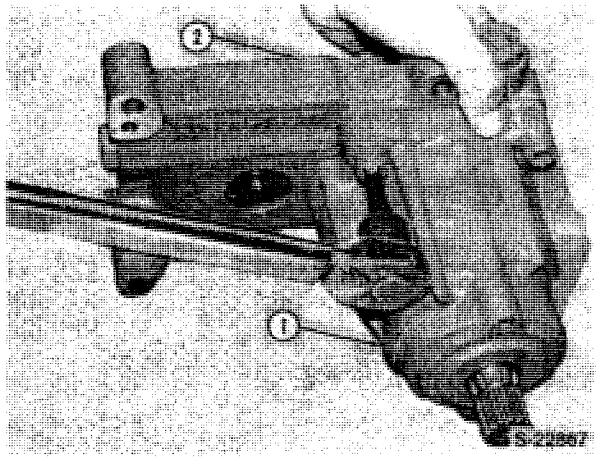


Figure 47
Hydrostatic Motor Housing – Separate
1. Motor Housing 2. Port Block

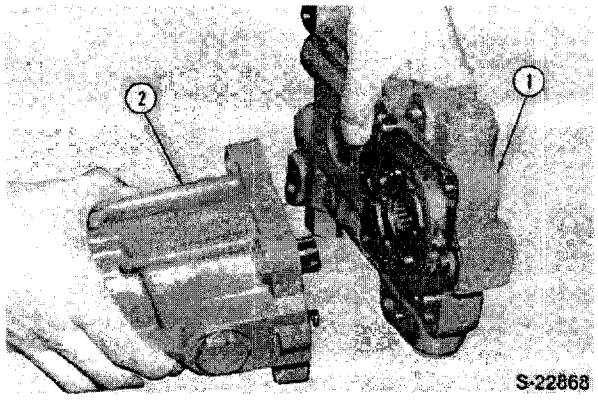


Figure 48
Hydrostatic Motor Housing Disassembly
1. Port Block 2. Motor Housing

2. Remove the four bolts retaining the charge pump to the housing and remove the rotors, wear plate, key and o-rings from the shaft.

   NOTE: *Identify the position of the inner and outer rotor so as to assemble in their original position.*

3. Remove the snap ring from the case, drive out the shaft and bearing as an assembly from the front of the case.

SWASH PLATE – REMOVAL

1. Scribe alignment marks on the swash plate covers. Remove the cover screws from each side, Figure 53.

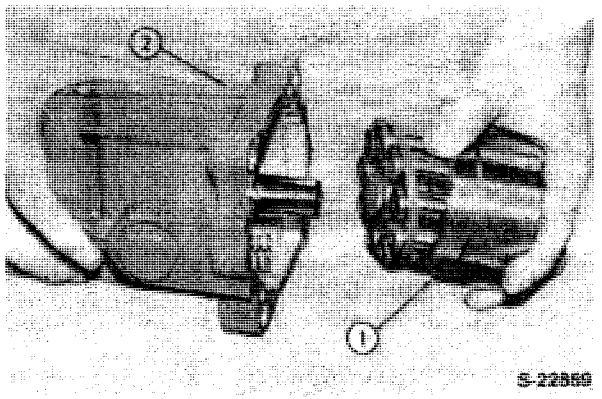


Figure 49
Cylinder Block (Motor) Assembly – Disassembly

1. Cylinder Block (Motor)
2. Pump Housing

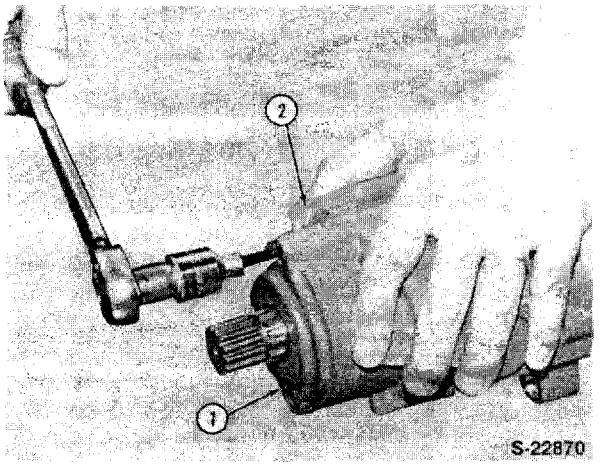


Figure 50
Cover Removal

1. Cover
2. Hydrostatic Motor Housing

2. Gently tap the axial end of the swash plate with a soft hammer and remove the opposite side cover.

3. Gently tap on the exposed trunnion end with a soft hammer and remove the remaining cover.

4. Remove the variable swash plate, Figure 53.

INSPECTION

Inspect the hydrostatic components for the following conditions:

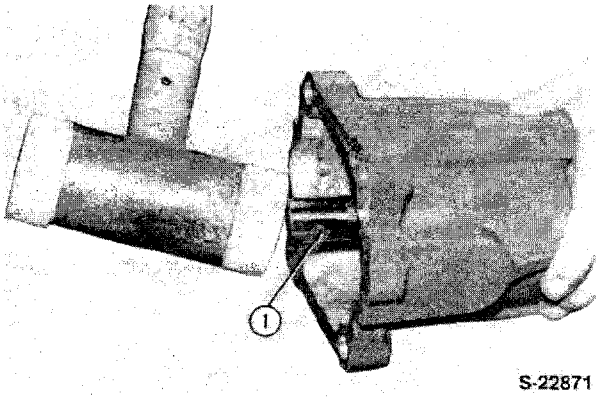


Figure 51
Shaft Removal

1. Shaft

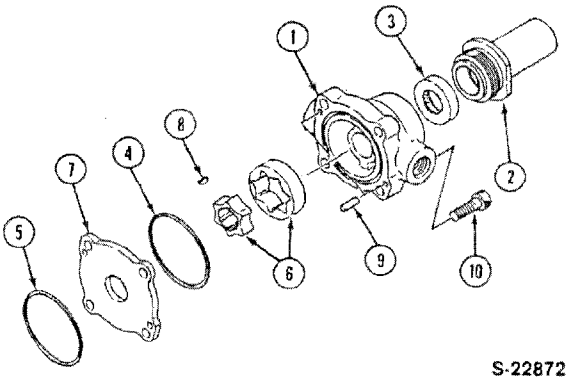


Figure 52
Charge Pump Disassembly

1. Charge Pump Housing
2. Throwout Bearing Hub
3. Seal
4. O-Ring
5. O-Ring
6. Pump Rotors
7. Wear Plate
8. Key
9. Pin
10. Bolt

1. Excessive wear or scored pistons and cylinder bores in the pump and motor block assemblies.

2. Excessive wear or scored cylinder block and valve port plate mating surfaces.

3. Excessive wear or scored charge pump rotor faces and lobes.

4. Excessive wear or scored charge pump body and wear plate surfaces.

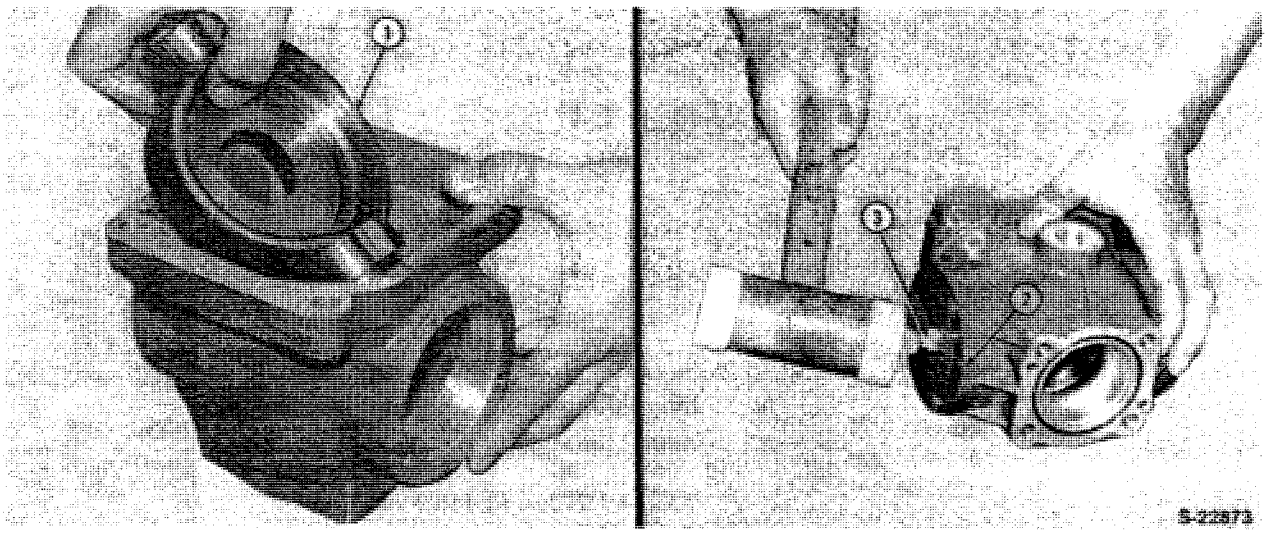


Figure 53
Swash Plate Removal

1. Variable Swash Plate
2. Covers
3. Swash Plate Shaft

5. Check the ball bearings for excessive wear and looseness or uneven rotation when rotated by hand.

6. Inspect the variable swash plate bushings for excessive wear or scoring. Replace the cover and bushing as an assembly if required.

ASSEMBLY

Before assembly, be sure all components are thoroughly cleaned and well lubricated with Ford Oil Part No. 134.

1. Position the variable swash plate into the case, Figure 54.

2. Lubricate the swash plate cover O-rings, seals and bushings and install the covers and retaining screws to the case. Tighten the retaining screws to 2.89 ± 0.29 lbs. ft. (3.92 ± 0.39 Nm) torque.

   NOTE: *Be sure to align the cover scribe marks, and install the covers in their original position.*

3. Press the bearing (2) in place on the input shaft (1) and secure with the snap ring (3), Figure 55.

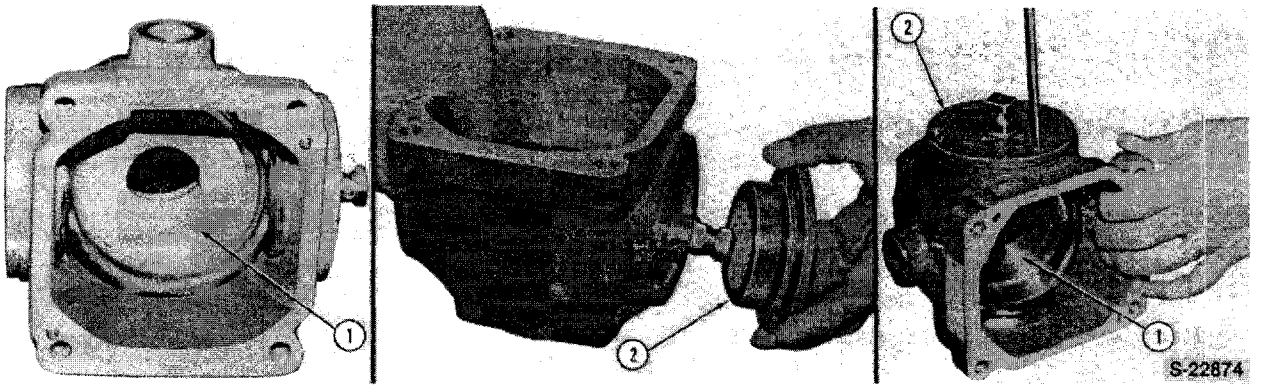
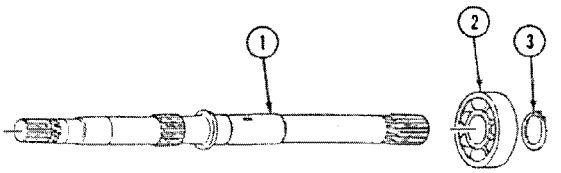


Figure 54
Hydrostatic Assembly

1. Variable Swash Plate
2. Covers



S-22875

Figure 55
Input Shaft Assembly

1. Input Shaft
2. Bearing
3. Snap Ring

4. Install the input shaft and bearing assembly into the case. Secure with the snap ring (4) in place in the case, Figure 56.

5. Install the dowel pin (10) and o-ring (5) in the hydrostatic pump housing, Figure 56.

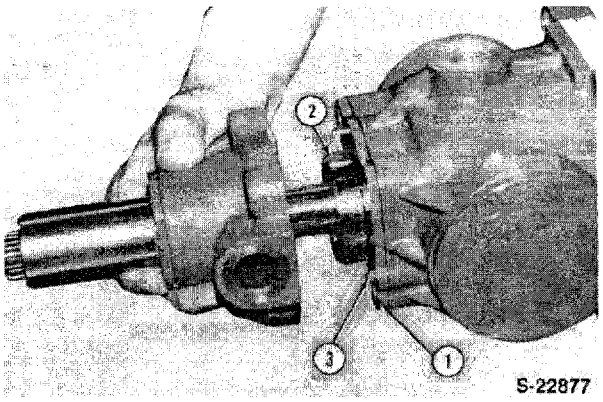
6. Install the wear plate (6) to the hydrostatic pump housing.

7. Install the drive key (8) and pump rotor assembly on the input shaft.

8. Press the seal (12), in place in the charge pump housing and install the throw-out bearing hub to the case. Tighten the retaining hub to 43.39 ± 4.39 lbs. ft. (58.80 ± 5.9 Nm).

9. Install the o-ring (7) to the charge pump housing.

10. Install the charge pump sub assembly to the case and tighten the retaining bolts to 13.0 ± 1.3 lbs. ft. (17.6 ± 1.7 Nm), Figure 57.



S-22877

Figure 57
Charge Pump Installation

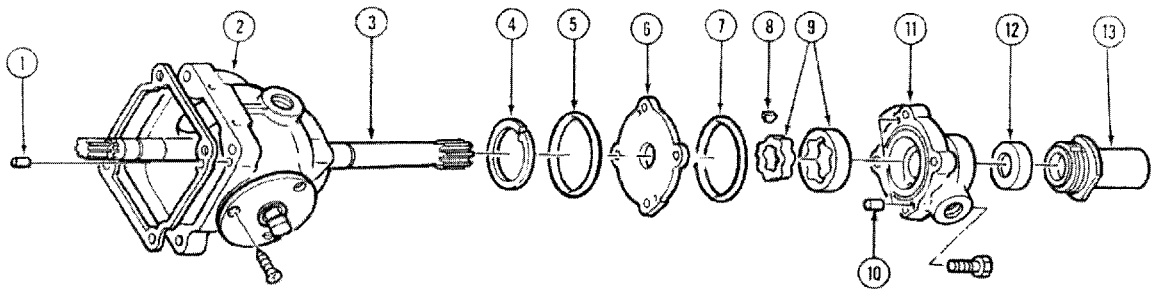
1. Wear Plate
2. Rotor Assembly
3. Dowel Pin

HST PISTON PUMP CYLINDER BLOCK — ASSEMBLY

1. Assemble the pins and retainer holder to the cylinder block, Figure 58.

2. If removed, assemble the washers (2), spring (3), and snap ring (4) in the cylinder block, Figure 59.

3. Assemble the piston and retainer assembly into the cylinder block, Figure 60.



S-22876

Figure 56
HST Pump and Charge Pump Assembly

1. Dowel Pin
2. HST Pump Housing
3. Input Shaft
4. Snap Ring
5. O-Ring
6. Wear Plate
7. O-Ring
8. Key
9. Rotors
10. Dowel Pin
11. Housing
12. Seal
13. Bearing Hub