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SPECIFICATIONS

HYDRAULIC SPECIFICATIONS

	4100 Gear Drive	4100 Hydrostatic Drive	4100 Narrow Gear Drive
(Measurements Taken At 2650 Engine RPM)			
Type	Open System	Open System	Open System
Working Pressure	17000 kPa (2466 psi)	17000 kPa (2466 psi)	17000 kPa (2466 psi)
Pump	Gear Type	Gear Type	Gear Type
Front Pump Capacity	10.62 liters/min (2.8 gpm)	N/A	10.62 liters/min (2.8 gpm)
Rear Pump Capacity	23.8 liters/min (6.3 gpm)	23.8 liters/min (6.3 gpm)	23.8 liters/min (6.3 gpm)
Hydrostatic Transaxle (Sump) Capacity	12.5 L (3.3 gal.)	12.5 L (3.3 gal.)	12.5 L (3.3 gal.)
Gear Transaxle (Sump) Capacity	10.5 L (2.8 gal.)	10.5 L (2.8 gal.)	10.5 L (2.8 gal.)

REPAIR SPECIFICATIONS

WRITERS NOTE: THE FOLLOWING DIMENSIONS ARE NOT INTENDED TO REFLECT WEAR.

Hydraulic Pump

Input Shaft Bearing OD	17.93 – 18.06 mm
Idler Gear Shaft Bearing OD	17.93 – 18.06 mm
Bushing ID	18.00 – 18.06 mm
Thrust Plate	
Thick	1.98 – 2.00 mm
Thin	1.18 – 1.20 mm



Rockshaft Specifications

Shaft Large Bearing OD	39.93 mm (1.572 in.)
Shaft Small Bearing OD	34.94 mm (1.375 in.)
Large Bushing ID	40.08 mm (1.578 in.)
Small Bushing ID	35.13 mm (1.383 in.)
Stop Rod Extension From Body	18 mm (0.709 in.)

Lift Arm

Lift Arm Raise Angle	
Above Horizontal (Maximum)	60°
Below Horizontal	15°
Stroke (Working)	75°
Maximum	78°

Maximum Variance Between Lift Arms ± 2.5°
Initial Set Up Height (To Center Of Ball End) 279 – 281 mm (10.984 – 11.063 in.)

TORQUE SPECIFICATION

Hydraulic Pump

Hydraulic Pump To Engine 26 N•m (19 lb-ft)
Intake And Pressure Fittings Cap Screws 6 N•m (53 lb-in.)
Pump Cover To Pump Body Cap Screws 15 N•m (133 lb-in.)

Selective Control Valve (SCV)

Banjo Bolts 17 N•m (150 lb-in.)
Socket Head Cap Screws Securing SCV To Rockshaft 16.7 N•m (148 lb-in.)

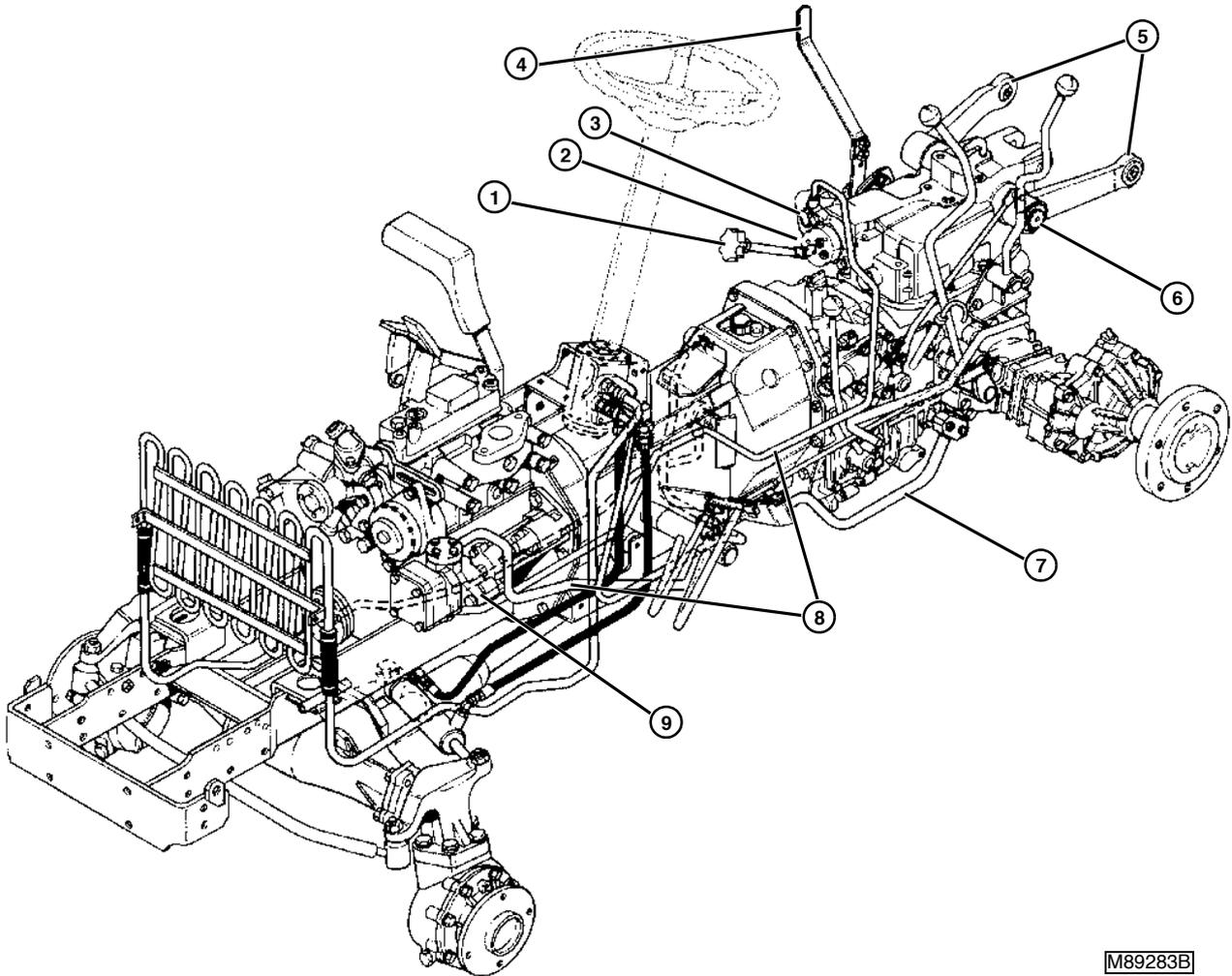
Rockshaft

Banjo Bolt (Hydraulic Pressure Line to Rockshaft) 17 N•m (150 lb-in.)



COMPONENT LOCATION—HST

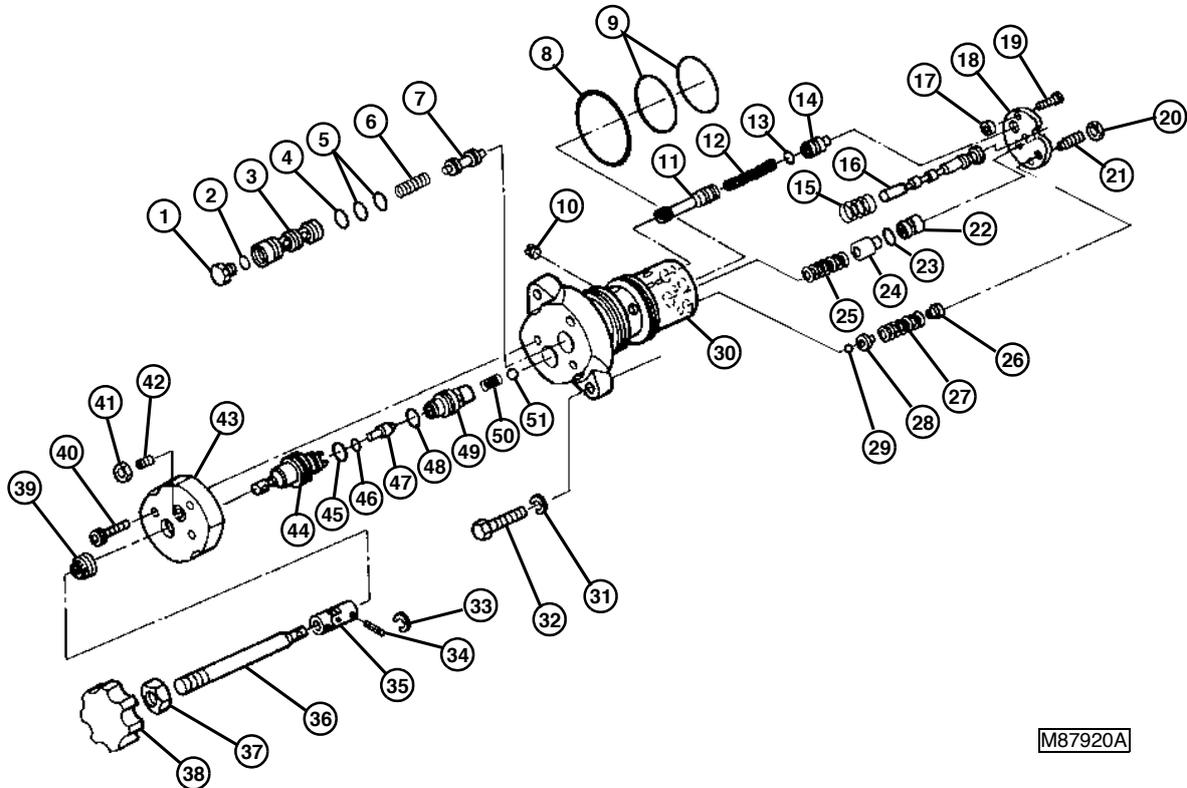
GENERAL



M89283B

- | | | |
|---------------------------------|-----------------------------------------------|---------------------------------------|
| 1. Speed Control | 4. Operator Control,
Rockshaft Raise/Lower | 6. Rockshaft |
| 2. Rockshaft Control Valve | | 7. Hydraulic Fluid Pick Up Line |
| 3. System Pressure Relief Valve | 5. Lift Arms | 8. Hydraulic Fluid High Pressure Line |
| | | 9. Hydraulic Pump |

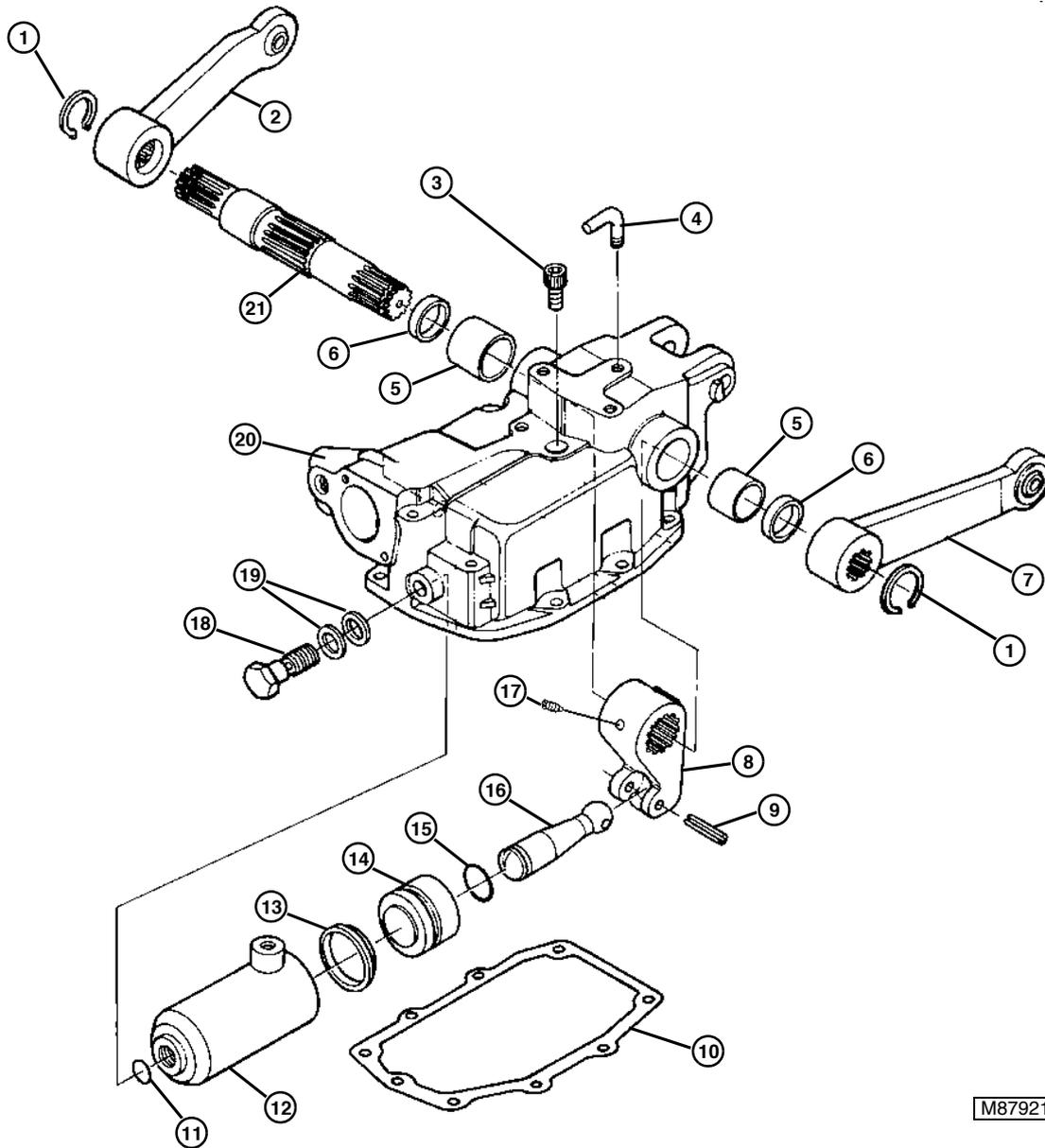
ROCKSHAFT CONTROL VALVE - COMPONENT LOCATION



M87920A

- | | | | |
|------------------|------------------------------|---------------------------|------------------|
| 1. Plug | 17. Spacer (x3) | 31. Lock Washer | 45. O-Ring |
| 2. O-Ring | 18. End Plate | 32. Cap Screw | 46. O-Ring |
| 3. Valve Body | 19. Socket Head Screw(x3) | 33. Spring Clip | 47. Needle Valve |
| 4. O-Ring | 20. Lock Nut | 34. Pin | 48. O-Ring |
| 5. O-Rings | 21. Adjustment Screw | 35. Universal Joint | 49. Valve Body |
| 6. Spring | 22. Valve Seat | 36. Rod | 50. Spring |
| 7. Spool | 23. O-Ring | 37. Lock Nut | 51. Ball |
| 8. O-Ring | 24. Valve | 38. Knob | |
| 9. O-Ring | 25. Spring | 39. Boot | |
| 10. Orifice Plug | 26. Spring Keeper | 40. Socket Head Cap Screw | |
| 11. Spool | 27. Spring | 41. Lock Nut | |
| 12. Spring | 28. Ball Seat | 42. Set Screw | |
| 13. O-Ring | 29. Ball | 43. Cover | |
| 14. Plunger | 30. Speed Control Valve Body | 44. Speed Control Valve | |

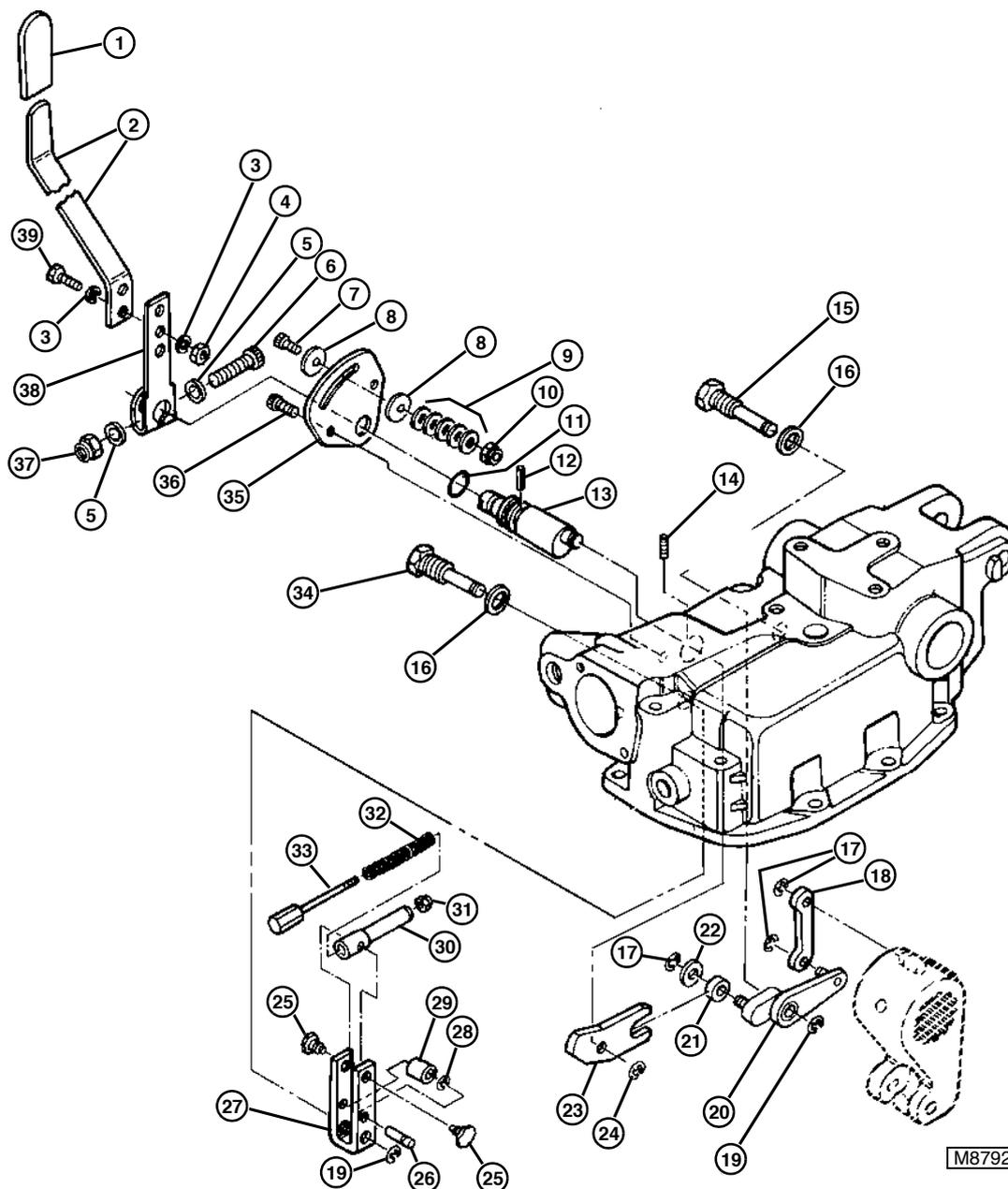
LIFT ARM AND CYLINDER - COMPONENT LOCATION



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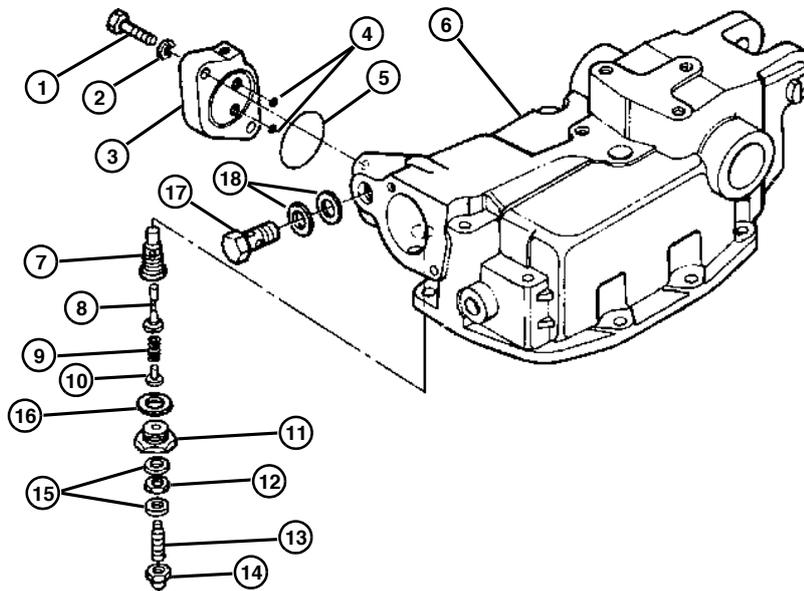
- | | | | |
|-------------------------|------------------|-----------------|-------------------|
| 1. External Snap Ring | 6. Seal | 11. O-Ring | 16. Rod |
| 2. R.H. Lift Arm | 7. L.H. Lift Arm | 12. Cylinder | 17. Set Screw |
| 3. Socket Head Capscrew | 8. Arm | 13. Piston Seal | 18. Cylinder Bolt |
| 4. Vent Tube | 9. Roll Pin | 14. Piston | 19. Seal Washers |
| 5. Bushing | 10. Gasket | 15. O-Ring | 20. Housing |
| | | | 21. Rockshaft |

DEPTH CONTROL MECHANISM - COMPONENT LOCATION



- | | | | |
|-------------------------|------------------------|------------------------|------------------------|
| 1. Handle Cover | 12. Roll Pin | 22. Washer | 33. Stop Rod |
| 2. Handle | 13. Eccentric Actuator | 23. Cam Plate | 34. Special Bolt |
| 3. Lockwasher | 14. Set Screw | 24. E-Clip Pivot Screw | 57 mm (2.244 in.) Long |
| 4. Nut | 15. Special Bolt | 25. Pivot Screw | 35. Plate |
| 5. Washer | 67 mm (2.637 in.) Long | 26. Axle | 36. Capscrew |
| 6. Socket Head Capscrew | 16. Copper Washer | 27. Yoke | 37. Nylock Nut |
| 7. Socket Head Capscrew | 17. E-Clip | 28. E-Clip | 38. Bracket |
| 8. Washers | 18. Link | 29. Roller | 39. Capscrew |
| 9. Belleville Washers | 19. E-Clip | 30. Body | |
| 10. Nylock Nut | 20. Pivot Link | 31. Nylock Nut | |
| 11. O-Ring | 21. Roller | 32. Spring | |

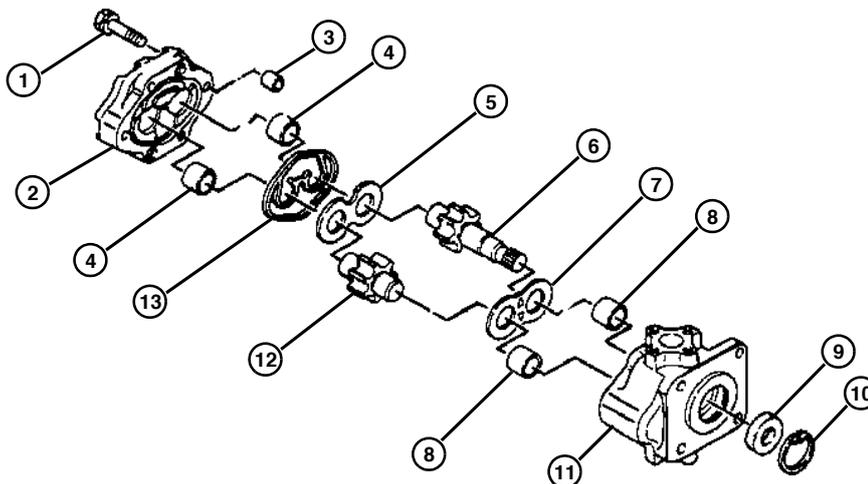
SYSTEM PRESSURE RELIEF - COMPONENT LOCATION



M87923A

- | | | | |
|---------------|---------------------|---------------------|-------------------|
| 1. Capscrew | 6. Housing | 11. Nut | 15. Copper Washer |
| 2. Lockwasher | 7. Valve Seat | 12. Lock Nut | 16. Copper Washer |
| 3. Plate | 8. Needle | 13. Adjusting Screw | 17. Banjo Bolt |
| 4. O-Ring | 9. Spring | 14. Acorn Nut | 18. Washer |
| 5. O-Ring | 10. Spring Follower | | |

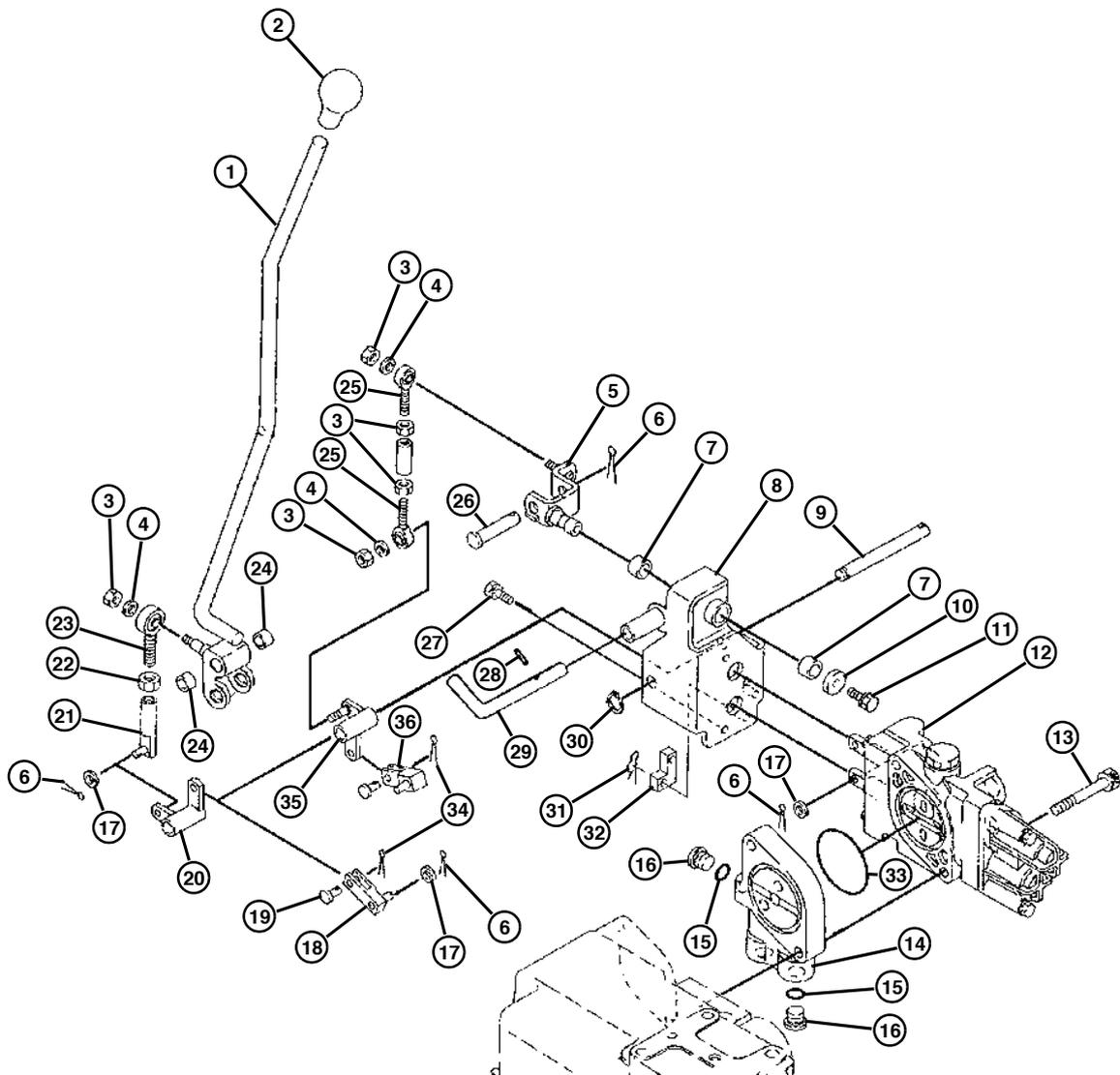
HYDRAULIC PUMP - COMPONENT LOCATION



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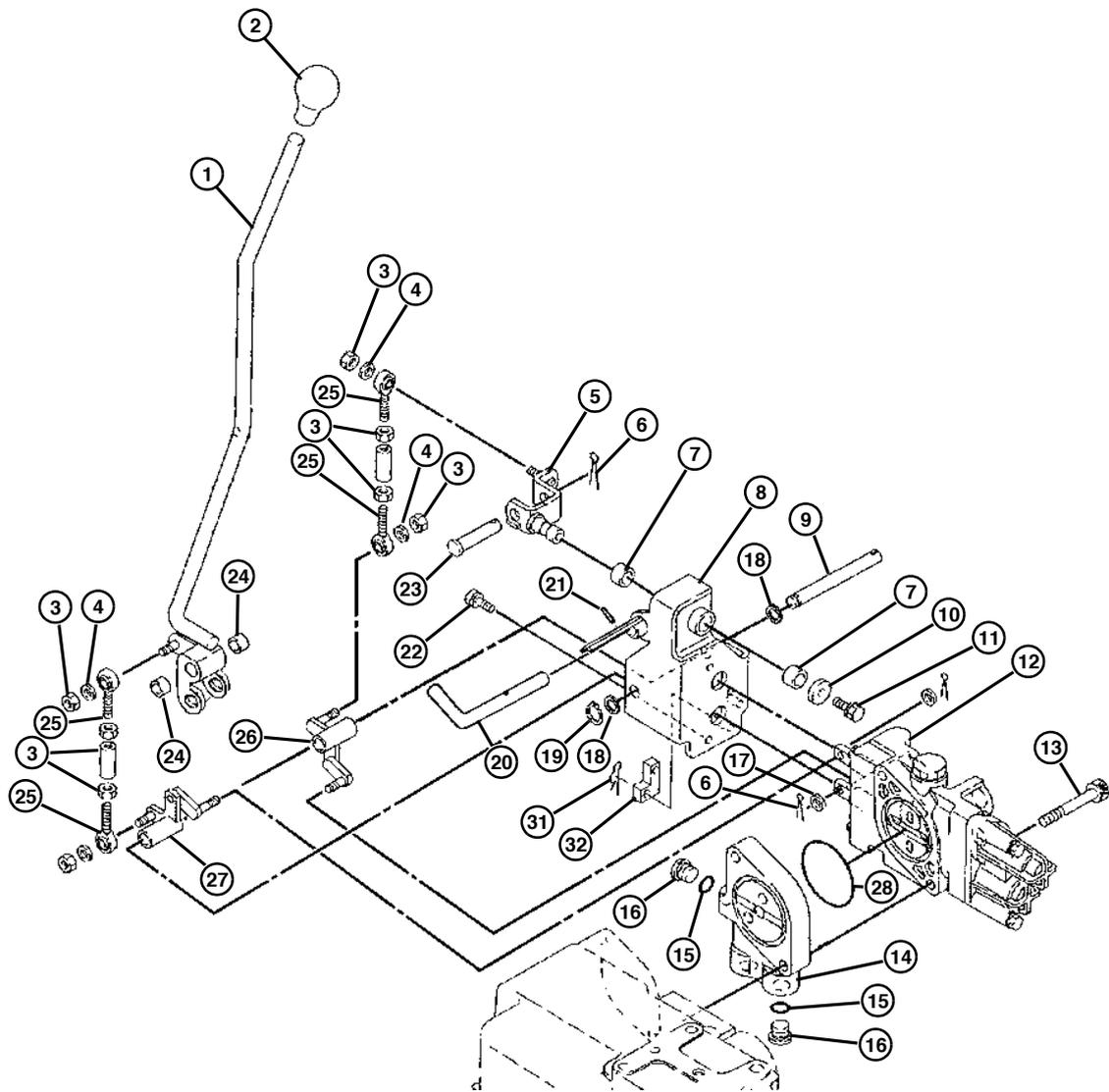
- | | | | |
|-------------|------------------------|------------------------|------------------------|
| 1. Capscrew | 4. Bushing | 7. Lower Bearing Plate | 10. Internal Snap Ring |
| 2. Cover | 5. Upper Bearing Plate | 8. Bushing | 11. Housing |
| 3. Locator | 6. Driven Gear | 9. Seal | 12. Idler Gear |
| | | | 13. Formed O-Ring |

SELECTIVE CONTROL VALVE - COMPONENT LOCATION (OLD)



- | | | | |
|---------------------|---------------|------------------|------------------|
| 1. Lever | 11. Cap Screw | 21. Rod End | 31. Hairpin Clip |
| 2. Knob | 12. Valve | 22. Nut | 32. Stop Block |
| 3. Nut | 13. Cap Screw | 23. Ball Rod End | 33. O-Ring |
| 4. Washer | 14. End Cap | 24. Bushing | 34. Cotter Pin |
| 5. Bracket | 15. O-Ring | 25. Ball Rod End | 35. Pivot |
| 6. Cotter Pin | 16. Plug | 26. Pin | 36. Link |
| 7. Bushing | 17. Washer | 27. Cap Screw | |
| 8. Mounting Bracket | 18. Link | 28. Pin | |
| 9. Shaft | 19. Pin | 29. Lock Rod | |
| 10. Washer | 20. Link | 30. C-Clip | |

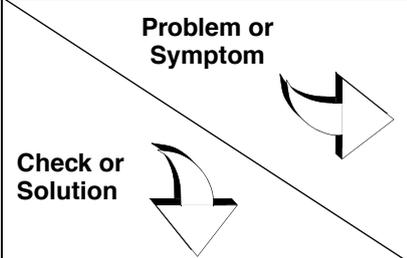
SELECTIVE CONTROL VALVE - COMPONENT LOCATION (NEW)



- | | | | |
|---------------|---------------------|---------------|-------------------|
| 1. Lever | 8. Mounting Bracket | 15. O-Ring | 22. Cap Screw |
| 2. Knob | 9. Shaft | 16. Plug | 23. Pin |
| 3. Nut | 10. Washer | 17. Washer | 24. Bushing |
| 4. Washer | 11. Cap Screw | 18. Washer | 25. Ball Rod End |
| 5. Bracket | 12. Valve | 19. Snap Ring | 26. Link Assembly |
| 6. Cotter Pin | 13. Cap Screw | 20. Lock Rod | 27. Link Assembly |
| 7. Bushing | 14. End Cap | 21. Pin | 28. O-Ring |

TROUBLESHOOTING CHART

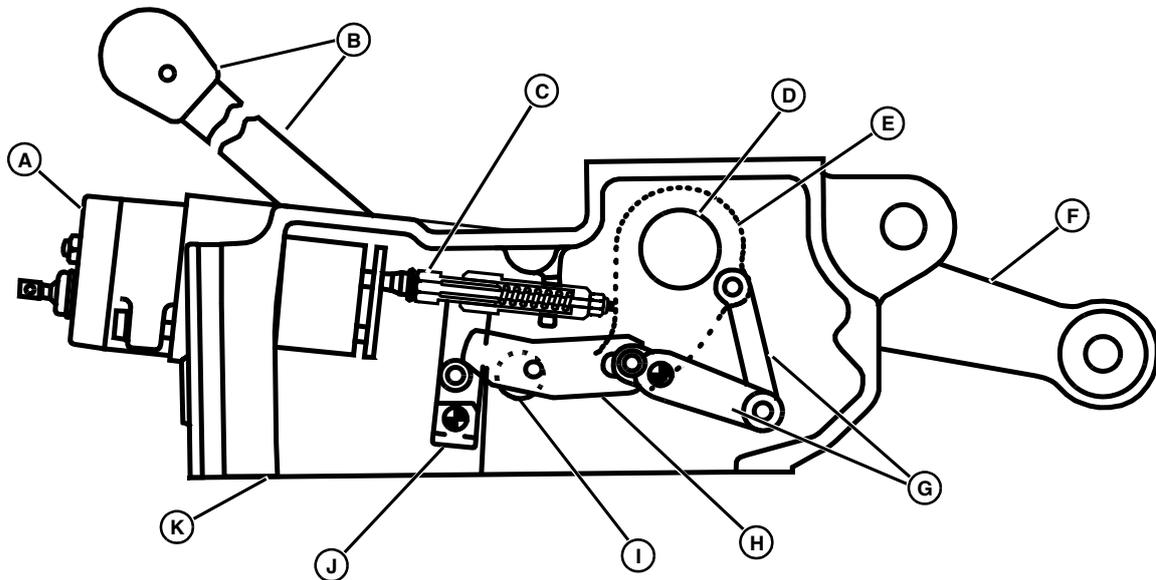
HYDRAULIC SYSTEM

	Jerky Operation.	Does Not Operate.	Does Not Go Down.	Does not lift rated load.	Lift arms oscillate.	Will not support load with engine off.	Will not lift and system relief valve operates.	Load drops with engine on.
Check oil level.	●	●		●	●			●
Pump Inlet Filter Clogged, Clean.	●			●				●
Fittings not tight, air in system.	●			●	●			●
Rockshaft control valve not functioning correctly.	●	●	●	●		●		●
Sensitivity valve not adjusted correctly.	●		●	●	●			●
Control lever not adjusted correctly.			●					
Isolation valve closed.		●	●	●			●	
Pump not operating correctly.	●	●		●	●			●
System relief valve not operating correctly.		●		●	●			●
Internal oil leakage in piston or control valve.		●		●		●		●
Cylinder port blocked.			●					



THEORY OF OPERATION

DRAFT LINKAGE

**Function:**

The draft linkage allows the operator to control the height of the rockshaft lift arms (F). It also provides a safety mechanism for overload and shock protection of the rockshaft (D). The draft linkage is located in the rockshaft housing (K) and consists of an operator controlled eccentric (I) and a series of linkages (G) connecting the rockshaft to the rockshaft control valve (A).

Theory—Raise:

In order for the rockshaft (D) to lift a load, the operator must move the operator control lever (B) to the desired raise position. When the operator control lever is moved it rotates the eccentric clockwise, displacing the front of the eccentric link (H) downward. This forces the plunger (C) carrier (J) towards the rockshaft control valve, moving the control spool in the rockshaft control valve (A) (See "ROCKSHAFT CONTROL VALVE—RAISE" on page 20.) The resulting movement of the piston rotates the rockshaft lever arm (E) counterclockwise, raising the lift arms. When the rockshaft lever arm rotates, it moves the rockshaft linkage which lowers the forked end of the eccentric link. This allows the plunger carrier and the control spool to move back to the neutral position, (See "ROCKSHAFT CONTROL VALVE—LOWER" on page 22.) halting movement of the lift arms.

Theory—Lower

Moving the operator control lever to a lower position rotates the eccentric counter clockwise, displacing the front of the eccentric link upward. This moves the plunger carrier away from the rockshaft control valve moving the control spool out of the rockshaft control valve (See "ROCKSHAFT CONTROL VALVE—LOWER" on page 22.) The resulting movement of the piston rotates the rockshaft lever arm clockwise, lowering the lift arms. When the rockshaft lever arm rotates, it moves the rockshaft linkage which raises the forked end of the eccentric link. This allows the plunger carrier, and the control spool, to move back to the neutral position, (See "ROCKSHAFT CONTROL VALVE—LOWER" on page 22.) halting movement of the lift arms.



HYDRAULICS (ROCKSHAFT)

FUNCTION:

The rockshaft provides a means of raising and lowering equipment attached to the three point hitch.

It also provides a means of setting specific operating depths for tillage equipment.

Provisions are also made for an optional auxiliary selective control valve to operate other equipment off the hydraulic fluid power system.

THEORY:

The hydraulic system consists on an engine mounted direct drive gear pump, pressure relief valve, speed control valve, and lift cylinder connected to the two lift arms through the rockshaft.

Operation:

A 9 cc per revolution dual gear pump is mounted on the left side of the engine and is gear driven off the engine camshaft.

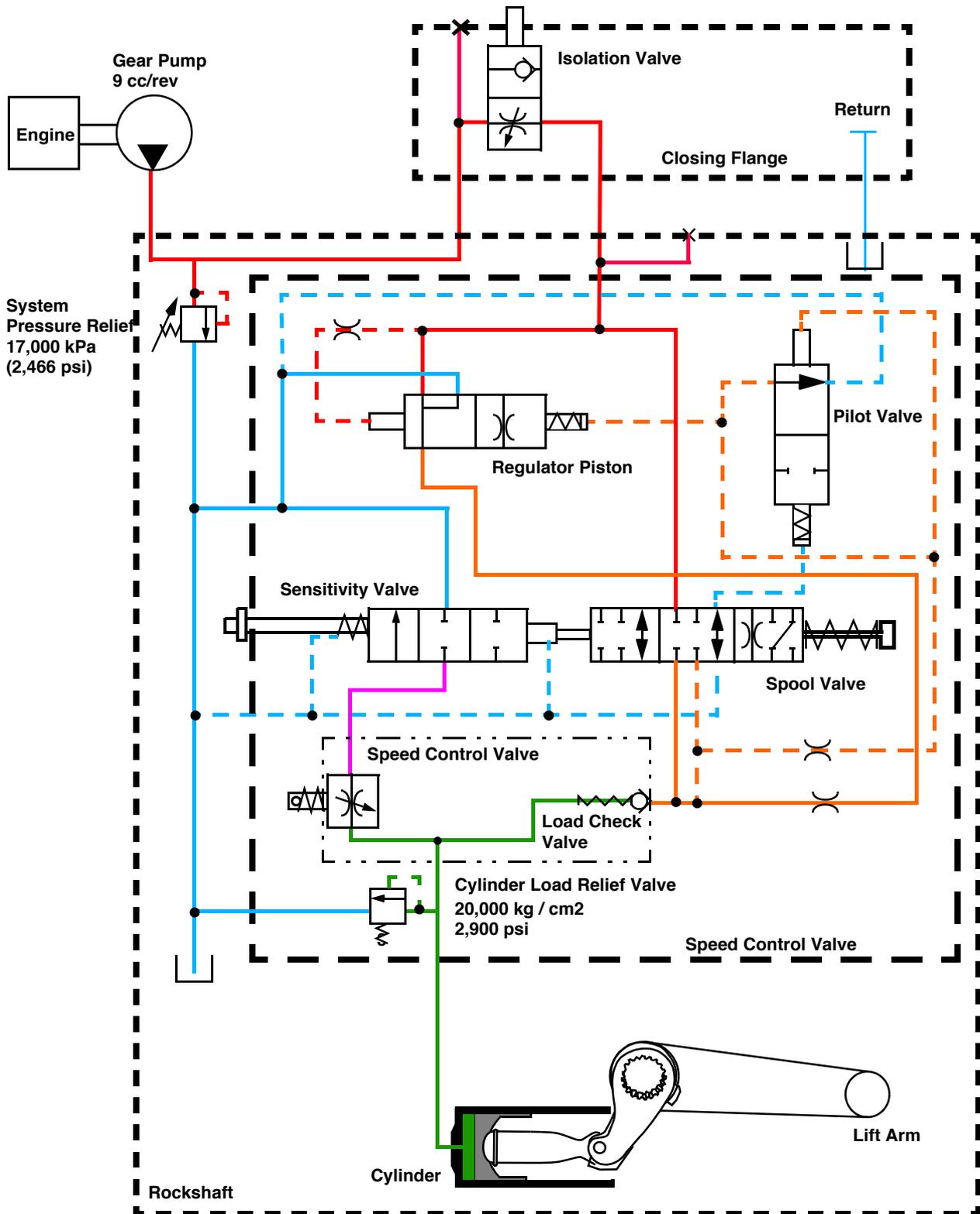
Oil is drawn from the transaxle sump through a 250 mesh screen by the gear pump. Oil is pumped, under pressure, to the rockshaft inlet port. System pressure is controlled by the adjustable pressure relief valve mounted in the inlet port of the rockshaft. The pressure relief valve vents back to the transmission sump through the rockshaft housing. Oil then passes through the rockshaft housing to the speed control valve.

The speed control valve is located on the right side of the rockshaft housing. And contains a operator adjustable down speed control, lift cylinder high pressure relief valve, depth control spool valve, and a safety pressure relief valve.

Rockshaft functions, up, down, and depth, are controlled by the operator using the rockshaft control lever mounted to the right of the operator seat. Moving the rockshaft control lever to the full back position will operate the spool valve in the speed control valve allowing oil to flow into the cylinder which in turn rotates the rockshaft and raises the lift arms to their full up position. Moving the rockshaft control lever to the full forward position will operate the spool valve in the speed control valve allowing oil to flow out of the cylinder which in turn rotates the rockshaft and lowers the lift arms to their full down position. A movable mechanical stop is provided on the rockshaft control lever mechanism to allow the operator to limit the movement of the rockshaft control lever. This allows the operator to repeatably set the range of movement of the lift arms thus controlling the height that any attachments operate at.



HYDRAULIC SCHEMATIC



SYSTEM PRESSURE RELIEF

FUNCTION:

The system pressure relief valve is provided to control hydraulic system operating pressure to **17,000 kPa (2,466 psi)** and to prevent damage to equipment caused by too high a hydraulic pressure.

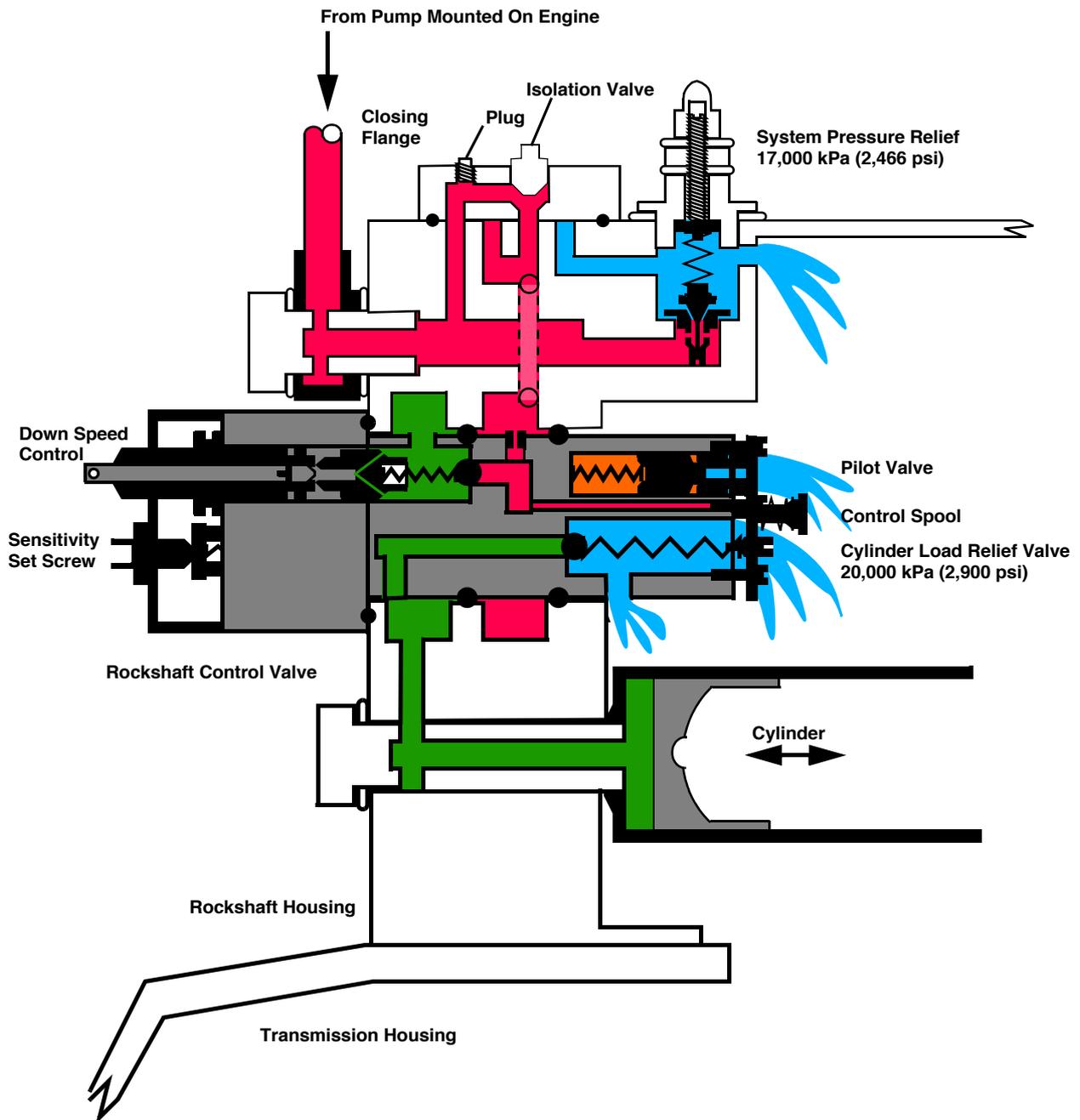
OPERATION:

Oil is pumped, under pressure, to the rockshaft inlet port. System pressure is controlled by the adjustable pressure relief valve mounted in the inlet port of the rockshaft. The pressure relief valve vents back to the transmission sump through the rockshaft housing. Oil then passes through the rockshaft housing to the speed control valve.

On systems that do not have a Selective Control Valve (SCV), a closing flange is provided with a pressure port and an isolation valve. The pressure port plug can be removed and a gauge installed to monitor system pressure. The isolation valve must be closed in order to adjust system pressure.



HYDRAULIC SYSTEM PRESSURE RELIEF



SPEED CONTROL VALVE— NEUTRAL

FUNCTION:

The speed control valve is located in the right side of the rockshaft housing.

The speed control valve contains a operator adjustable down speed control, lift cylinder high pressure relief valve, depth control spool valve, and a safety pressure relief valve. Rockshaft functions, up, down, and depth, are controlled by the operator using the rockshaft control lever mounted to the right of the operator seat.

The neutral function is initiated any time the operator selected elevation has been achieved. The neutral function serves to automatically keep the rockshaft at the desired elevation.

OPERATION:

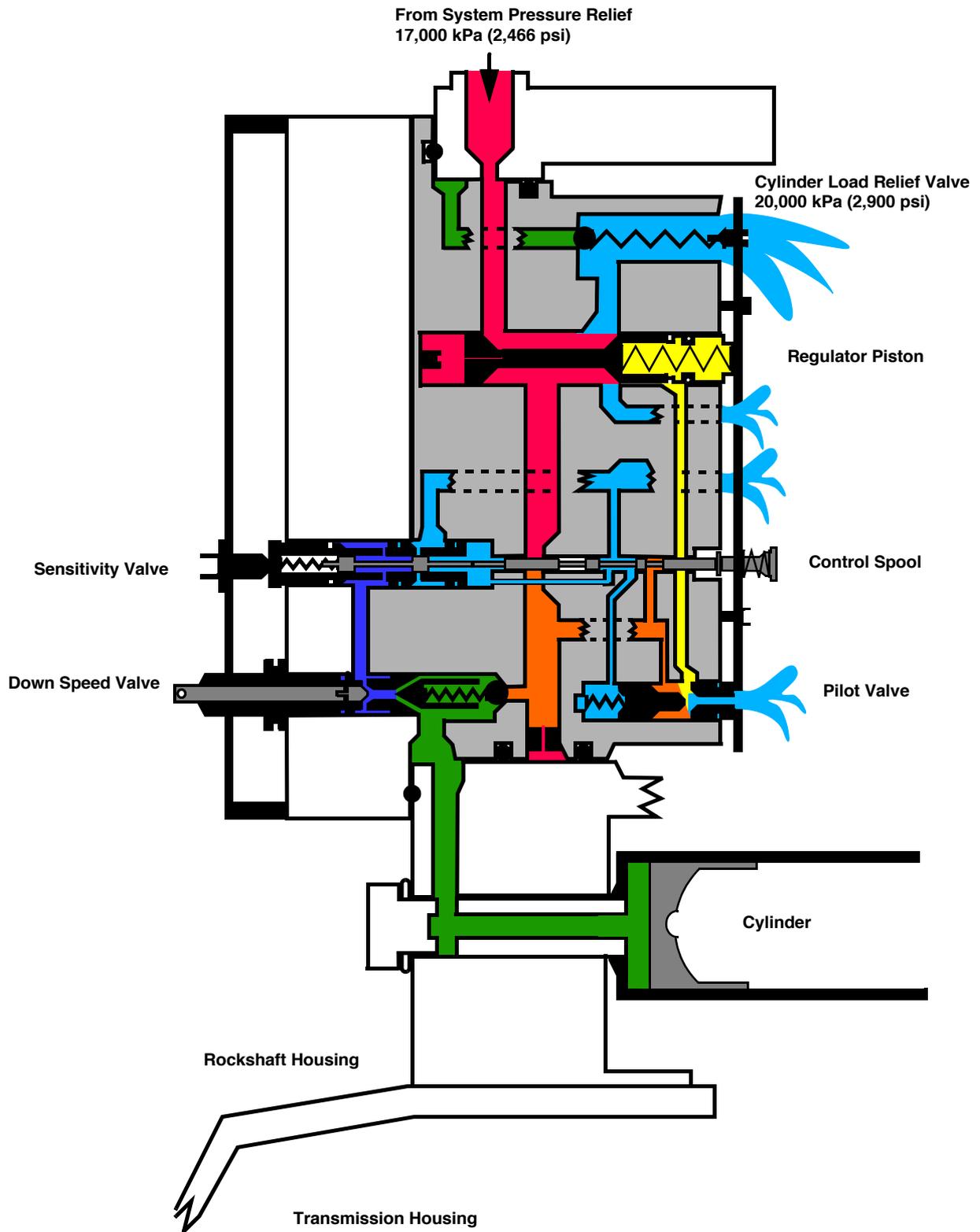
Once a selected elevation is achieved, the control spool is returned to the neutral position. In this position several circuits are established:

- main oil flow, under pressure (Red circuit), is blocked from the cylinder by the control spool.
- a port is opened from the spring side of the pilot valve to the sump. Pressurized oil is simultaneously routed to the valve side of the pilot valve, overcoming the pilot valve spring and relieving to sump. This also opens the port from the spring side of the regulator piston and relieves oil from the regulator piston to the sump.
- once oil is relieved from the regulator piston spring side, the regulator piston center portion is exposed directly to high pressure oil, shifting the regulator piston and relieving system oil directly to the sump.
- The control spool also shifts the spool in the sensitivity valve, blocking the passage of oil from the cylinder to sump. This effectively locks the cylinder in the desired position.

Thermal and shock protection are provided to the lift cylinder by the cylinder load relief valve. This valve relieves directly from the cylinder, by-passing all other internal control valves, to the sump.



SPEED CONTROL VALVE—NEUTRAL



ROCKSHAFT CONTROL VALVE— RAISE

FUNCTION:

The rockshaft control valve is located in the right side of the rockshaft housing.

The rockshaft control valve contains a operator adjustable down speed control, lift cylinder high pressure relief valve, depth control spool valve, and a safety pressure relief valve. Rockshaft functions, up, down, and depth, are controlled by the operator using the rockshaft control lever mounted to the right of the operator seat.

The lift function is initiated any time the operator moves the control lever in order to raise the rockshaft.

OPERATION:

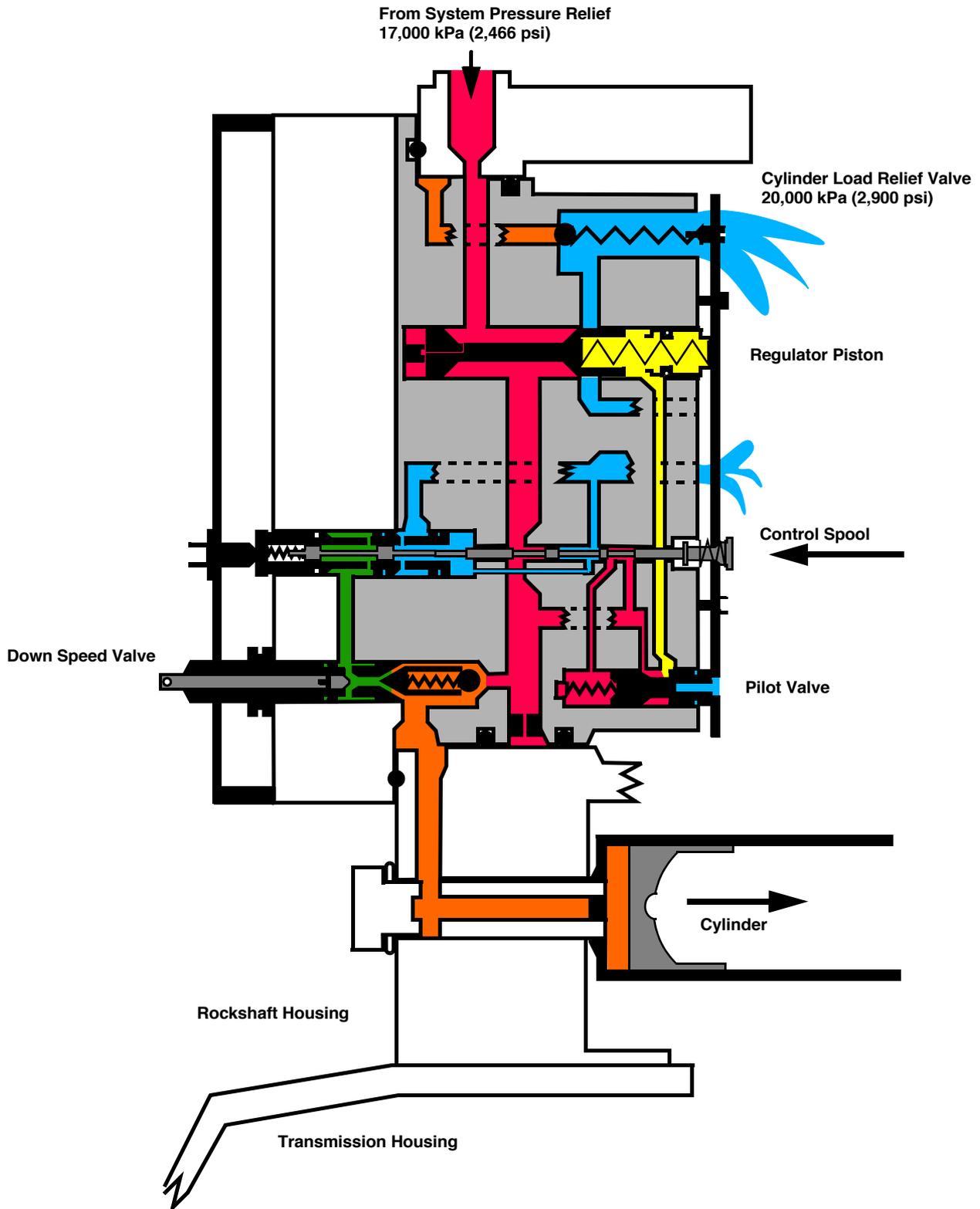
When the operator moves the control lever to the raise position this rotates the draft linkage, off center, and displaces the spool valve. In this position several circuits are established:

- A port is opened from the spring side of the pilot valve to system pressure (Red circuit), shifting the pilot valve and closing the port from the regulator piston. Pressurized oil is simultaneously routed to the valve side of the pilot valve and to the spring side of the regulator piston (Yellow circuit).
- Once the spring side of the regulator piston is pressurized it shifts the regulator piston closing the path for oil to the sump. This allows system pressure to build in the main passage of the rockshaft control valve. The orifice passage in the opposite end of the regulator piston acts as a cushion, controlling the movement of the regulator piston and provides a “soft start & stop” in the circuit. The differential pressure created on either end of the regulator piston controls the ultimate speed of operation of the rockshaft.
- Once pressure builds sufficiently, the check valve in the down speed control valve un-seats and allows high pressure oil to be made available to the cylinder (Orange circuit) which raises the rockshaft.

Once the desired height has been achieved the draft control linkage re-centers itself and moves the spool valve back to the neutral position.



ROCKSHAFT—RAISE



ROCKSHAFT CONTROL VALVE— LOWER

FUNCTION:

The rockshaft control valve is located in the right side of the rockshaft housing.

The rockshaft control valve contains a operator adjustable down speed control, lift cylinder high pressure relief valve, depth control spool valve, and a safety pressure relief valve. Rockshaft functions, up, down, and depth, are controlled by the operator using the rockshaft control lever mounted to the right of the operator seat.

The neutral function is initiated any time the operator selected elevation has been achieved. The neutral function serves to automatically keep the rockshaft at the desired elevation.

OPERATION:

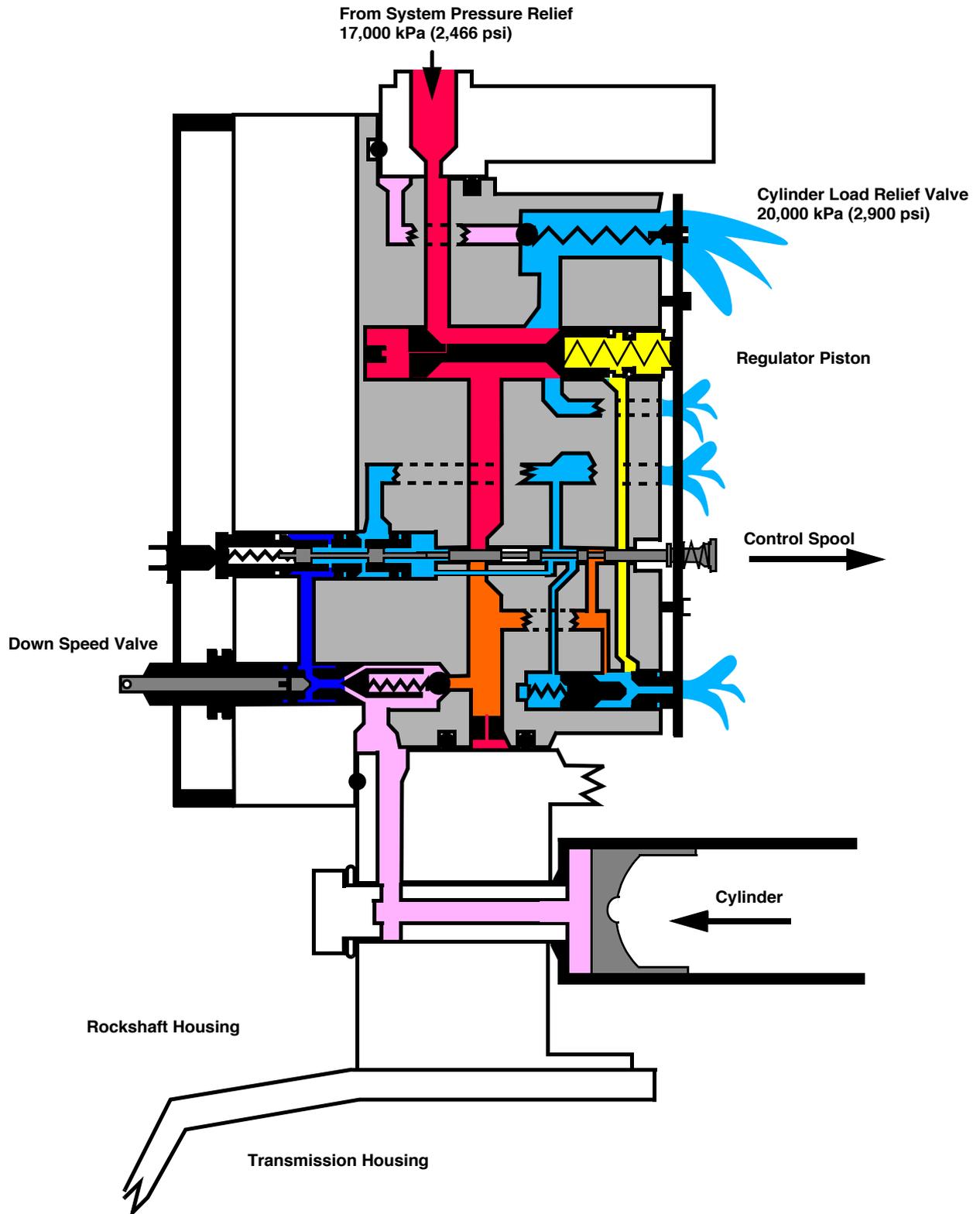
When the operator moves the control lever to the down position this rotates the draft linkage, off center, and displaces the spool valve. In this position several circuits are established:

- Main oil flow, under pressure (Red circuit), is blocked from the cylinder by the control spool.
- a port is opened from the spring side of the pilot valve to the sump. Pressurized oil (Red circuit) is simultaneously routed to the valve side of the pilot valve, overcoming the pilot valve spring and relieving to sump. This also opens the port from the spring side of the regulator piston and relieves oil from the regulator piston to the sump (Yellow circuit).
- Once oil is relieved from the regulator piston spring side, the regulator piston center portion is exposed directly to high pressure oil, shifting the regulator piston and relieving system oil directly to the sump.
- The control spool also shifts the spool in the sensitivity valve, opening the passage of oil from the cylinder to sump. Oil flows from the cylinder (Pink circuit), through the down speed valve (Purple circuit), sensitivity valve and the to sump (Blue circuit).

Once the desired height has been achieved the draft control linkage re-centers itself and moves the spool valve back to the neutral position.



ROCKSHAFT—NEUTRAL



TESTS AND ADJUSTMENT

HYDRAULIC WARM UP PROCEDURE

Reason:

For accurate hydraulic tests, the oil must be heated to normal operating temperature of **43°C (110°F)**.

Equipment:

- JDG282 — Temperature Gauge

Procedure:

1. Install JDG temperature gauge on supply line to oil pump.
2. Apply park brake.
3. Start engine and run at fast idle.

IMPORTANT: DO NOT overheat oil.

4. Operate hydraulic system to create back pressure in system:
 - On units without SCV — Use a 13 mm open end wrench to partially close isolation valve, located on side of rockshaft, until system pressure relief valve opens.
 - On unit with SCV — Operate SCV lever to cause system to go over relief.
5. Operate until oil reaches normal operating temperature of **43°C (110°F)**.



SENSITIVITY ADJUSTMENT

Reason:

To make sure that the rockshaft control valve sensitivity is set correctly.

Equipment:

- BW13586 Ballast Box

Procedure:



1. Install BW13586 ballast box, or approximately **227 kg (500 lbs)**, on the three point hitch.
2. Open speed control valve completely.
3. Set engine speed at fast idle.
4. Put position operator control lever so that weight is suspended approximately midway in operating range.
5. Loosen lock nut on sensitivity set screw (A).
6. Slowly rotate set screw counterclockwise until lift arms begin to sway up and down.
7. Slowly rotate set screw clockwise until lift arms just stop swaying.
8. Rotate set screw an additional **1/2 to 3/4** of a turn clockwise. Hold set screw in this position and tighten lock nut.

LIFT ARM ADJUSTMENT

Reason:

To make sure that the lift arms upper limit stop is correctly adjusted.

Equipment:

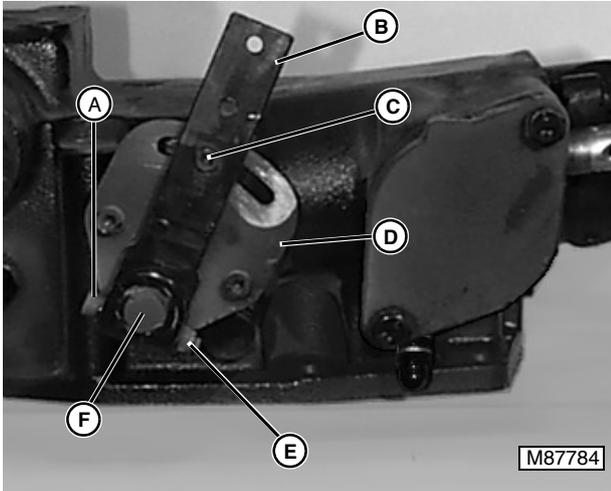
- BW13586 Ballast Box
- Magnetic Angle Gauge

Procedure:

NOTE: If lift arms have been removed from rockshaft the initial set up procedure must be done before proceeding with the following adjustment procedure. (See "LIFT ARMS REMOVAL AND INSTALLATION" on page 36.)

1. Install BW13586 ballast box, or approximately **227 kg (500 lbs)**, on the three point hitch.
2. Open speed control valve completely.
3. Set engine speed at fast idle.

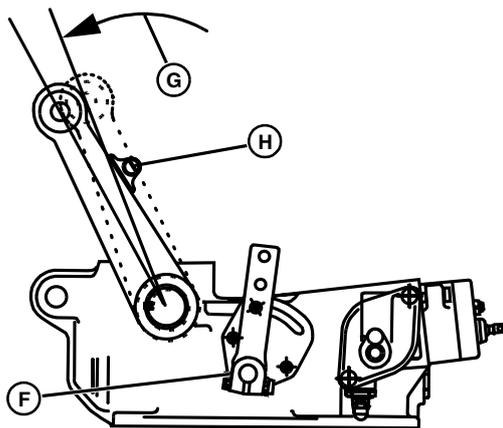
10. Cycle lift arms through range of motion several times using the magnetic angle gauge (H) to make sure that lift arms return to the same position when fully raised.



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NOTE: Illustrated removed from vehicle for clarity.

4. Rotate bracket (B), operator control lever, to full up position.
5. Place magnetic angle gage on lift arm.
6. Loosen nylock nut (E) and socket head cap screw (A) securing bracket (B) to eccentric actuator (F).
7. Rotate bracket until stop screw (C) seats fully against end of slot in plate (D).



8. Use 13 mm open end wrench to slowly rotate eccentric actuator (F) counter clockwise until lift arms stop moving, back off eccentric actuator, clockwise, until lift arms rotate **down 3—5 degrees (G)**.
9. Hold eccentric shaft in position and tighten nylock nut and socket head cap screw securing bracket to eccentric actuator.

NOTE: Lift arms in the raised position, after stop is set, should be at approximately **60°** above horizontal. At bottom of travel lift arms should be approximately **15°** below horizontal.

SYSTEM PRESSURE RELIEF ADJUSTMENT

Reason:

To make sure that the hydraulic system pressure relief valve is correctly set.

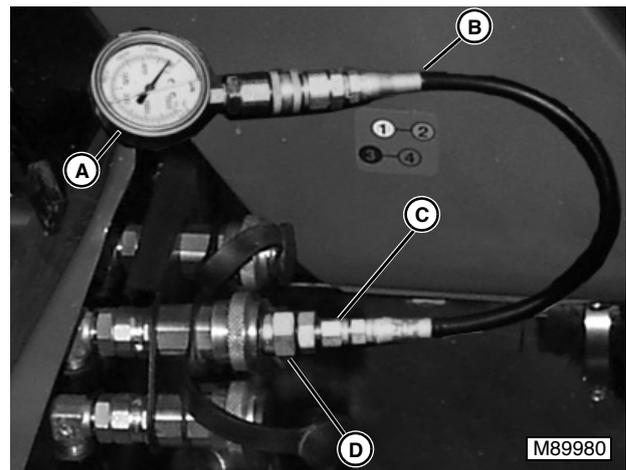
Equipment:

- JTO3345 — 3000 psi gauge
- JTO3017 — Hose with coupler
- JTO5486 — Connector, 1/4 M NPT x 7/16-20M 37°
- AM105467 — Internal half of coupler

Procedure:

IMPORTANT: Oil in system should be at normal operating temperature. (See “HYDRAULIC WARM UP PROCEDURE” on page 24.)

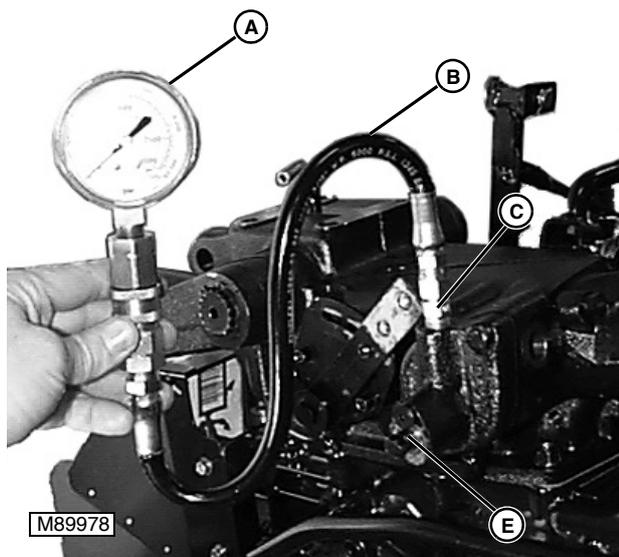
1. Install pressure gauge as follows:



M89980

- If unit is equipped with Selective Control Valve, assemble AM105467 coupler (D), JTO5486 connector (C), TO3345 hose (B), and JTO3345 pressure gauge (A) in pressure port.





- If unit does not have SCV valve, remove plug on top of closing flange. Assemble JTO5486 connector (C), JTO3345 hose (B), and JTO3345 pressure gauge (A).
- 2. Start engine and set throttle at fast idle.

IMPORTANT: The following step dead heads the hydraulic pump. DO NOT operate in this condition for more than 5 seconds!

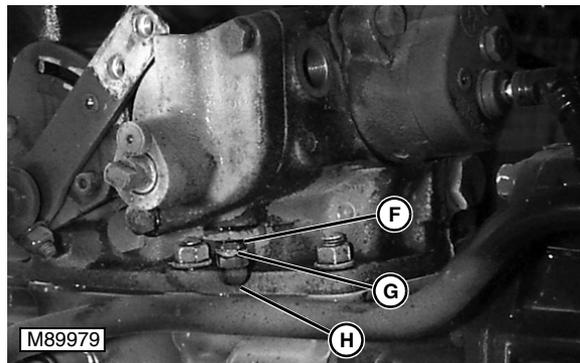
- 3. Check pressure on gauge by:
 - SCV units — activate handle, read gauge, and release.
 - Non SCV units — use wrench to shut isolation valve (E) on side of closing flange, read gauge, and re-open valve.



Results:

System pressure should be between **16182 kPa and 17160 kPa (2347 – 2488 psi)**. If not, adjust as follows.

Adjustment:



1. Remove acorn nut (H) and copper washer (G) from end of adjustment screw.
2. Loosen lock nut (F).
3. Adjust pressure by rotating adjusting screw in - clockwise, increase pressure, - or out - counter clockwise, reduce pressure.
4. Retest system pressure, and repeat adjustment as required.
5. Once system pressure is set correctly, tighten lock nut, replace copper washer, and replace acorn nut.

PUMP FLOW TEST –TRACTORS WITHOUT SCV

Reason:

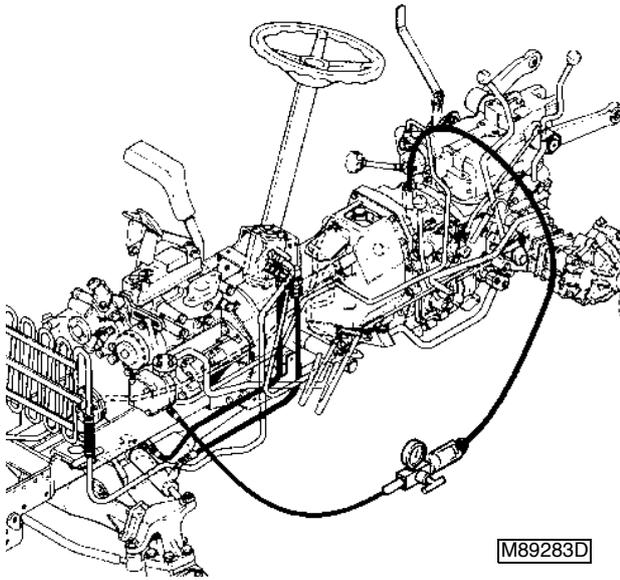
To determine if hydraulic pump is providing adequate flow under pressure.

Equipment:

- JDG694 — Pump Test Fitting
- JTO5469 — Flowmeter

Procedure:

IMPORTANT: Oil in system should be at normal operating temperature. (See “HYDRAULIC WARM UP PROCEDURE” on page 24.)



1. Remove pressure line from bottom of hydraulic pump. Plug end of pressure line.

NOTE: It may be necessary to remove clamp retaining pressure line to side of tunnel, under left side footboard, and loosen banjo fitting at the rockshaft in order to provide clearance to install pump test fitting.

2. Install JDG694 pump test fitting on pressure side of pump.
3. Install JTO5469 flowmeter and hoses between pump test fitting and fill port on transaxle.
4. Open valve on flowmeter all the way.
5. Start engine and run at fast idle.
6. Slowly close valve on flowmeter until pressure on gauge reads 1500 psi.
7. Observe flow, then release pressure.

Results:

Pump flow should be a minimum of **19.2 liters/min (5 gpm)**, if not:

- Check intake filter for obstruction, clean and/or replace as required. (See “SCREEN FILTER REMOVAL AND REPLACEMENT” on page 32.)
- Repair/replace pump as required. (See “HYDRAULIC PUMP REMOVAL AND INSTALLATION” on page 29.)

PUMP FLOW TEST—TRACTORS WITH SCV

Reason:

To determine if hydraulic pump is providing adequate flow under pressure.

Equipment:

- JTO5469 — Flowmeter
- AM105467 — Internal half of coupler
- JTO3041 — Adaptor 1/2 M NPT x 3/4-16 F ORB

Procedure:

IMPORTANT: Oil in system should be at normal operating temperature. (See “HYDRAULIC WARM UP PROCEDURE” on page 24.)

1. Install pump test fitting in coupler.
2. Install JTO5469 flowmeter and hoses between working ports of SCV.
3. Open valve on flowmeter all the way.
4. Start engine and run at fast idle.
5. Actuate appropriate SCV valve and hold in fully actuated position.
6. Slowly close valve on flowmeter until pressure on gauge reads 1500 psi.
7. Observe flow, then release pressure.

Results:

Pump flow should be a minimum of **19.2 liters/min (5 gpm)**, if not:

- Check intake filter for obstruction, clean and/or replace as required. (See “SCREEN FILTER REMOVAL AND REPLACEMENT” on page 32.)
- Repair/replace pump as required. (See “HYDRAULIC PUMP REMOVAL AND INSTALLATION” on page 29.)

ROCKSHAFT LIFT CYCLE TEST

Reason:

To make sure that the hydraulic system is functioning correctly and capable of lifting rated load.

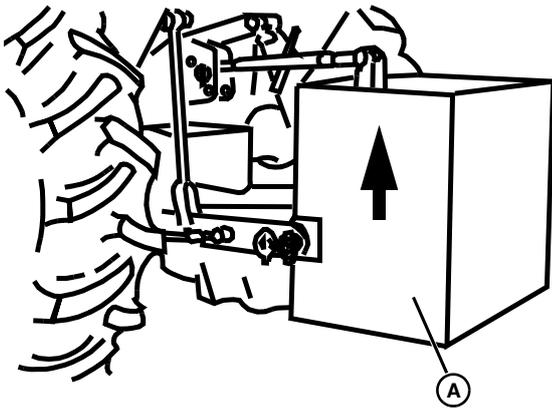
Equipment:

- BW13586 Ballast Box



Procedure:

IMPORTANT: Oil in system should be at normal operating temperature. (See “HYDRAULIC WARM UP PROCEDURE” on page 24.)



1. Install BW13586 ballast box, or approximately **227 kg (500 lbs) (A)**, on the three point hitch.
2. Open speed control valve completely.
3. Set engine speed at fast idle.
4. Put position lever in full down position.
5. Time duration of lift cycle from full down to full up.

Specifications

Rockshaft Lift Cycle Time 2-1/2 to 3 sec.



Results:

If the weight raises slower than specified there may be internal leakage in the cylinder or rockshaft control valve, or a problem with the pump, see troubleshooting at the beginning of this section.

ROCKSHAFT LEAKAGE TEST

Reason:

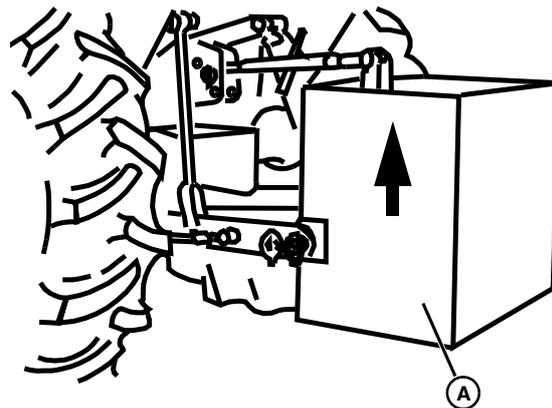
To test for excessive internal leakage in the rockshaft lift cylinder and rockshaft control valve.

Equipment:

- BW13586 Ballast Box

Procedure:

IMPORTANT: Oil in system should be at normal operating temperature. (See “HYDRAULIC WARM UP PROCEDURE” on page 24.)



1. Install BW13586 ballast box, or approximately **227 kg (500 lbs) (A)**, on the three point hitch.
2. Set engine speed at fast idle.
3. Put position lever in full UP position.
4. Raise weight as high as it will go.
5. **Close** speed control valve.
6. Turn engine OFF.
7. Measure distance weight drops in 5 minutes.
8. Restart engine, **OPEN** speed control valve fully and raise weight to full UP position.
9. Turn off engine.
10. Measure distance weight drops in **5 minutes**.

Specifications

Maximum Drop in 5 minutes 51 mm (2 in.)

Results:

If the weight drops further than specified distance with the speed control valve **closed**, first test, there may be leakage in the cylinder, cylinder load relief valve or speed control valve.

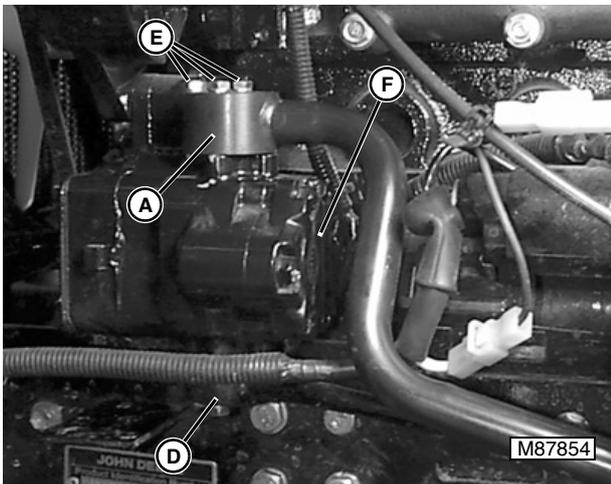
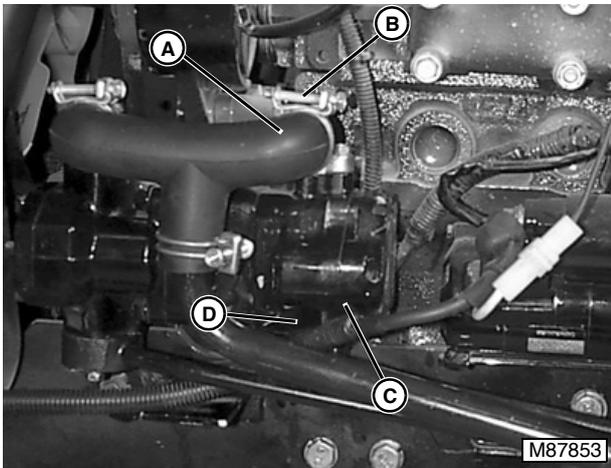
If the weight drops **further** with the speed control valve **open**, second test, than it did in the first test there may be leakage in the rockshaft control valve.

REPAIR

HYDRAULIC PUMP REMOVAL AND INSTALLATION

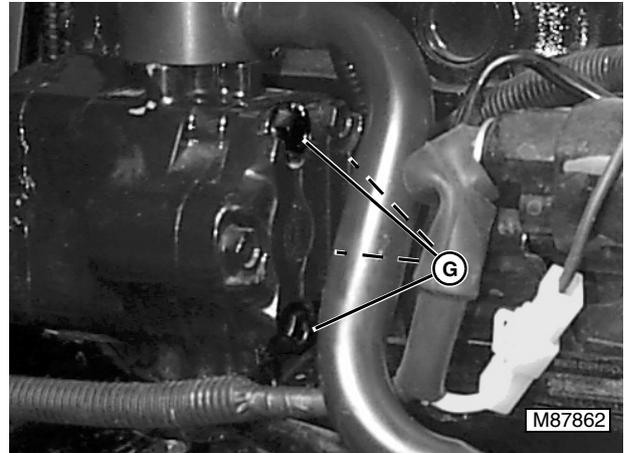
Removal:

The hydraulic pump is the same on both hydrostatic and gear drive tractors. The only difference in the removal and installation of the two is in the method of the attachment of the intake (A) manifold and the specific routing of the individual hydraulic fluid intake and pressure side (D) hoses/tubes.



1. Drain oil from sump.
2. Disconnect fittings from pump:
 - On hydrostatic tractor remove three cap screws (E) securing each fitting, intake and pressure, to pump (F) body.

- On gear drive tractor remove hose clamp (B) securing rubber intake manifold to pump (C) and three cap screws securing pressure fitting to pump body.



3. Remove four (4) cap screws (G) securing pump to engine drive housing.
4. Remove pump.

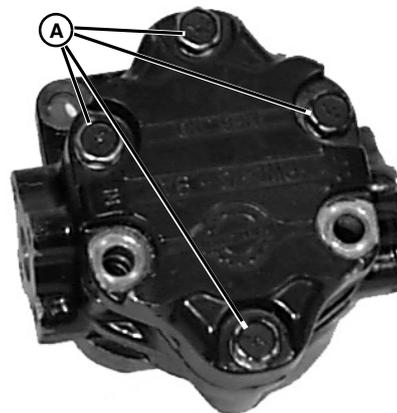
Installation:

1. Align splines on pump input shaft with splines on engine drive. Insert pump into engine housing.
2. Secure hydraulic pump to engine with four (4) cap screws. Tighten to **26 N·m (19 lb-ft)**.
3. Install new O-ring on intake and pressure fittings as required and secure to pump body. Tighten to **6 N·m (53 lb-in)**.

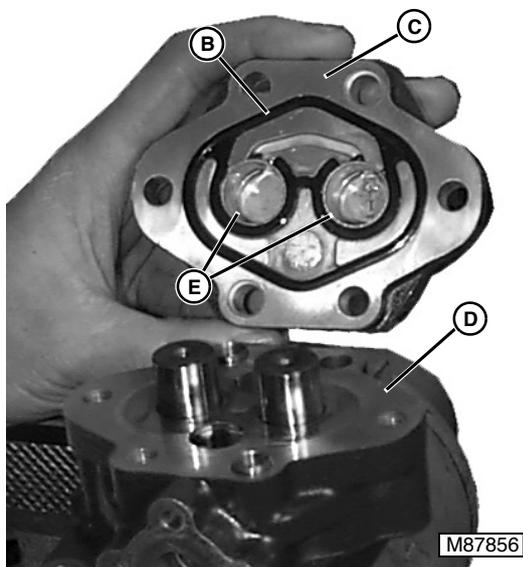
HYDRAULIC PUMP DISASSEMBLY AND INSPECTION



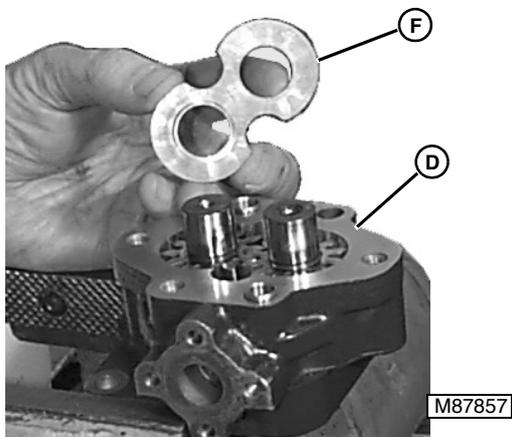
1. Remove pump from engine. (See "HYDRAULIC PUMP REMOVAL AND INSTALLATION" on page 29.)



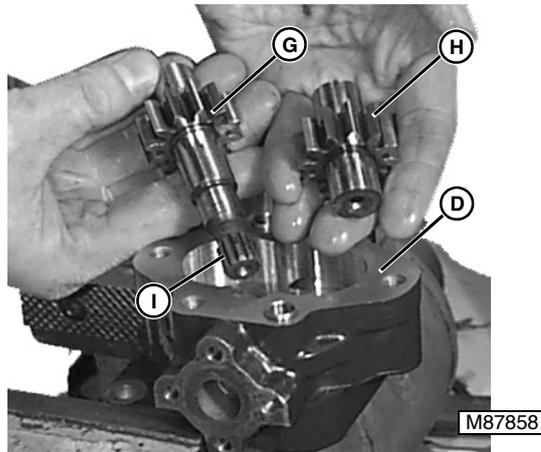
2. Remove four (4) remaining cap screws (A) securing pump cover to pump body (D).



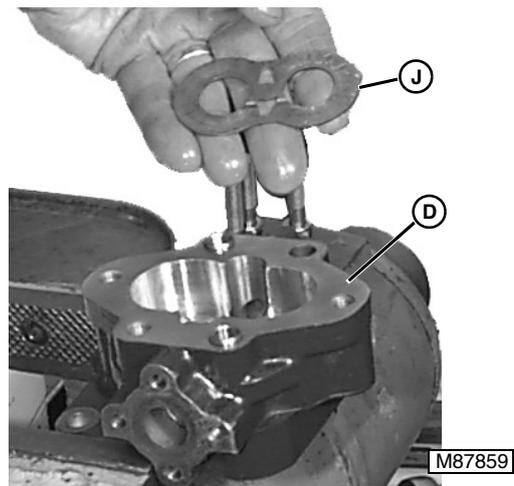
- 3. Remove pump cover (C).
- 4. Remove formed O-ring gasket (B).
- 5. Inspect bushings (E) in cover. If not to specifications, replace.



6. Remove thick thrust plate (F).

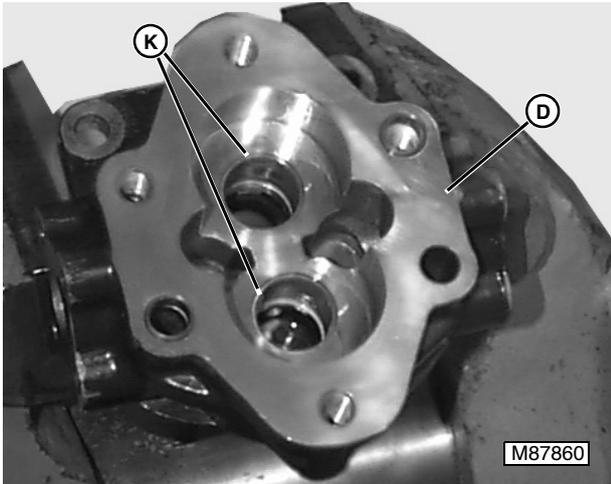


- 7. Remove pump drive gear (G) and idler gear (H).
- 8. Inspect gear faces for wear. Replace as required.
- 9. Inspect drive gear (G) shaft splines (I). Replace if damaged.
- 10. Measure idler gear (H) and drive gear (G) shaft bearing surfaces. Replace if not within specifications.

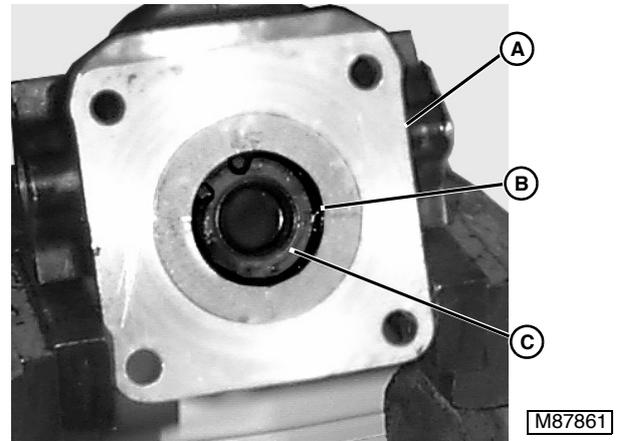


11. Remove thin thrust plate (J) from pump body (D).

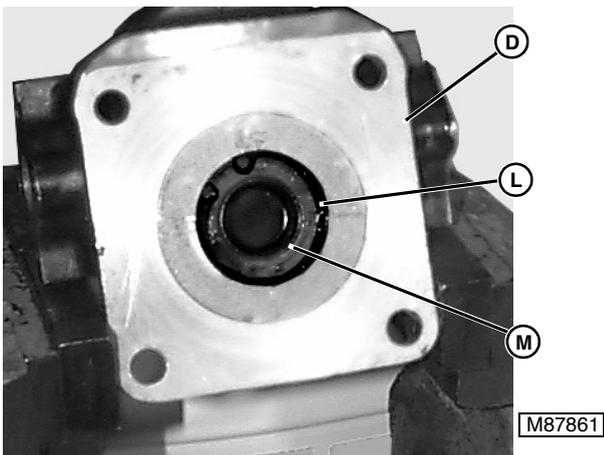
HYDRAULIC PUMP ASSEMBLY



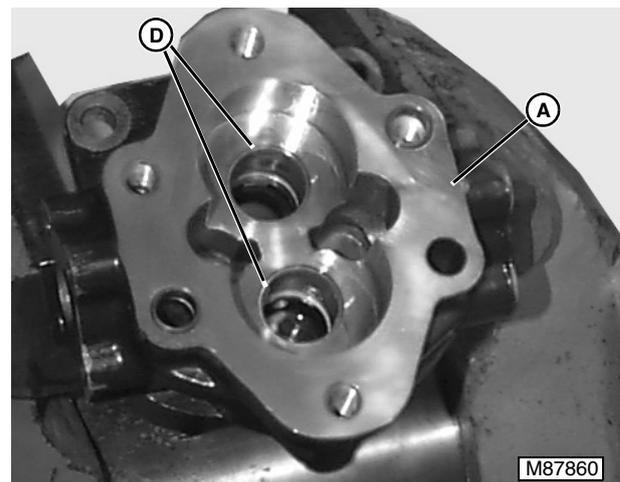
- 12. Inspect bushings (K) in pump body (D).
- 13. Inspect pump body internal surfaces for scoring or excessive scratching. Replace pump if damaged.



- 1. If not already done, install new seal (C) in pump body (A). Secure with internal snap ring (B).



- 14. Remove internal snap ring (L) retaining seal (M) in pump body (D).
- 15. Remove seal (M).

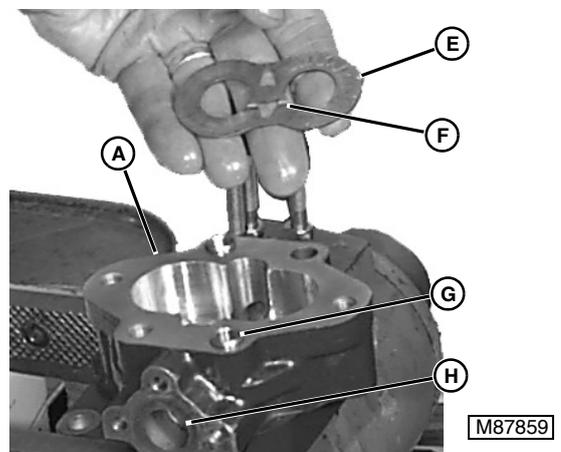


- 2. If not already done, replace bushings (D) in pump body (A) using suitable bearing driver.



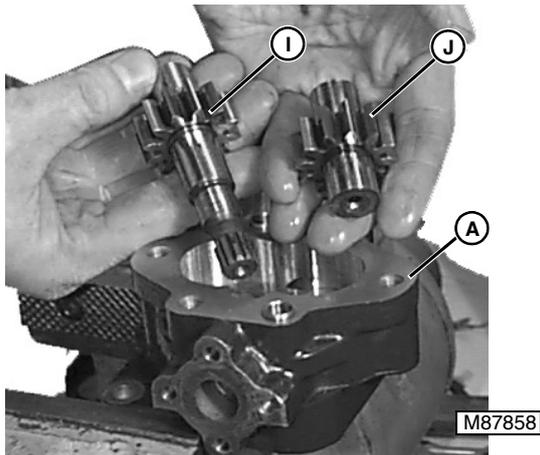
Specifications:

Input Shaft Bearing OD	.....	17.93 – 18.06 mm
Idler Gear Shaft Bearing OD	.....	17.93 – 18.06 mm
Bushing ID	.....	18.00 – 18.06 mm
Thrust Plate		
Thick	.....	1.98 – 2.00 mm
Thin	.....	1.18 – 1.20 mm



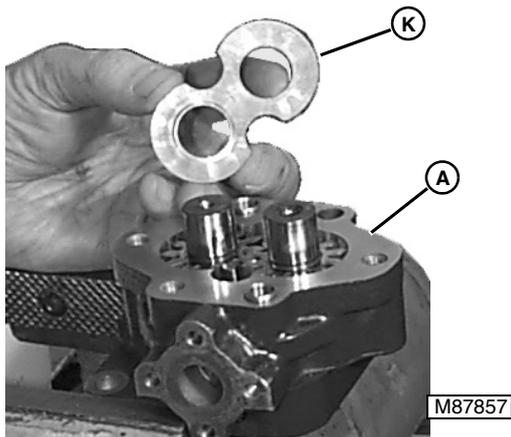
- Place thin thrust plate (E) in pump body (A) with "brass" colored side facing to gears and groove (F) in thrust plate toward intake port (H) side of pump.

NOTE: Intake side of pump body can be identified by locator bushing in through hole (G) in pump body.

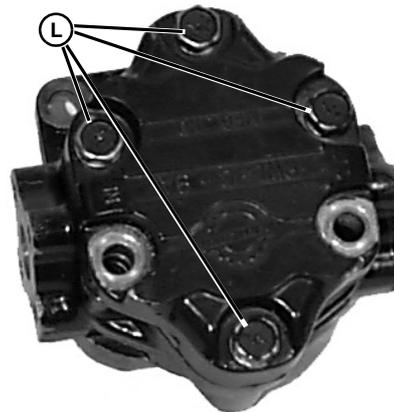


- Place pump drive gear (I) and idler gear (J) in pump body (A).

NOTE: Idler gear (J) is symmetrical and can be placed in the body either end first.



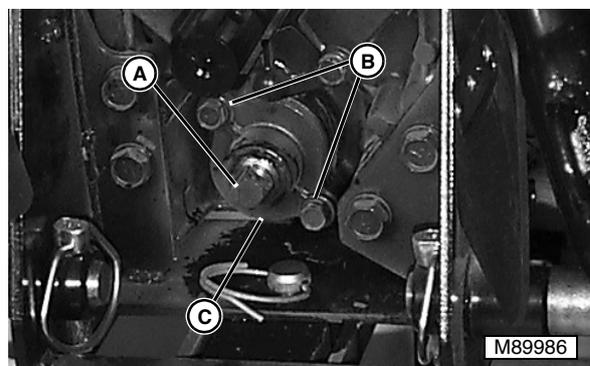
- Place pump thick thrust plate (K), with "brass" colored surface towards gears, on gear shafts. Pump thrust plate should be flush with pump body (A) gasket surface when correctly installed.



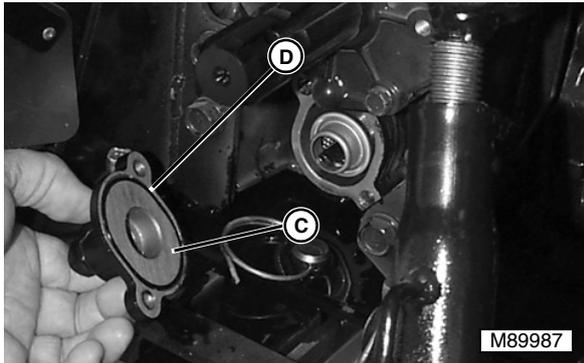
- Place pump cover on pump body. Secure with four (4) cap screws (L). Tighten to **15 N·m (133 lb-in.)**.

SCREEN FILTER REMOVAL AND REPLACEMENT

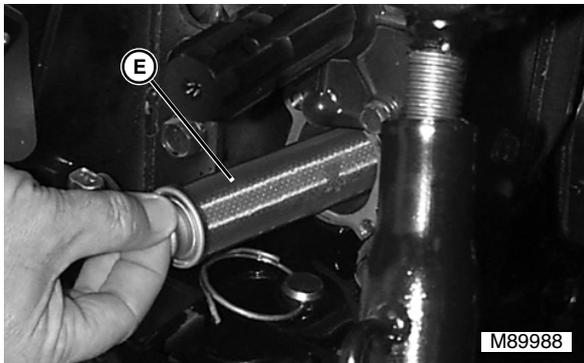
*NOTE: Gear Transmission holds approximately 10.5 L (2.8 gal.)
Hydrostatic Transmission holds approximately 12.5 L (3.3 gal.)*



- Drain oil from transmission through drain plug (A).
- Remove filter cover (C) retaining cap screws (B).



3. Remove filter cover (C). Inspect and/or replace formed O-ring (D) in filter cover.



4. Remove filter (E).
5. Inspect and clean filter in suitable. Remove magnets from inside of filter and clean, if required.
6. If filter is damaged, torn or bent, replace.

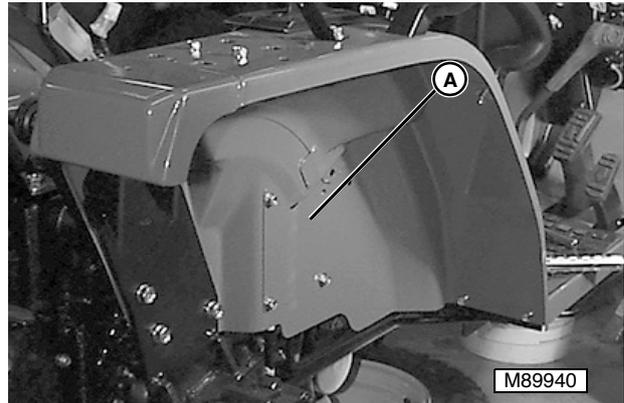
Installation:

- Install magnets in filter.
- Install filter reversing the procedure for removal.
- Refill transmission with correct oil.

SELECTIVE CONTROL VALVE (SCV)

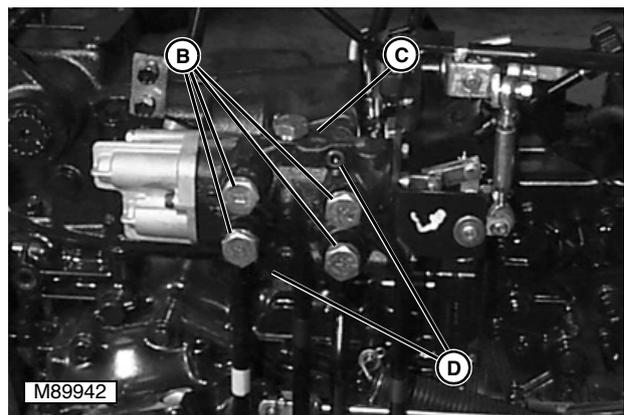
Removal:

1. Remove seat. See "SEAT AND SEAT FRAME REMOVAL AND INSTALLATION" on page 6 of MISCELLANEOUS SECTION.
2. Jack up right rear side of tractor, support safely and remove right rear wheel.



3. Remove access panel (A) in fender.

NOTE: SCV can be removed without removing fenders by removing access panel located in right rear fender. Fenders shown removed in the following illustrations for clarity.

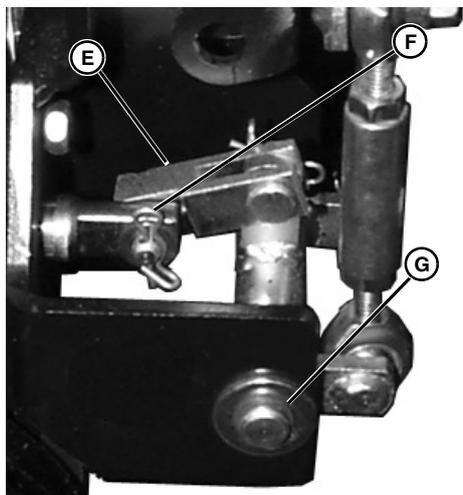


4. Remove four (4) banjo bolts (B) connecting distribution lines to SCV. Be sure not to lose the two (2) copper washers, one on each side of banjo fitting.
5. Remove two socket head cap screws (D) securing SCV to rockshaft. Remove SCV with control linkage and adaptor plate (C).

NOTE: SCV does not contain any serviceable components. If SCV is worn, or not functioning correctly after cleaning, replace entire SCV.

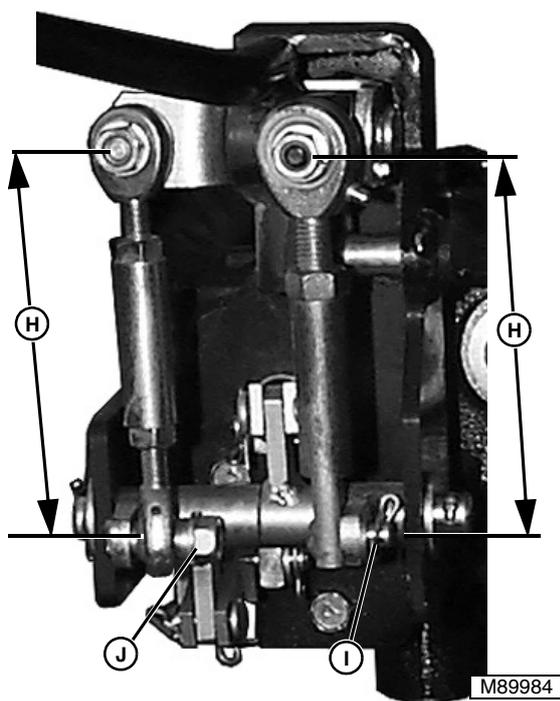


Disassembly:



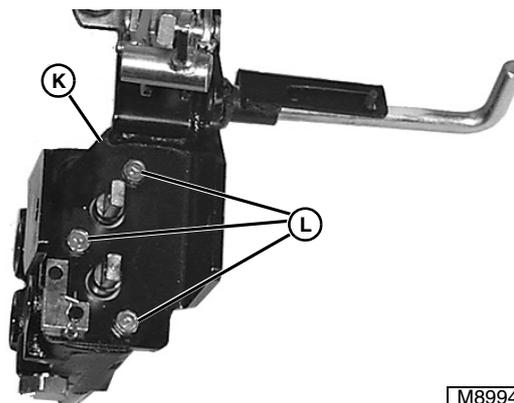
M89943

1. Remove spring clips (F) and washers from ends of links (E) in spool shafts.
2. Remove C-clip (G) and washer from end of pivot shaft. Remove pivot shaft.



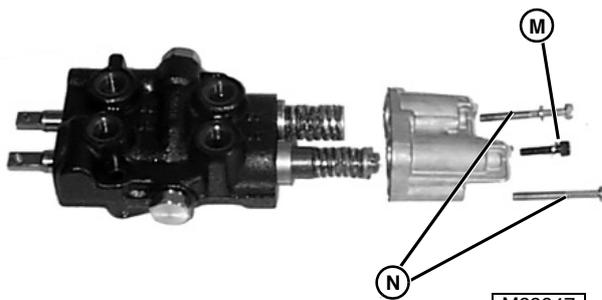
M89984

3. If disassembly of linkage is required, remove nuts (J) and/or spring clips (I) securing rod ends to pivots.
4. If rod ends are remove from rods, adjust length from center of rod end to center of rod end, or pin, to **88.5 mm (3.484 in.) (H)**.



M89946

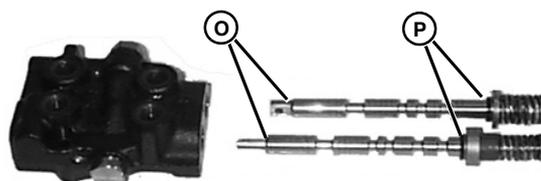
5. Remove three (3) cap screws (L) securing bracket (K) to SCV. Remove bracket with linkage.
6. Remove spool seals under bracket.



M89947

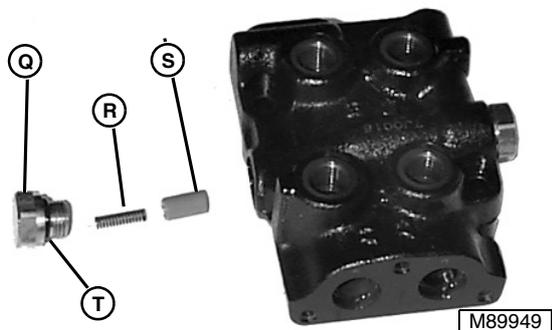
7. Remove two (2) capscrews (N) and one (1) socket head cap screw (M), with lock washers, securing end cap to SCV. Remove end cap.

NOTE: When removing spools from SCV body be sure to note or mark which spool is removed from which bore. Spools MUST be returned to their original locations.



M89948

8. Carefully remove spools (O) (from body. Clean and inspect spools. Replace O-rings (P). No further disassembly of spools is required.



9. Remove check valves from ports in SCV.
10. Clean cap (Q), spring (R), plunger (S), and O-Ring (T) components in suitable solvent.
11. Inspect all components for wear, deep scratches, or breakage. Replace SCV as required.

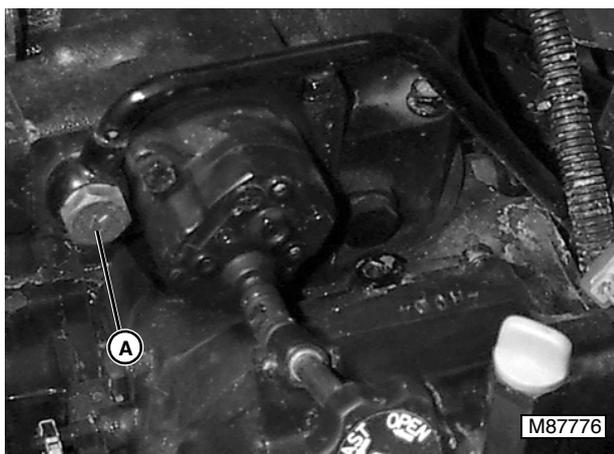
Installation:

Installation is the reverse of removal.

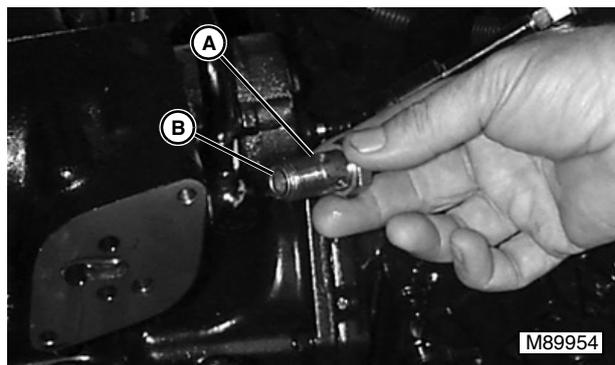
- Tighten banjo bolts to **17 N•m (150 lb-in.)**.
- Tighten socket head cap screws securing SCV to rockshaft to **16.7 N•m (148 lb-in.)**.

ROCKSHAFT ASSEMBLY REMOVAL

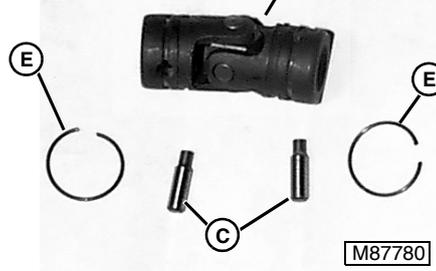
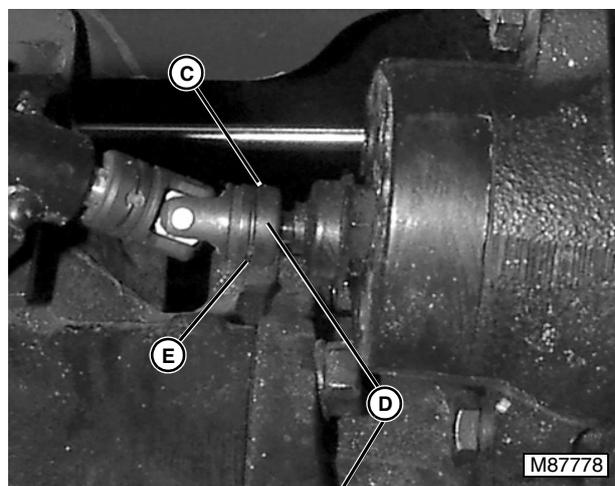
1. Remove seat. See "SEAT AND SEAT FRAME REMOVAL AND INSTALLATION" on page 6 of MISCELLANEOUS SECTION.
2. Remove tunnel cover.



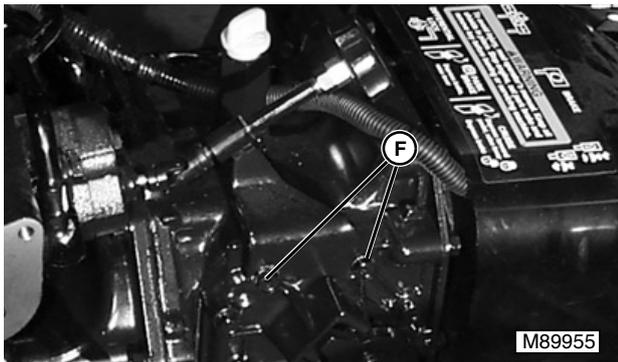
3. Remove banjo bolt (A). Move oil line out of the way slightly, taking care not to bend or kink line.



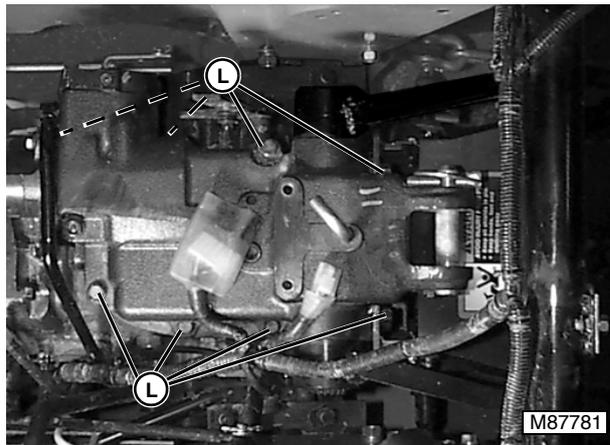
4. Make sure intake screen (B) is removed with banjo bolt (A). Clean screen with a suitable solvent.



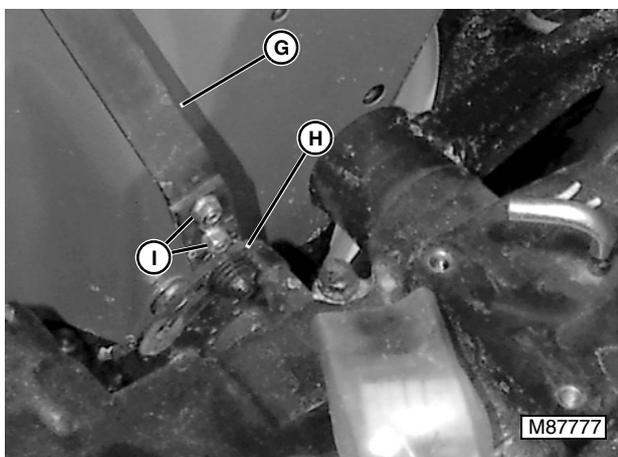
5. Remove C-clip (E) from universal joint on rockshaft control shaft.
6. Drive pin (C) from universal joint (D).



7. Remove cap screws (F) securing bracket to tunnel. Remove bracket and rockshaft control shaft assembly.



10. Remove capscrews (L) securing rockshaft housing to transmission. Remove rockshaft housing from transmission.



8. Remove two cap screws (I) securing depth control handle (G) to bracket (H).

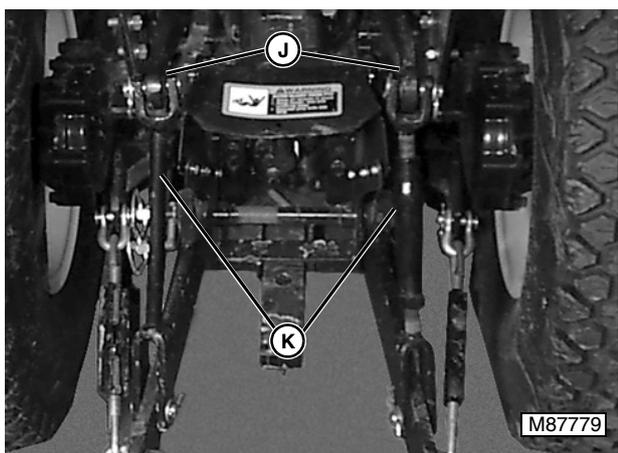
Installation:

Rockshaft installation procedure is the reverse of removal.

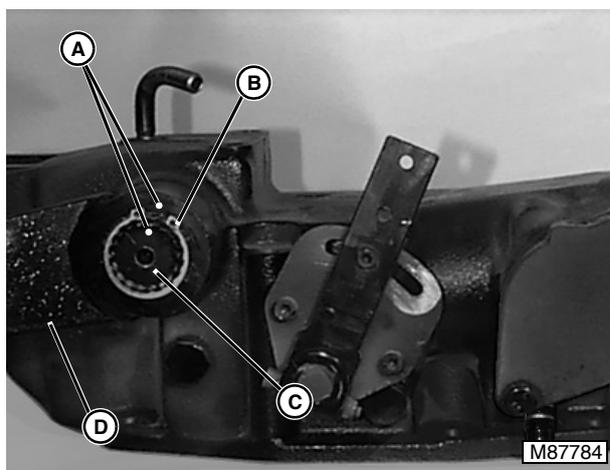
- Install lift arms, if they were removed. (See "LIFT ARMS REMOVAL AND INSTALLATION" on page 36.)
- Always use new gasket between rockshaft housing and transmission.
- Tighten banjo bolt to 17 N•m (150 lb-in.).

LIFT ARMS REMOVAL AND INSTALLATION

Removal:



9. Disconnect both draft links (K) from lift arms (J).



1. Remove external snap ring (B) from end of splined shaft (C).

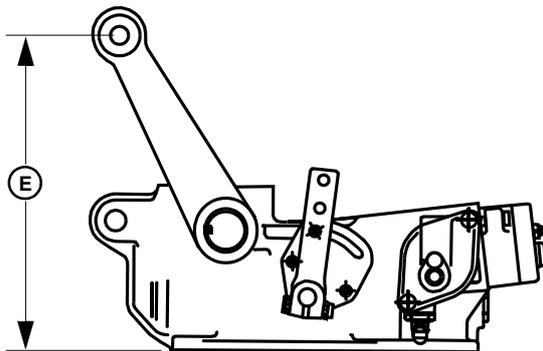
2. Use wire brush to clean paint and any dirt from end of splined shaft.
3. Mark (A) end of splined shaft (C) and lift arm (D) for ease of reassembly.
4. Use soft face hammer to tap inside of lift arm to remove lift arm from splined shaft.

ROCKSHAFT ASSEMBLY DISASSEMBLY AND INSPECTION

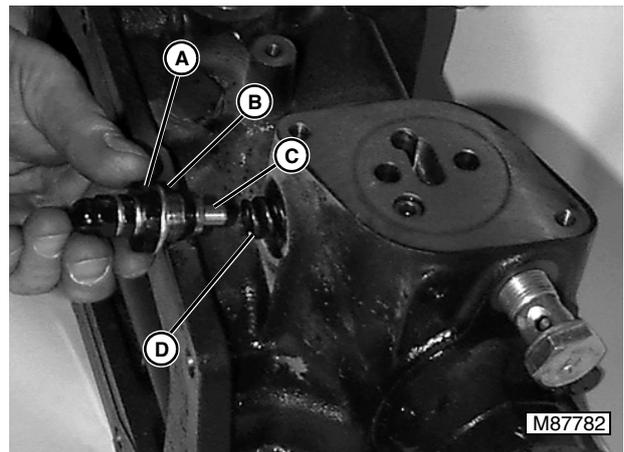
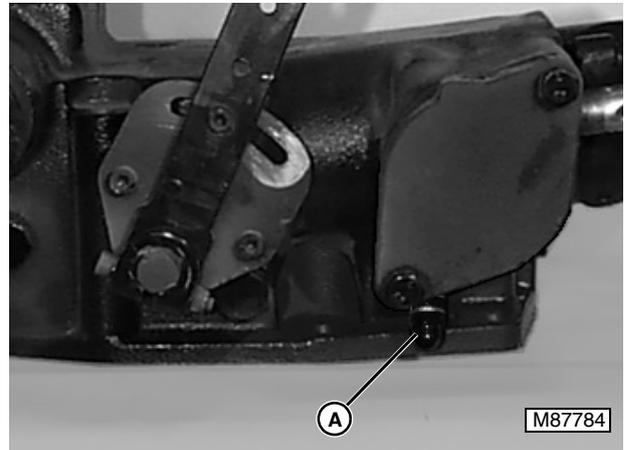
RELIEF VALVE REMOVAL AND INSTALLATION:

Installation:

- Align marks on splined shaft and lift arm and slide lift arms onto splines on rockshaft. If marks are not available (new lift arms or shaft) use following procedure:

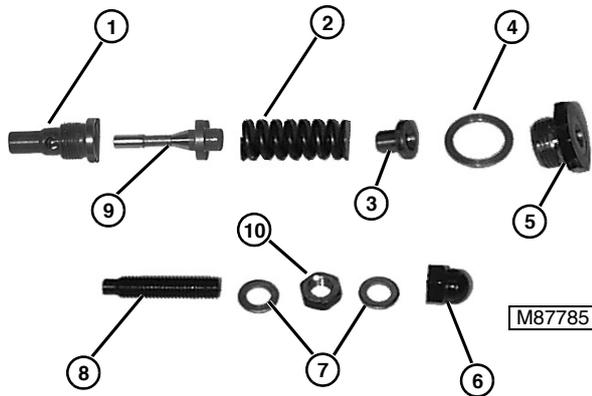


- Rotate rockshaft manually until upper mechanical stop is reached.
- Align lift arm, so that ball end center measures **279 – 281 mm (10.984 – 11.063 in.) (E)** from base, with splines on rockshaft and install.
- Secure with C-clip.
- Align second lift arm with first and install on rockshaft. Secure with C-clip. Check angle of both lift arms, they should be within **5°** of each other. If not, reset lift arms on splines and/or replace rockshaft.
- Once rockshaft assembly is installed on vehicle be sure to perform lift arm upper stop adjustment procedure. (See "LIFT ARM ADJUSTMENT" on page 24.)



1. Remove relief valve assembly (A), large copper washer (B) and spring follower (C).
2. Remove spring (D) and needle from valve bore.
3. Use a screwdriver with a **13 mm x 2 mm** blade to remove seat.





- | | |
|--------------------|--------------------|
| 1. Valve Seat | 6. Acorn Nut |
| 2. Spring | 7. Copper Washer |
| 3. Spring Follower | 8. Adjusting Screw |
| 4. Copper Washer | 9. Needle |
| 5. Nut | 10. Lock Nut |

4. Remove acorn nut.
5. Remove copper washer.
6. Remove lock nut.
7. Remove second copper washer.
8. Unscrew adjuster from body nut.
9. Remove copper washer from body nut.
10. Inspect all components for wear or damage. Replace as required.

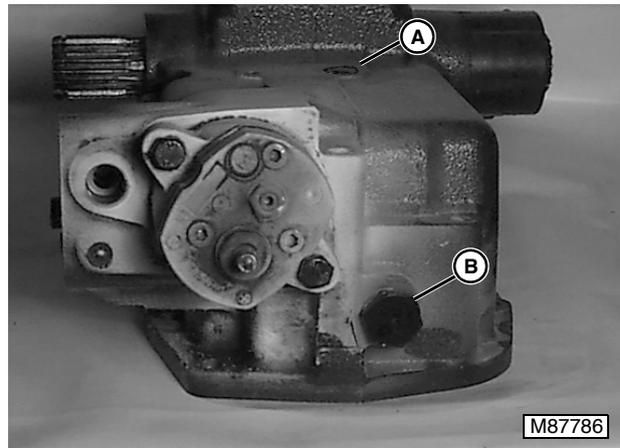


Installation:

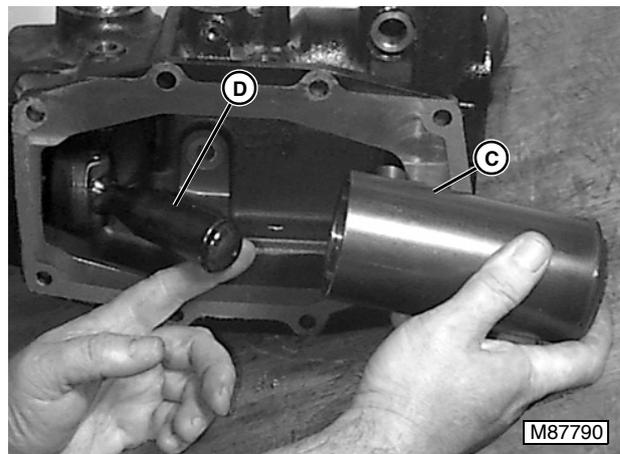
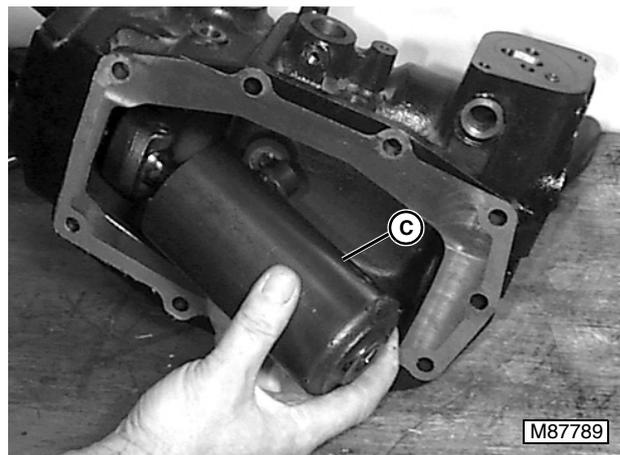
Assemble and install system relief valve in the reverse order of removal and disassembly.

- Adjust system relief pressure. (See "SYSTEM PRESSURE RELIEF ADJUSTMENT" on page 25.)

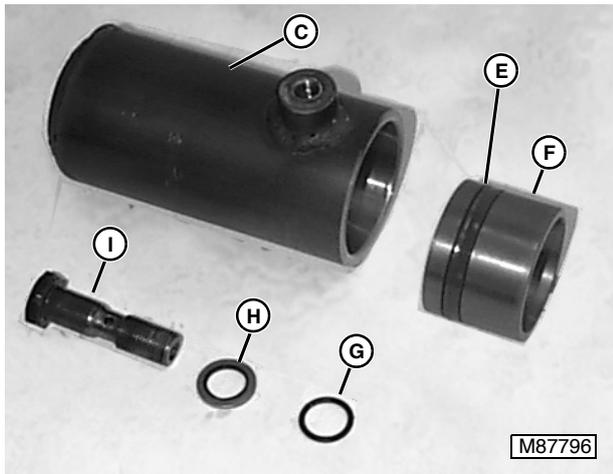
CYLINDER REMOVAL:



1. Remove socket head cap screw (A) securing cylinder to body.
2. Support cylinder and remove cylinder bolt (B) securing front of cylinder (C) to body.



3. Carefully rotate cylinder (C) out of body and separate cylinder from plunger (D).



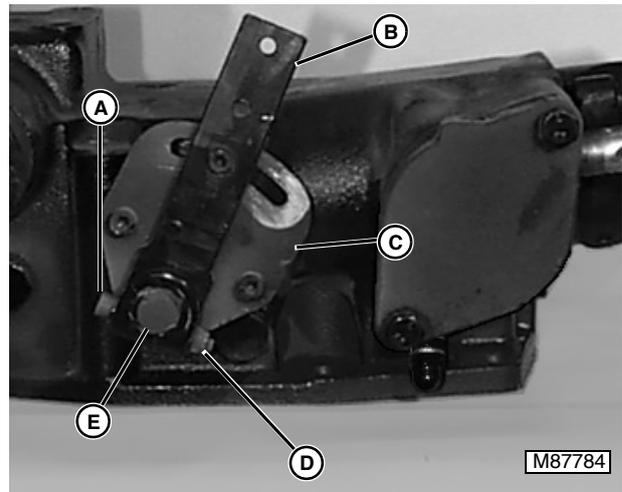
4. Hold cylinder (C) with large opening down and remove piston (F) from bore.
5. Inspect cylinder bore, piston (F), piston seal (E) and special bolt (I) for damage. Replace as necessary.
6. Replace O-ring (G) and seal washer (H).

DEPTH CONTROL MECHANISM REMOVAL:

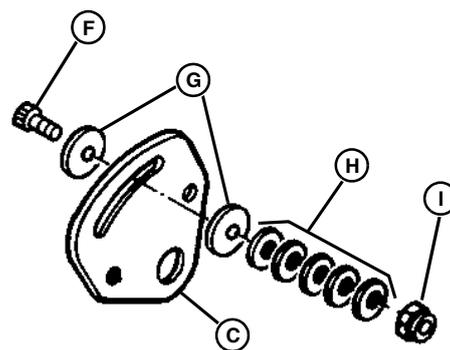
1. Remove cylinder if not already removed. (See "CYLINDER REMOVAL:" on page 38.)
2. Remove rockshaft control valve. (See "ROCKSHAFT CONTROL VALVE REMOVAL AND INSTALLATION" on page 43.)

NOTE: Depth control mechanism components must be removed and replaced in order. Incorrect assembly will result in damage to components which in turn could severely damage entire mechanism.

IMPORTANT: Do not force components during disassembly or assembly. Clearances are tight and components must be free to move for depth control mechanism to function correctly.

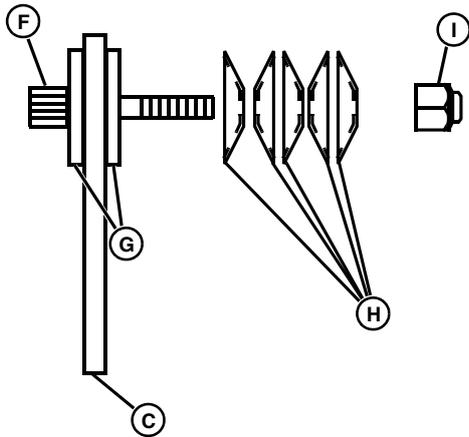


3. Remove nylock nut (D) and socket head cap screws (A) from bracket (B). Remove bracket from end of eccentric actuator (E).
4. Remove two (2) socket head cap screws securing plate (C) to housing. Remove plate.

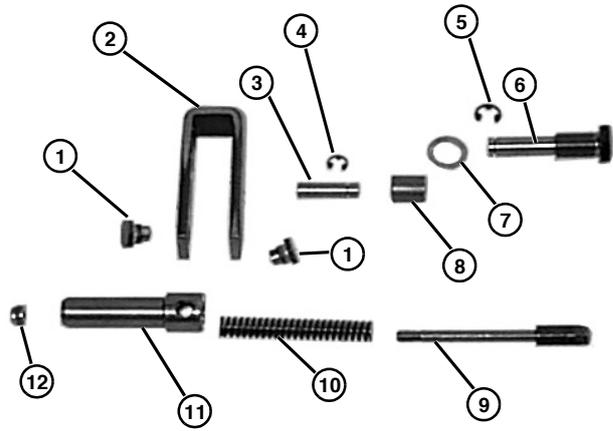


5. Remove Nylock nut (I) from end of socket head cap screw (F).
6. Remove stack of Belleville washers (H) and washers (G) from socket head cap screw.
7. Remove plate (C).
8. Inspect component for wear or damage paying special attention to make sure that Belleville washers are not flattened. Replace as required.





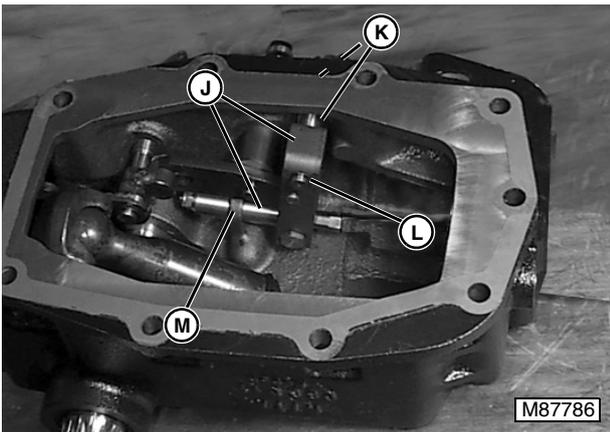
9. When reassembling make sure that Belleville washers (H) are installed as shown in illustration so they act like a spring. Tighten Nylock nut (I) until correct friction is achieved between washers (G) and plate (C).



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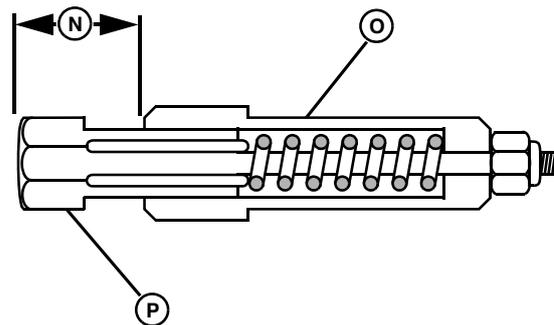
- | | | |
|-----------------|------------------|--------------|
| 1. Pivot Screw | 5. Large E-Clip | 9. Stop Rod |
| 2. Yoke | 6. Pivot Bolt | 10. Spring |
| | (57 mm Long) | |
| 3. Axle | 7. Copper Washer | 11. Body |
| 4. Small E-Clip | 8. Roller | 12. Lock Nut |

13. Remove body/stop rod assembly (J) from yoke by removing pivot screws (2) from either side of yoke.
14. Remove stop rod from body by removing lock nut from end of threaded stop rod.
15. Remove roller from yoke by removing E-clip from axle (located between roller and yoke).
16. Inspect component for wear or damage. Replace as required.

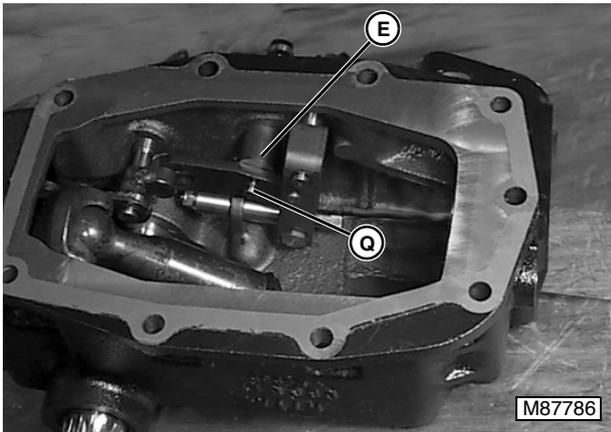


M87786

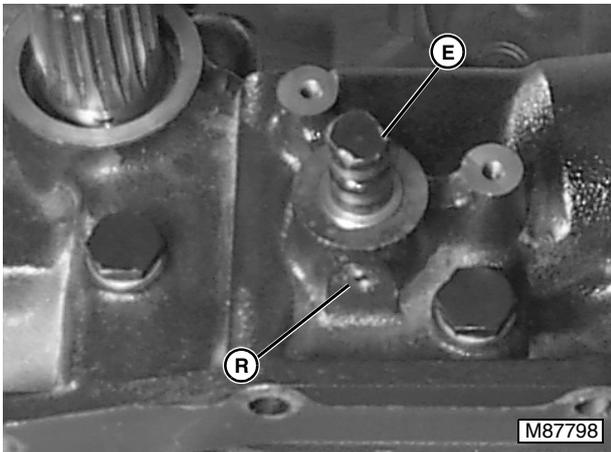
10. Remove E-clip (L) retaining plunger assembly to pivot bolt (K).
11. Unscrew pivot bolt (K) - 57 mm (2.244 in.) long - from outside of body making sure that plunger assembly does not bind on shaft of pivot bolt during removal.
12. Slide plunger from guide (M) and remove plunger assembly from body.



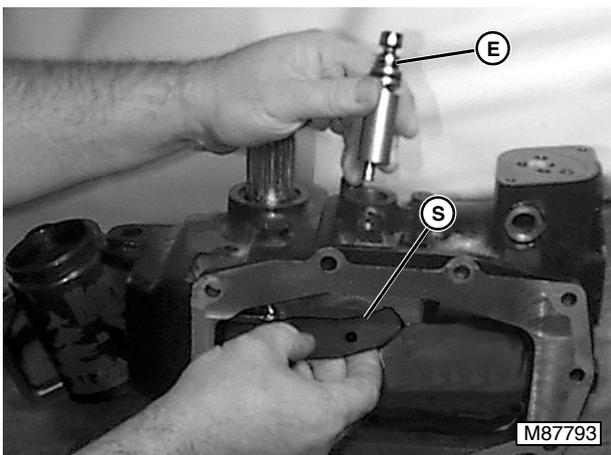
17. When assembling stop rod (P) in body (O), adjust lock nut until stop rod extends 18 mm (0.709 in.) (N) from body.



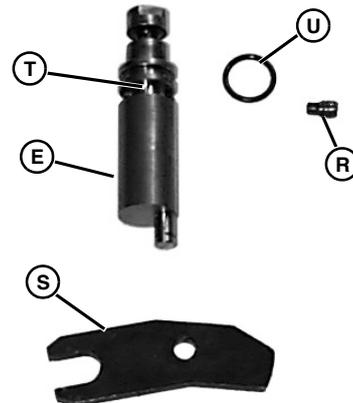
18. Remove E-clip (Q) retaining cam plate to eccentric actuator (E).



19. Remove set screw (R).



20. Remove eccentric actuator (E) from outside of housing and cam plate (S) from inside of housing.

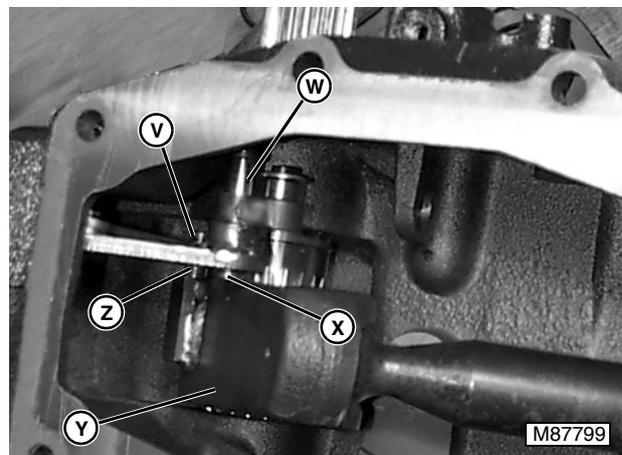


21. Measure eccentric actuator outside diameter and bore in housing. Replace if not in specifications.

Eccentric Actuator Specifications:

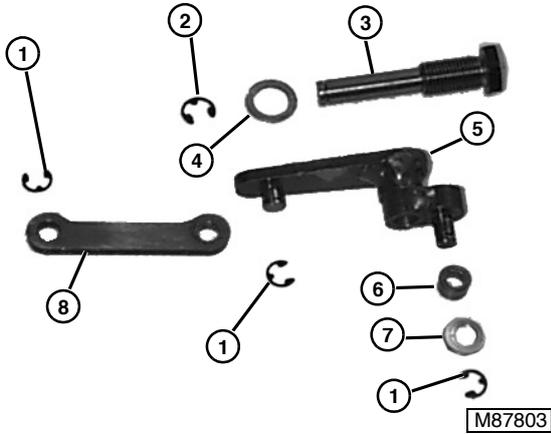
OD 21.95 mm (0.864 in.)
 Bore ID 22.00 mm (0.866 in.)

22. Inspect eccentric actuator (E), O-ring (U), set screw (R), cam plate (S), and roll pin (T) for damage or wear. Replace as required.



- 23. Remove E-clip (X) from pivot bolt (W).
- 24. Remove E-clip (V) from end of stud (Z) on arm (Y).
- 25. Unscrew pivot bolt (W) - 67 mm (2.637 in.) long - from outside of body making sure that pivot link does not bind on shaft of pivot bolt during removal.
- 26. Slide link from stud end and remove link assembly from body.





- | | |
|-------------------------------|---------------|
| 1. Small E-Clip | 5. Pivot Link |
| 2. Large E-Clip | 6. Roller |
| 3. Pivot Bolt
(67 MM Long) | 7. Washer |
| 4. Copper Washer | 8. Link |

27. Separate links by removing small E-clip securing link to pivot link. Remove small E-clip retaining washer and roller on pivot link.
28. Inspect component for wear or damage. Replace as required

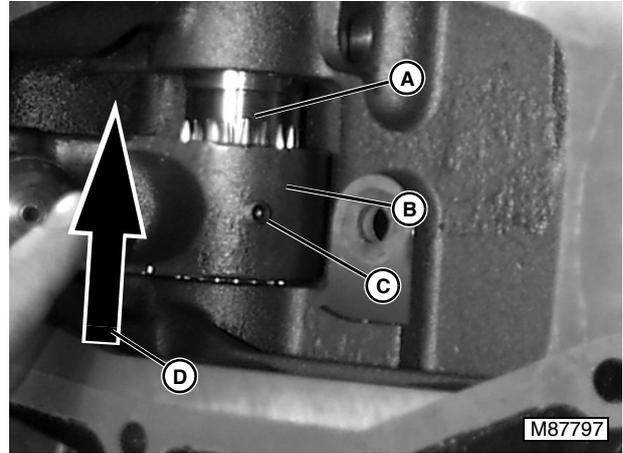
Installation:



Installation is the reverse of removal. Be sure to pay attention to orientation of components when assembling.

IMPORTANT: Do not force components during disassembly or assembly. Clearances are tight and components must be free to move for depth control mechanism to function correctly.

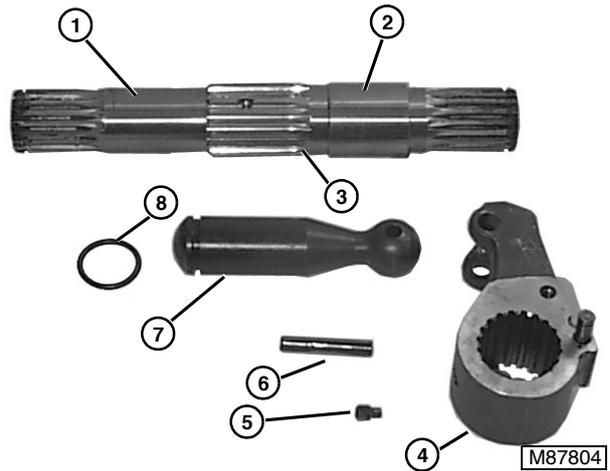
ROCKSHAFT REMOVAL



1. Remove set screw (C) securing arm (B) to rockshaft.

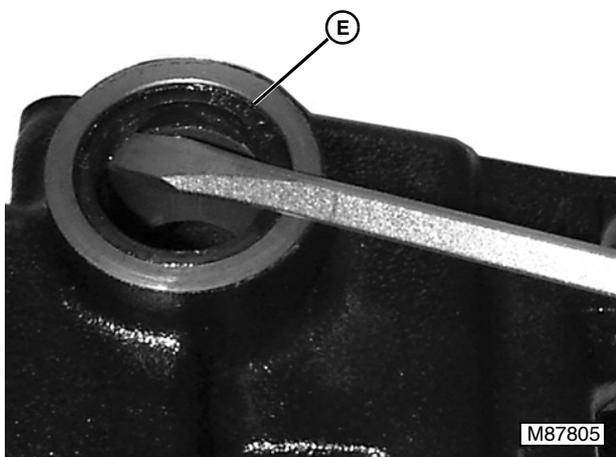
IMPORTANT: Rockshaft can only be removed from one side of housing due to stepped bearing surfaces. Be sure to determine correct orientation of rockshaft before attempting to remove rockshaft from housing.

2. Determine to which side of rockshaft splines are cut (shallow taper in splines (A)). This is direction (D) rockshaft must move for removal.
3. Using a press remove rockshaft from housing.

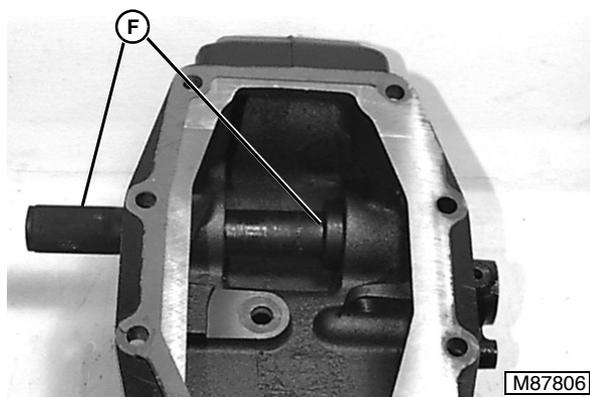


- | | |
|---------------------|--------------|
| 1. Small Bearing OD | 5. Set Screw |
| 2. Large Bearing OD | 6. Roll Pin |
| 3. Rockshaft | 7. Plunger |
| 4. Arm | 8. O-Ring |

4. Measure Rockshaft bearing surfaces. Replace rockshaft if not within specifications
5. Inspect component for wear or damage. Replace as required



6. Using a screwdriver remove rockshaft seals (E) from housing.
7. Measure bushings. Replace if not within specifications.



8. If bushings require replacement use appropriate bushing driver (F) to remove rockshaft bushings. Drive bushings out from inside of housing. Replace by driving in from outside of housing.

NOTE: THE FOLLOWING MEASUREMENTS ARE FOR NEW COMPONENTS, AND DO NOT REFLECT WEAR SPECIFICATIONS.

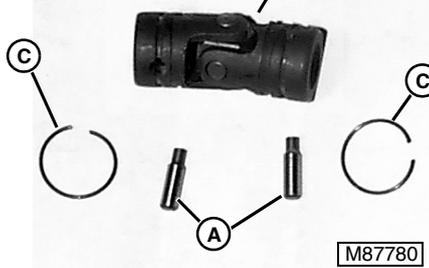
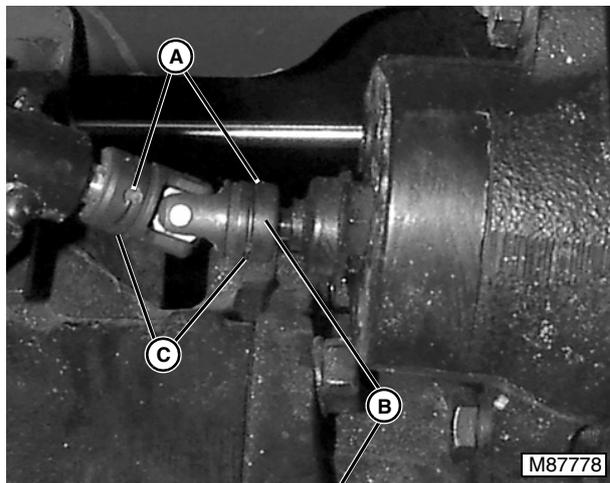
Rockshaft Specifications:

Shaft Large Bushing OD	39.93 mm (1.572 in.)
Shaft Small Bushing OD	34.94 mm (1.375 in.)
Large Bushing ID	40.08 mm (1.578 in.)
Small Bushing ID	35.13 mm (1.383 in.)

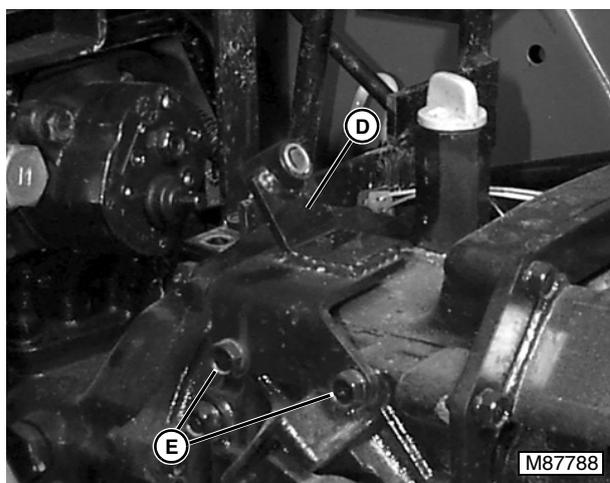
ROCKSHAFT CONTROL VALVE REMOVAL AND INSTALLATION

Removal:

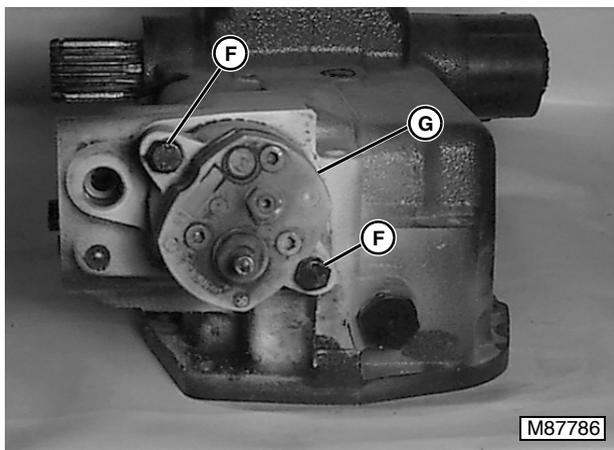
1. Remove tunnel cover.



2. Remove both C-clips (C) from universal joint (B) on speed control shaft.
3. Drive both pins (A) from universal joint and remove speed control shaft from universal joint and universal joint from input shaft.



- Remove two capscrews (E) securing bracket (D) to side of transmission. Remove bracket.



- Remove two (2) cap screws (F) securing rockshaft control valve (G) to housing.
- Remove rockshaft control valve from housing taking care not to damage O-rings on valve body.
- Disassemble and inspect rockshaft control valve. (See "ROCKSHAFT CONTROL VALVE DISASSEMBLY, INSPECTION & ASSEMBLY" on page 44.)

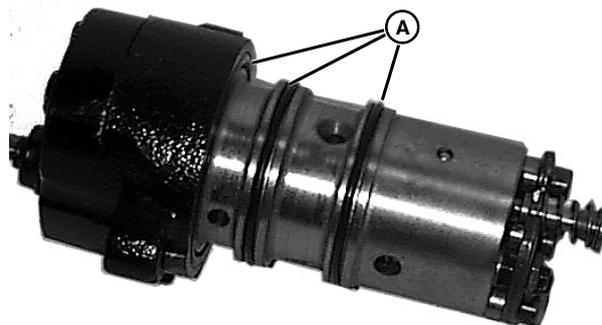
Installation:

NOTE: Installation is carried out in reverse order of removal.

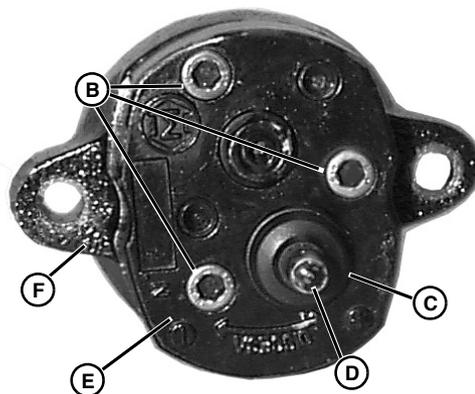
- Install new O-rings on body of rockshaft control valve if required.
- Orient rockshaft control valve so that the mounting holes line up with the appropriate holes in the housing with the rockshaft control shaft located towards the bottom of the housing (See removal story step #5.)
- Lubricate rockshaft control valve bore in housing with hydraulic oil and being careful not to damage O-rings, slide rockshaft control valve into housing. Secure with two capscrews.
- Install bracket and secure with two capscrews.
- Install rockshaft control shaft and U-joint securing with two pins and C-clips.
- Replace tunnel cover.

ROCKSHAFT CONTROL VALVE DISASSEMBLY, INSPECTION & ASSEMBLY

- Remove rockshaft control valve from rockshaft housing. (See "ROCKSHAFT CONTROL VALVE REMOVAL AND INSTALLATION" on page 43.)

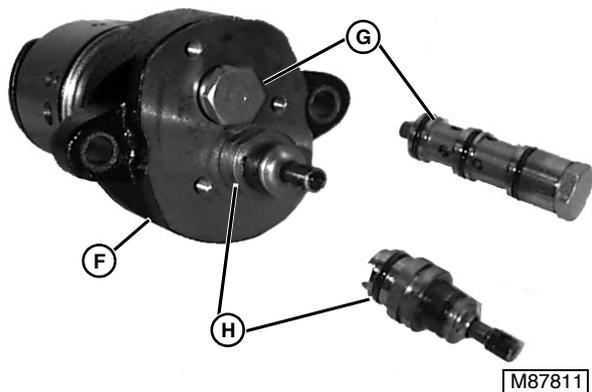


- Remove O-Rings (A) from outside of body.

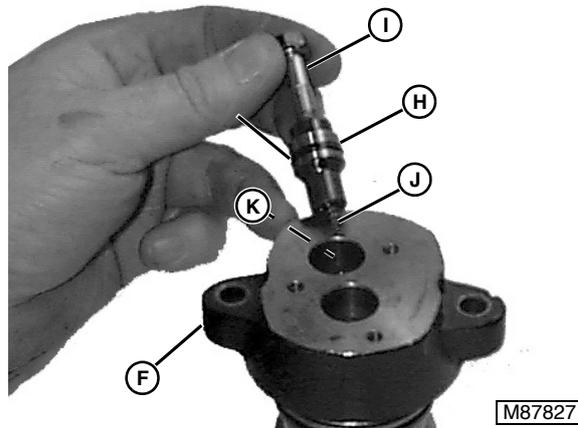


- Remove rubber boot (C) from speed control shaft (D).
- Remove three socket head cap screws (B) securing head (E) to body (F) of rockshaft control valve.

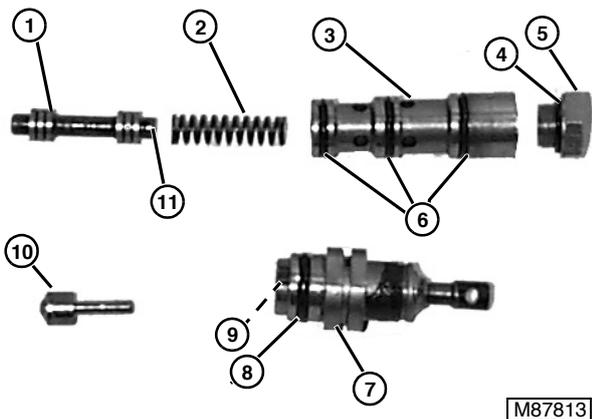
HYDRAULICS ROCKSHAFT CONTROL VALVE DISASSEMBLY, INSPECTION & ASSEMBLY



5. Remove spool valve (G) from head end of body (F).
6. Remove speed control valve (H) from head end of body.



8. Screw a bolt (I) into speed control valve (H) located under speed control valve and remove valve.
9. Remove spring (J) and ball (K) under valve.
10. Inspect components for wear paying special attention to ball and seats. Replace as required.



- | | | |
|-----------|------------|-----------------------|
| 1. Spool | 5. Cap | 9. O-Ring |
| 2. Spring | 6. O-Rings | 10. Needle |
| 3. Body | 7. Body | 11. Balancing Passage |
| 4. O-Ring | 8. O-Ring | |

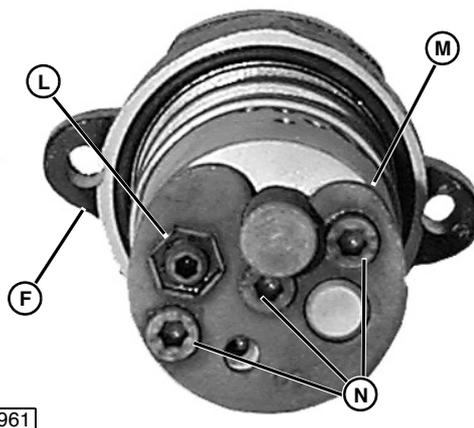
NOTE: Valves are composed of matched components (spools, springs, body, etc.) If any component shows wear entire valve must be replaced.

NOTE: Orientation of balancing passage in one end of spool is very important. This balancing passage must be assembled facing towards cap of spool valve.

7. Inspect components for wear. Replace as required.

IMPORTANT: End plate is under tension from valve springs. **DO NOT** remove socket head cap screws securing end plate (M) to body without retaining head as indicated in story.

DO NOT disturb set screw with lock nut (L)! Removing this screw will change internal relief pressures.



11. Remove center socket head cap screw (N). Use one of the socket head cap screws that were used to secure head to body (F) (longer than plate screw) in center hole.
12. Place valve, head end down, on a level surface to reduce chance of losing internal components.

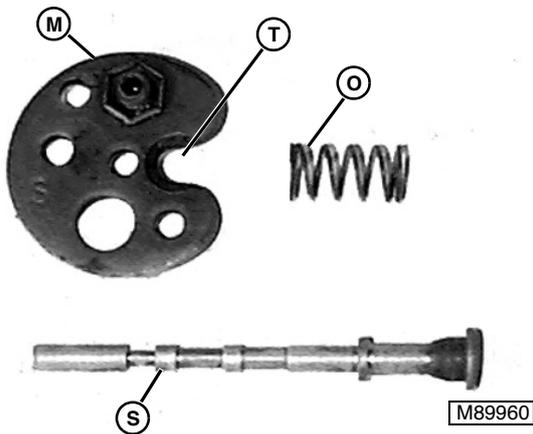
ROCKSHAFT CONTROL VALVE DISASSEMBLY, INSPECTION & ASSEMBLY HYDRAULICS

13. Back off all three screws (N) evenly until two outside screws disengage from threads in body. At this point spring tension will be relieved to a safe level. Unscrew center screw and remove.



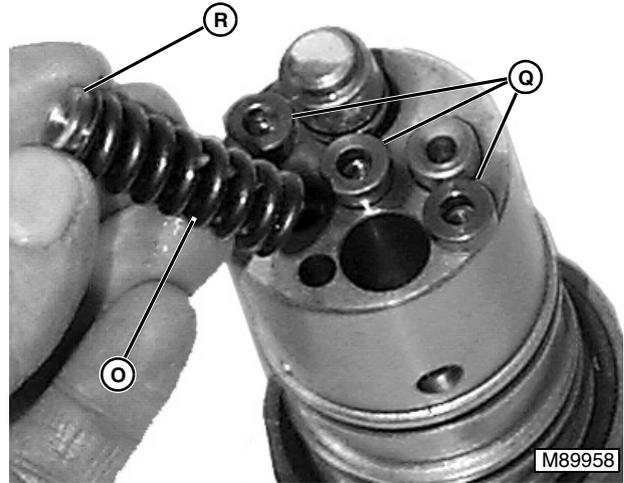
M89959

14. Remove end plate (M), spring (O) and valve spool (S) as a unit.
 15. Note location of spacers (Q), piston (P), and spring followers (R).



M89960

16. Compress spring (O) until it is free of spring pocket (T) and remove spring and valve spool (S) from end plate (M).



M89958

17. Remove spacers (Q).
 18. Remove spring follower (R) and spring (O) from body.



M89962

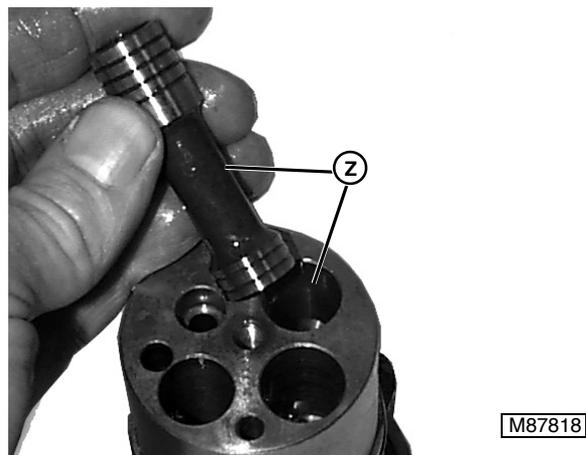
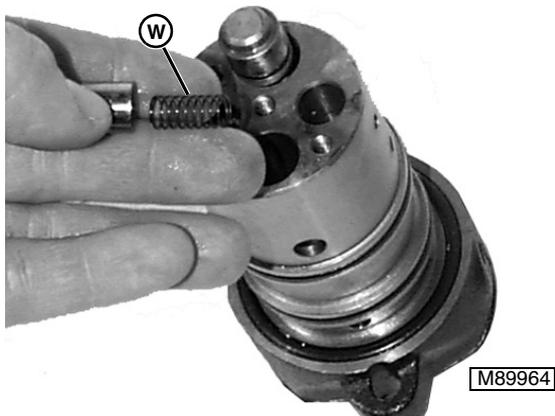
19. Use magnet to remove ball from body. Also remove ball seat if it did not come out with spring.



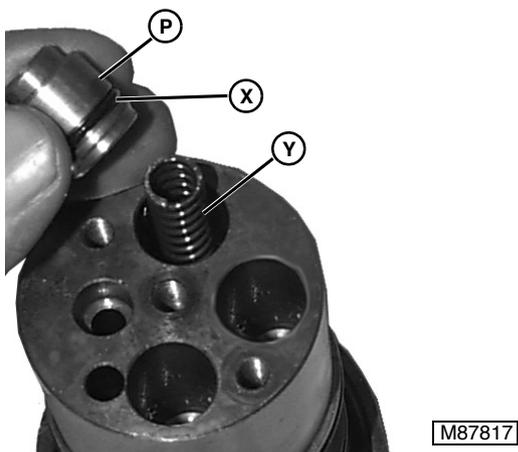
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HYDRAULICS ROCKSHAFT CONTROL VALVE DISASSEMBLY, INSPECTION & ASSEMBLY

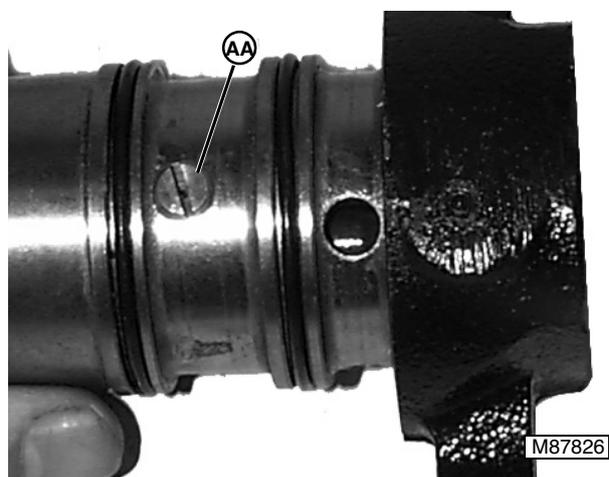
20. Remove relief valve (V) with O-Ring (U) from body.



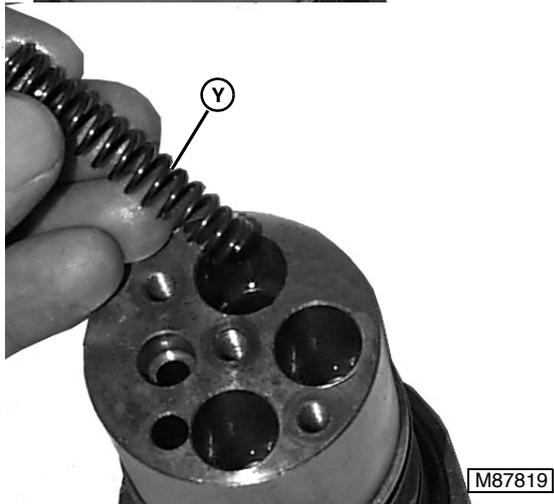
21. Remove relief valve spring (W) from body.



24. Remove spool (Z) from body.



25. Remove orifice screw (AA) from side of body.
 26. Make sure hole in orifice screw is not plugged or damaged.



22. Remove piston (P) and piston spring (Y) from body.
 23. Inspect O-ring (X) on piston. Replace if damaged.

IMPORTANT: DO NOT attempt to remove balls used to block drill passages in body.

- 27. Clean body and components in suitable solvent. Carefully blow out all passages in body with compressed air.
- 28. Inspect body and all components for wear or damage. Pay special attention to be sure that ports and small passages are clean and open. Replace as required.

NOTE: Individual components of speed control valve are not serviceable. If body and/or components are worn or damaged the entire speed control valve must be replaced as a unit.

ROCKSHAFT CONTROL VALVE DISASSEMBLY, INSPECTION & ASSEMBLY HYDRAULICS

Assembly:

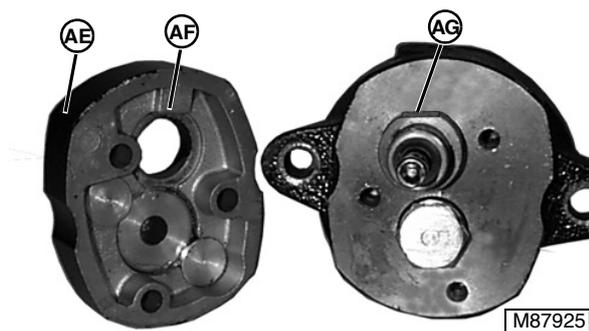
NOTE: Assembly is carried out in reverse order of disassembly.

- Lubricate all components liberally with hydraulic fluid during assembly.
- Always install new O-rings when reassembling components.

- secure head (E) to body (F) with socket head cap screws (B).
- Replace rubber boot (C) on speed control shaft (D).



- Make sure that balancing passage (AC) in spool (AB) is facing cap (AD) of spool valve.



- Make sure that flat (AG) on speed control valve lines up with flat (AF) on the inside of the cover (AE) when installing head cover.

