# ARROW - MASTER

**MOBILE HYDRAULIC HAMMER**

# MODEL 1350

## Service Manual

**Publication No. 5000054**
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**SERIAL NUMBER:** _____

**SOLD AND SERVICED BY:** _____

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**ARROW-MASTER, INCORPORATED**

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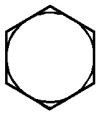
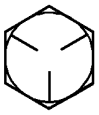
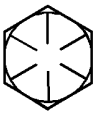
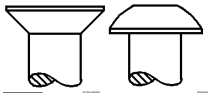
# Table III - Bolt and Cap Screw Torque Specifications

| MATERIAL SPEC AND MARKING | Hex Head Bolts & Hex Head Cap Screws | | | Socket Head Cap Screws | |
|---|---|---|---|---|---|
| | SAE Grade 2 ASTM A307 (No Mark)  | Grade 5* ASTM A449  | Grade 8* ASTM A354  | Grade 8  | **  |

*** Manufacturer's marks may vary**

**** For Flat and Button Head Socket Cap Screws, use Grade 5 minimum recommended torque values.**

| Size (Inches) | Grade 2 Recommended Torque*** | | | | Grade 5 Recommended Torque*** | | | | Grade 8 Recommended Torque*** | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | lb-ft | | N•m | | lb-ft | | N•m | | lb-ft | | N•m | |
| | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. | Min. | Max. |
| 1/4 | 5 | 6 | 6.8 | 8.1 | 9 | 11 | 12.2 | 14.9 | 12 | 15 | 16.3 | 20.3 |
| 5/16 | 10 | 12 | 13.6 | 16.3 | 17 | 21 | 23.1 | 28.5 | 24 | 29 | 32.5 | 39.3 |
| 3/8 | 20 | 23 | 27 | 31 | 35 | 42 | 48 | 57 | 45 | 54 | 61 | 73 |
| 7/16 | 30 | 35 | 41 | 47 | 54 | 64 | 73 | 87 | 70 | 85 | 95 | 115 |
| 1/2 | 45 | 52 | 61 | 70 | 80 | 96 | 108 | 130 | 110 | 125 | 149 | 170 |
| 9/16 | 65 | 75 | 88 | 102 | 110 | 125 | 149 | 170 | 160 | 175 | 217 | 237 |
| 5/8 | 95 | 105 | 129 | 142 | 150 | 175 | 203 | 237 | 220 | 245 | 298 | 332 |
| 3/4 | 150 | 185 | 203 | 251 | 270 | 300 | 366 | 407 | 380 | 425 | 515 | 576 |
| 7/8 | 160 | 200 | 217 | 271 | 400 | 450 | 542 | 610 | 600 | 660 | 814 | 895 |
| 1 | 250 | 300 | 339 | 406 | 580 | 680 | 786 | 922 | 900 | 990 | 1220 | 1342 |
| 1-1/8 | | | | | 800 | 175 | 1085 | 1193 | 1280 | 1440 | 1736 | 1953 |
| 1-1/4 | | | | | 1120 | 1240 | 1519 | 1681 | 1820 | 2000 | 2468 | 2712 |
| 1-3/8 | | | | | 1460 | 1635 | 1980 | 2217 | 2380 | 2720 | 3227 | 3688 |
| 1-1/2 | | | | | 1940 | 2180 | 2631 | 2956 | 3160 | 3560 | 4285 | 4827 |

***** Use minimum recommended torque value when threads are coated with a lubricant, such as engine oil, or fasteners with phosphate and oil coatings. Use maximum recommended torque value for dry fasteners or zinc plated fasteners without any lubricant.**

**Notes: 1. This specification is intended to be a general guideline for coarse threaded hardware in ferrous materials (steel, cast-iron).**

**2. Thread engagements in non-ferrous materials (aluminum, brass, plastic, etc.) may not be adequate to allow torque specified above.**

**3. Where a particular application gives specific torque values, use them in lieu of those given above.**

## Table i-2 -Wheel Lug Nut Torque Specifications

| Steering Axle | | Drive Axle | |
|---|---|---|---|
| 1/2"-20 Thread | 70-90 lb-ft (95-122 N•m) | 5/8"-18 Thread | 175-225 lb-ft (238-306 N•m) |
| 9/16"-18 Thread | 110-140 lb-ft (150-190 N•m) | 3/4"-16 single cap nut | 450-500 lb-ft (612-680 N•m) |
| 5/8"-18 Thread | 175-225 lb-ft (238-306 N•m) | 3/4"-16 inner cap nut | 450-500 lb-ft (612-680 N•m) |
| | | 1-1/8"-16 outer cap nut | 450-500 lb-ft (612-680 N•m) |

# Adjustments

## CABLE LENGTH

In order to account for differences in the length of certain tools it may be necessary to make adjustments to the length of the cable.* Refer to Figure 7-1 and use the following procedure when adjusting the cable:

1. Move the auto-manual control valve handle forward to the manual/start position and set the parking brake.
2. Start the engine and raise the lead to the vertical position with the layback control. Move the lead all the way to the right-hand side of the slide using the sideshift control.
3. Lower the tool to the ground or flat surface by pushing forward on the hammer control valve handle. Shut the engine off.
4. Loosen the cable wedge at the hammer weight or at the base of the lift cylinder. (Refer to Figure 7-1)
5. Start the engine and use the hammer control valve handle to carefully extend the lift cylinder upward 10 inches (25 cm) above the bottom of the stroke. Shut the engine off.
6. Pull the slack out of the cable and resecure the wedge(s).
7. Restart the engine and use the hammer control valve handle to carefully extend the lift cylinder to its maximum length. The weight should stop no closer than 6-10 inches (15 - 25 cm) from the stop blocks located near the top of the lead. Readjust the cable, if necessary, to obtain the correct gap.

**NOTICE** **If the cable length is too short, or improperly set, it may be possible to adjust the lift height so that the weight strikes the upper travel limit stop blocks on the lead. Striking the travel limit stop blocks can cause severe structural damage to the machine. Make sure that the lift height and cable length are properly set to prevent damage to the machine.**

* When the Arrow hammer is shipped from the factory, the cable length has been set for use with a short tool such as a breaker or a scoring tool. If a longer tool is to be used, it may be necessary to shorten the cable setting as described above. On mechanically adjusted units, the automatic trip fingers will not be in the proper position in relationship to hammer stroke unless cable length is properly adjusted. The cable length must be set long enough to enable the hammer to strike a full blow before starting the up stroke. Too long a cable will result in a time lag between strokes. Minor changes in cable length can be accounted for without making physical changes to the cable setting by adjusting the mechanical up and down limit trips on mechanically actuated units. Machine equipped with electronic stroke control are self-compensating for minor changes in cable length.

## REPLACING THE CABLE

Inspect the cable daily. If the cable is badly worn, bent, kinked, or has broken wires or strands, it must be replaced. The Arrow Hammer is equipped with either a one-piece cable or a cable spool. A one-piece cable will require replacement whenever the cable is broken, damaged, or frayed. The cable spool, which holds 250 ft. (76 m) of spare cable, permits replacement of the broken or damaged section only.

### Cable Spool - Refer to the following instructions and Figure 7-1.

*NOTE: When carrying spare cable, Do not cut the cable between the cable spool and the lift cylinder. Cable fraying usually starts near the end of the cable closest to the weight. Leaving the cable intact makes it possible to feed only as much cable as needed to replace the damaged section. Using this procedure, insures the most efficient use of the cable on the cable spool.*

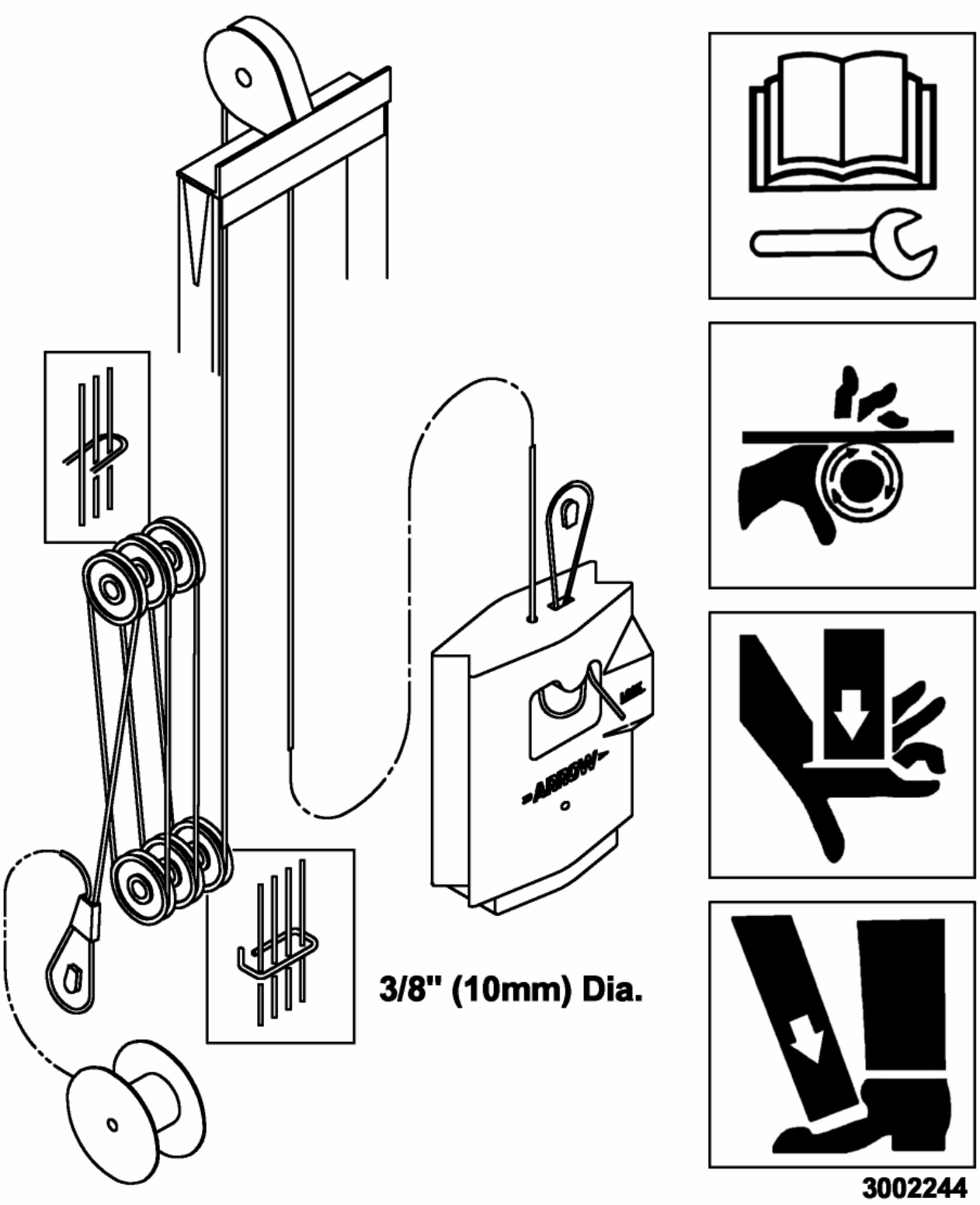



*Figure 7-1*
*CABLE THREADING*

## REPLACING THE CABLE - *Cable Spool cont'd.*

1. Lock the hammer weight (See Figure 5-3) and lay the lead back into the stowed transport position. Shut the engine off and set the parking brake.

*NOTE: If the cable has broken during operation, it will not be possible to raise and lock the hammer weight. DO NOT attempt to lay the lead back with the hammer weight on the ground. Retract the lift cylinder completely and temporarily re-attach the broken cable end to the hammer weight. Lift and lock the hammer weight in place before proceeding.*

2. Remove both cable wedges and the cable clamp. Remove the broken or damaged section of cable.
3. Loosen the cable spool nut and rethread the cable as needed (refer to Figure 7-1). Make sure the cable is threaded inside the two retaining loops on the attachment bracket.
4. Thread the cable back through the hammer weight. Reinstall the cable wedge and cable clamp.

*NOTE: When replacing a section of damaged cable, pull the cable through the hammer weight until the damaged section is clear of the cable wedge when reinstalled. Cut and discard the damaged section.*

5. Follow the procedure for adjusting the CABLE LENGTH to complete the installation. Be sure to retighten the spool nut before resuming operation.

### Short Cable - 51' (15.5 m) Minimum - Refer to the following instructions and Figure 7-1.

1. Lock the hammer weight (See Figure 5-3) and lay the lead back into the stowed transport position. Shut the engine off and set the parking brake.

*NOTE: If the cable has broken during operation, it will not be possible to raise and lock the hammer weight. DO NOT attempt to lay the lead back with the hammer weight on the ground. Retract the lift cylinder completely and temporarily re-attach the broken cable end to the hammer weight. Lift and lock the hammer weight in place before proceeding.*

2. Remove both cable wedges (Refer to Figure 7-1).
3. Remove the broken or damaged cable. Be sure to remove and retain the cable clamp.
4. Insert the end of the new cable at the base of the lift cylinder and reinstall the cable wedge (Refer to Figure 7-1).
5. Thread the cable through the sheaves in the lift cylinder as shown in Figure 7-1. Make sure that the cable is threaded inside the two retaining loops on the attachment bracket (Refer to Figure 7-1).
6. Run the cable through the sheave at the top of the lead and back down to the weight.
7. Reinstall the cable wedge and the cable clamp at the hammer weight.
8. Follow the procedure for adjusting the CABLE LENGTH to complete the installation.

Refer to the "**Specifications**" section for proper cable specifications. Minimum length for the cable is 51 ft. (15.5 m). Replacement part numbers: 4001024 - 51 ft. (15.5 m), 2000616 - 250 ft. (76 m)

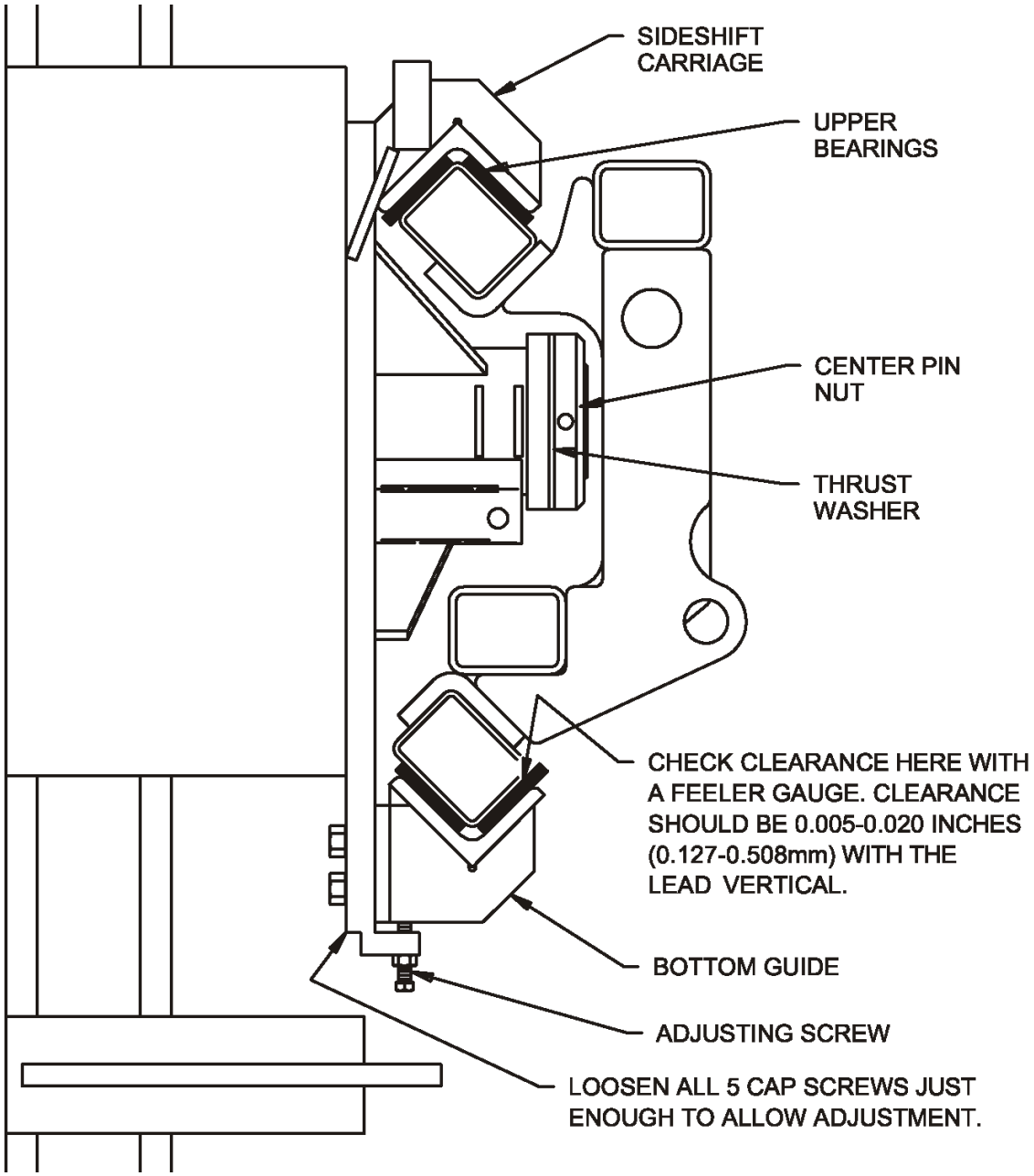



*Figure 7-2*
*CARRIAGE & CENTER PIN ADJUSTMENTS*

## CROSS-SLIDE BEARING ADJUSTMENT

The carriage assembly is equipped with plastic slider bearings which operate in contact with the surfaces of the sideshift ways. It will occasionally be necessary to adjust these bearings for wear. (Refer to Figure 7-2)

1. Using the layback control valve, raise the lead into a vertical position.
2. Using the sideshift control valve, move the carriage assembly to a position approximately 3 inches (8 cm) from the extreme right hand end of its travel.
3. Loosen, but **DO NOT REMOVE**, the bolts that attach the lower bearing retainer to the carriage assembly. (Refer to Figure 7-2)

**⚠WARNING** **Removal of the bottom guide will allow the lead and carriage assembly to tip off the sideshift frame in any direction. Do not remove the bottom guide unless the top of the lead has been properly secured such as to an overhead hoist or crane.**

4. Loosen the jam nuts from the adjustment screws located at the bottom of the carriage assembly.
5. Turn the adjustment screws to obtain a running clearance of 0.005" to 0.020" (0.127 - 0.508 mm) at the lower bearing. (Refer to Figure 7-2)
6. Retighten the jam nuts and the mounting bolts.
7. Clean the sideshift ways and apply fresh lubricant to the slide contact surfaces of the ways.
8. Check the sideshift mechanism for freedom of movement by shifting the mechanism from side to side.
9. Readjust to provide greater bearing clearance as required for freedom of movement.

## CARRIAGE BEARING END PLAY

The center pivot bearing on the carriage assembly should be checked periodically for end play. To adjust the end play, refer to Figure 7-2 and use the following procedure:

1. Lay the lead down onto the lead rest and shut the engine off.
2. Move the layback control valve lever both directions to relieve any cylinder pressure.
3. Using standard feeler gauges, check the end play between the thrust washer and the retaining ring at the back of the carriage center pivot. (Refer to Figure 7-2)
4. The correct end play is 0.005" to 0.010" (0.127 - 0.254 mm).
5. Loosen the lock bolt on the retaining ring.
6. Turn the retaining ring clockwise to reduce the end play.
7. Retighten the lock bolt.

## SIDESHIFT CHAIN

To adjust the tension on the sideshift drive chain, refer to Figure 7-3 and the following procedures:

1. Using the layback control valve, raise the lead into an upright position.
2. Using the sideshift control valve, move the carriage until it is approximately 3 inches (8 cm) away from the right hand travel limit.
3. Loosen the jam nuts on each of the two chain adjustment screws located at the rear of the carriage, near the center pivot. (Refer to Figure 7-3)
4. Adjust both screws equally until the slack has been removed from the chain.

**NOTICE** **Do not over tighten the sideshift chain. Over tightening will lead to excess wear and possible failure of he chain and chain drive components.**

5. To check for proper chain tension, locate the approximate center of the chain span. Grasp two adjacent strands of the chain between thumb and forefinger. It should be easy to deflect each chain approximately 1 inch (2.5 cm), but difficult to make the chains touch.
6. Retighten the nuts and the jam nuts on the chain tensioning screws.

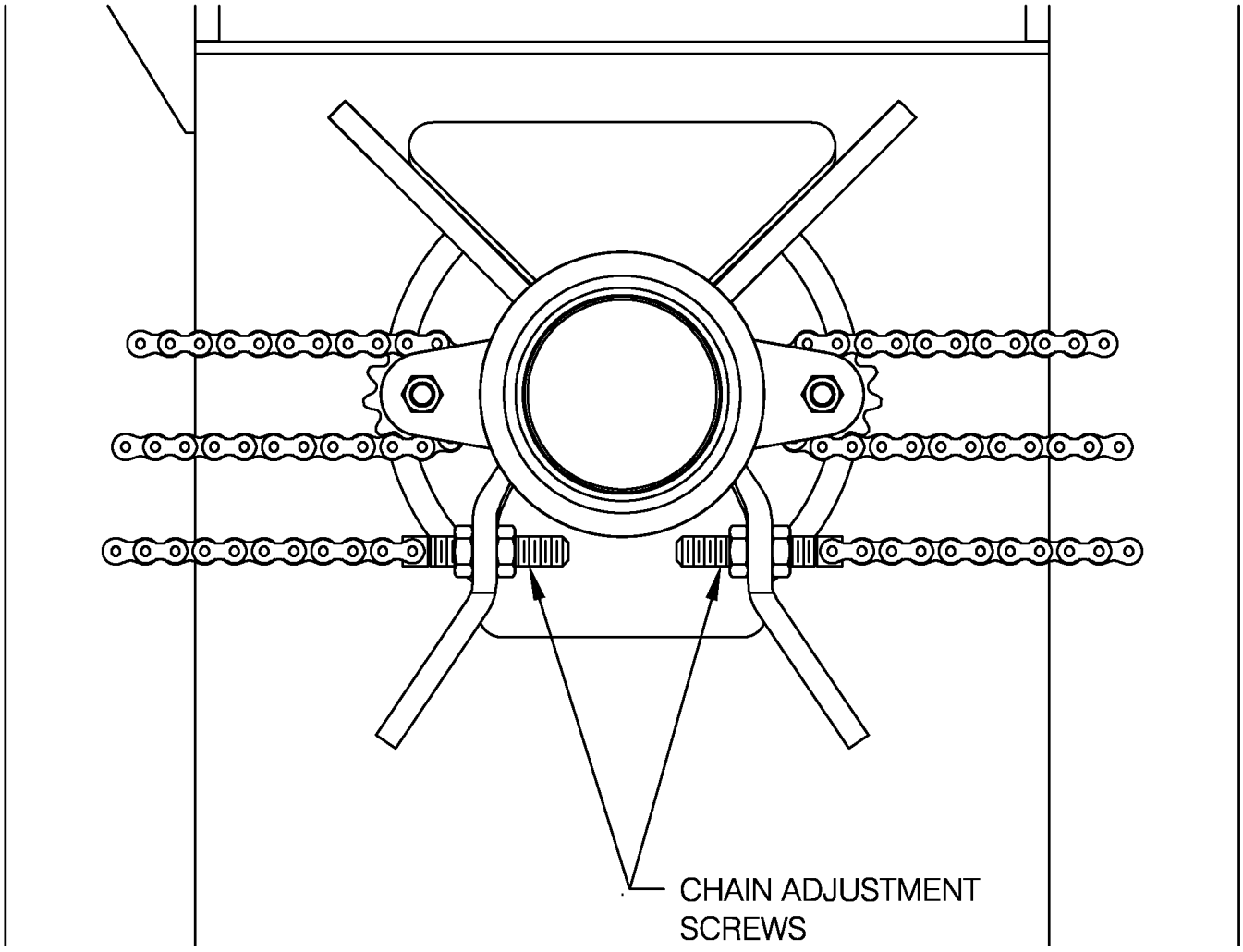



*Figure 7-3*
*SIDESHIFT CHAIN ADJUSTMENT*

## PROXIMITY SENSOR - electronic stroke control option

The proximity sensor is located on the right hand side of the sheave housing at the top of the lead. To adjust the proximity sensor, refer to Figure 7-4 and use the following procedure:

1. Lay the lead down onto the lead rest.
2. Remove the two bolts securing the sensor to the sheave housing.
3. Remove the sensor bracket (with the sensor attached).
4. Move the sheave until the hub contacts the side of the sheave housing which has the sensor mounting hole.

*NOTE: Excessive sheave side play can result in erratic operation of the unit, or damage to the sensor.*

5. Measure the distance between the spoke on the sheave and the outer face of the sheave housing.
6. Subtract 1/8" (3.2 mm) from the dimension obtained in step 5. This dimension is dimension "A". (Refer to Figure 7-4)
7. Adjust the distance from the sensor face to the bracket face to dimension "A".
8. Reinstall the sensor bracket and sensor to the sheave housing.

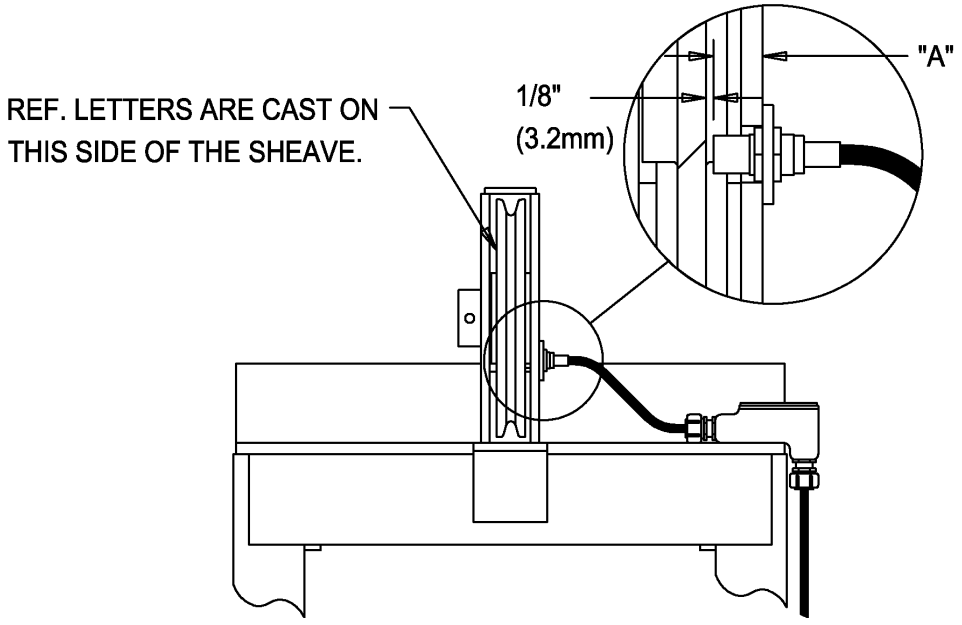



*Figure 7-4*
*SHEAVE SENSOR ADJUSTMENT*

# Hydraulic Pressure Adjustment

**NOTICE** **The following procedures and sequences should be followed accurately when setting pressures. Failure to do so will result in poor and short service life of hydraulic components.**

Always use an accurate pressure gauge for setting hydraulic pressures - never guess. Increasing pressures above those recommended will not increase the productivity of the machine but will cause unnecessary strain on machine components.

## REQUIRED EQUIPMENT

One (1) 3000 psi gauge, graduations 50 psi or less, accurate to ± 20 psi.

*NOTE: Before setting or adjusting hydraulic pressures, do the following:*

1. Fill the reservoir with hydraulic fluid to the full mark on the dipstick, with the hammer lift cylinder down.
2. Warm the hydraulic system until the oil in the reservoir reaches a temperature of approximately 100°F. The hydraulic system can be warmed by operating the hammer lift circuit over relief by attempting to lift a locked weight or by raising the weight to maximum height and holding the hammer-valve control lever back, in the "UP" position. DO NOT operate the valve in relief longer than 15 seconds at a time without a cool down period of similar length to prevent damage to the relief valve.
3. DO NOT attempt to adjust relief pressures if the reservoir temperature is exceedingly warm (approximately 150°F).
4. Check the relief pressures with the engine operating at fast-idle speed (2200 rpm no load). Full-load speed should be 2000-2100 rpm.

## HAMMER LIFT CIRCUIT

1. Remove the 1/2" hex head pipe plug (gauge plug) from the base of the lift cylinder. Refer to Figure 8-1.
2. Install the 3000 psi gauge.
3. Start the engine. Set governed speed to 2200 rpm no load (2000-2100 rpm full load).
4. Warm the hydraulic-system oil to approximately 100°F.
5. With the weight locked into position, pull back slowly on the hammer valve-control lever and hold it in the "UP" position. Pressure should read 1400-1450 psi.
6. To change the relief pressure, remove the plug from the relief-valve port on the hammer valve (refer to Figure 8-1). Add or remove shims (Arrow part no. 3001344) between the spring and cap nut. Each shim will change the pressure approximately 40 psi.

*NOTE: If adding shims does not increase circuit pressure, check for one or more of the following conditions:*

- worn pump
- drive line key missing
- incorrect hydraulic fluid
- oil temperature too high
- hammer valve not actuated to full stroke
- defective or worn relief valve and/or seat in the hammer valve
- leaking hammer lift cylinder (leak may be internal)
- engine not maintaining governed speed

The engine in proper operating condition will easily turn the pump at the required pressure setting and rpm. (Service the engine to correct any difficulty.)

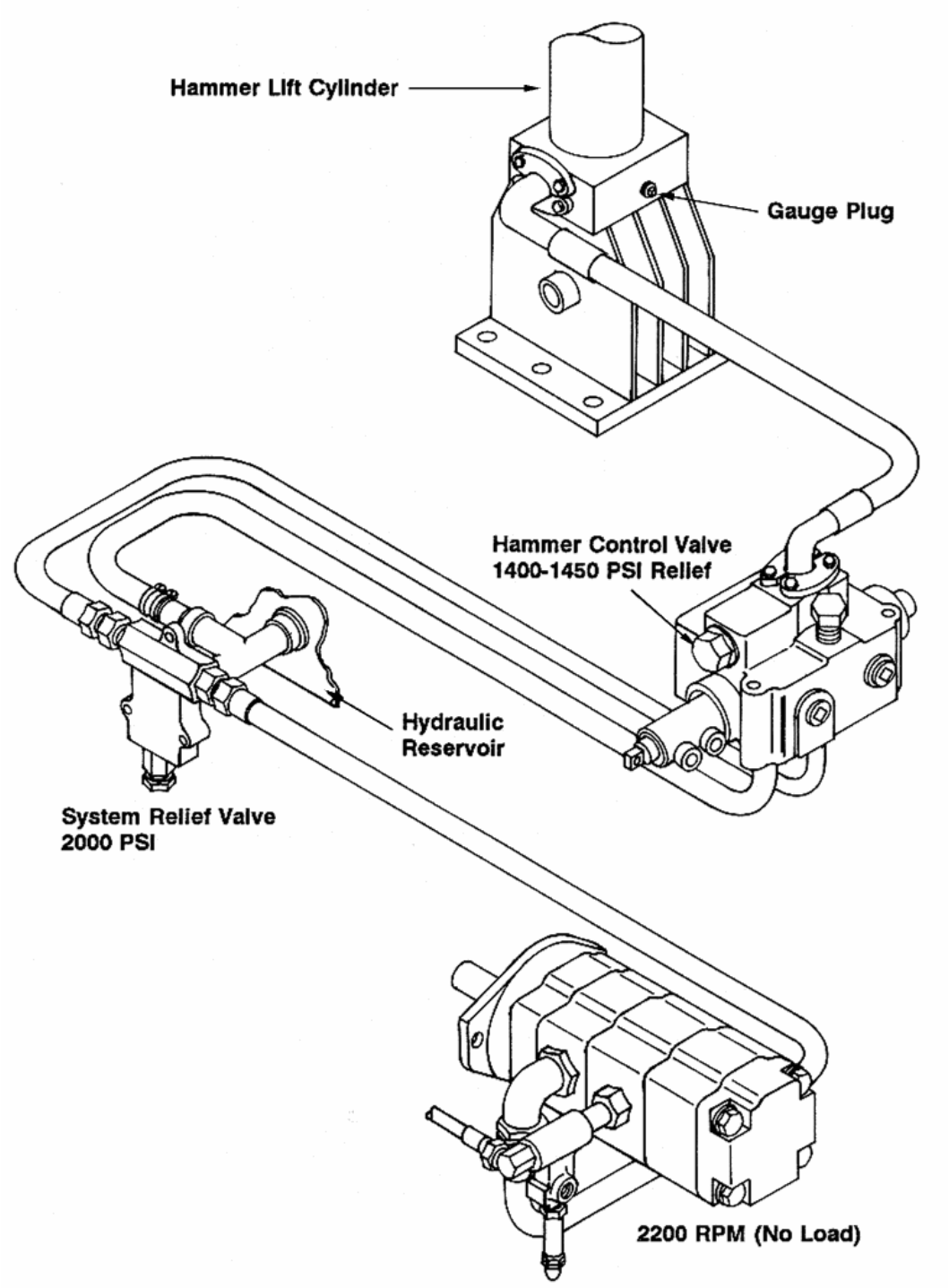



*Figure 8-1*
*Hydraulic Lift Circuit*

## CONTROL CIRCUIT MAIN RELIEF

1. Remove the pipe plug from the tee fitting at the creeper control valve. Install a 3000 psi gauge in the tee. (reference point "A" in Figure 8-2).
2. Actuate the sideshift control lever forward until the carriage reaches the end of its travel.
3. Actuate the tilt-control lever forward until the lead are tilted to the extreme travel of the cylinder.

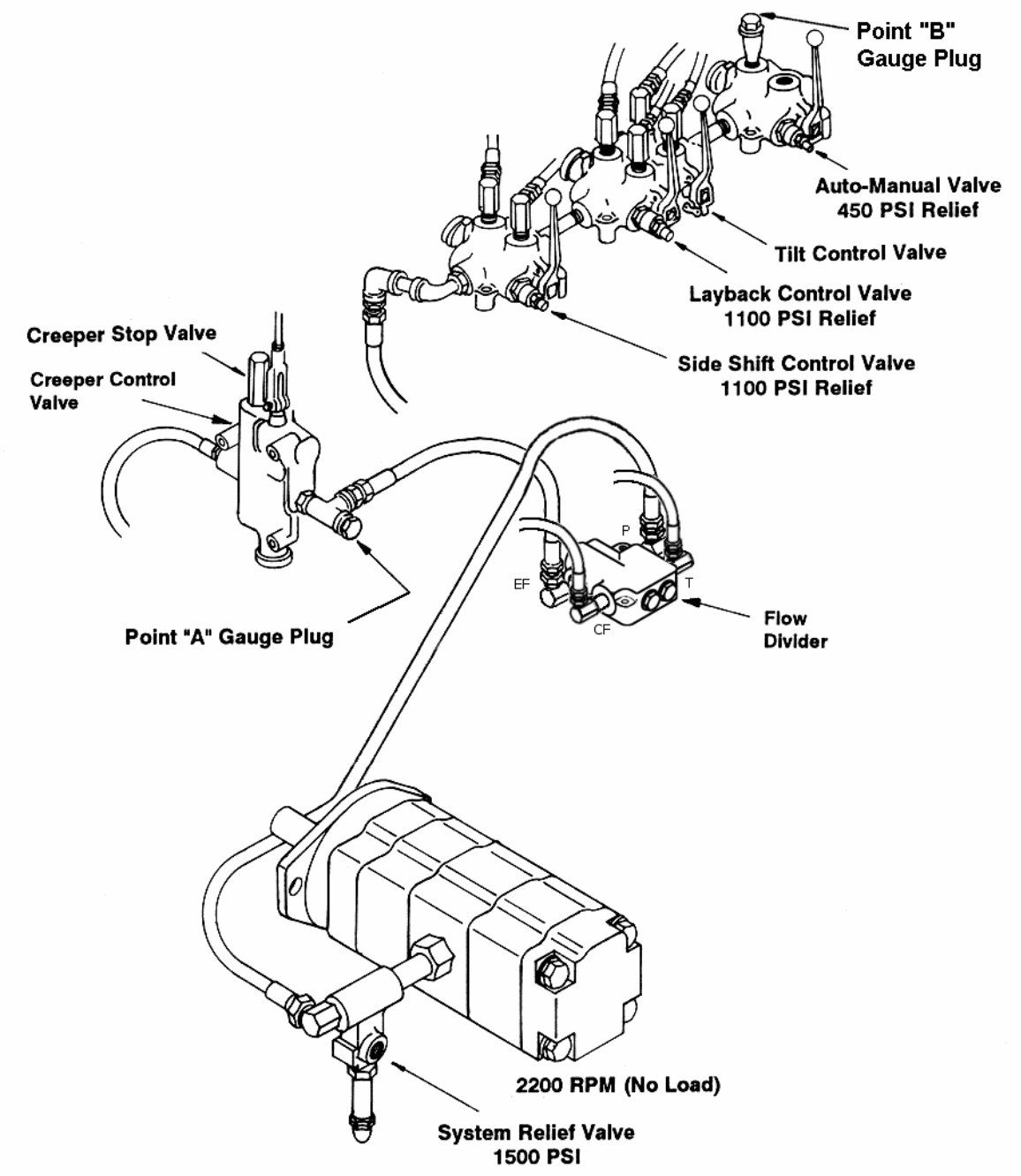



*Figure 8-2*
*Hydraulic Control Circuit*

4. Adjust the engine speed hand-control lever to provide maximum fast-idle rpm.
5. Actuate both valve-control levers forward (sideshift and tilt) at the same time.
6. With both valves actuated forward, the gauge attached at point "A" (Figure 8-2) should read 1500 psi.
7. The main-relief valve for the control circuits is located at the left side of the hydraulic pump at the rear of the machine (see Figure 8-2).

*Control Circuit Main Relief cont'd.*

8. To adjust the relief pressure, remove the acorn nut and loosen the lock nut. Turn the slotted screw clockwise to increase pressure. 1/4 turn of the screw will change the pressure approximately 50 psi.

**NOTICE** **Failure to push forward on sideshift and tilt-control levers at the same time when checking the pressure will cause an incorrect setting of the relief pressure (most likely too high), providing no protection for the pump, pump drive, and creeper-control circuit.**

9. If relief pressure does not increase when adjusted according to step 10, check for the following conditions:

- improper hydraulic fluid
- broken relief-valve spring
- dirty or damaged relief valve
- worn pump
- oil too hot (above 150°F)

## SIDESHIFT CONTROL-VALVE RELIEF

1. Check and set the main relief (at the pump) prior to adjusting the sideshift valve relief. Refer to the previous section - "CONTROL CIRCUIT MAIN RELIEF".
2. The sideshift relief valve is located in the body of the sideshift-control valve, beside the control spool (see Figure 8-2).
3. Set the engine to operate at maximum fast-idle rpm with the hand throttle.
4. Push the sideshift control-valve handle forward until the carriage reaches the end of its travel. Gauge pressure at point "A" (see Figure 8-2) should read 1100 psi.
5. If the pressure is incorrect, loosen the jam nut on the sideshift relief valve. The jam nut can be accessed from below, through the slot in the cowl. Insert a screwdriver through the hole at the rear of the cowl (near the valve-control handle) and turn the screw clockwise to increase the pressure.
6. If adjusting the screw fails to correct the pressure, check for the following:
   - broken relief-valve spring
   - dirty or damaged relief valve
   - sideshift valve not at full-stroke position

## TILT AND LAYBACK CONTROL-VALVE RELIEF

1. Check and set the main relief (at the pump) prior to adjusting the tilt and layback control-circuit relief. Refer to the section titled "CONTROL CIRCUIT MAIN RELIEF".
2. The relief valve is located in the tilt and layback control-valve body, beside the layback-control spool (see Figure 8-2).
3. Set the engine to operate at maximum fast-idle rpm with the hand throttle.
4. Push the tilt control-valve handle forward until the lead are tilted to the extreme travel of the cylinder. Gauge pressure at point "A" (see Figure 8-2) should read 1100 psi.
5. If the pressure is incorrect, loosen the jam nut on the relief valve. The jam nut can be accessed from below, through the slot in the cowl (near the valve-control handle). Turn the screw clockwise to increase the pressure.
6. If adjusting the screw fails to correct the pressure, check for the following:
   - broken relief-valve spring
   - dirty or damaged relief valve
   - tilt valve not at full-stroke position

## PILOT-CIRCUIT RELIEF (electronic stroke control)

1. Check and set the main relief (at the pump) prior to adjusting the pilot-circuit (auto-manual) relief. Refer to the section titled "CONTROL CIRCUIT MAIN RELIEF".
2. Remove the plug and install a 3000 psi gauge in the tee fitting at the creeper control valve (refer to point "A" in Figure 8-2).
3. Lock the weight using the lock pin on the side of the lead mast.
4. Turn the on-off switch on the electronic control station to the "off" position.
5. Pull back slowly on the hammer-valve control lever to raise the weight against the pin. Release the control lever.
6. Set the engine to operate at maximum fast-idle rpm with the hand throttle.
7. Pull the auto-manual valve-control lever back into "auto" (automatic) mode. The machine will attempt to raise the weight.
8. Set the relief valve on the auto-manual control valve by using the same procedure outlined for the other relief valves. The correct pressure is 400 psi.

**NOTICE** **The hammer-valve control lever will be actuated automatically into the "UP" position. Once actuated, the hammer valve will become "stuck" in the "UP"position as long as pressure remains in the pilot circuit. The pilot circuit does not bleed down instantly after the auto-manual valve is returned to the neutral position. The hammer valve can be manually overridden with considerable difficulty. Be prepared to shut the engine down if a problem arises.**

## PILOT-CIRCUIT RELIEF (mechanical stroke control)

1. Check and set the main relief (at the pump) prior to adjusting the pilot-circuit (auto-manual) relief. Refer to the section titled "CONTROL CIRCUIT MAIN RELIEF".
2. Remove the plug and install a 3000 psi gauge in the tee fitting at the creeper control valve (reference point "A" in Figure 8-2).
3. Lower the weight to the ground to set the trip lever on the rotary valve (located on the side of the hammer cylinder) into the "down" position.
4. Raise and lock the weight using the lock pin on the side of the lead mast.
5. Pull back slowly on the hammer-valve control lever to raise the weight against the pin.
6. Set the engine to operate at maximum fast-idle speed.
7. Pull back on the hammer-valve control lever and hold the valve in the "UP" position. The machine will attempt to raise the weight.
8. Pull the auto-manual valve-control lever back into "auto" (automatic) mode.

**NOTICE** **Once actuated, the hammer valve will become "stuck" in the "UP" position as long as pressure remains in the pilot circuit. The pilot circuit does not bleed down instantly after the auto-manual valve is returned to the neutral position. The hammer valve can be manually overridden with considerable difficulty. Be prepared to shut the engine down if a problem arises.**

*Pilot-Circuit Relief (mechanical stroke control) cont'd.*

9. Set the relief valve on the auto-manual control valve by using the same procedure outlined for the other relief valves. The correct pressure is 550 - 600 psi at point 'A'; 350 - 400 psi at point B. (Refer to Figure 8-2.)
10. If adjusting the screw fails to correct the pressure, check for the following:

    - broken relief-valve spring
    - dirty or damaged ball or seat
    - auto-manual valve not at full-stroke position

## VALVE SPOOL CENTERING ADJUSTMENT

If valve-spool travel is uneven in either direction, or if the valve spools do not return normally to the neutral (center) position, check to make sure the screw at the rear end of the spool is tight. These parts are illustrated in the parts catalog. The screw is reached by removing the stop disc and the snap ring.

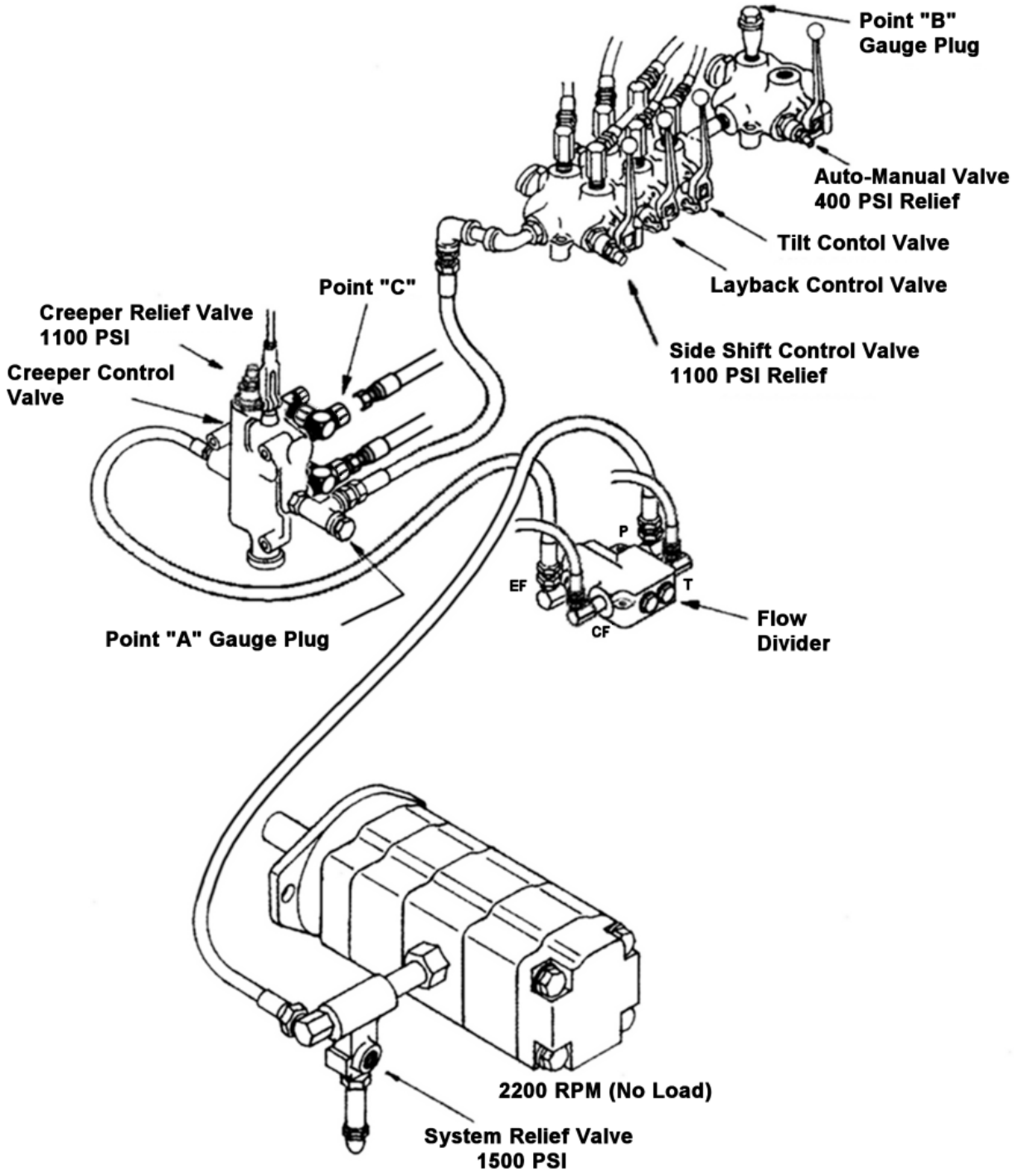



*Figure 8-3*
*Hydraulic Control Circuit* (S/N 7050-)

# CONTROL CIRCUIT MAIN RELIEF (S/N 7050-)

Arrow Hammers above serial number 7049 have a slightly different control valve configuration than the earlier machines. They are distinctive in that there are no control valves to the left of the steering wheel and one three spool valve and the auto-manual valve to the right. This system requires a different pressure setting sequence and the additional setting of the creeper control valve which now has an adjustable relief. Remove the left side, top, and front cowling sections for easier access to the gauge ports and adjustments.

1. Remove the pipe plug from the tee fitting at then creeper control valve. Install a 2000psi gauge in the tee. (Reference point “A” in Figure 8-3).
2. Actuate the sideshift control forward until the carriage reaches the end of its travel.
3. Lock the weight using the lock pin on the side of the lead.
4. Turn the on-off switch on the electronic control station to the "off" position.
5. Pull back slowly on the hammer-valve control lever to raise the weight against the lock pin. Release the control lever.
6. To set the main relief, the auto-manual valve must be first be turned up to 1000 psi. This can be read at the point “A” gauge.
7. Set the engine to operate at maximum rpm with the hand throttle.
8. Pull the auto-manual valve-control lever back into "auto" (automatic) mode. The machine will attempt to raise the weight.
9. Adjust the engine speed hand-control lever to provide maximum rpm.
10. Actuate both valve-control levers (sideshift forward and auto-manual valve back) at the same time.
11. With both valves actuated, the gauge attached at point "A" (Figure 8-3) should read 1500 psi.
12. The main-relief valve for the control circuits is located at the left side of the hydraulic pump at the rear of the machine (see Figure 8-3).
13. To adjust the relief pressure, remove the acorn nut and loosen the lock nut. Turn the slotted screw clockwise to increase pressure. 1/4 turn of the screw will change the pressure approximately 50 psi.
14. If relief pressure does not increase when adjusted according to step 12, check for the following conditions:

**NOTICE** **Failure to activate the sideshift and auto/manual control levers at the same time when checking the pressure will cause an incorrect setting of the relief pressure (most likely too high), providing no protection for the pump, pump drive, and creeper-control circuit.**

- Improper Hydraulic Fluid
- Broken Relief-valve Spring
- Dirty or Damaged Relief Valve
- Worn Pump
- Oil Too Hot (Above 150°f)

15. The auto-manual valve must now be set to 400 psi. This is detailed in the Pilot Circuit Relief section that follows.

## SIDESHIFT CONTROL-VALVE RELIEF (S/N 7050-)

1. Check and set the main relief (at the pump) prior to adjusting the sideshift valve relief. Refer to the previous section - "CONTROL CIRCUIT MAIN RELIEF".
2. The sideshift relief valve is located in the body of the three-spool control valve, beside the left control spool (see Figure 8-3).
3. Set the engine to operate at maximum rpm with the hand throttle.
4. Push the sideshift control-valve handle forward until the carriage reaches the end of its travel. Gauge pressure at point "A" (see Figure 8-3) should read 1100 psi.
5. If the pressure is incorrect, loosen the jam nut on the sideshift relief valve. The jam nut can be accessed from below, through the slot in the cowl. Insert a screwdriver through the hole at the rear of the cowl (near the valve-control handle) and turn the screw clockwise to increase the pressure.
6. If adjusting the screw fails to correct the pressure, check for the following:

- Broken Relief-valve Spring
- Dirty or Damaged Relief Valve
- Sideshift Valve Not at Full-stroke Position

## PILOT-CIRCUIT RELIEF (S/N 7050-)

1. Check and set the main relief (at the pump) prior to adjusting the pilot-circuit (auto-manual) relief. Refer to the section titled "CONTROL CIRCUIT MAIN RELIEF".
2. Remove the plug and install a 1000 psi gauge in the tee fitting at the auto-manual control valve (refer to point "B" in Figure 8-3).
3. Lock the weight using the lock pin on the side of the lead.
4. Turn the on-off switch on the electronic control station to the "off" position.
5. Pull back slowly on the hammer-valve control lever to raise the weight against the pin. Release the control lever.
6. Set the engine to operate at maximum rpm with the hand throttle.
7. Pull the auto-manual valve-control lever back into "auto" (automatic) mode. The machine will attempt to raise the weight.
8. Set the relief valve on the auto-manual control valve by using the same procedure outlined for the slide relief valve. The correct pressure is 400 psi.

**NOTICE** **The hammer-valve control lever will be actuated automatically into the "UP" position. Once actuated, the hammer valve will become "stuck" in the "UP"position as long as pressure remains in the pilot circuit. The pilot circuit does not bleed down instantly after the auto-manual valve is returned to the neutral position. The hammer valve can be manually overridden with considerable difficulty. Be prepared to shut the engine down if a problem arises.**

## CREEPER CONTROL VALVE RELIEF (S/N 7050-)

1. Check and set the main relief (at the pump) prior to adjusting the sideshift valve relief. Refer to the previous section - "CONTROL CIRCUIT MAIN RELIEF"
2. Remove the top 80" creeper motor hose from the tee at point “C” and cap it to prevent leakage. Attach a 2000psi gauge to the vacant top port on the creeper valve. Check that all hoses and fittings are tight and that the creeper valve is in neutral. Start the engine and check for leaks.
3. At engine idle, move the creeper valve handle to the ***forward*** position and read the test gauge. Throttle up to full engine rpm and read the test gauge. 1100 psi is the proper relief valve setting. The relief valve adjustment is on the creeper valve next to the spool where the linkage attaches. If adjustment is needed, loosen the jam nut and turn the adjusting screw in to increase pressure. Tighten the jam nut.
4. Remove the pressure gauge and reconnect the creeper motor hose and check for leaks Replace the cowling. Operate the machine in creeper and creeper bypass modes to check proper operation.

# Mechanical System

## ENGINE REPAIR

Engine repair is not within the scope of the Arrow model 1350 Service Manual. Refer engine problems to an authorized service center for Deere power products. The following engine manuals are supplied from the factory with each Arrow Hammer:

Operator's Manual **Arrow part no. 5000083**

The service manual for this engine may be obtained directly through any authorized John Deere dealer (Ag, Industrial or Lawn & Garden). These are available in several foreign-language translations.

## SERPENTINE BELT REPLACEMENT

Belt replacement is recommended whenever the radiator must be removed.

1. Remove the louvered side panels. Remove the bolts from the tail light mounting plate and lay to the side, using care to avoid damage to the wire harness.
2. Disconnect the air cleaner hose at the engine. Remove the muffler.
3. Remove the attaching bolts and remove the hood.
4. Remove the top bolt only on the lead rest and lay it forward. Remove the bolts and the right rear side panel.
5. Disconnect and remove the battery.
6. Drain the engine coolant at the radiator.
7. Disconnect the upper and lower radiator hoses from the radiator.
8. Remove the engine fan guard.
9. Remove the bolts from the fan shroud. Loosen the fan shroud from the radiator.
10. Remove the 5/16"-18 cap screws which connect the radiator upper mounts to the upright member of the mainframe on each side of the radiator. Remove the center bolts from both sides of the bottom rubber mounts.
11. Disconnect the oil-cooler return hose at the oil-filter inlet fitting. Some hydraulic fluid will be lost.
12. Disconnect the oil-cooler inlet hose at the oil-cooler inlet fitting.
13. Remove the four cap screws which attach the oil cooler to the upright members of the mainframe. Note the number and position of the oil-cooler isolation mounts.
14. Remove the oil cooler. Remove the radiator and fan shroud.
15. Unload the serpentine belt tension idler pulley at the left side and lift the belt from the alternator pulley. A ½" drive breaker bar fits the tensioner or a pry bar may be used between the idler and spring tensioner.
16. Remove the engine fan, noting the number of spacers between the fan and pulley. Due to close clearance between the fan and alternator pulley, the fan spacing must be exact.
17. Refer to page 54 in the 1350 Parts Manual. Loosen the set screw on the pump yoke, item 23, and slide the pump coupling to the rear as far as possible. Remove the bolts from the pump adapter, item 20, and slide to the rear.
18. Loosen the two 5/8" mounting bolts at the hydraulic pump and slide the pump to the rear. If the nuts are removed from the mounting bolts, the pump will need to be supported from the ground. At this point there will be sufficient clearance between the pump adapter and the crankshaft pulley to remove the old belt.
19. Install the new belt.
20. Reverse this procedure to re-install. Use Loctite® grade 242 on the fan bolts and the radiator side mounts to keep them secure.

# TRANSMISSION, CLUTCH, AXLES, SERVICE BRAKES AND STEERING VALVE

Major repair of mechanical drive-train components is best left to the Arrow dealer or to other trained personnel who make a business of servicing light trucks. The Arrow factory service-department personnel can work with the Arrow dealer to resolve problems concerning the repair of these items.
The section of this manual covering replacement of the parking brake includes enough technical information to disassemble and reassemble the drive axle during brake repair.

# CREEPER DRIVE

## Adjustment of Gear Backlash

Refer to Figure 9-1 and use the following procedure to adjust creeper gear backlash:

**⚠WARNING** **Never attempt this procedure with the engine running.**

1. Shut the unit down and apply the parking brake.
2. Remove the cover from the transmission and creeper housing.

*NOTE: Older 1350 models may require the removal of the parking brake hand lever and bracket assembly from the transmission and creeper housing cover.*

3. Remove the small inspection cover from the front of the creeper drive housing (opposite the creeper motor). Refer to Figure 9-1.
4. Remove the access cover from the rear of the creeper drive housing to expose the adjustment linkage.
5. Engage the creeper drive mechanism (rotate the creeper drive actuator lever down).
6. Make sure the gears are completely meshed. It may be necessary to actuate the creeper drive control lever to allow the gears to completely mesh.
7. Slide a small piece of 0.005" (0.127 mm) thick shim stock between the gears.
8. Loosen the jam nuts on the adjustment linkage.
9. Rotate the top of the adjustment rod in the direction of the arrow as shown in Figure 9-1.
10. Retighten the jam nuts on the adjustment linkage.
11. Remove the shim stock from the gear teeth and recheck the backlash. The correct amount of backlash is 0.005" to 0.008" (0.127 - 0.203 mm).
12. Reinstall the access covers, transmission and creeper housing cover, and the parking brake lever assembly if removed.

*Adjustment of Gear Backlash cont'd.*

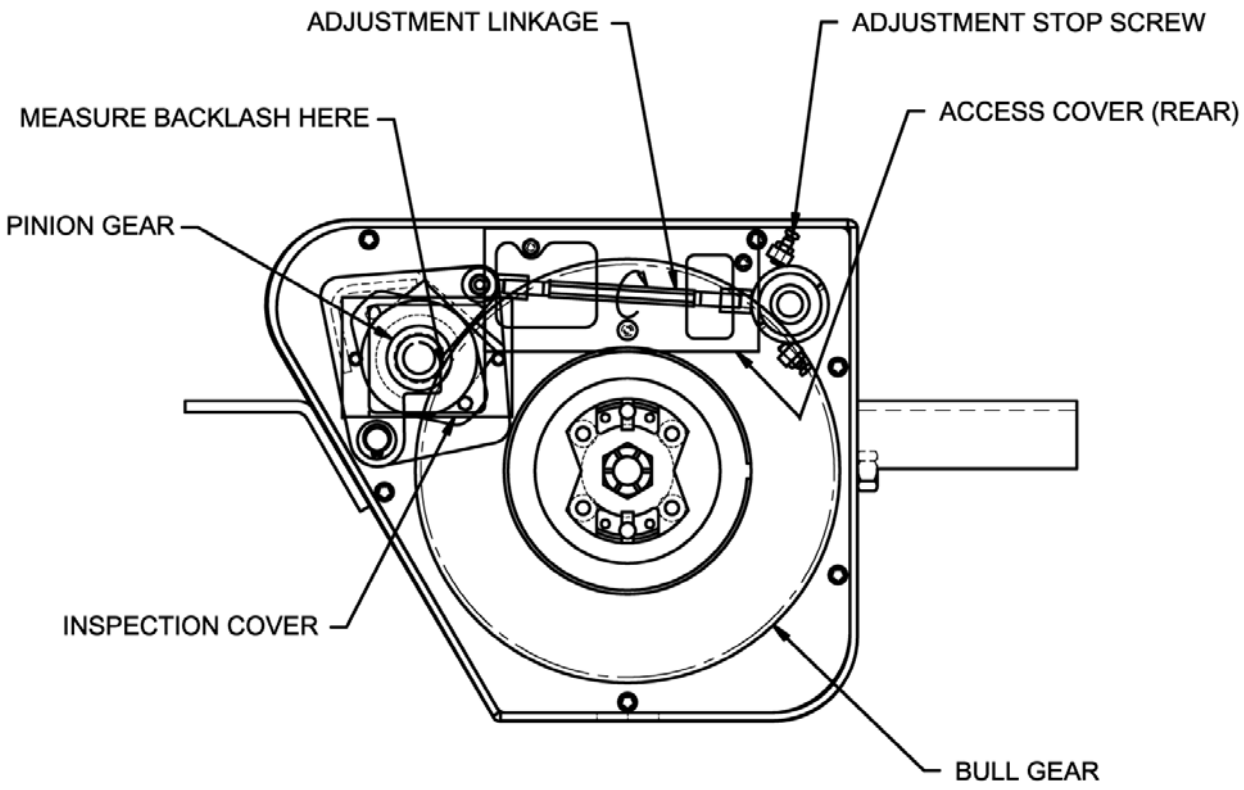



*Figure 9-1*
*CREEPER DRIVE GEAR BACKLASH ADJUSTMENT*

## Creeper-Drive Motor and Pinion Replacement

The creeper-drive motor and pinion can be removed and replaced without disturbing other components of the creeper-drive mechanism. (Refer to Figure 9-2).

1. Remove the front creeper-drive shift lever (if used) and creeper cover housing. If a top mounted creeper shift lever is used, remove the cotter and clevis pin. Loosen the jam nut and rotate the shifter clevis 90° degrees so that the creeper cover can be removed. Disconnect the ball joint at the top of the accelerator pedal. Remove the seat and base. Remove the main floor plate.
2. Place the creeper-drive control valve in neutral (center) position. This will prevent hydraulic fluid from siphoning out of the hydraulic reservoir while the hoses are open.
3. Disconnect the hoses from the drive motor. Protect the open ends from contamination. (There will be a slight loss of fluid from the hoses.)
4. Remove the tie wire from the two socket head cap screws which connect the motor to the creeper assembly. Remove the cap screws.
5. Pull the motor back and away from the creeper housing. Make sure not to lose the key on the motor shaft or the loose spacer between the motor and the pinion gear. The pinion gear will usually remain attached to the motor. (If a new motor is to be installed, install the two fittings and the Woodruff key onto the new motor. Use the new key which is supplied with the new motor.)
6. Install a new needle bearing on the pinion if necessary. Work a little no. 2 lithium grease into the bearing rollers.
7. Clean the tapped motor-mounting holes and the cap screws with Loctite® cleaner. Allow the cleaner to dry.
8. Apply one or two drops of Loctite® grade 242 (blue) to the threads of each cap screw. Install the motor and spacer.
9. Reinstall and torque the cap screws to 110-125 lb-ft.
10. Reinstall the tie wire between the heads of the two cap screws.
11. Reconnect the hydraulic hoses.
12. Reinstall the creeper-drive cover assembly and the shift lever.

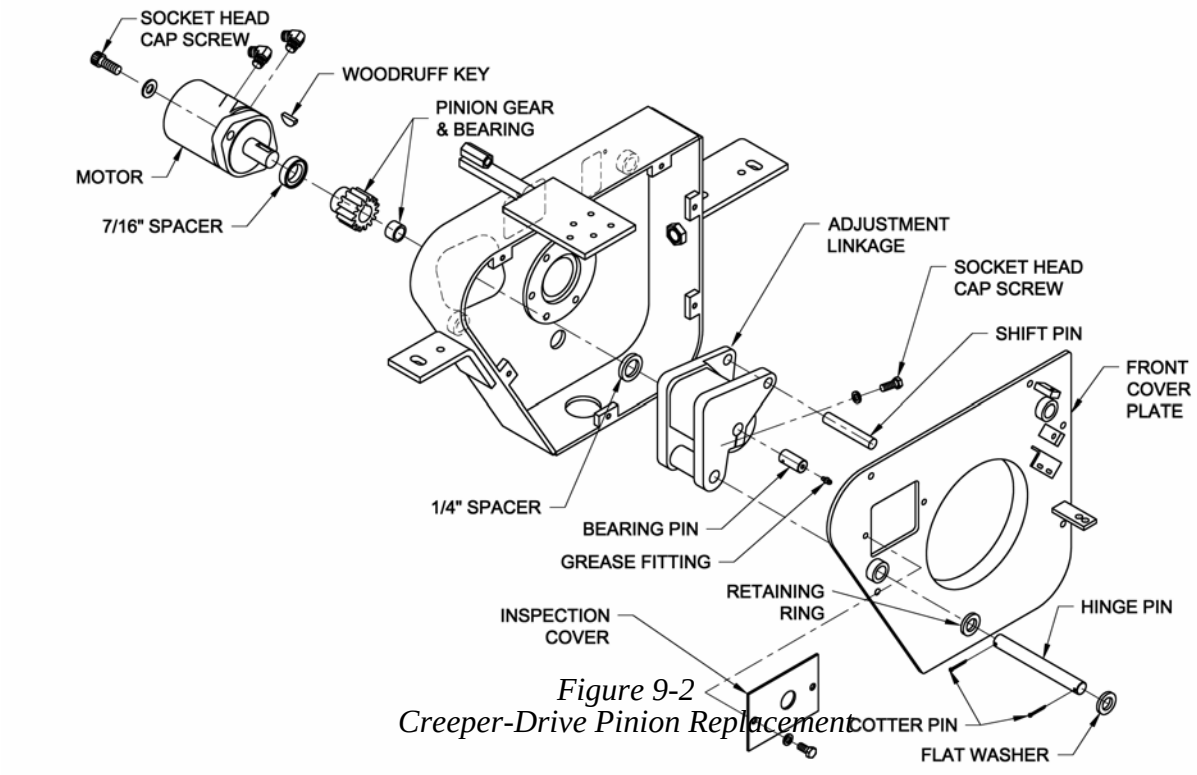



*Figure 9-2*
*Creeper-Drive Pinion Replacement*

## Creeper-Drive Pinion Shaft Replacement - Refer to Figure 9-2

1 Remove the creeper-drive shift lever and housing cover. Disconnect the ball joint at the top of the accelerator pedal. Remove the seat and base. Remove the main floor plate.
2. Remove the creeper-drive motor according to the procedure given in "Creeper-Drive Motor and Pinion Replacement".
3. Remove the retaining ring from the pivot shaft. Remove the creeper-adjustment bar and tension spring from the shift-lever shaft. Remove the front cover assembly from the creeper-drive housing. (Refer to Figure 9-1 ).
4. Loosen the 3/8"-16 socket head cap screw which retains the pinion shaft in the pinion bracket.
5. Remove the pinion shaft from the pinion bracket. **Do not lose the 1/4" spacer.** (There are two spacers on the pinion shaft. The other spacer should have remained with the drive motor and pinion assembly.)
6. If the pinion shaft is worn, replace it with a new pinion shaft.
7. Reinstall the new pinion shaft into the pinion bracket. The pinion shaft should be flush with the surface of the bracket.
8. Tighten the 3/8"-16 socket head cap screw (shaft retaining cap screw) to 45-54 lb-ft.
9. Reinstall the creeper-drive motor and the spacer according to the procedure given in "Creeper-Drive Motor and Pinion Replacement".
10. Replace the front cover assembly, adjustment bar and tension spring, and the pivot-shaft retaining ring.
11. Replace the floor plate, creeper-drive cover, the shift lever.

## Creeper-Drive Bull Gear Replacement - Refer to Figure 9-3

1. Remove the front creeper-drive shift lever (if used) and creeper cover housing. If a top mounted creeper shift lever is used, remove the cotter and clevis pin. Loosen the jam nut and rotate the shifter clevis 90° degrees so that the creeper cover can be removed. Disconnect the ball joint at the top of the accelerator pedal. Remove the seat and base. Remove the main floor plate.
2. Remove the adjustment bar and tension spring from the creeper shift-lever shaft.
3. Remove the retaining ring or cotter pin, from the front end of the creeper pinion-bracket pivot shaft.
4. Disconnect the drive shaft from the bull gear and drop the Driveshaft out of the way.
5. Remove the screws attaching the safety switch to the housing cover. Note the position of the switch arm for re-assembly.
6. Remove the front cover assembly from the creeper-drive housing assembly (Refer to Figure 9-2).
7. Remove the retainer nut from the transmission output shaft.
8. Slide the bull gear and drive-yoke assembly off the transmission output shaft.
9. Remove the four 7/16" grade 5 cap screws and locknuts which connect the drive yoke to the bull gear.
10. Remove the drive yoke. Tap the dowel pins with a brass hammer, if necessary. The dowel pins are a close fit with the gear. They are pressed into the drive yoke and will stay with the drive yoke.
11. Install the drive yoke with dowel pins into the new bull gear.
12. Reinstall the 7/16" grade 5 cap screws and locknuts through the yoke assembly and the gear, and torque the locknuts to 54-64 lb-ft.
13. Before installing the new bull gear, replace the creeper-drive pinion with a new pinion following the instructions in "Creeper-Drive Motor and Pinion Replacement". The gear teeth on a worn pinion will not mesh correctly with the teeth on the new bull gear and will reduce the service life of the bull gear.
14. Slide the bull gear and yoke assembly over the transmission output shaft. (Make sure that the bearing spacer is still in place behind the transmission rear bearing.)
15. Install the retainer nut on the transmission output shaft. Torque the nut to 35-45 lb-ft.
16. Install the cotter pin through the retainer nut.

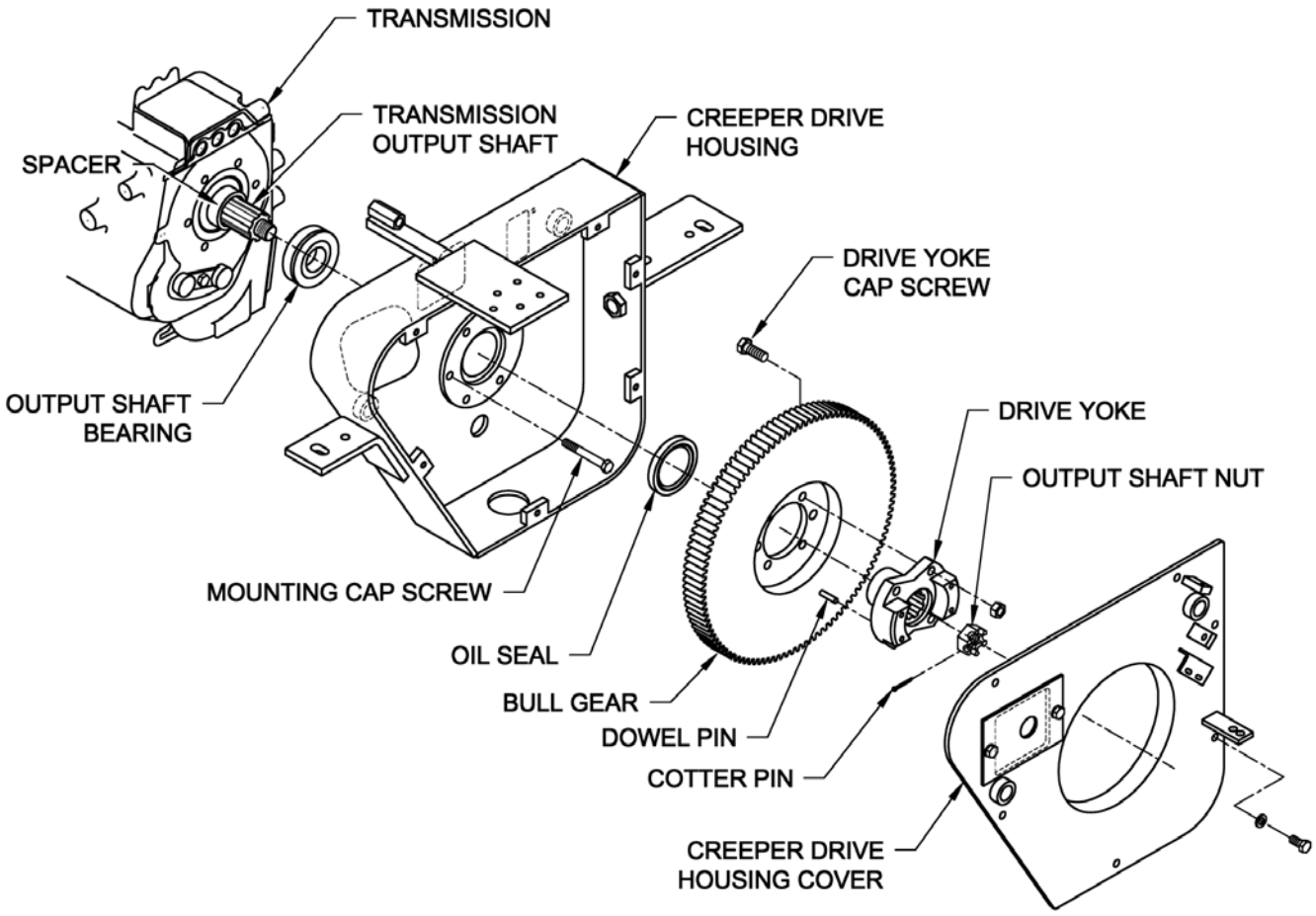



*Figure 9-3*
*Creeper-Drive Bull Gear Replacement*

17. Reinstall the front cover assembly. Torque the cap screws according to Table i-1 - "Bolt and Cap Screw Torque Specifications".
18. Reconnect the drive shaft to the drive yoke. Torque the cap screws to 22-27 lb-ft.
19. Reinstall the retaining ring or cotter pin, over the pinion-bracket pivot shaft.
20. Reinstall the adjustment bar and tension spring on the shift-lever shaft.
21. Adjust the two stop adjustment screws which control the movement of the creeper-adjust bar if this adjustment was disturbed. The pinion teeth should disengage from the teeth on the bull gear by about 1/8" - without the pinion bracket hitting the wall of the creeper housing. The pinion teeth should not travel beyond full engagement with the teeth on the bull gear.
22. After the stop adjustment has been set, adjust the creeper-drive gear backlash according to the procedures on page 9-2.

***NOTE**: Incorrect backlash setting upon initial installation of new gears will considerably shorten the life of the gears.*

23. Install the safety switch and check that the switch arm is activated when the creeper is engaged.
24. Reinstall the floor plate, creeper-drive cover and the shift lever, or top mounted shift lever yoke. Torque the cap screws according to Table i-1 - "Bolt and Cap Screw Torque Specifications".

## Creeper-Drive Housing Support Mount Replacement

The creeper-drive assembly is supported on either side by rubber mounts. These mounts are installed at the factory in a preloaded condition in order to provide the correct support for the drive-train under all conditions. If the engine or creeper- drive assembly are removed from the machine for any reason, use the following procedure to correctly preload these mounts.

1. Install the engine and engine mounts and tighten the mounting cap screws according to Table i-1.
   **Do not install the creeper-drive mounts until the engine mounts are properly tightened.**
2. Place the creeper-drive mounts into the space provided for them. There will be clearance between the mounts and the brackets to which they will be attached.
3. Add spacer washers (see the Arrow parts manual for the correct part number). Install as many of the spacer washers that will fit freely between the mount and brackets. If more than one spacer (3/16" thick) is required, place them above and below the mount. There will still be some gap remaining between the mount and the brackets.
4. Place a floor jack under the transmission.
5. Raise the transmission no less than 1/8" and no more than 3/16".
6. Place any additional spacers that will easily slide into the gap. Spacers may be placed above or below the mount.
7. Place a drop or two of Loctite® grade 242 on the 1/2" diameter cap screws and install the cap screws loosely into the mounts.

*NOTE: If no spacers are installed between the mount and bracket, the correct cap screw length will be 3/4". With one or two spacers, the correct cap screw length will be 1". If the cap screw is too long, it will bottom out when installed in the mount and not tighten properly.*

8. Lower the transmission and remove the floor jack. Both mounts should be compressed slightly.
9. Torque the mounting cap screws to 80-96 lb-ft.

## Transmission Output-Shaft Seal Replacement

The transmission output-shaft seal is located in the creeper-drive housing. It is necessary to remove the housing to gain access to the seal. (Refer to Figure 9-3 ).

1. Follow the instructions outlined under "Creeper-Drive Bull Gear Replacement".
2. Disconnect the hoses to the creeper-drive motor according to the instructions given in "Creeper-Drive Motor and Pinion Replacement".
3. Remove the lower cap screws from the creeper-support mounts. Note the number and location of shim washers.
4. Remove the five 3/8"-16 flange head cap screws which connect the creeper-drive housing to the transmission.
5. Slide the creeper-drive housing away from the transmission face and remove it.

*NOTE: The creeper-drive housing fits over the exposed end of the transmission output shaft. The housing may require several raps from a mallet to dislodge it from the output shaft.*

6. Remove the old oil seal from the creeper-drive housing.
7. Install the new seal. (see the Arrow parts manual)

*NOTE: The transmission output-shaft bearing can also be replaced at this time without further disassembly of the transmission. The procedure for changing the rear bearing is contained in the transmission manufacturer's repair manual.*

8. Before reinstalling the creeper-drive housing, make sure the spacer is installed over the output shaft behind the bearing.
9. Reinstall the creeper-drive housing over the transmission output shaft making sure to not damage the new seal.

*Transmission Output-Shaft Seal Replacement cont'd.*

10. Check to make sure the creeper-drive housing fits flush with the face of the transmission gearcase, and that it has not wedged on the output shaft.

**NOTICE** **If the creeper-drive housing is not installed tightly against the transmission face, the transmission output shaft will have excessive end play. This condition will eventually damage components inside the transmission. The immediate result will be a tendency for the machine to slip out of gear when operating in third gear.**

11. Place a drop or two of Loctite® grade 242 on the threads of the five 3/8"-16 flange head cap screws and install them into the transmission gearcase. Torque the cap screws to 45-54 lb-ft.
12. Follow the instructions for installing the bull gear and creeper mounts to complete the reassembly.

# ENGINE, RADIATOR, AND MOUNTS

## Radiator Upper Mount Replacement

The engine-radiator upper mounts can be replaced without complete removal of the radiator.

1. Remove the hood.
2. Drain the engine coolant sufficiently to remove coolant from the top radiator tank and upper radiator hose.
3. Disconnect the upper radiator hose from the radiator.
4. Remove the engine fan guard.

*NOTE: There are eight holes in the fan spacer on two different mounting patterns. It is difficult to locate the correct holes for mounting the spacer with the holes in the fan without a little preplanning.*

5. Use a marking pen of contrasting color (such as white) to mark the alignment of the mounting cap screw (installed in step 13) on the side of the fan spacer where it can be clearly seen. Place a similar mark on the engine fan where it will be visible during installation.
6. Loosen the fan shroud from the radiator. Remove the engine fan. The fan cannot be pulled out through the opening in the fan shroud unless the shroud is first loosened from the radiator.
7. Remove the 5/16"-18 cap screws which connect the radiator upper mounts to the upright member of the mainframe on each side of the radiator.
8. Tilt the top of the radiator toward the engine sufficiently to expose the mounts.
9. Twist the mounts in a counterclockwise (CCW) direction to unscrew the mounts from the radiator.
10. Install the new mounts.
11. Tilt the radiator forward to align the hole in the mount with the hole in the frame upright.
12. Place a drop of Loctite® grade 242 on the threads of the 5/16"-18 cap screws which connect the mounts to the upright members of the frame. Torque to 17-21 lb-ft.
13. Install one of the fan-mounting bolts through the fan spacer and into the fan-drive hub on the engine.

*NOTE: On S/N 6500 and up the fan hub spacer is not used. Spacing washers are used instead. Note the number of spacer washers used, as this determines the clearance between the fan and the alternator pulley.*

14. Remove the cap screw (installed in step 13).
15. Place a drop of Loctite® grade 242 on each of the four engine fan-mounting cap screws.
16. Install the mounting cap screws, fan, and fan spacer using the marks which were made on the fan and spacer as an alignment guide. Torque the cap screws to 17-21 lb-ft.
17. Reinstall the radiator shroud, fan guard, and upper hose.
18. Fill the engine coolant to the proper level.

## Radiator and Lower Radiator Mount Replacement

1. Follow the procedure for removing the upper mounts with one exception - **drain all of the engine coolant.**
2. Disconnect the lower radiator hose from the radiator.
3. Disconnect the oil-cooler return hose at the oil-filter inlet fitting. Some hydraulic fluid will be lost.
4. Disconnect the oil-cooler inlet hose at the oil-cooler inlet fitting.
5. Remove the four cap screws which attach the oil cooler to the upright members of the mainframe. **Do not lose the oil-cooler isolation mounts**.
6. Remove the oil cooler.
7. Remove the nuts from the two mounting studs at the bottom center of the radiator.
8. Lift the radiator off the mounting studs and set it aside. The lower mounting plate and the radiator lower mounts will remain attached to the mainframe.
9. Remove the two 1/2"-13 cap screws at each end of the lower mounting plate. (Some early units have a nut below the frame rail behind the hoses.) Remove the mounting plate with mounts.
10. Remove the 3/8" cap screws that attach the mount assembly to the mounting plate. Install the new mount assemblies.
11. Inspect the mounting plate to determine if the centerline between the two radiator-mounting holes at the center are offset (.090") from the centerline of the mounts located at either end of the plate. (some machines do not have the offset.) It is necessary to install the mounting-plate assembly with the offset toward the rear of the machine. Otherwise, there will be insufficient running clearance between the radiator and fan.
12. Reinstall the radiator and follow the procedure for installing the new radiator upper mounts.
13. Reinstall the oil cooler. Make sure the correct number of isolation pads are installed under each "P" clamp.
14. Reinstall the four 3/8"-16 cap screws which mount the oil cooler to the upright members of the mainframe. Tighten the cap screws sufficiently to deflect the isolators about 1/8". Install the jam nuts.

## Engine Replacement

1. Disconnect the battery ground at the negative post on the battery. Disconnect the positive lead and remove the battery.
2. Drain the fluids from the hydraulic tank, fuel tank, engine-cooling system, and engine-oil pan.
3. Remove the hood and the two removable side panels. Remove the left-hand rear side panel and the rear access door. The right-hand rear side panel and the lead support may be left in place.
4. Remove the exhaust muffler, air cleaner, hose, and band clamps.
5. Remove the creeper-drive shift lever, cover, seat-support pedestal, and the floor plate.
6. Note the locations and attachment points of the electrical connections and cables which connect to the engine, firewall, or other components of the machine. Disconnect the wires and control cables from the engine.
7. Remove the firewall.
8. Disconnect the fuel-supply hose from the fuel pump. Cap the hose end and pump inlet to prevent system contamination.
9. Disconnect the two hydraulic-pump suction lines from the tank. Disconnect the high-pressure hose from the large pump. Disconnect the oil-cooler supply hose and the low-pressure return hose from the tee fitting on the relief valve. Disconnect the high-pressure hose from the regulated pressure port on the relief valve.
10. Cover or cap the open hose ends and ports on the pumps and tank to prevent system contamination.
11. Remove the radiator and oil cooler as outlined under "Radiator and Lower Radiator Mount Replacement".

*Engine Replacement cont'd.*

12. Note the connector locations of the two hoses which connect to the creeper-drive motor. Disconnect the hoses and cap the open hose ends and motor ports to prevent system contamination.
13. Disconnect the drive shaft from the creeper bull gear and drop the Driveshaft out of the way.
14. Disconnect the clutch cable from the actuator lever on the side of the clutch housing. Unfasten the cable from the clamping bracket beside the transmission.
15. Remove the six cap screws that attach the four engine mounts, and the two creeper-drive housing mounts to the frame.
16. Check to make sure that all of the connections between the engine and the machine have been disconnected.
17. Fasten a sling or chain from a hoist and through the two lifting eyes on the engine. Move the engine assembly to the rear, and raise it out of the frame. Set the entire assembly down on an appropriate support.
18. Attach a sling from an overhead hoist around the transmission, just forward of the creeper drive. Remove the cap screws which attach the clutch housing to the rear of the engine flywheel housing. Apply enough support to the transmission and creeper-drive housing to keep it from binding.
19. Carefully slide the transmission, creeper drive, and clutch-housing assembly back from the engine until the transmission input shaft clears the clutch disc and pressure plate. Refer to Figure 9-4.
20. Remove the clutch pressure plate and clutch disc from the flywheel. Refer to Figure 9-4.
21. Remove the cap screws which connect the double-pump assembly to the pump-mounting bracket. Pull the double-pump assembly out of the mounting bracket. The pump drive will pull away from the engine along with the pumps, leaving the splined coupling on the front of the engine.
22. Remove the splined coupling and the pump-mounting bracket from the front of the engine.
23. Remove the air-cleaner mounting brackets from the top of the engine.
24. Remove the fuel control-cable mounting bracket.
25. The engine should be completely stripped of Arrow related components at this stage of disassembly.
26. Follow the reverse of this procedure to reinstall the engine. Be sure to reinstall the creeper-housing mounts according to the procedure outlined under "Creeper-Drive Housing Support Mount Replacement".

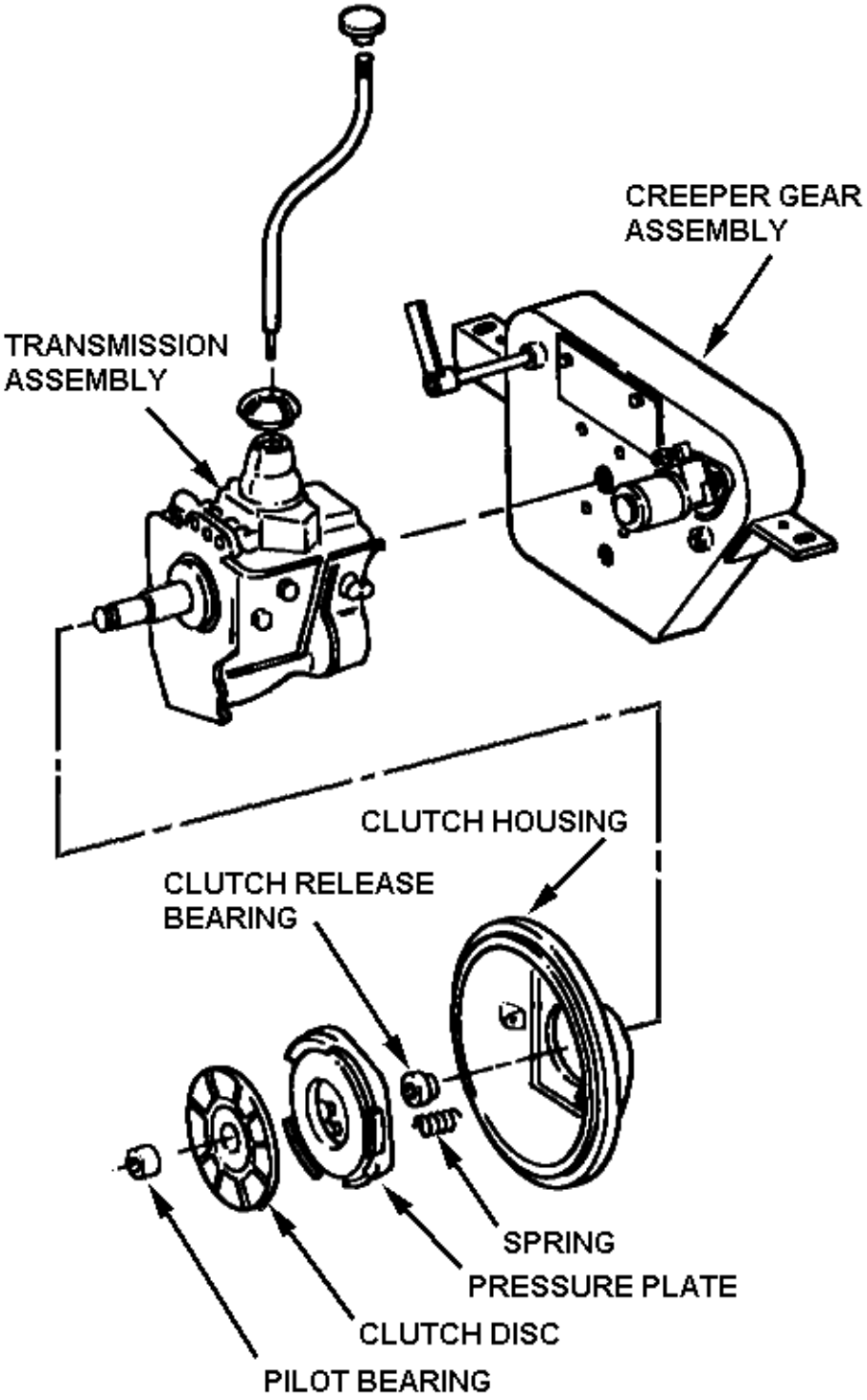



*Figure 9-4*
*Clutch and Transmission Assembly*

## HAMMER WEIGHT REPLACEMENT

1. Raise the lead mast into the vertical position and move the carriage to the far right-hand travel limit.
2. Remove the tool, clamp, and tool holder.
3. Using the hammer-valve control lever, carefully lower the weight to the ground.
4. Loosen the cable wedge at the hammer weight and remove the cable from the weight.
5. Start the machine and engage the creeper drive.
6. Actuate the layback control to slowly lay the lead mast back, while at the same time operating the machine slowly in reverse creep. The machine should back out of the weight until the weight is clear of the lead.

**⚠WARNING** **Keep personnel clear of the lead and weight area when the weight falls to the ground.**

7. Remove the hammer head and anvil from the old weight and reinstall them onto the new weight.
8. Using lift and rigging equipment rated to support at least 1500 lbs., set the weight upright.
9. Lubricate the sliding surfaces of both the lead and weight with SAE no. 30 engine oil.
10. Lay the lead mast back so that it is approximately 30° above horizontal. Using the lifting equipment, tip the weight back and set the top of the weight into the lead at the bottom of the lead mast.
11. Place the machine in forward creep and operate the machine slowly forward, while actuating the layback control valve to raise the lead mast to a vertical position. This action should force the weight up between the lead.

*NOTE: When replacing a hammer weight, it may become necessary to hydraulically spread the lead angles slightly to allow installation of the new weight. Consult the Arrow-Master Service Department before attempting to spread the lead angles.*

12. Remove the rigging and reconnect the cable to the weight.
13. Lift the weight high enough to reinstall the tool holder. Reinstall the tool holder and lower the weight to the ground.
14. Readjust the cable length according to the cable length adjustment procedure in the "Adjustments" section of this manual.

## LEAD REPLACEMENT - Refer to Figure 9-5

1. Remove the hammer weight. Refer to the "Hammer Weight Replacement" procedure.
2. Using the sideshift control, move the carriage to the right until it is approximately 3 inches away from the right side travel limit.
3. Lower the lead onto the lead rest. Turn the engine off and relieve hydraulic system pressure by moving all valve handles through a full cycle - forward and backward.
4. Remove the hydraulic connections to the hammer lift cylinder. Be sure to mark the connector locations for each hose, especially if the unit is equipped with one of the mechanical stroke control options. Identification of the hoses prior to disassembly will be beneficial during reassembly of the unit.
5. Cap the open ends of hoses and the open hydraulic ports to prevent dirt from entering the hydraulic system.
6. Remove the mounting pin from the upper end of the lead tilt cylinder and rotate the tilt cylinder out of the way.
7. Secure the lift cylinder with an overhead hoist or crane, capable of lifting at least 2000 lbs. Remove the six mounting bolts, nuts, and the cylinder. Be sure to remove the cable with the lift cylinder. Set the lift cylinder and cable aside.
8. Secure the lead to an overhead hoist or crane, capable of lifting at least 2000 lbs.
9. Loosen the locking cap screw on the retaining ring at the back of the lead tilt pin. The retaining ring can be accessed from behind the carriage assembly.
10. Unscrew the retaining ring by rotating the ring in a counter-clockwise (CCW) direction. Remove the ring and thrust washer.

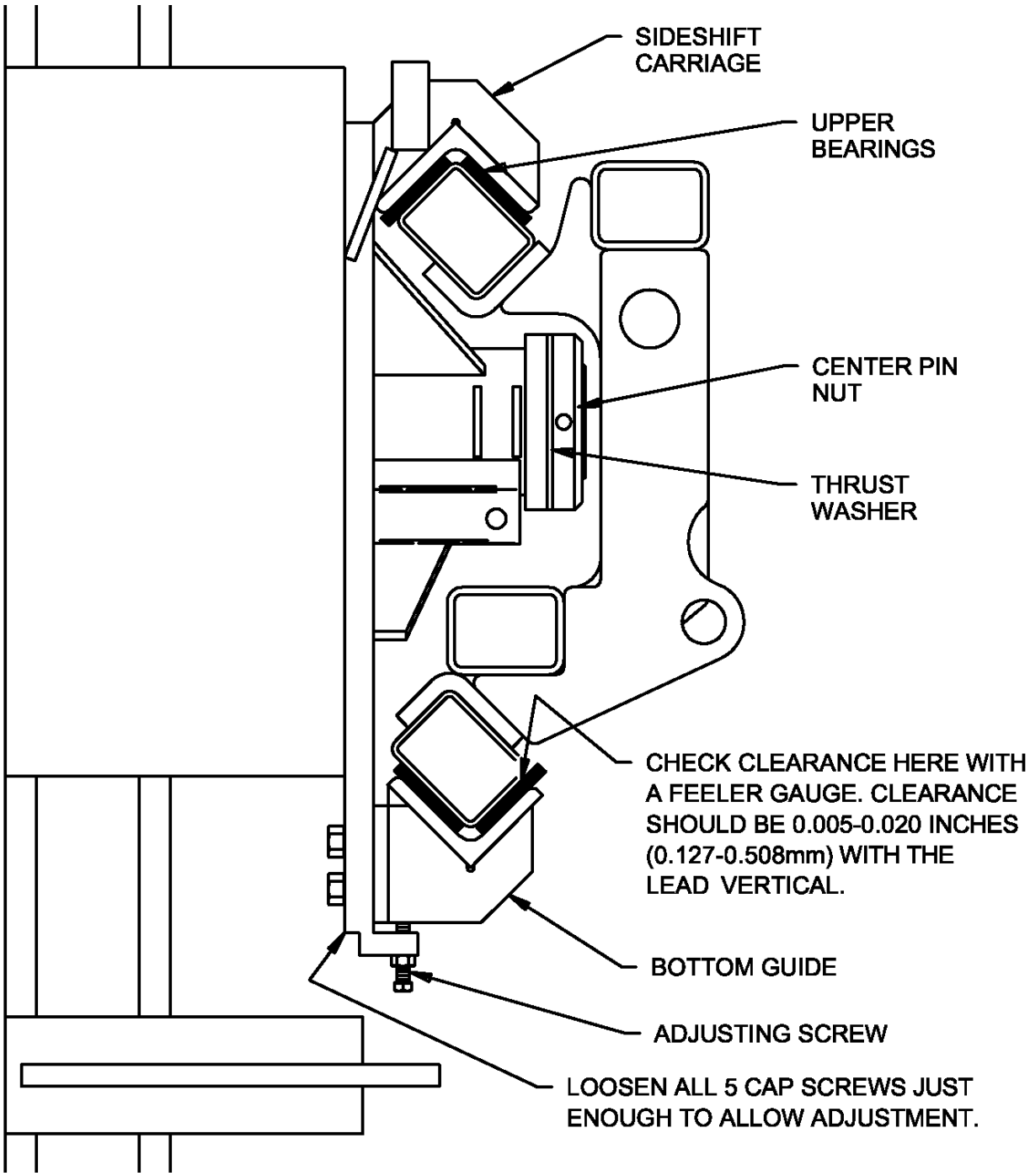



*Figure 9-5*
*Lead Center-Pivot Bearing*
*& Cross-Slide Bearing Block*

*Lead Replacement cont'd.*

11. Lift the lead assembly from the carriage with the overhead hoist, while guiding the lead pivot pin out of the bearings in the carriage assembly.
12. Carefully lower the lead mast assembly to the floor.
13. Follow the above procedure in reverse order to reinstall the lead mast. Refer to the "Adjustments" section of this manual to set the end play on the carriage center bearing.
14. Reinstall the weight according to the "Hammer Weight Replacement" procedure.
15. Lubricate the carriage center bearing with no. 2EP lithium grease at the fittings provided on the carriage and on the end of the pivot pin.

## SIDESHIFT CARRIAGE REPLACEMENT - Refer to Figure 9-5

1. Follow the instructions for removing the hammer weight and for removing the lead assembly.
2. Secure the carriage assembly to an overhead hoist.
3. Disconnect the sideshift chain from the carriage by removing the two adjustment screws located at the rear of the carriage on either side of the center pivot.
4. Remove the two chain sprockets.
5. Disconnect the lower tilt-cylinder pin from the carriage. Move the tilt cylinder out of the way or remove it entirely.
6. Remove the cap screws which connect the lower cross-slide bearing holder to the carriage assembly. The lower-bearing holder is located at the bottom of the carriage assembly.
7. Remove the bearing holder with bearings. The carriage will now be freed from the machine.
8. Lift the carriage assembly off the sideshift frame using the overhead hoist.
9. Follow the above procedure in reverse order to reinstall the carriage assembly. Refer to the "Adjustments" section of this manual for the adjustment procedures for the lower-bearing assembly and the sideshift chain.

## CROSS-SLIDE BEARING BLOCK REPLACEMENT - Refer to Figure 9-5

**⚠WARNING** **It is not necessary to remove the lead and carriage assemblies in order to replace the cross-slide bearings. Removal of the bottom guide will allow the lead and carriage assembly to tip off the sideshift frame in any direction. Do not attempt to replace the cross-slide bearings with the lead in place unless the lead has been properly secured to an overhead hoist or crane.**

1. Using the sideshift control, move the carriage to the right until it is approximately 3 inches away from the right side travel limit.
2. Lower the lead onto the lead rest. Turn the engine off and relieve hydraulic system pressure by moving all valve handles through a full cycle - forward and backward.
3. Release the tension on the sideshift chain by loosening the two adjustment screws located at the rear of the carriage on either side of the center pivot. It is not necessary to remove the chain sprockets or the chain.

**⚠CAUTION** **Use proper tools and be sure to keep hands and fingers away from pinch points.**

4. Secure the lead with an overhead hoist or crane which is capable of lifting at least 5000 lbs.

*Cross-Slide Bearing Block Replacement cont'd.*

5. Loosen the two jam nuts and adjusting screws at the bottom of the carriage. Remove the five cap screws which connect the bottom guide to the carriage assembly. The bottom guide is located at the bottom of the carriage assembly. Remove the bottom guide with the bearings.
6. Remove the countersunk screws which retain the bearings in the bottom guide.
7. Install the new bearings. Use new screws if the original screws are worn. Order the correct replacement screws from the Arrow parts department.
8. Torque the screws according to the Table i-1 - "Bolt and Cap Screw Torque Specifications".
9. Temporarily set the bottom guide with the new bearings aside.
10. Using the overhead hoist, carefully raise the lead and carriage assemblies off the sideshift frame. Lift the assemblies only the distance which is required (about 2") to allow access to the retaining screws for the upper bearings. Block the work area to prevent movement of the mast.
11. Replace the upper bearings according to steps 6-8 of this procedure.
13. Reinstall the bottom guide into the carriage assembly. Leave the cap screws loose enough to allow adjustment of the running clearance. Refer to the "Adjustments" section of this manual for cross-slide bearing adjustment procedures.
14. Readjust the sideshift chain according to the procedure in the "Adjustments" section of this manual.

## HAMMER WEIGHT SHIM-KIT INSTALLATION - Cast Iron Weight

The hammer weight on the Arrow Hammer, p/n 3000771, was made from cast iron before 2003. (Beginning in 2003, the cast iron weight was replaced with a steel fabricated weight, p/n 2000835.) Since the iron casting is softer than the steel surfaces of the lead, most of the abrasive wear which occurs during operation will take place on the weight casting (thus protecting the lead). Welding on the cast-iron weight is not recommended. Arrow makes a shim kit available to correct excessive play between the weight and the lead, thereby extending the useful life of the weight. The shim kit should be installed when the total clearance between the weight and the lead exceeds 1/2 inch. Total clearance is measured with the weight shifted completely to one side of the lead. To install the shim kit, use the following procedure:

1. Remove the weight according to the procedure under "Hammer Weight Replacement".
2. Check the V grooves in the weight for bell-mouthing (wider at the top and bottom than in the middle). It is not necessary to correct bell-mouthing prior to installing the shim kit. However, the life of the shim kit will be enhanced if the faces of the V grooves are flat prior to installation.
3. If bell-mouthing is to be corrected, the surfaces of the V grooves will need to be machined flat, making sure to keep the opposing faces of each groove at a 90° angle. **Do not remove more than 1/8 inch from any surface. The weight should never be allowed to become to narrow. The weight must remain wide enough to be held securely between the lead without the shims in place.**
4. Align the outside edge of each shim with the outside edge of the hammer weight. Use the shim as a template to mark the center location for each of the mounting screws.
5. Drill 1/4" holes a minimum of 3/4" deep at each screw location.
6. Install the shims using the 1/4"-20 UNC self-tapping screws supplied with the kit. Torque the screws to 9-11 lb-ft.
7. Reinstall the weight with the shims according to the procedure under "Hammer Weight Replacement.

# Hydraulic System

## PUMPS AND GEARMOTORS

The main equipment pumps and the hydraulic gearmotors which are used in the creeper-drive and sideshift circuits are not usually repairable upon failure. Arrow recommends that these items be replaced or taken to a competent service center that specializes in hydraulic components if repair is to be attempted. Hydraulic service specialists are listed in the telephone books of most metropolitan areas.

## HAMMER VALVE

The hammer-valve spool and valve housing are machined together to a very close fit tolerance. Therefore, the valve spool and housing are serviced together as a unit. The other components of the hammer valve are serviceable.

### Valve-Spool Seals and Servo-Valve Assembly Replacement - Refer to Figure 10-1

1. To replace the seals on the main-valve spool, and to access the servo-valve components, the entire hammer-valve assembly must be removed from the machine. The control handle can be left in place on the machine.
2. Locate the retaining ring at the base of the servo-valve body (Key 17, Figure 10-1). Remove the retaining ring and pull the servo-valve body out of the main-valve housing.
3. Pull the servo-valve body off the end of the servo-valve spool. Remove the servo-valve spool from the hammer-valve spool by sliding the two spools apart at the sliding joint.
4. Carefully pull the main-valve spool out of the housing. The spool guide (Key 6), stop sleeve (Key 5) and spring assembly will come out of the valve bore along with the valve spool.
5. Remove the spool guide from the hammer-valve spool.
6. If only the seals are to be replaced, proceed to step 9.
7. Manually compress the spring (Key 15) and slide the C-washer (Key 4) sideways, off the valve spool. The spring can now be removed from the valve spool.
8. Remove the retaining ring (Key 16) to allow the stop sleeve (Key 5) to be removed from the valve spool.
9. Remove the O-ring (Key 22) and oil seal (Key 23) from the lower end of the valve-spool bore in the valve housing.
10. Repair the relief-valve and the check-valve assemblies if necessary, before beginning reassembly of the valve assembly. Instructions for repairing the relief valve and the check valve are provided in separate subsections in this chapter.
11. The hammer valve and its components should be reassembled in a clean area. Make sure that dirt and contamination are removed from all components prior to assembly. Apply a small amount of hydraulic oil to the components prior to assembly, to ease the assembly process and to reduce the risk of damage to the parts during assembly.
12. Install a new seal (Key 22) into the valve housing.
13. Install a new lip seal (Key 23) into the lower end of the valve housing. The lips of the seal should point toward the outside. (Refer to Figure 10-1A).
14. Install a new seal (Key 18) into the upper end of the servo-valve housing.
15. Install a new lip seal (Key 21) into the upper end of the servo-valve housing. The lips of the seal should point toward the outside. (Refer to Figure 10-1B).
16. Reinstall the stop sleeve (Key 5) over the hammer-valve spool and install the retaining ring (Key 16).
17. Install the spring (Key 15) over the valve spool and stop sleeve. Manually compress the spring and install the C-washer (Key 4).

*Valve-Spool Seals and Servo-Valve Assembly Replacement cont'd.*

18. Carefully insert the valve spool, with the spring and stop sleeve, into the valve bore.

*NOTE: The valve spool is a very close fit to the valve bore.* ***Do not force the parts!*** *They will slide together easily when aligned correctly. A twisting motion will help with assembly.*

19. Install new seal (key 18) on the inside and O-ring (key 19) on the outside diameters of the spool guide (Key 6).
20. Install the spool guide over the upper end of the valve spool (Key 2) and slide the spool guide down into the valve housing. Be careful to not damage the O-ring on the outside diameter of the spool guide as it passes over the retaining ring groove in the valve housing.
21. Install a new O-ring (Key 19) into the bore above the spool guide. Work the O-ring into the corner which is formed between the spool guide and the valve housing.

*NOTE: Apply a small amount of grease to the O-ring to help keep it in position.*

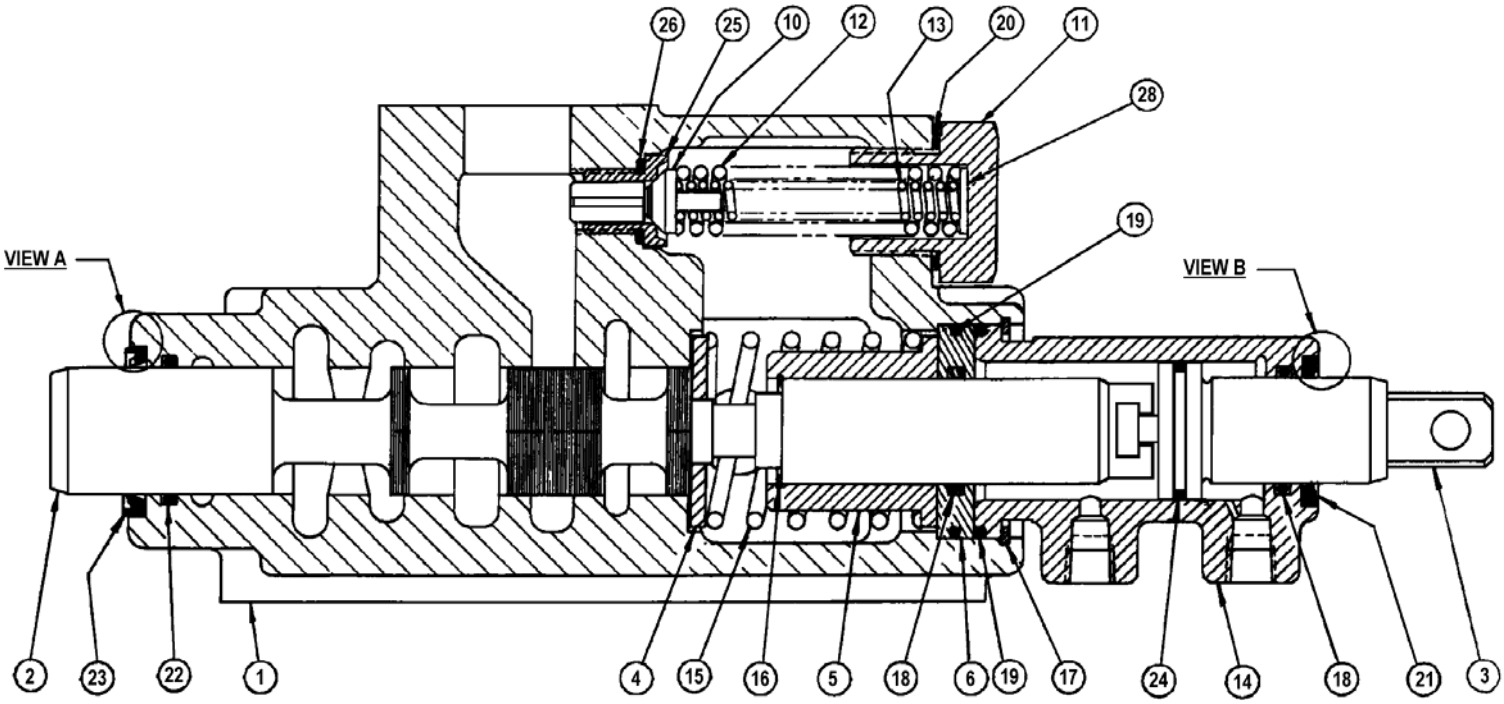



*Figure 10-1*
*Hammer Valve Assembly*

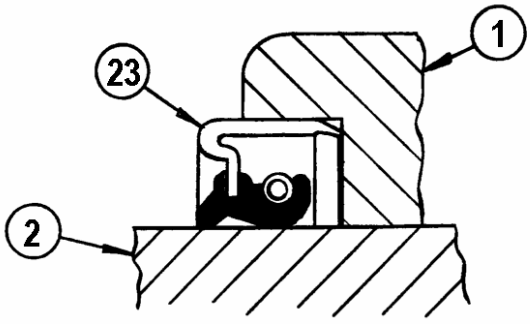



*Figure 10-1A*
*Hammer-Valve Spool Seal*

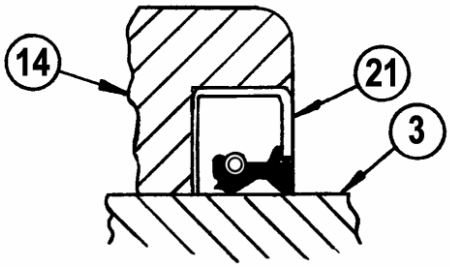



*Figure 10-1B*
*Servo-Valve Spool Seal*

*Valve-Spool Seals and Servo-Valve Assembly Replacement cont'd.*

22. Install a new piston ring (Key 24) onto the servo-valve spool (Key 3).
23. Slide the small knob on the end of the servo valve into the mating notch that is machined into the upper end of the hammer-valve spool.
24. Install the retaining ring (Key 17) over the body of the servo-valve housing. (The retaining ring will be difficult to place over the housing after the housing has been inserted into the valve bore.)
25. Carefully insert the servo-valve housing over the end of the servo-valve spool, being careful not to damage the seals on the spool, and inside the servo-valve housing.
26. Insert the servo-valve housing into the bore of the hammer-valve housing. The O-ring (Key 19) that was installed on top of the spool guide in step 21, must fit into the machined step on the end of the servo-valve housing. Be careful to not damage this seal during installation.
27. Set the hammer valve up on end and install the retaining ring (Key 17) into the bore of the hammer-valve housing. Apply down pressure against the servo-valve housing to expose the retaining ring groove in the hammer-valve housing. Push the retaining ring into place.
28. The reassembly of the hammer valve is now complete. Reinstall the valve onto the machine.
29. Check the relief-pressure setting. Check for leaks and for proper function of the valve.

## Hammer Relief Valve and Seat Replacement

1. The relief valve and seat are located under the large hexagonal plug near the control-handle end of the hammer-valve assembly. Remove the plug, valve springs, shims, and relief-valve plunger. (Refer to Figure 10-1, Keys 10-13, 20, 25, 26 & 28).
2. The relief-valve seat is threaded into an SAE O-ring boss in the valve housing. The valve seat contains machined slots 1/8" wide by .09" deep on its outer ring to aid in its removal. Insert an appropriate tool (such as a 1-1/16" drag-link socket) into the slots in the valve seat.
3. Twist the valve seat in a CCW direction to remove it.
4. Install a new O-ring on the seat. Reverse the disassembly procedure to reinstall the relief-valve components.
5. Reset the hammer lift-circuit relief pressure according to the procedure given in the "Hydraulic Pressure Adjustment" section of this manual.

## Load Check Valve Replacement - Refer to Figure 10-2

1. The load check valve is located on the upper surface of the hammer-valve assembly near the work port. Remove the large hexagonal plug. Remove the check-valve plunger and spring (refer to Figure 10-2).
2. The check-valve seat is threaded into the valve housing. The check-valve seat contains machined slots similar to those on the relief-valve seat. However, the check-valve seat is installed with a thread-locking compound which makes removal difficult.
3. Carefully remove the check-valve seat.
4. Inspect the mating surfaces of the check-valve plunger and seat for wear and scoring. Minor wear may be repaired by polishing or burnishing the seating areas. If wear is excessive the plunger and the seat must be replaced.
5. Coat the threads of the new check-valve seat with thread locking compound and reinstall the check-valve seat (see Figure 10-2).

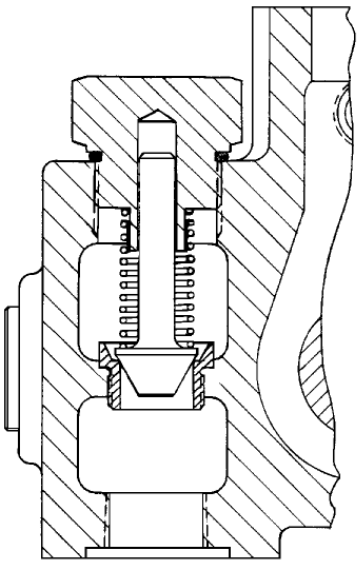


*Figure 10-2*
*Load Check Valve*

## CONTROL-CIRCUIT RELIEF VALVE

The system relief valve for the control circuit (small pump) is located to the left side of the hydraulic pump, at the rear of the machine (see Figure 10-3). The relief valve is serviced by Arrow, as a complete unit only. However, if disassembly of the relief valve should be required, use the following procedure:

1. Remove the entire relief cartridge from the relief-valve body (see Figure 10-3).
2. Set the cartridge in a bench vise and remove the bottom section of the cartridge from the center section. This procedure will allow access to the spring, plunger, and valve spool.
3. Reassemble the components in the reverse order.

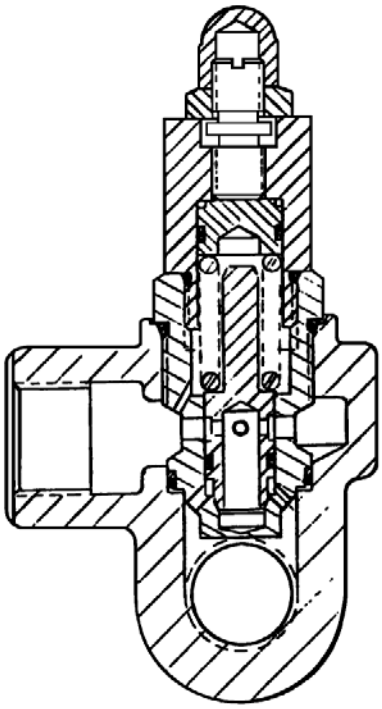


*Figure 10-3*
*Control Circuit Relief Valve*

## HAMMER-CIRCUIT RELIEF VALVE

The system main-relief valve for the hammer circuit (large pump) is located in the high-pressure line next to the hydraulic tank. It is attached to the return-line tee connector at the tank. The hammer-circuit relief valve is a pilot-operated type (which provides smooth and reliable operation). The relief valve is factory set to actuate at 2000 psi pressure. Under most conditions, it will never be necessary to repair or adjust this relief valve. The circuit relief, inside the hammer-control valve, is set to operate at a lower pressure than the main relief and it will control the operating pressures within the circuit. The main-relief valve functions as a back-up to the circuit relief in the hammer-control valve and also acts to remove pressure spikes which occur during automatic operation of the hammer valve. Arrow does not service the components of the hammer-circuit relief valve. However, if disassembly should become necessary, use the following procedure:

1. Drain the fluid from the hydraulic-fluid tank.
2. Remove the relief-valve cartridge from the valve body located next to the hydraulic tank. It is not necessary to remove the valve body, or to disconnect any hoses in order to gain access to the relief-valve cartridge.
3. Set the cartridge in a bench vise having soft jaws, preferably with V-shaped inserts, in order to grip the round body of the cartridge.
4. Remove the upper section of the cartridge from the lower section to gain access to the relief-valve main spool, spring, and pilot-valve seat. Refer to Figure 10-4.
5. The main spool contains a small passage (hole) at the bottom end which is covered by a filter screen. Make sure the small passage and the filter screen are clean.
6. The upper portion of the cartridge contains the pilot valve and spring. Access to these items can be gained by removing the adjusting screw. However, if the adjusting screw is tampered with, the relief-valve pressure setting must be reset prior to installation on the machine. (See note in step 9).
7. The upper portion of the cartridge also contains small passages in the center of the pilot-valve seat and in the side of the cartridge. The pilot valve blocks the hole in the pilot-valve seat, the other passage should be open.

*Hammer-Circuit Relief Valve cont'd.*

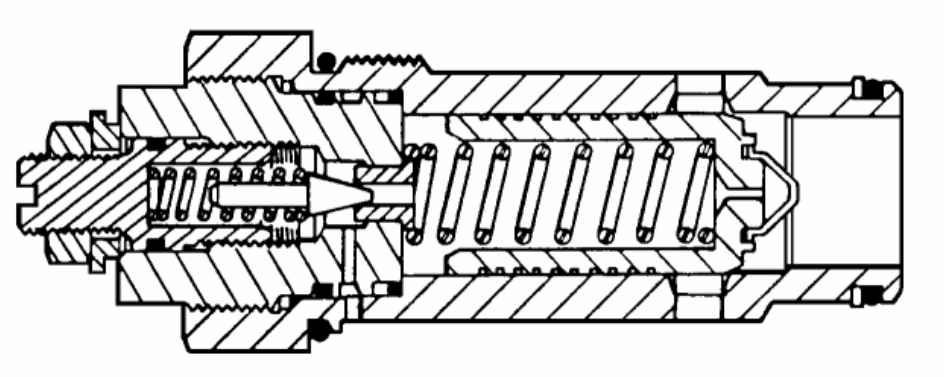


*Figure 10-4*
*Hammer-Circuit Relief Valve*

8. To reassemble the relief valve, follow the sequence for disassembly in reverse order.
9. If the relief-valve setting was tampered with, take the entire relief-valve cartridge (including the valve body) to a hydraulic components service specialist who has test stand equipment for checking pressures and flows. The correct pressure setting is 2000 psi.

*NOTE: It is not possible to reset the hammer-circuit main-relief pressure with the main-relief valve installed on the machine. The circuit-relief valve, inside the hammer control-valve assembly, will interfere with the setting of the main relief.*

**NOTICE** **Pressure settings in excess of 2000 psi are capable of causing serious damage to the hydraulic pump.**

## PILOT-SYSTEM ROTARY VALVE

The pilot-system rotary-valve assembly is located on the side of the hammer cylinder. Units with electronic stroke control do not have this valve. The pilot valve distributes the control signal to the correct side of the servo mechanism to make the unit operate in "automatic" mode. To repair the rotary valve, refer to Figure 10-5 and the following instructions.

1. Note and mark the locations of the four hoses connected to the valve before removing the valve from the machine. (The hoses are difficult to trace back through the hose bundle.)
2. Disconnect and cap the hydraulic hoses to prevent system contamination.
3. Remove the entire rotary-valve assembly along with the actuator arm and bracket from the machine.
4. Remove the spring.
5. Loosen the socket head cap screw which retains the actuator arm on the actuator shaft. Remove the actuator arm and the key.
6. Remove the six #10-24 UNC socket head cap screws which connect the valve body to the bracket. Remove the valve body and the end cap. (The valve assembly may come apart during removal.)
7. The valve base may be removed in the same manner. Note that the retaining screws for the rear end cap are slightly shorter than the ones used to retain the front end cap and bracket.
8. Pull the valve spool and shaft out of the front-end cap.
9. Install a new O-ring in the end cap.
10. The valve spool and valve body are machined to a close fit to control leakage. They are not serviced separately.

*Pilot System Rotary Valve cont'd.*

11. Install the valve base onto the valve body and spool assembly making sure to use a new gasket. Coat the threads of the six #10-24 UNC socket head cap screws with Loctite® grade 242 and torque to 65 lb-in. Double check each screw for tightness after assembly.
12. Reinstall the front end cap to the bracket and to the valve body and spool assembly using a new gasket. Refer to Figure 10-5 for the correct bracket orientation.
13. Double check the screws for tightness after assembly. Check the spool for free movement.
14. Reinstall the actuator arm assembly and tighten the 5/16"-18 UNC socket head cap screw. Torque to 20 lb-ft.
15. Reinstall the spring.
16. Reinstall the entire assembly on the unit and reconnect the hydraulic hoses.
17. Reset the actuator arm to the correct relationship with the trip finger as explained in the operator's section of this manual.
18. Check the unit for leaks and for correct operation.

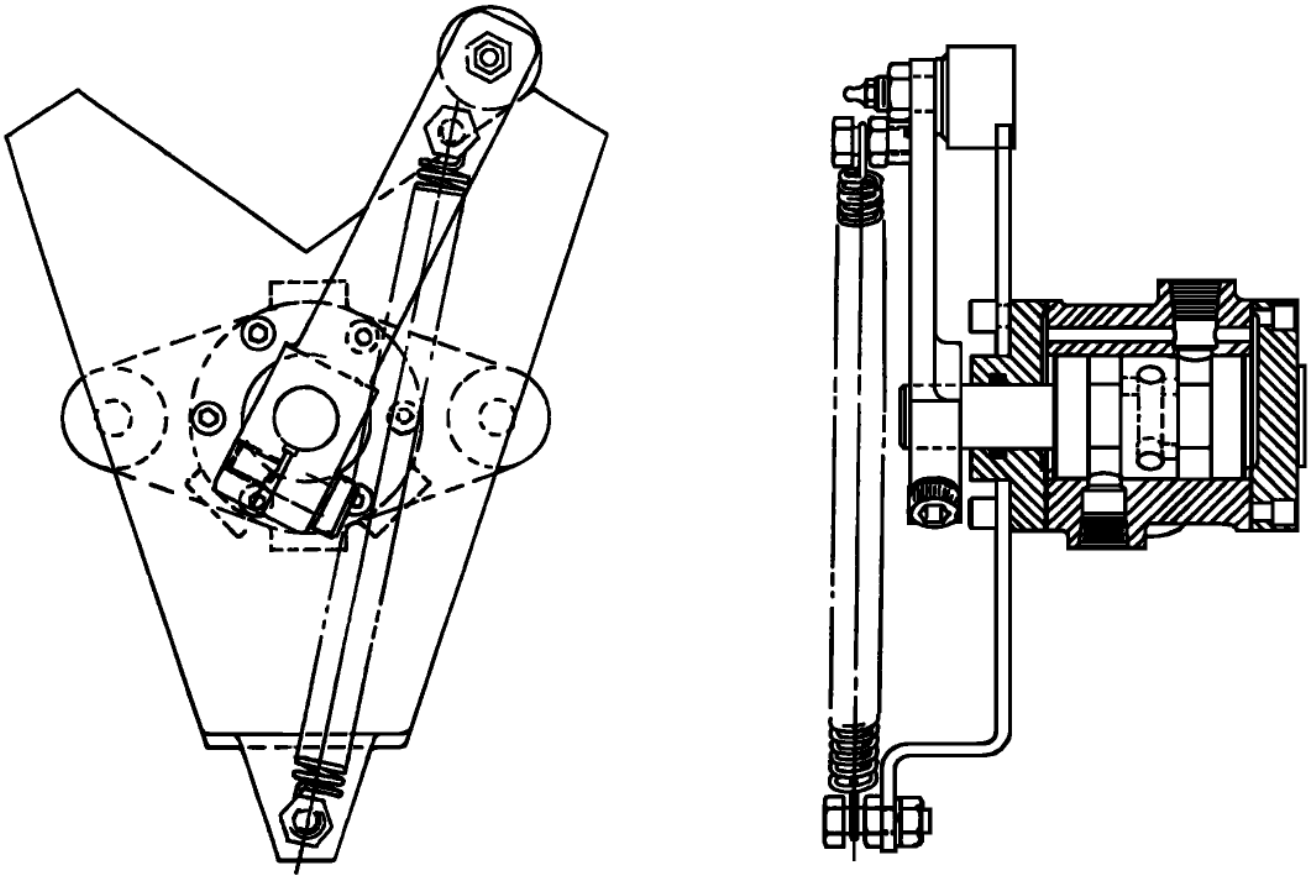


*Figure 10-5*
*Pilot-System Rotary Valve*

## CREEPER-CONTROL VALVE S/N: 6000-7049

The creeper-control valve contains a single-spool valve with a detent mechanism. There are no load-check valves and no internal relief valves in the assembly. The creeper-bypass valve is a separate assembly which screws into an open port on the creeper-control valve. To repair the creeper-control valve assembly, refer to Figure 10-6 and the following instructions.

1. Remove the front, and left-hand side cowling. Note and mark the six hose connections before disconnecting the hoses from the valve. Disconnect and cap the hoses to prevent contamination.
2. Disconnect the two brake lines from the fitting on the creeper-bypass valve.
3. Disconnect the control lever and remove the entire valve assembly from the machine.
4. The valve body and valve spool are not serviced separately. The seals and the detent mechanism are serviceable.
5. Remove the creeper-bypass valve assembly and set it aside for installation on the new creeper-control valve if the entire valve assembly is to be replaced. (The procedure for removing the creeper-bypass valve components is covered in a separate subsection of this manual).
6. Remove the plastic cup which covers the end of the valve assembly. Remove the retaining ring below the cup.
7. Insert a large screwdriver into the slot in the end of the detent assembly. Hold the opposite end of the valve spool, and twist the detent assembly in a CCW direction to release it from the valve spool. Remove the detent assembly. (Refer to 10-6).

*NOTE: The detent should come out as a assembly. If there are any loose balls or springs when the detent is removed, the detent assembly must be replaced.*

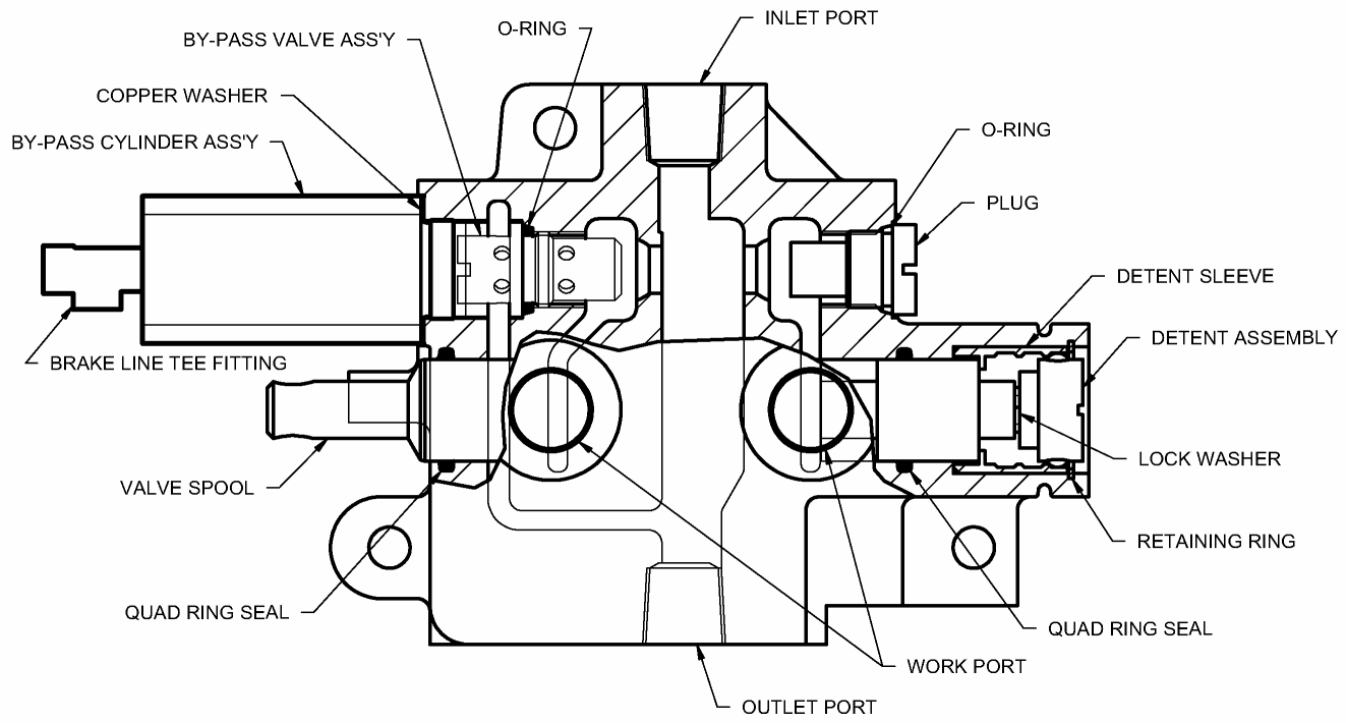



*Figure 10-6*
*SP Creeper-Control Valve*

*Creeper-Control Valve cont'd.*

8. Pull the valve spool out of the valve housing.
9. Remove the O-rings (or quad rings) which are located in the valve housing at each end of the valve bore.
10. Install a new quad ring (from the spool-seal kit) in each of the O-ring grooves. (The groove will accept either the O-ring or the quad ring. The quad ring provides improved sealing ability.) Use a lubricant such as hydraulic oil when installing the new seals.
11. Lubricate the valve spool and slide it back into the valve bore. Insert the spool with control handle end first from the rear of the valve body. The chamfer at the control-handle end of the spool will help prevent damaging the new seals during reassembly.
12. Insert the detent assembly back into the valve bore. Screw the detent assembly into the end of the valve spool.
13. Reinstall the snap ring and the plastic cup.
14. Install the creeper-bypass valve assembly.
15. Reinstall the creeper-control valve onto the machine. Reattach the six hydraulic hoses and the two brake lines.
16. Bleed the brake lines, and add brake fluid if necessary. Check the service-brake system for correct operation.
17. Check for leaks and for correct function of the creeper system. Check for proper creeper-bypass function.

## CREEPER-CONTROL VALVE S/N: 7050-

The creeper-control valve contains a single spool valve spool with a detent mechanism. It is a 4-way valve with a separate bypass solenoid valve. To repair the creeper-control valve assembly, refer to Figure 10-6a or 10-7a and the following instructions.

1. Remove the front cowl and left-hand side cowling. Note and mark the six hose connections before disconnecting the hoses from the valve. Disconnect and cap the hoses to prevent contamination
2. Disconnect the control lever and remove the entire valve assembly from the machine.
3. The valve body and valve spool are not serviced separately. When disassembling the valve for seal or detent replacement, remove, clean and inspect the spool; lubricate the spool before assembling it back into the body. Whenever a valve is disassembled for repair, use care to keep all parts clean and use hydraulic oil when assembling.
4. If the detent assembly must be inspected or replaced, remove the four screws from the bottom spool cover. Remove the spool cover. Remove the screw in the center of the spool to remove the detent kit.
5. Remove the two screws and the handle bracket to replace the top spool seal and backup ring. The spool may now be removed for cleaning and inspection.

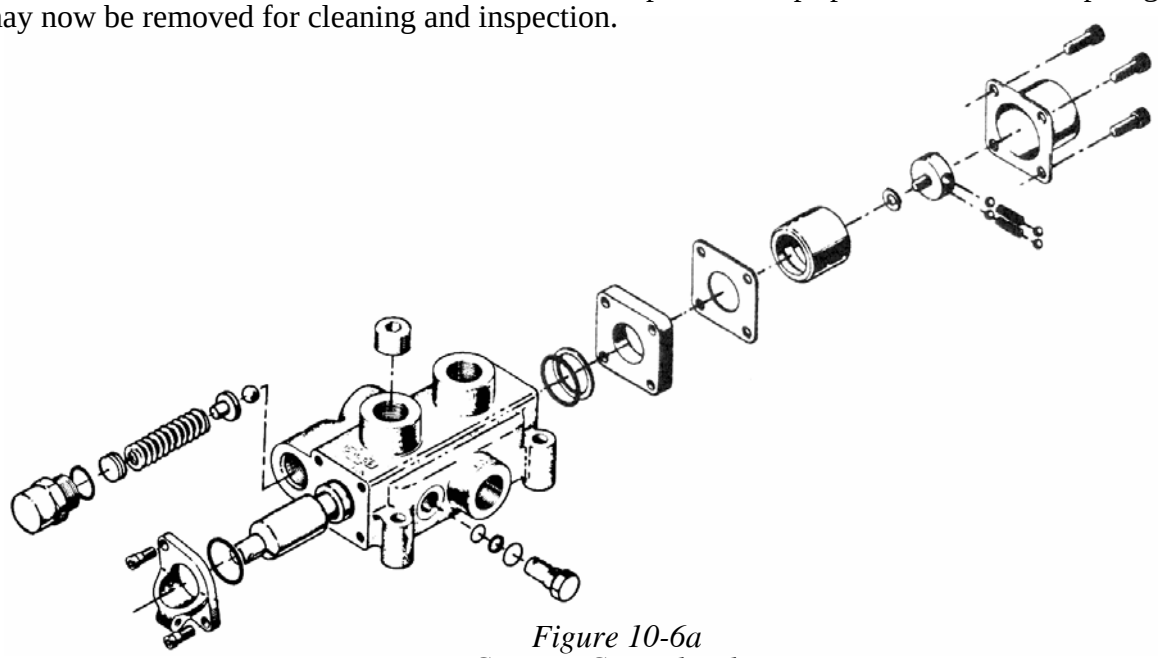


*Figure 10-6a*
*Creeper-Control Valve*

*Creeper-Control Valve cont'd.*

6. Replace the detent kit and mounting screw. Replace the spool seals and backup rings. Replace the bottom spool cover and screws. Replace the handle bracket.
7. Reinstall the creeper-control valve onto the machine. Reattach the six hoses and control lever.
8. Check for leaks and for correct function of the creeper system. Check for proper creeper-bypass function.

## CREEPER-BYPASS VALVE S/N 6000-7049

The creeper-bypass valve is connected directly to the creeper-control valve. The internal components of this valve assembly may be exposed to hydraulic fluid or brake fluid, depending on their location in the assembly. The design of the bypass valve prevents the two fluids from commingling, even in the event of a seal failure. Fluid leakage past the seals is vented to the outside of the assembly through a weep hole. Refer to Figure 10-7 and the following instructions to repair the creeper-bypass valve.

1. Prior to removing any hoses or brake lines, examine the external surface of the creeper-bypass valve for the presence of brake fluid or hydraulic fluid. The type of fluid present, if any, will provide a clue as to which components are in need of repair.
2. Disconnect the two brake lines from the fitting at the top of the assembly.
3. Unscrew the hexagonal-shaped bypass-cylinder assembly from the creeper-valve housing. This assembly contains the components of the creeper-bypass valve which are related to the brakes and brake fluid. The "hydraulic" related components will remain inside the creeper control-valve assembly.
4. The bypass-valve cylinder assembly has a 1/8"-wide by 1/8"-deep slot milled into the upper surface to aid in installation and removal. Insert a flat-bottomed blade approximately 5/8" wide into the slots. Turn the assembly CCW to remove it from the valve housing.
5. The bypass-valve cylinder section of the creeper valve, including the bypass spool, cylinder, and spring, are serviced only as a complete assembly. With the spring removed, check to make sure the spool slides freely inside the cylinder. If the spool sticks, clean the spool and cylinder or replace the assembly. Install the bypass-valve cylinder assembly into the port in the creeper-valve housing. Use a new O-ring.
6. Insert a dowel through the brake-line fitting, if necessary, and push the piston and piston cup out of the cylinder. Do not lose the plunger, cylinder head, and spring.
7. Check the inside surface of the bypass cylinder for contamination and/or corrosion. Do not reuse a cylinder with a corroded bore.
8. Install a new piston cup.
9. Install new O-rings on the inside and outside of the bypass cylinder
10. Reinstall the bypass-valve piston, spring, and cylinder into the bore of the bypass cylinder.
11. Reinstall the plunger and install a new O-ring.
12. Reinstall the finished assembly into the creeper-valve housing. Attach the two brake lines.
13. Bleed the brake lines, and add brake fluid if necessary. Check the service-brake system for correct operation.
14. Check for leaks and for correct function of the creeper bypass.

*Creeper-Bypass Valve cont'd.*

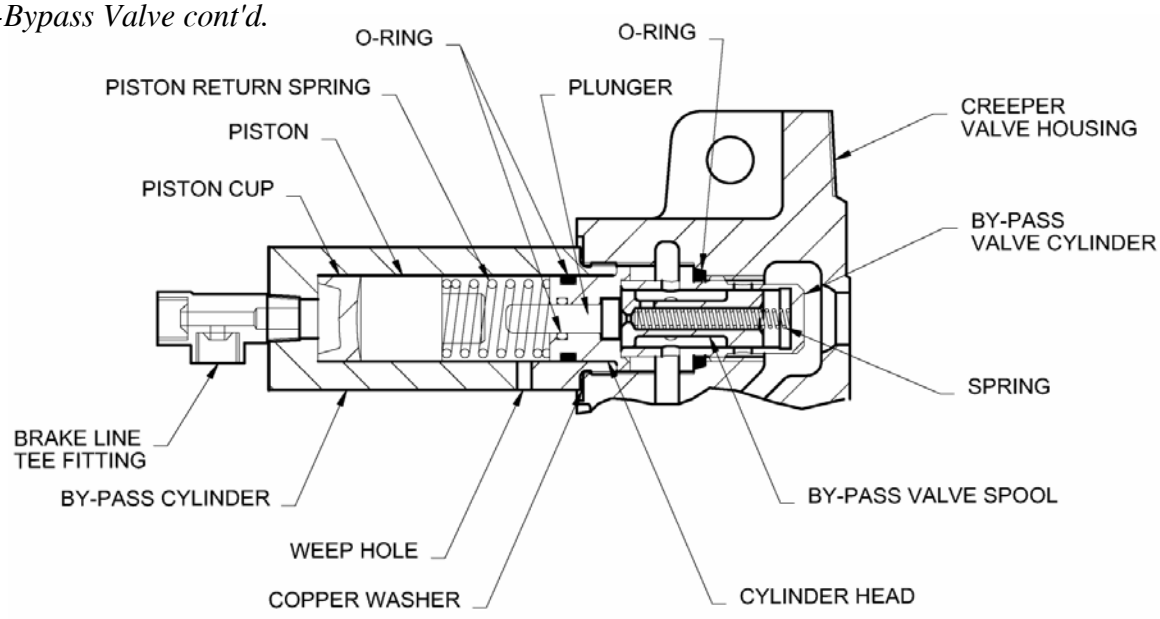



*Figure 10-7*
*Creeper-Bypass Valve Assembly*
*(Ref 2000372)*

## CREEPER-BYPASS VALVE S/N: 7050-

The creeper-bypass is a separate solenoid valve assembly which is a normally closed valve. The stop light switch on the brake master cylinder actuates the solenoid valve when the brake pedal is depressed. This stops hydraulic pressure to the creeper motor. It is mounted on the left side of the control panel. Remove the left side cowl to access this valve for service. To replace the solenoid-valve, refer to Figure 10-6b:

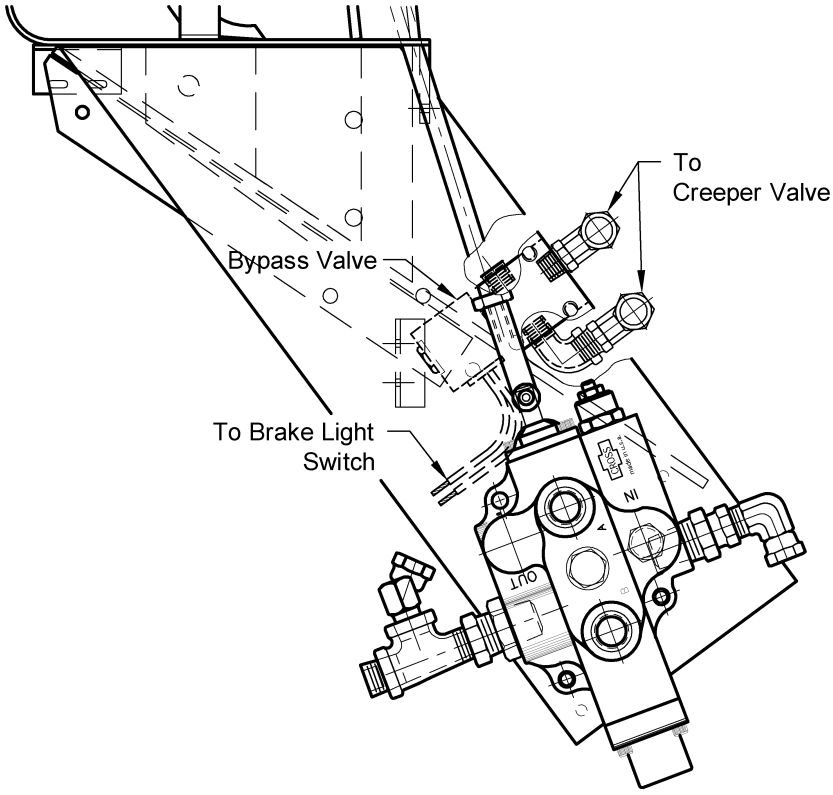



*Figure 10-6b*
Bypass Solenoid Valve

**1.** If the solenoid-valve is suspected of not working, connect a 12-Volt DC power supply to the yellow lead at the wire connection on the control panel. Listen for an audible clicking sound from the solenoid-valve.

2. If no clicking sound can be detected, place the lead from a Volt/Ohmmeter across the two terminal lead. (Make sure that the service brakes and optional Mico lock are released.) Check the resistance across the coil lead. Resistance should be about 4.3 Ohms. Infinite resistance indicates an open circuit. No resistance or very low resistance indicates a short circuit. The coil is not serviced separately. Replace the entire assembly if the coil is bad.

3. Note and mark the locations of the hoses connected to the valve. Disconnect the wires, hoses, and mounting bolts to replace the solenoid valve assembly.

## CUSHION VALVE (crossover relief) S/N 6000-7035

The cushion valve (or crossover relief) valve is located on the left hand A-frame upright near the creeper control valve. The cushion valve protects the creeper circuit from shock loads which result from the unit striking objects while operating in creep. The cushion valve contains two ball poppet style relief valves which allow some fluid to be exchanged between the two supply lines to the creeper drive motor without passing through the motor. Arrow services the cushion valve as a complete assembly. If it becomes necessary to dismantle the cushion valve for any reason, the procedure is described below:

1. Note and mark the two hose connections leading to the cushion valve. Disconnect and cap the hoses.
2. Remove the cushion-valve assembly from the machine.
3. Remove the plug from one side of the assembly and tip the assembly to remove the spring guide, shims, and ball. (Refer to Figure 10-8).
4. The seat (Key 1) will remain inside the valve body. The seat can be removed only with the aid of a special tool having prongs that fit into the two holes in the upper surface of the seat.
5. Repeat the procedure with the opposite side of the assembly.
6. Reassemble the valve in the reverse order.
7. Install the valve assembly on the unit and check for leaks.

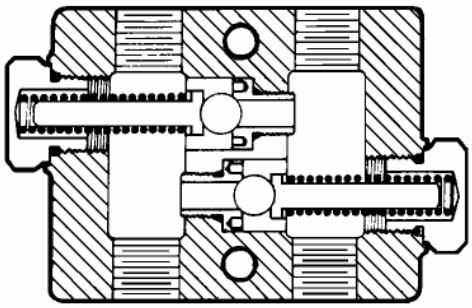


*Figure 10-8*
*Cushion Valve Assembly*

## AUTO-MANUAL VALVE S/N 6000-7049

The auto-manual valve supplies pressurized hydraulic fluid to the pilot system when the control handle is placed in the "auto" or automatic position. The other two positions of the control spool block flow from the valve into the pilot system. There is no return flow to the auto-manual valve. Only the work port furthest from the control handle is used. The other work port is plugged. The auto-manual valve consists of a single 3 way valve spool with a 3 position detent assembly, adjustable differential style pressure relief and a single load check (the relief valve cartridge functions as the other load check). To repair the auto-manual valve assembly:

1. Remove the access panel above the control valves.
2. Disconnect the starter interlock switch if the interlock switch is mounted to the control handle.
3. Remove the control handle from the valve assembly.
4. Note and mark the hose connections before disconnecting the hoses from the valve. Disconnect and cap the hoses to prevent contamination.
5. Remove the cap screws which connect the auto-manual valve to the valve mounting plate. Loosen and/or remove as many of the mounting cap screws as necessary to allow the entire control valve bank to be shifted enough to allow removal of the auto-manual valve assembly.
6. Rotate the auto-manual valve assembly CCW to disconnect it from the pipe nipple which connects the auto-manual valve to the adjacent valve assembly. Remove the auto-manual valve assembly from the machine.
7. Remove the plastic cup which covers the back end of the valve spool assembly. Remove the retaining ring below the cup.
8. The valve spool may be pushed backward out of the valve housing without disconnecting the detent assembly if the detent assembly does not require repair. Continue the procedure with step 11.
9. Insert a large screwdriver (or a 15/16" drag link socket) into the slot in the end of the detent assembly. Twist the detent assembly in a CCW direction to release it from the end of the valve spool. Remove the detent assembly making sure to not lose the two balls, spring and washer. (Refer to Figure 10-9).
10. Push the valve spool backward out of the valve housing.

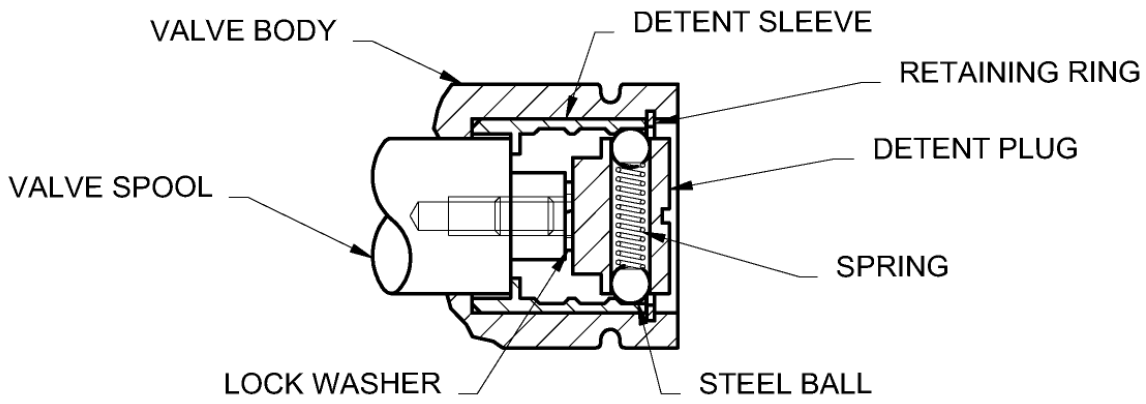



*Figure 10-9*
*SP Auto-Manual Valve Detent Assembly*

*NOTE: The valve spool and valve housing are not serviced separately. If the valve spool or valve housing are worn or damaged, order a complete new valve assembly.*

*Auto-Manual Valve cont'd.*

11. Remove the O-rings (or quad rings) located in the valve housing at each end of the valve bore.
12. If the relief-valve cartridge and load checks are not to be removed, skip to step 19.
13. The relief valve cartridge is located at the handle end of the control valve, adjacent to the valve spool. Remove the long hexagonal-shaped cap assembly to expose the relief-valve spool and spring. There also may be several shim washers of various thicknesses in the assembly.
14. Remove the spring and shim washers and lift out the relief-valve spool.
15. Unscrew the relief-valve housing from the valve housing. The relief-valve housing also acts as the load check on this side of the valve assembly.
16. Turn the valve housing over and remove the slotted plug, directly opposite the relief valve. Remove the load check.

*NOTE: The auto-manual valve does not contain a load check below the relief-valve cartridge. The work port on this side of the auto-manual valve is permanently blocked by the valve spool. Load checks in hydraulic circuits prevent the load from dropping momentarily when the valve spool has been actuated, but before the pump has generated sufficient pressure to hold the load. The load check is not important to the function of the auto-manual valve.*

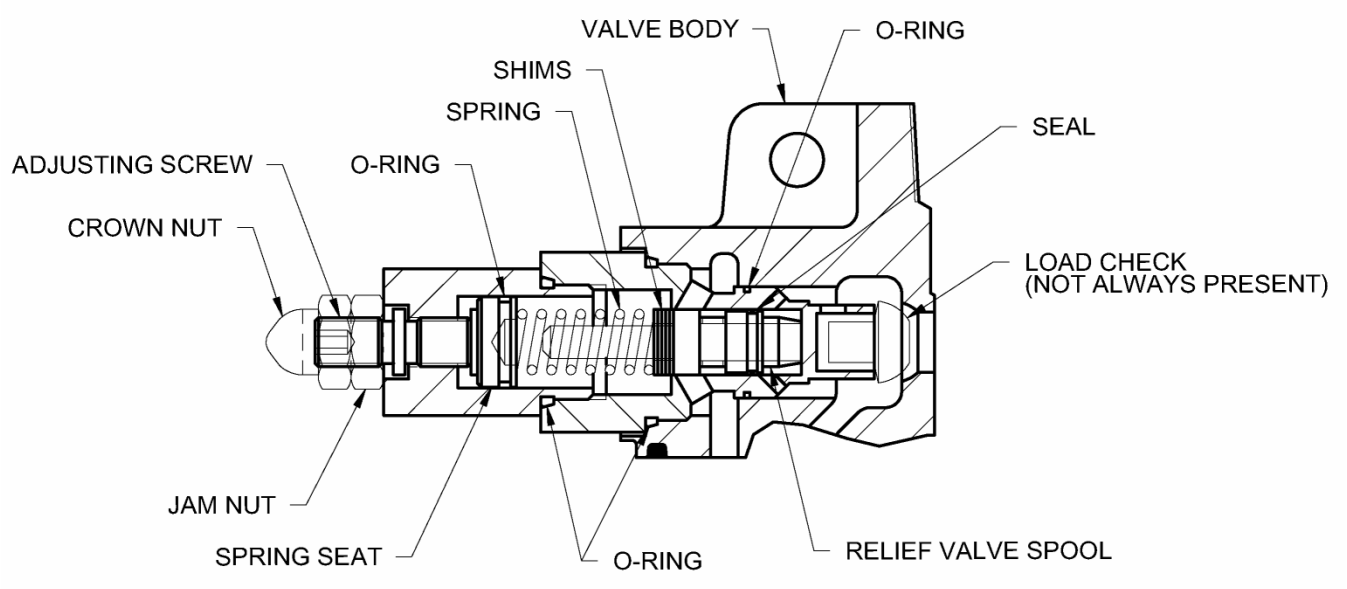



*Figure 10-10*
*SP Control-Function Valve Relief-Valve Assembly*

17. Install new packing on the relief-valve spool and on the relief-valve housing, if necessary.

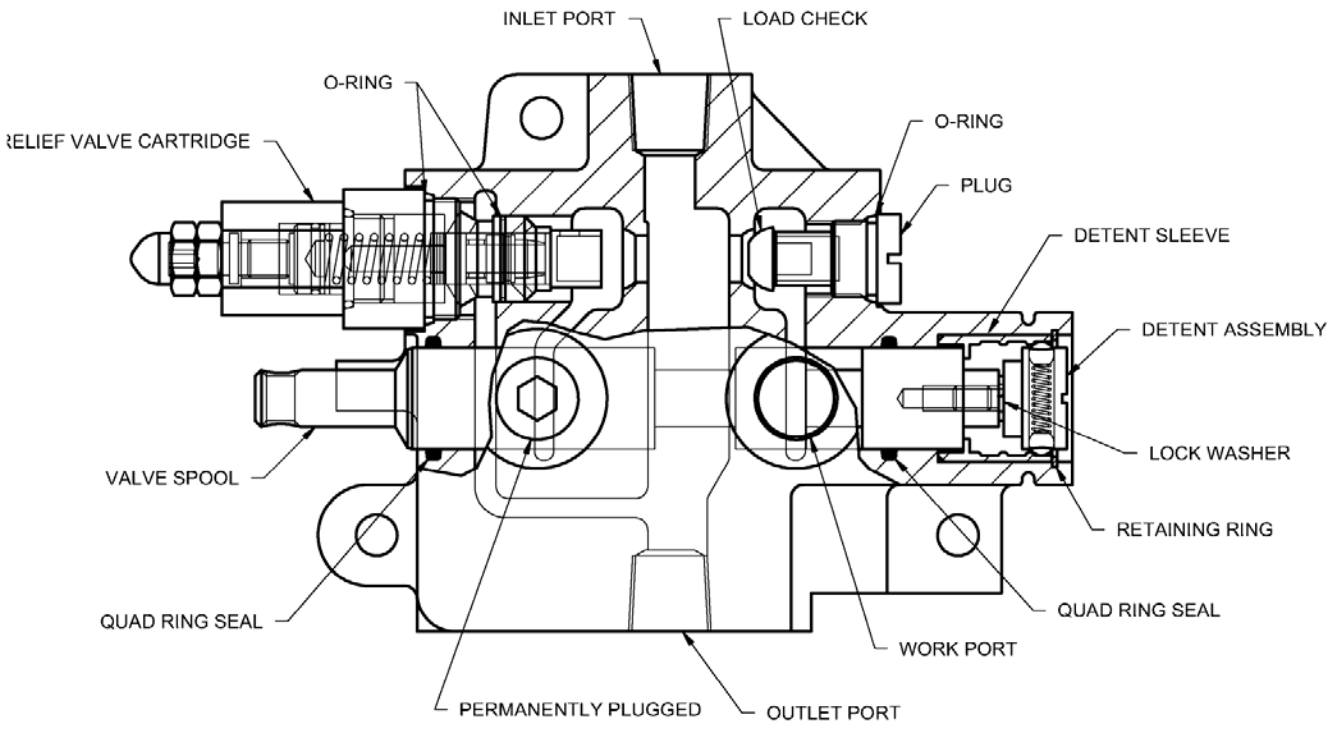
*NOTE: The relief-valve spool is not serviced separately. If the spool is worn or damaged, replace the entire relief-valve cartridge. The part numbers for the relief-valve spring and for the entire relief-valve cartridge used on the auto-manual valve assembly are different than the part numbers used on similar components of the other control-valve assemblies. Be sure to order the correct parts.*

18. Reinstall the relief-valve spool, spring, and shim pack. Replace the cap assembly.
19. Reinstall the load-check valve and the slotted plug.
20. Install a new quad ring (from the spool-seal kit) in each of the O-ring grooves in the valve-spool bore. (The groove will accept either the quad ring or an O-ring. The quad ring provides improved sealing ability.) Use a lubricant, such as hydraulic oil when installing the new seals.

*Auto-Manual Valve cont'd.*

21. Lubricate the valve spool and slide it back into the valve bore. Insert the spool, control-handle end first, from the rear of the valve body. (The chamfer at the control-handle end of the valve spool will help to prevent damage to the new seals during installation of the valve spool).
22. Insert the detent-plug assembly back into the valve bore after first making sure that both detent balls, spring, and washer are in place. Screw the detent assembly into the end of the valve spool.
23. Reinstall the retaining ring and the plastic cup.
24. Reattach the auto-manual valve assembly to the other control-panel valves. Seal the threads on the pipe nipple with pipe sealant.
25. Reinstall the valve-mounting hardware, hydraulic hoses, and the valve-control handle.
26. Reinstall the starter-interlock switch if the machine is so equipped.
27. Set the relief-valve pressure in the pilot circuit according to the procedure in the "Hydraulic Pressure Adjustment" section of this manual.

*Figure 10-11*




*SP Auto-Manual Valve Assembly*

28. Check the machine for proper function of the auto-manual valve and any additional control circuits which were disturbed during the repair.
29. Check the starting circuit to make sure that the engine will not crank if the control handle on the auto-manual valve is positioned for automatic operation or if the valve is in neutral (center) position. The engine should crank only when the control lever on the auto-manual valve is pushed all the way forward into the position labeled "man" or "man/start". Make corrections to the limit switch or wiring if necessary.

## FUNCTION-CONTROL VALVES (other than auto-manual 4001968, 4001970, 4001971) S/N 6000-7049

There are several function-control valves on the Arrow control panel which are housed in separate two-spool or three-spool assembly configurations, depending upon the control options which were selected when the machine was built. Each valve assembly contains a differential-area style relief-valve cartridge and a load check in addition to the particular combination of valve spools. All of the valves in each arrangement are spring return to neutral 4-way valves. To repair the function valves, refer to Figure 10-12 and follow the repair procedures auto-manual valve assembly with the following exceptions:

1. Note and mark the locations of all of the hoses connected to the entire valve-bank assembly. The entire assembly must be removed in order to access the particular assembly on which the work is being performed. Tracing all of the hoses back to their respective functions would be a long and difficult task.
2. Each valve spool is equipped with a spring-centering device instead of a detent assembly. The procedure for disassembly and reassembly of the spring-centering device is nearly identical to the procedure described for the disassembly and reassembly of the detent assembly.
3. The load checks have a functional purpose as described in the repair procedure for the auto-manual valve assembly.

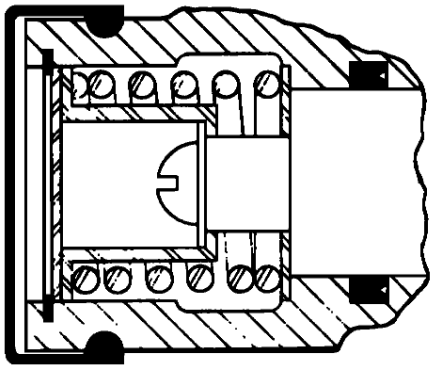


*Figure 10-12*
*Spring Return to Neutral*

## SOLENOID-VALVE ASSEMBLY (electronic stroke only)

The solenoid-valve assembly on units equipped with electronic stroke control is located on the floor plate extension below and slightly forward of the hammer valve. The solenoid-valve assembly is a solenoid-actuated, 4-way, 2-position valve which distributes the pilot-control signal to the correct side of the servo mechanism when the unit is operating in automatic mode. This valve is either energized or de-energized, depending upon the output of the electronic control station. To repair the solenoid-valve, refer to Figure 10-13:

1. If the solenoid-valve is suspected of not working, connect a 12-Volt DC power supply to the yellow lead at the wire connection on the control panel. Listen for an audible clicking sound from the solenoid-valve.
2. If no clicking sound can be detected, place the lead from a Volt/Ohmmeter across the two terminal lead. (Make sure that the on/off switch on the electronic control station is in the "off" position prior to doing this.) Check the resistance across the coil lead. Resistance should be about 4.3 Ohms. Infinite resistance indicates an open circuit. No resistance or very low resistance indicates a short circuit. The coil is not serviced separately. Replace the entire assembly if the coil is bad.
3. Disconnect the filter from the inlet port to the valve assembly. Check the filter to make sure it is not plugged. Replace a plugged filter with a new filter.
4. Note and mark the locations of the four hoses connected to the valve. Disconnect and plug the hoses to prevent system contamination.

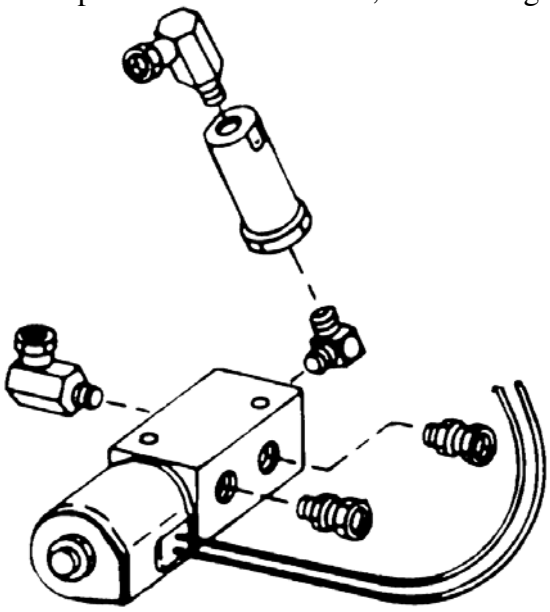


*Figure 10-13*
*Solenoid-Valve Assembly*
*Ref 4001805*

*Pilot-Valve Assembly cont'd.*

5. Remove the valve assembly from the machine.
6. Unscrew the nut from the center post on the coil. Remove the coil to expose the top of the spool section.
7. Remove the threaded fitting at the top of the spool section, and remove the spool and the return spring. If these components are damaged or worn, replace the entire assembly.
8. Reinstall the components in the reverse sequence. Reattach the control wires to the correct terminals on the terminal strip. Refer to Figure 10-14 or the Wiring Diagram in Section11.

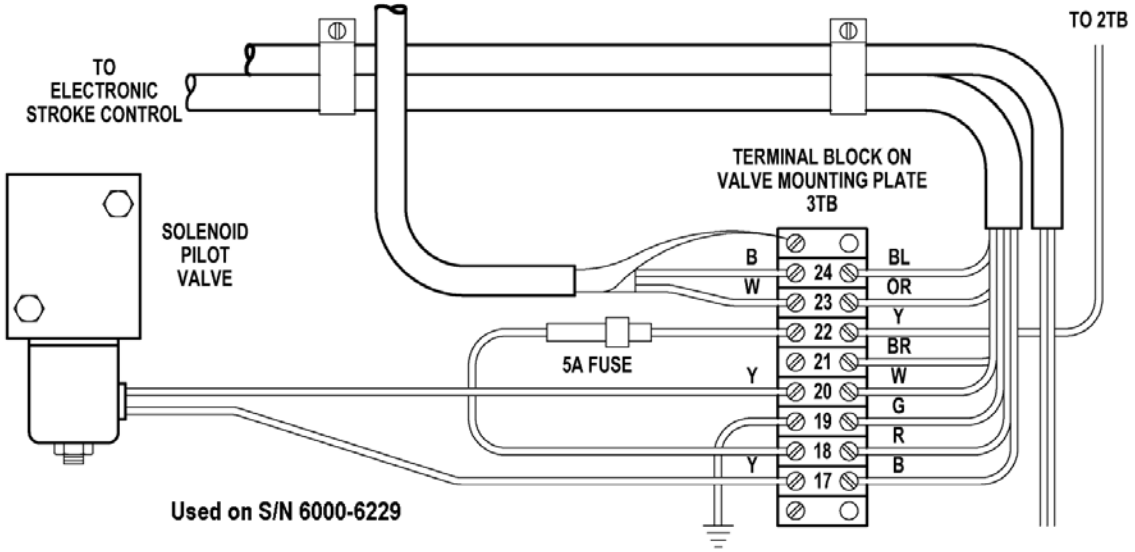



*Figure 10-14*
*Terminal Strip Connections*

## FLOW DIVIDER (priority valve)

The flow divider or priority valve is located in the pressure line between the creeper-drive valve and the control-valve bank. The purpose of the flow divider is to maintain a constant flow of 3 gpm to the steering circuit regardless of pressure or flow requirements of the downstream control circuits. All of the flow exiting the creeper-drive valve enters the flow divider. The flow divider is located just above the left-hand floor plate extension, forward of the steering column. Internal components of the flow divider are not serviced by Arrow. However, if it should become necessary to disassemble the flow divider, refer to Figure 10-15 or Figure 10-15A and the following instructions.

1. Note and mark the locations of the hose connections to the flow divider. Disconnect and plug the hoses to prevent system contamination.
2. Remove the valve assembly from the machine and place it in a bench vise.
3. Remove the hex plug from the end of the valve bore. Remove the valve spool, spring, and shim. Note that there are no seals on the valve spool.
4. Remove the hexagonal-shaped cap from the relief valve which is located next to the bypass port (labeled BP).

*Flow Divider cont'd.*

5. Turn the relief-valve screw in a CCW direction to remove it from the valve housing. Remove the spring and the cone-shaped valve plunger.

*NOTE: The relief valve on the flow divider is factory set to provide a maximum pressure of 1000 psi to the regulated (steering) circuit. If the relief valve is disturbed, the relief pressure must be reset after reassembly. This can be accomplished by holding the steering against one of the stops (extreme RH or LH turn) while the unit is running. Install a pressure gauge in the supply line to the steering valve.*

6. Reassemble the flow divider using the reverse of the disassembly procedure. Refer to Figure 10-15 or Figure 10-15A and note the orientation of the valve spool, spring, and shim. It is possible to insert these items backward.
7. Set the relief pressure as outlined in step
8. Check for proper function of the power-steering system.

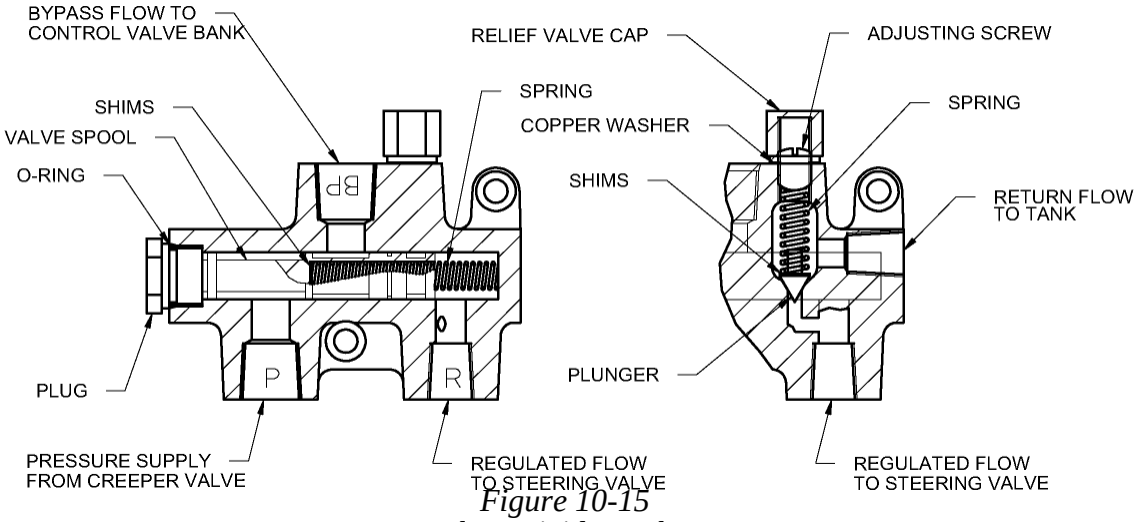



*Figure 10-15*
*Flow-Divider Valve*
*4001356 (S/N 6000 - 6503)*

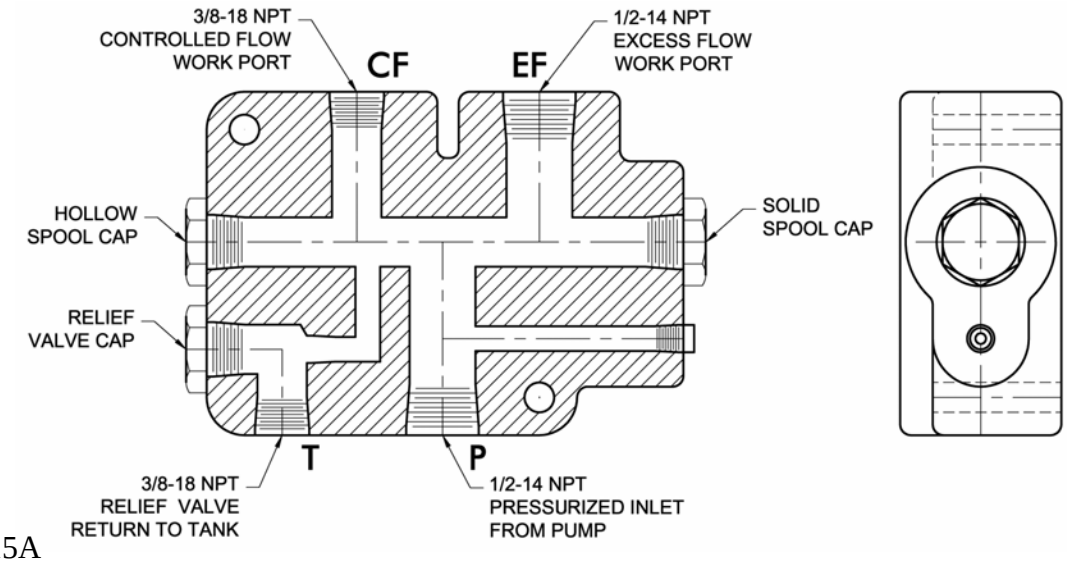


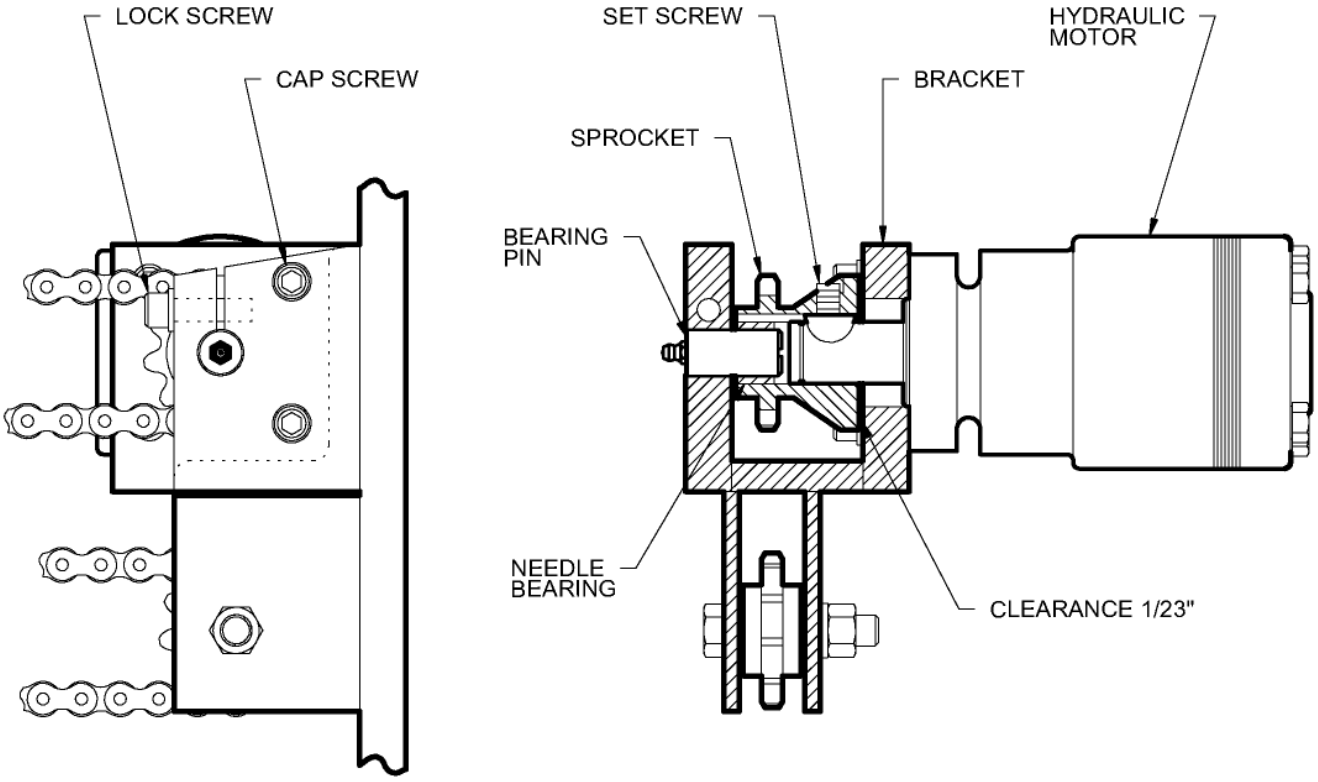

Figure 10-15A
Flow-Divider Valve

*4002188 (S/N 6504 - . . . )*

# SIDESHIFT MOTOR AND SPROCKET REPLACEMENT

1. Refer to Figure 10-16, Sideshift Motor and Sprocket Assembly.
2. Loosen the jam nuts on each of the two chain adjustment screws, located at the rear of the carriage near the center pivot, and loosen the sideshift drive chain.
3. Loosen the set screw in the sprocket.
4. Remove the four socket head cap screws holding the motor to the motor-mounting bracket. Remove the motor, making sure to not lose the key.
5. Loosen the lock screw which clamps the bearing pin in the mounting bracket.
6. Pull the bearing pin forward to free the sprocket.
7. Check the needle bearing and sprocket. Replace the needle bearing and/or sprocket if necessary. Work a small amount of lithium grease between the rollers of the bearing.

*Figure 10-16*




*Sideshift Motor and Sprocket Assembly*

*Sideshift Motor and Sprocket Replacement cont'd.*

8. Reinstall the motor, making sure the key is in place on the motor shaft.
9. Push the bearing pin back in the mounting bracket until the pin bottoms on the end of the motor shaft. **Do not tighten the pinion shaft clamping screw at this point**.
10. Tighten the four socket head cap screws on the motor. Torque the cap screws to 45 lb-ft.
11. Adjust the end play between the end of the bearing pin and the end of the motor shaft to about .030". The end play can be set by feel.
12. Tighten the lock screw on the bearing-pin clamping bracket.
13. Check for sprocket end clearance. End clearance should be approximately .030". Tighten the set screw on the sprocket.
14. Readjust both chain adjustment screws equally until the slack has been removed from the chain.

**NOTICE** **Do not over tighten the sideshift chain. Over tightening will lead to excess wear and possible failure of the chain and chain drive components.**

15. To check for proper chain tension, locate the approximate center of the chain span. Grasp two adjacent strands of the chain between thumb and forefinger. It should be easy to deflect each chain approximately one inch, but difficult to make the chains touch.
6. Retighten the nuts and the jam nuts on the chain-tensioning screws.1
7. Lubricate the sideshift-motor sprocket bearing with lithium based grease.

## LAYBACK CYLINDER

1. To repair the layback cylinder, lock the weight, lay the lead mast down onto the lead support or otherwise block the sideshift frame and the lead mast assembly against movement. Shut the engine off and cycle the valve handle to relieve hydraulic-line pressure.
2. Note and mark the two hoses leading to the layback cylinder. Loosen the hydraulic fittings SLOWLY to relieve any remaining system pressure. Disconnect and cap the two hoses to prevent system contamination.
3. Remove the cotter pin from one end of the pin that connects the rod end of the cylinder to the sideshift frame. Remove the hair-pin cotter from the pin that connects the base end of the cylinder to the mainframe. Drive the pins out and remove the cylinder from the machine.
4. Grasp the mounting lug at the base of the cylinder body with a bench vise to restrain it against rotation.

*NOTE: Do not grasp the body of the cylinder directly between the jaws of a vise. The vise can permanently distort the walls of the cylinder, rendering the cylinder body useless.*

5. Loosen the set screw in the cylinder head retaining ring.
6. Place a spanner wrench over the two holes in the cylinder head retaining ring. Rotate the spanner wrench in a CCW direction to unscrew the cylinder head retaining ring from the cylinder body.

*Layback Cylinder cont'd.*

7. Pull the cylinder rod assembly and the cylinder head from the cylinder body.
8. Grasp the base end of the rod yoke with a bench wise.

*NOTE: Do not grasp the plated surface of the cylinder rod between the jaws of a vise. The vise will permanently mar the finish on the rod rendering the rod useless.*

9. Remove the piston retaining nut from the rod assembly. Remove the piston and the cylinder head from the rod.
10. Inspect the plated surface of the rod for the presence of corrosion, nicks, paint or any other foreign material. Any of these defects, when present, will destroy the seals on the rod over a short period of time. Remove any foreign material found on the surface of the rod.

*NOTE: Replace the cylinder rod if corrosion or nicks are found on surface. These defects cannot be corrected.*

11. Remove and replace the seals from the inside and outside diameters of the cylinder head, and from the outside diameter of the piston.

*NOTE: Remove and replace one seal at a time. This will help insure that all new seals are installed in the proper location.*

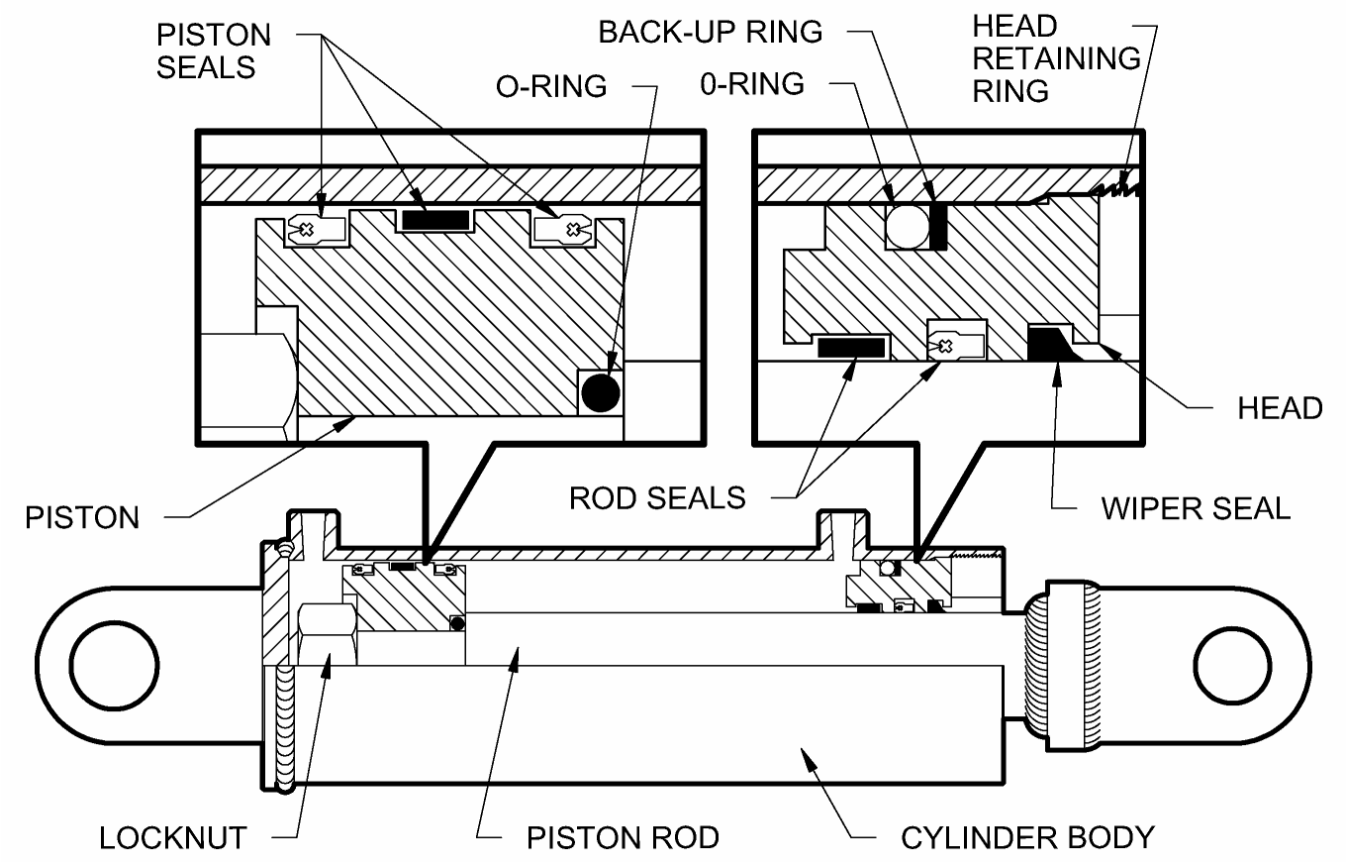



*Figure 10-17*
*Layback Cylinder Assembly*

*Layback Cylinder cont'd.*

12. Install a new O-ring and back-up ring (from the seal kit) on the inside diameter of the cylinder head. Install the back-up ring on the low pressure side of the O-ring (toward the outside). Refer to Figure 10-17.

*NOTE: Apply a lubricant such as hydraulic oil to the components prior to assembly to ease the assembly process and to reduce the risk of damaging the parts during assembly.*

13. Install the wiper in the top of the cylinder head. The lips of the wiper should point toward the outside.
14. Install a new O-ring and back-up ring on the outside diameter of the cylinder head. The back-up ring should be on the side away from hydraulic pressure. Refer to Figure 10-17.
15. Install the O-ring and the special double back-up ring on the outer diameter of the piston.
16. Install the piston and the piston nut on the rod assembly after having first installed the cylinder head on the rod. Torque the piston nut according to Table i-1 - Bolt and Cap Screw Torque Specifications.
17. Carefully slide the cylinder rod and the piston assembly into the open end of the cylinder tube after first making sure the parts are properly lubricated. Be careful not to cut the seals during reassembly.
18. Using a rubber mallet and a piece of wood, tap the cylinder head and seat it into position in the cylinder tube.
19. CAREFULLY reinstall the cylinder head retaining ring into the cylinder tube. Use a spanner wrench to tighten the cylinder head retaining ring.

*NOTE: Use extreme caution when reinstalling the cylinder head retaining ring. DO NOT force the assembly. Be sure the retaining ring is not cross-threaded before tightening.*

20. Retighten the set screw in the cylinder head retaining ring.
21. Reinstall the cylinder to the machine using the reverse of the disassembly process.

## TILT CYLINDER

1. To repair the tilt cylinder, lock the weight, lay the lead down onto the lead support, or otherwise block the lead mast assembly against rotation. Shut the engine off and cycle the valve handle to relieve hydraulic-line pressure.
2. Note and mark the two hoses leading to the cylinder. Loosen the hydraulic fittings SLOWLY to relieve any remaining system pressure. Disconnect and cap the two hoses to prevent system contamination.
3. Remove the pins connecting the tilt cylinder to the carriage and to the base of the automatic cylinder.4. The internal structure of the tilt cylinder is similar to the structure of the layback cylinder. Refer to the Layback Cylinder repair instructions and Figure 10-17 and torque the piston nut according to Table i-1 - Bolt and Cap Screw Torque Specifications.

## STROKE-ADJUST AND CABLE-ADJUST CYLINDERS

The two adjustment cylinders are nearly identical in design and will be covered together:

1. Note and mark the two hoses leading to the adjustment cylinder. Disconnect and cap the two hoses to prevent system contamination.
2. Remove the nut and washer which connect the adjustment cylinder to the upper-sheave mounting bracket and to the adjustment trip finger on the side of the automatic cylinder.
3. Remove the adjustment cylinder from the machine. Clamp the base of the cylinder in a bench vise.

*NOTE: Do not grasp the body of the cylinder directly between the jaws of a vise. The vise can permanently distort the walls of the cylinder rendering it useless.*

*Stroke Adjust and Cable Adjust Cylinders cont'd.*

4. Place a wrench over the hexagonal-shaped cylinder head. Twist the cylinder head in a CCW direction to unscrew it from the cylinder body.
5. Slide the cylinder rod assembly with the cylinder head out of the cylinder body.
6. Slide the cylinder head off the piston rod over the threaded portion of the rod. (It is not necessary to remove the piston in order to access the rod seals in the cylinder head.
7. If the piston and piston seals are not to be removed, proceed to step 13.
8. Install two 1/2"-20 UNF hex nuts over the threaded end of the piston rod. Jam the two nuts together to lock them in place.9. Clamp the piston rod by the two nuts (installed in step 8) in a bench vise.

*NOTE: Do not grasp the plated surface of the piston rod between the jaws of a vise. The vise will permanently mar the finish on the piston rod rendering it useless.*

10. Inspect the plated surface of the rod for the presence of corrosion, nicks, paint or any other foreign material. Any of these defects, when present, will destroy the rod seals after a short period of time. Remove any foreign material.

*NOTE: Replace the piston rod if corrosion or nicks are found on the surface of the rod. These defects cannot be corrected.*

11. Reinstall the new piston outer seal and outer seal PIP ring (from the seal kit). Refer to Figure 10-18.

*NOTE: Remove and replace one seal at a time. This will help insure that all new seals are installed in the proper location.*

12. Reinstall the piston nut. Torque the nut according to Table i-1 - Bolt and Cap Screw Torque Specifications. Remove the two nuts installed in step 8.
13. Remove the seal retaining ring from the inside bore in the cylinder head. Remove the seal and the wear ring. Remove the O-ring from the outside diameter of the cylinder head.
14. Install a new wear ring and a new piston-rod seal from the seal kit. Refer to Figure 10-18.

*NOTE: Apply a lubricant such as hydraulic oil to the components prior to assembly to ease the assembly process and to reduce the risk of damaging the parts during assembly.*

15. Install the retaining ring behind the piston-rod seals.
16. Install a new dust seal. The lips of the dust seal should point toward the outside.
17. Install a new O-ring on the outside diameter of the cylinder head. Refer to Figure 10-18.
18. Carefully install the cylinder head over the threaded end of the cylinder rod. Make sure the threads on the cylinder rod do not cut the rod seal.
19. Thread the cylinder head back into the cylinder body. Do not over tighten the cylinder head.
20. Reinstall the cylinder assembly to the machine using the reverse of the disassembly process.

*Stroke Adjust and Cable Adjust Cylinders cont'd.*

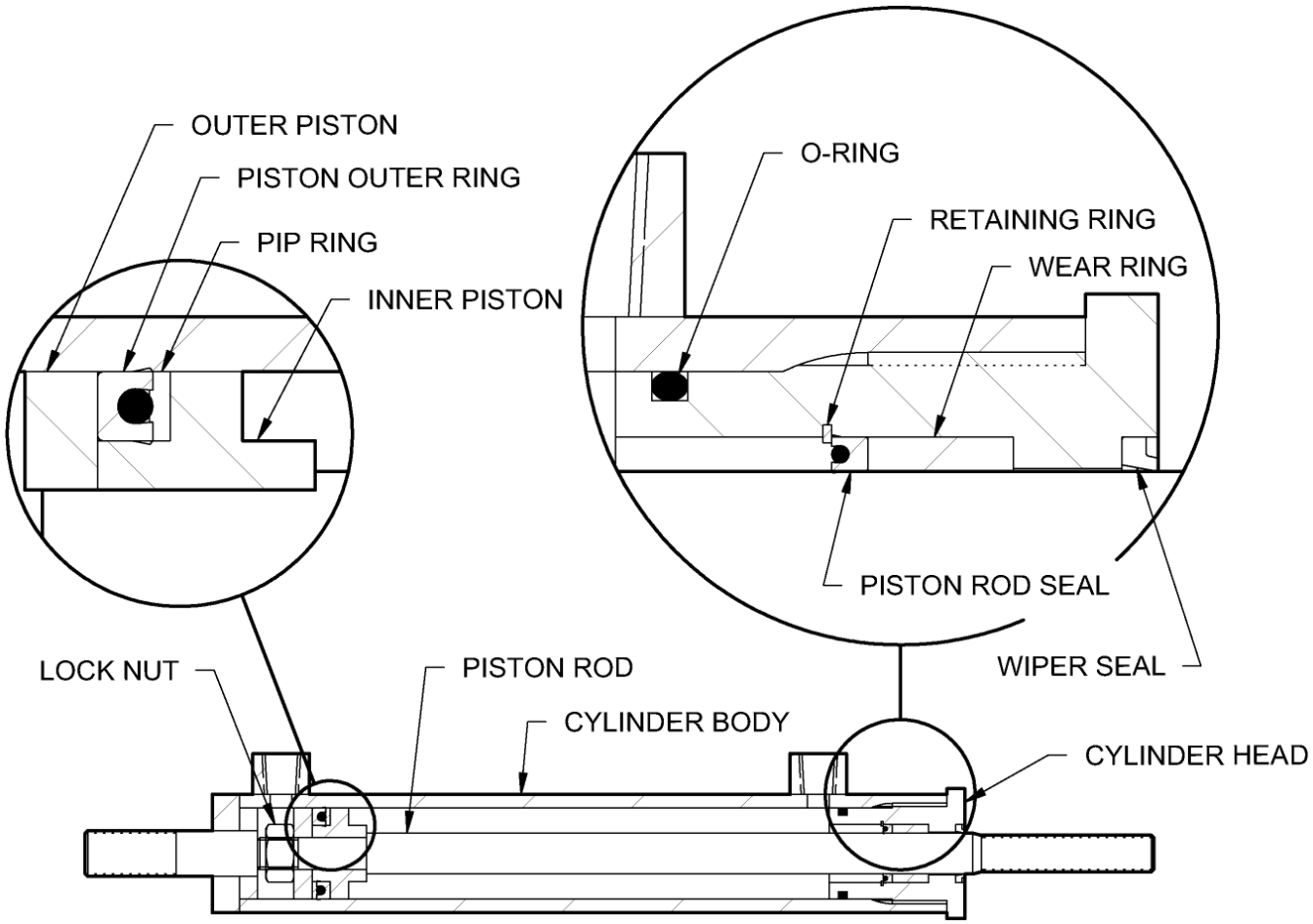



*Figure 10-18*
*Adjustment Cylinder Assembly*

# HAMMER LIFT CYLINDER (automatic cylinder)

## LIFT CYLINDER DISASSEMBLY

Refer to the following instructions and Figures 10-19,10-20, & 10-21 when disassembling the Lift Cylinder.

1. Start the engine and raise the weight into the proper position and lock it in place using he locking pin on the lead.
2. Tilt the lead back into the stowed position. Turn the engine "OFF" and remove the key.
3. Push the hammer valve control lever all the way forward into the "DOWN" position. Push the Sheave Housing & Cylinder Rod back into the cylinder as far as possible.
4. The Lift Cylinder must be collapsed to a point where the cable is slack enough to remove the Sheave Housing from the Cylinder Rod. As an alternate method, the cable can be removed from the lift cylinder.

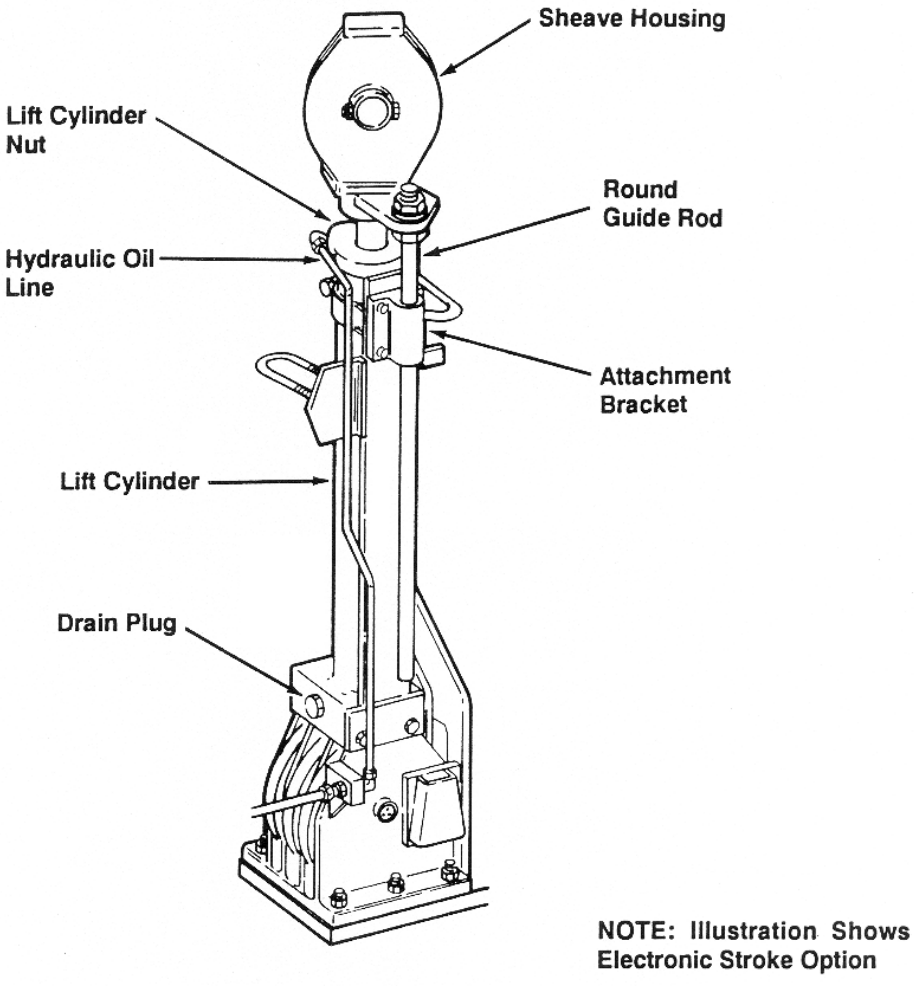



*Figure 10-19*
*Lift Cylinder Assembly*

*Lift Cylinder Disassembly con't.*

5. Remove the hardware that secures the Guide Rod (3001290) to the Sheave Housing. Refer to Figures 10-19 & 10-20.

*NOTE: On units equipped with a Mechanical Stroke or Cable Adjust option, the Hex Rod and Adjustment Cylinders must also be removed.*

6. Remove the hardware that secures the Sheave Housing to the Lift Cylinder Rod. Separate the Sheave Housing from the Lift Cylinder Rod and the Guide Rod. Refer to Figures 10-19 & 10-20.

*NOTE: Be sure to note the location and orientation of the Sheave Housing and cable. These items must be reassembled in the same exact position for the unit to operate properly.*

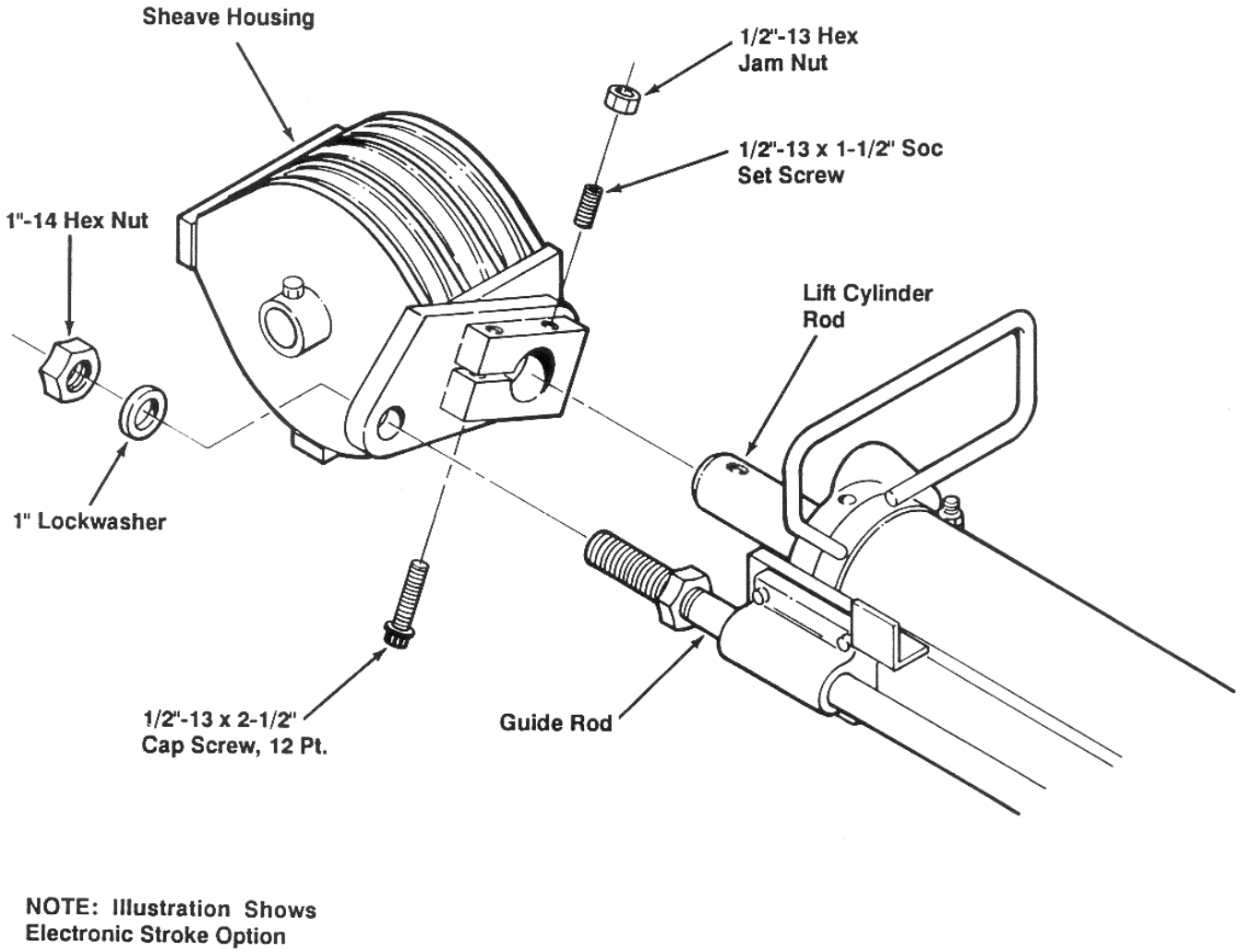



*Figure 10-20*
*Sheave Housing Removal*

*Lift Cylinder Disassembly con't.*

7. Remove the Lift Cylinder Drain Plug. Drain and discard any remaining oil from the Lift Cylinder (See Figure 10-19).
8. Loosen the connections on the Hydraulic Oil Line on both ends, and separate the Oil Line from the elbow fittings on the Lift Cylinder. (See Figure 10-19).
9. Loosen the upper (clamping) end of the Attachment Bracket. Slide the bracket down, out of the way or remove it. Refer to Figures 10-19 & 10-21.
10. Unscrew the Lift Cylinder Nut and remove it with the Lift Cylinder Rod & Piston. Refer to Figures 10-19 & 10-21.

*NOTE: Be sure to note the location of the elbow fitting in relation to the Hydraulic Oil Line. The elbow fitting must be in the same location at reassembly to properly reconnect the oil line. Inspect the surface of the Lift Cylinder Rod and the Lift Cylinder bore. If scratched or scored, they must be replaced.*

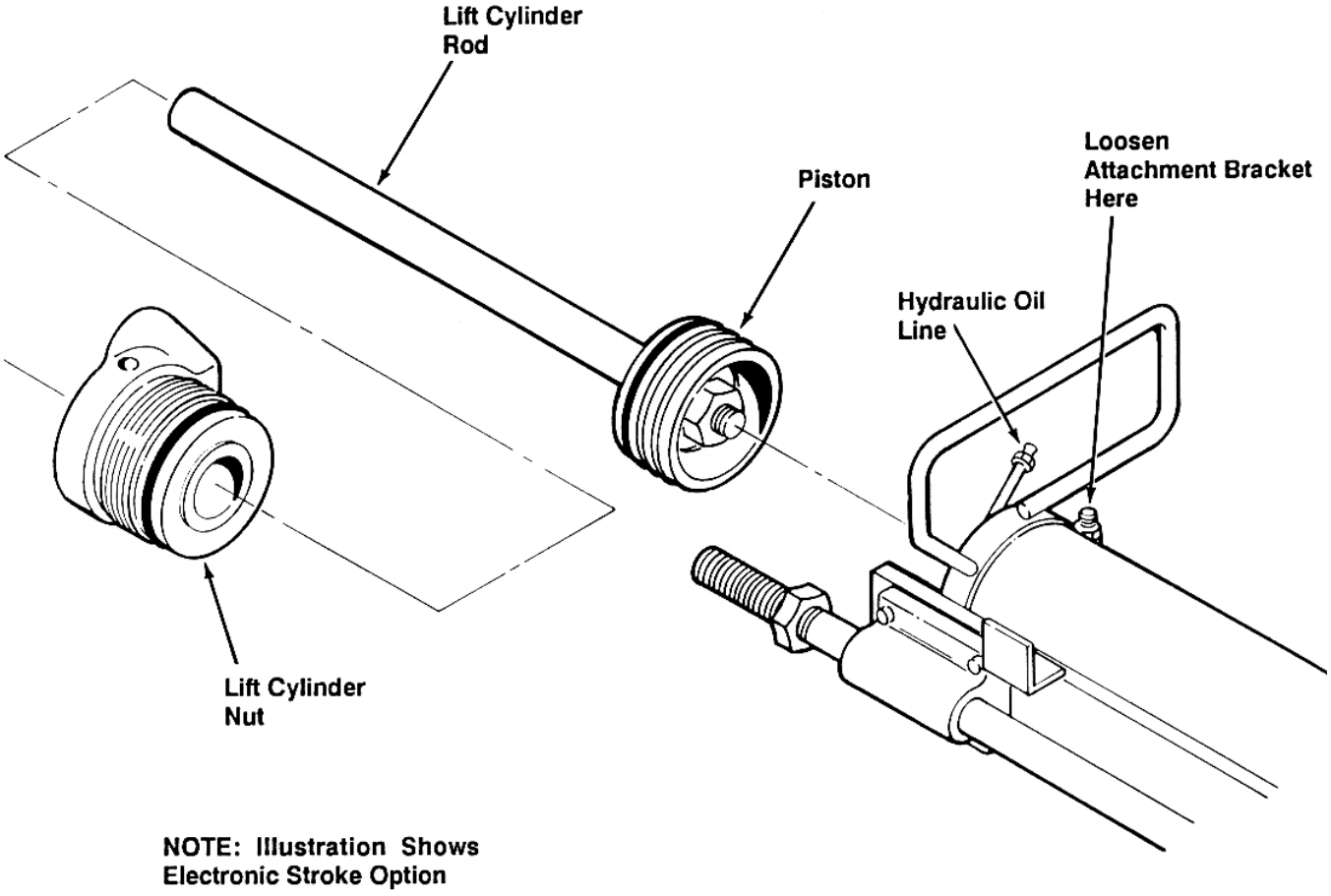



*Figure 10-21*
*Piston & Rod Removal*

## CYLINDER NUT SEAL INSTALLATION

The Cylinder Nuts on every Lift Cylinder are identical. In some cases, the Cylinder Nut may be equipped with an O-Ring inside the bore. This internal O-Ring will be replaced by the new Internal Seal (p/n: 4001927) contained in the kit. (See Figure 10-22).

Refer to the following instructions and Figure 10-22 when installing the New Wiper & O-Rings on Lift Cylinders with a square groove.

1. Remove the Cylinder Nut from the Lift Cylinder Rod.
2. Remove the old Wiper and O-Rings from the Lift Cylinder Nut.

*NOTE: Make sure the Lift Cylinder Nut is clean before installing the New Wiper and O-Rings. Wash the Lift Cylinder Nut with solvent and wipe with a clean, dry cloth.*

3. Install the New Wiper and O-Rings (See Figure 10-22). Set the Cylinder Nut aside for reassembly.

> ***IMPORTANT:*** The New Seal (p/n: 4001927) in the Cylinder Nut MUST be installed correctly. Be sure the New Internal Seal is installed in the Cylinder Nut exactly as shown in Figure 10-22.

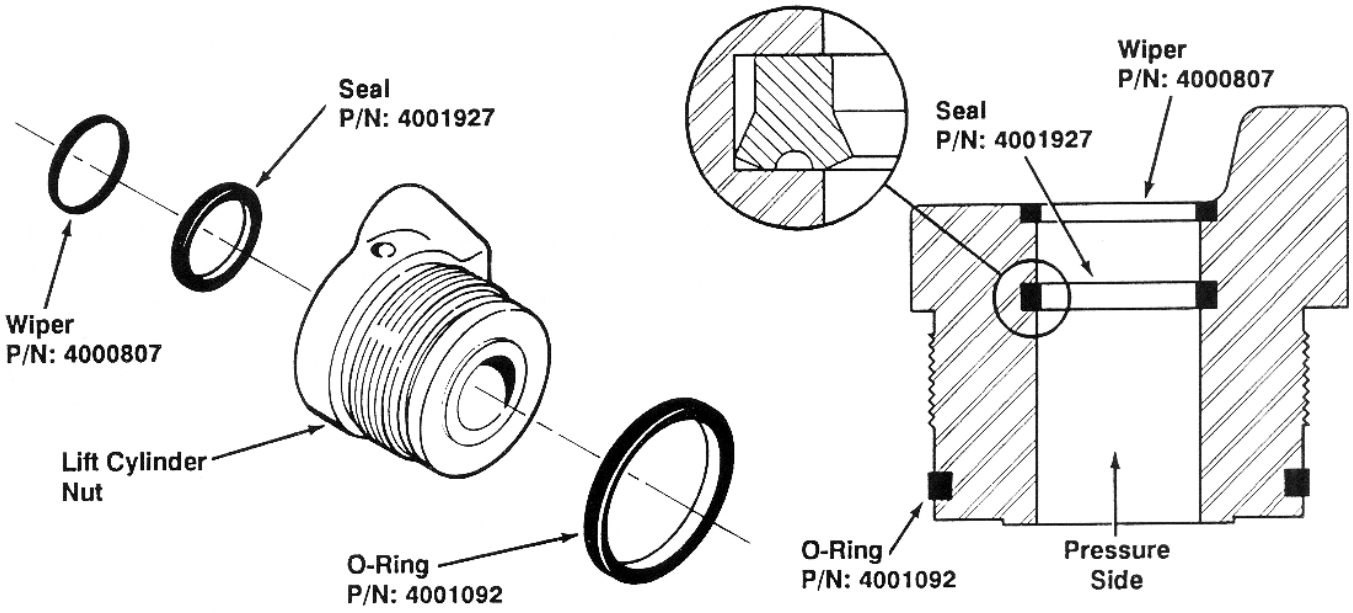



*Figure 10-22*
*Cylinder Nut Seal Installation*

## PISTON RING & PISTON SEAL INSTALLATION

Before the Piston Rings and Seals can be replaced, the groove inside the Lift Cylinder tube, just below the threads, must be examined. **Newer Lift Cylinders** are equipped with a **chamfered groove**, while **Older Lift Cylinders** are equipped with a **square groove**. Figure 10-23 illustrates the details and differences between the two grooves. Examine the grove and study Figure 10-23 carefully to determine which groove is present in the Lift Cylinder. **THE CYLINDER GROOVE DETERMINES WHICH REPLACEMENT SEAL IS REQUIRED FOR THE PISTON!** Newer Lift Cylinders with a chamfered groove require the Piston Seal (p/n: 4002005). Older Cylinders with a square groove require the Piston O-Ring (p/n: 4001092). The Seal Kit contains both the Piston Seal (p/n: 4002005) and the Piston O-Ring (p/n: 4001092). **BE SURE TO INSTALL THE CORRECT PART.** the Piston Seal (p/n: 4002005) has a longer service life the Piston O-Ring (p/n: 4001092), however, it is not practical to use the Piston Seal (p/n: 4002005) on square groove cylinders due to difficult assembly.
Refer to the following instructions and Figures 10-23 & 10-24 when installing the Piston Rings and seals.

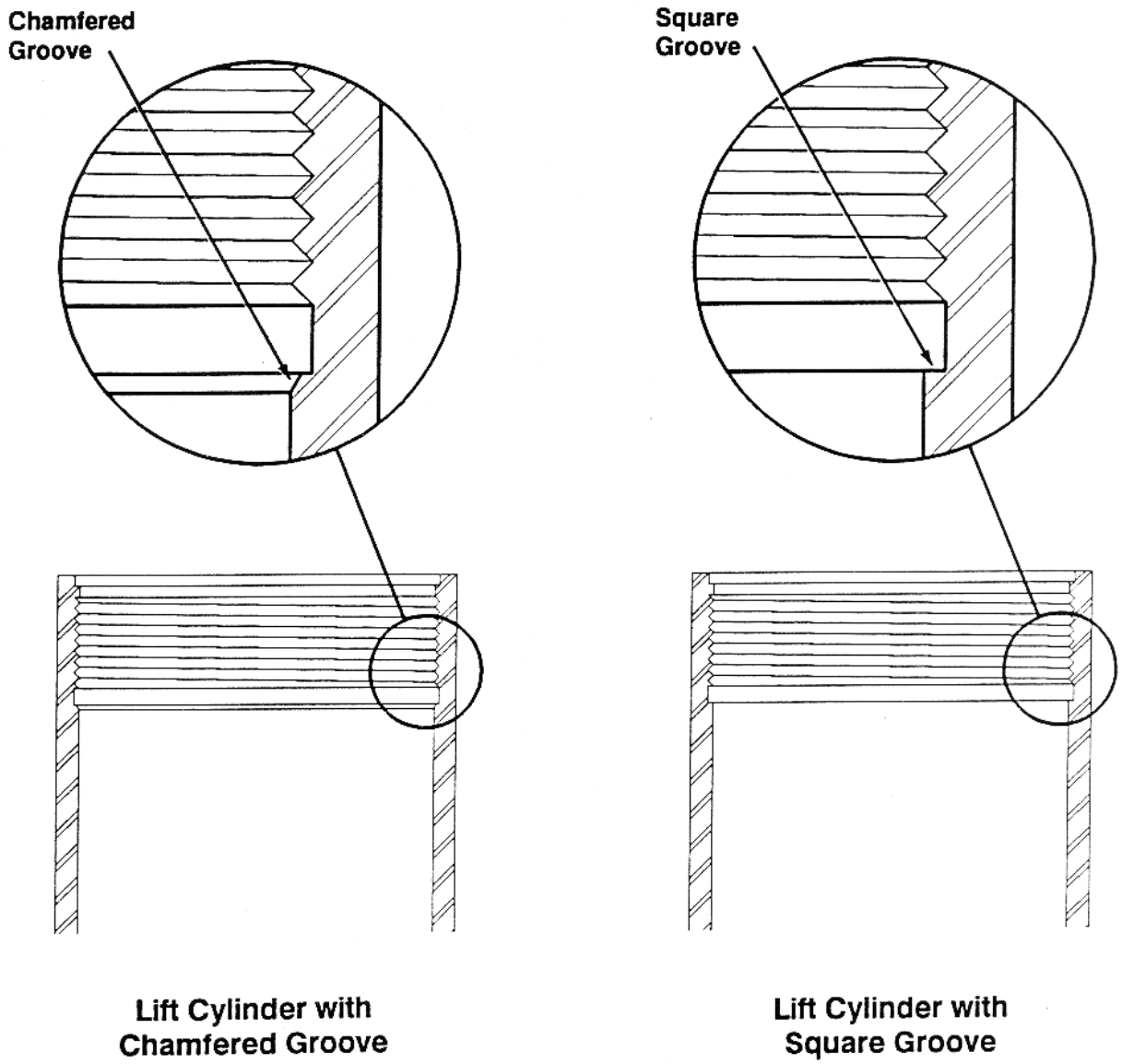



*Figure 10-23*
*Lift Cylinder Groove Details*

*Piston ring & piston seal installation con't*

1. Remove the Piston Nut (p/n: 4001207) that secures the Piston to the Lift Cylinder Rod, and remove the Piston (p/n: 3001322).

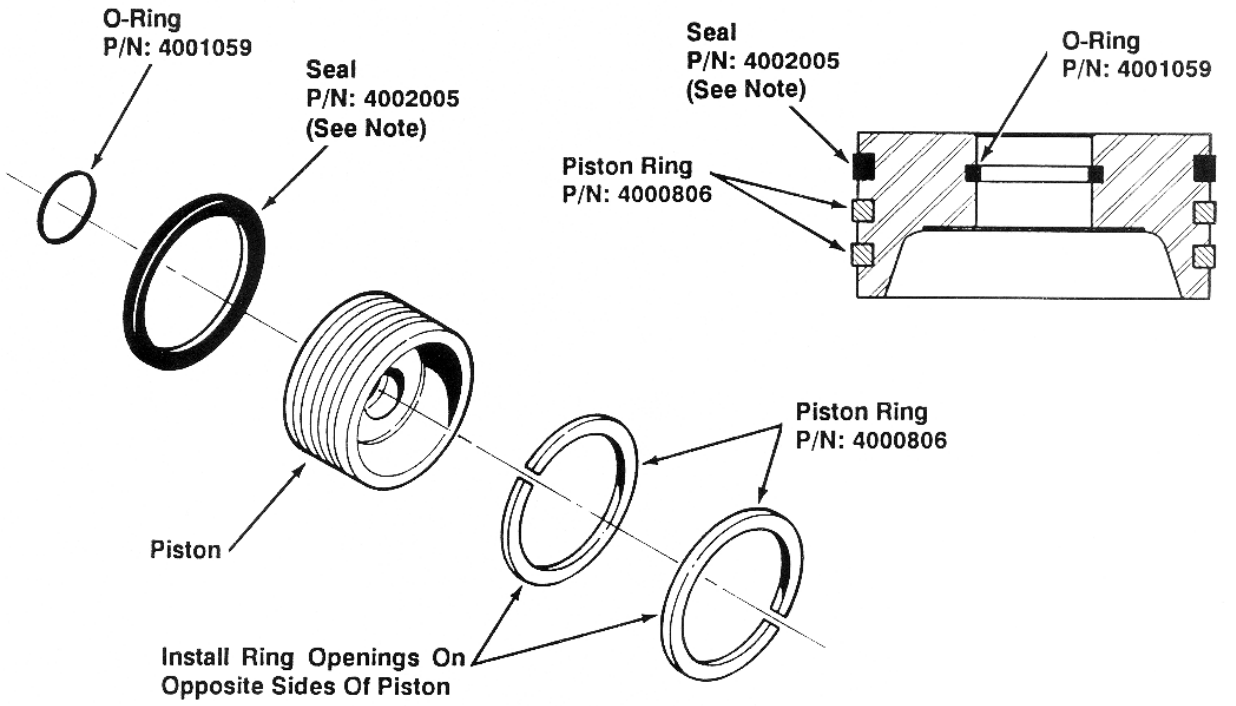
2. Remove the old O-Rings and Piston Rings from the Piston.

*NOTE: Make sure the Piston (p/n: 3001322) and Piston Nut (p/n: 4001207) are clean before installing the New O-Rings & Piston Rings and reassembling. Wash the Piston (p/n: 3001322) & Piston Nut (p/n: 4001207) with solvent and wipe with a clean, dry cloth.*

3. Install the New O-Rings, & Piston Rings (See Figure 10-24). Set the Piston & Piston Nut aside for reassembly.

*NOTE: Make sure the Piston Rings are installed with the openings on opposite sides of the Piston as shown in Figure 10-24.*

4. Proceed to **Lift Cylinder Reassembly** on page 10-28.




**NOTE: On Lift Cylinders with the Square Groove (See Figure 10-23) The O-Ring (p/n: 4001092) MUST be used in place of the Seal (p/n: 4002005).**

*Figure 10-24*
*Piston Ring & Piston Seal Installation*

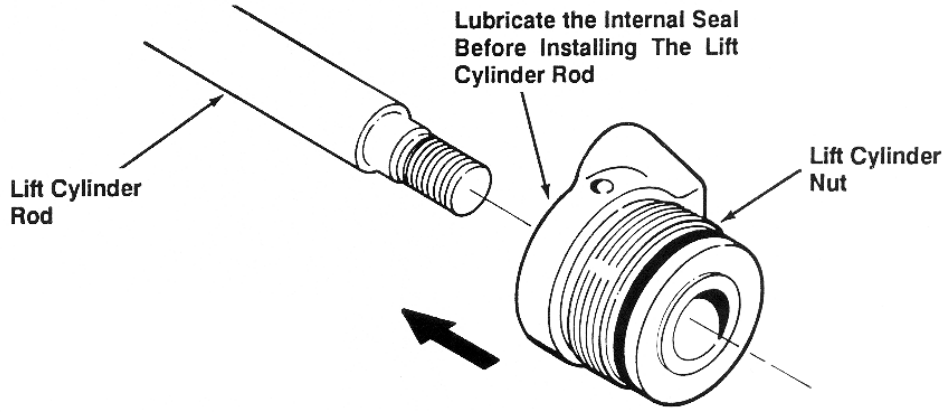
## LIFT CYLINDER REASSEMBLY

Refer to the following instructions and Figures 10-25, 10-26, & 10-27 when reassembling the Lift Cylinder.

1. Lubricate the Wiper and Seal on the Cylinder Nut (p/n: 3001325) with hydraulic oil, and carefully slide it onto the threaded (bottom) end of the Cylinder Rod (p/n: 3001321) as shown in Figure 10-25.

**NOTICE** **The Cylinder must be installed exactly as shown in figure 10-25. Installing the Cylinder Nut over the chamfered (top) end of the lift Cylinder Rod can damage the seal.**

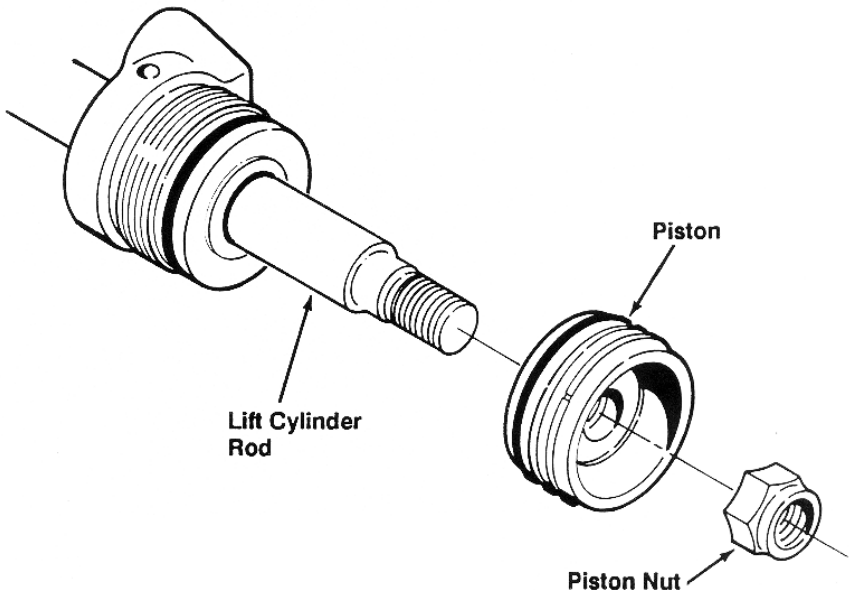
*Figure 10-25*




*Lift Cylinder & Rod Removal*

2. Push the Cylinder Nut SLOWLY onto the Lift Cylinder Rod until the Cylinder Nut is in the center of the Cylinder Rod.
3. Reassemble the Piston (p/n: 3001322) and Piston Nut (p/n: 4001207) to the Lift Cylinder Rod (p/n: 3001321). See Figure 10-26.

*Figure 10-26*




*Piston Reasembly*

*Lift Cylinder Reassembly con't.*

4. Lubricate the Piston Seal or O-Ring with hydraulic oil, and carefully slide the Piston into the end open of the Cylinder Tube as shown in Figure 10-27).
NOTE: It may be necessary to tap the upper end of the Lift Cylinder Rod firmly with a mallet in order to get the Piston to slide into the Cylinder tube.
5. Carefully push the Piston into the Cylinder as far as it will go (See Figure 10-27).

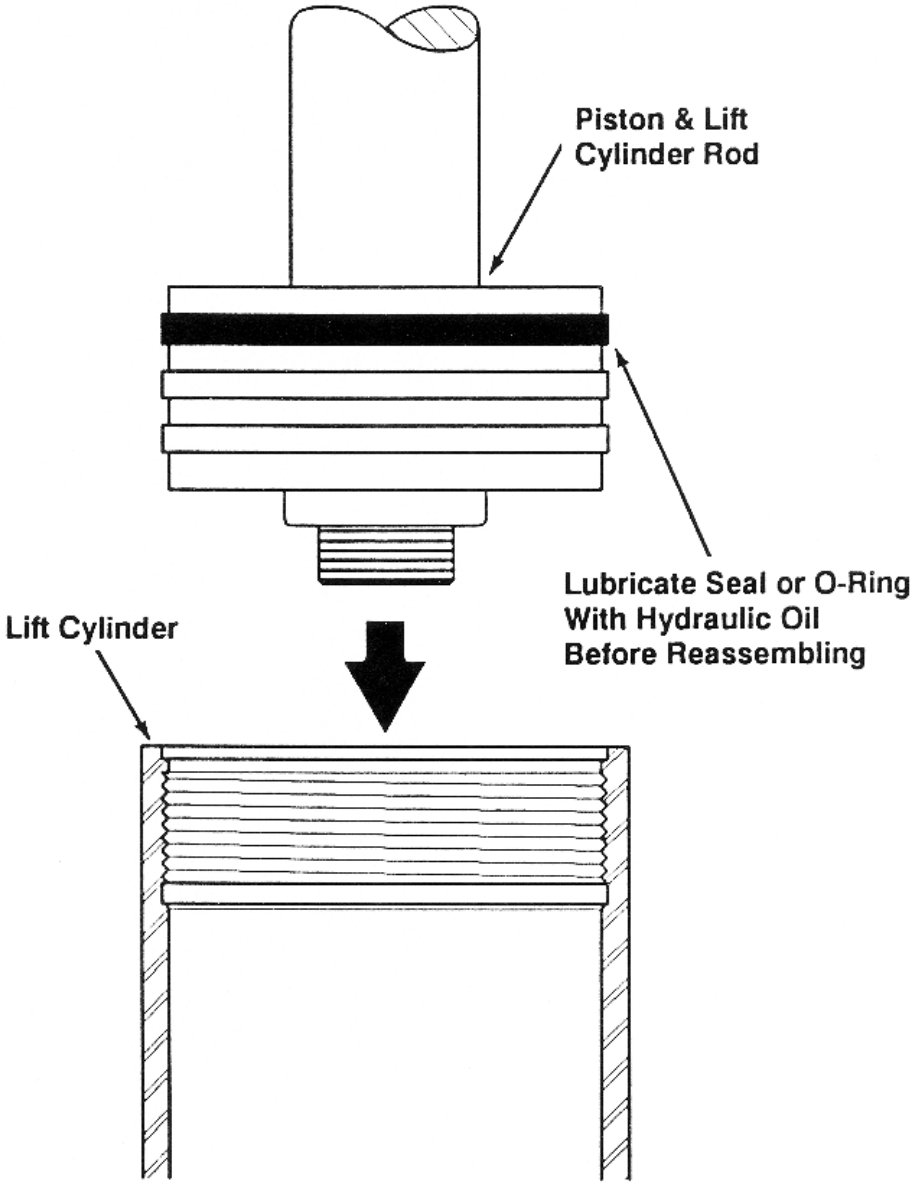



*Figure 10-27*
*Piston Installation*

6. Thread the Cylinder Nut into the Cylinder and tighten it back to the original position (See Figure 10-21).
7. Replace the Cylinder Drain Plug (See Figure 10-19).
8. Reconnect the Hydraulic Oil Line to the elbow fittings on the Cylinder Nut and manifold.
9. Reposition the Attachment Bracket, and retighten the hardware at both ends (See Figure 10-19 & 10-21).

*Lift Cylinder Reassembly con't.*

10. Reinstall the Sheave Housing to the Lift Cylinder Rod and align the Sheave Housing set screw with the hole in the Lift Cylinder Rod. Reinstall the Guide Rods.

*NOTE: Be sure the Sheave Housing is reassembled in the same location and orientation as it was prior to disassembly. Install the cable and check to be sure the cable is not twisted or tangled.*

11. Apply Loctite® 242 to the hardware that secures the Sheave Housing. Reinstall the hardware (See Figure 10-20).
12. Reinstall the hardware that secures the Guide Rods(s) (See Figure 10-20).

*NOTE: On units equipped with Mechanical Stroke or Cable Adjust option, align the Guide Rods and Trip Fingers.*

13. Start the engine and raise the lead to the operating (vertical) position.
14. SLOWLY and CAREFULLY pull the Hammer Valve Control lever back into the "UP" position, until the slack in the cable is taken up. Release the locking pin on the lead and unlock the weight.
15. CAREFULLY full-stroke the Lift Cylinder manually several times to remove air from the Hydraulic System.

**⚠ CAUTION** **Some erratic response may occur when purging air from the hydraulic system. Use an energy absorber (a wooden 4" x 4" for example) under the weight to protect the floor from damage, or move the unit outside onto a dirt surface.**

16. Lock the weight back in place on the lead and turn the engine "OFF".
17. Open the Hydraulic Fluid Reservoir and refill the Hydraulic Fluid to the "FULL" mark. Replace the cap.
18. Inspect the Lift Cylinder and Hydraulic line connections for Hydraulic Fluid leaks.

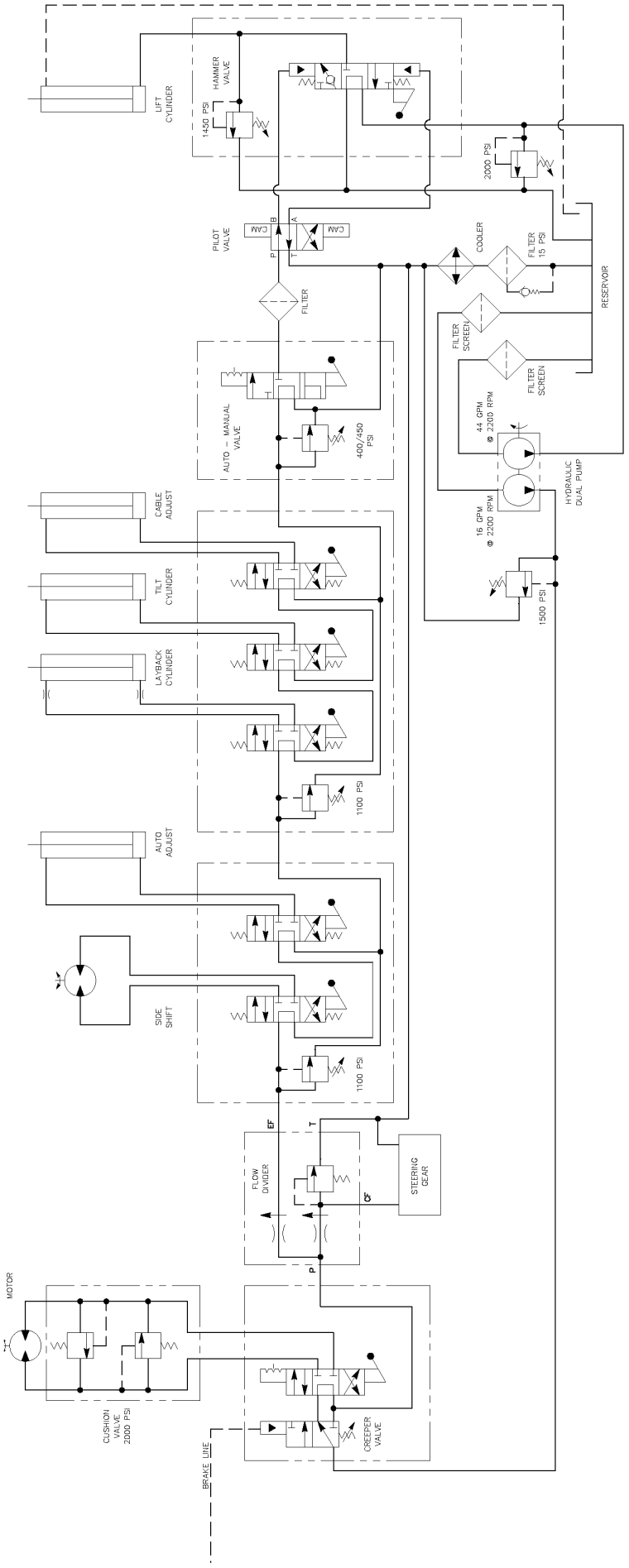



*Figure 10-28A*
*Hydraulic Diagram*
*Mechanical Stroke/Cable Adjust*

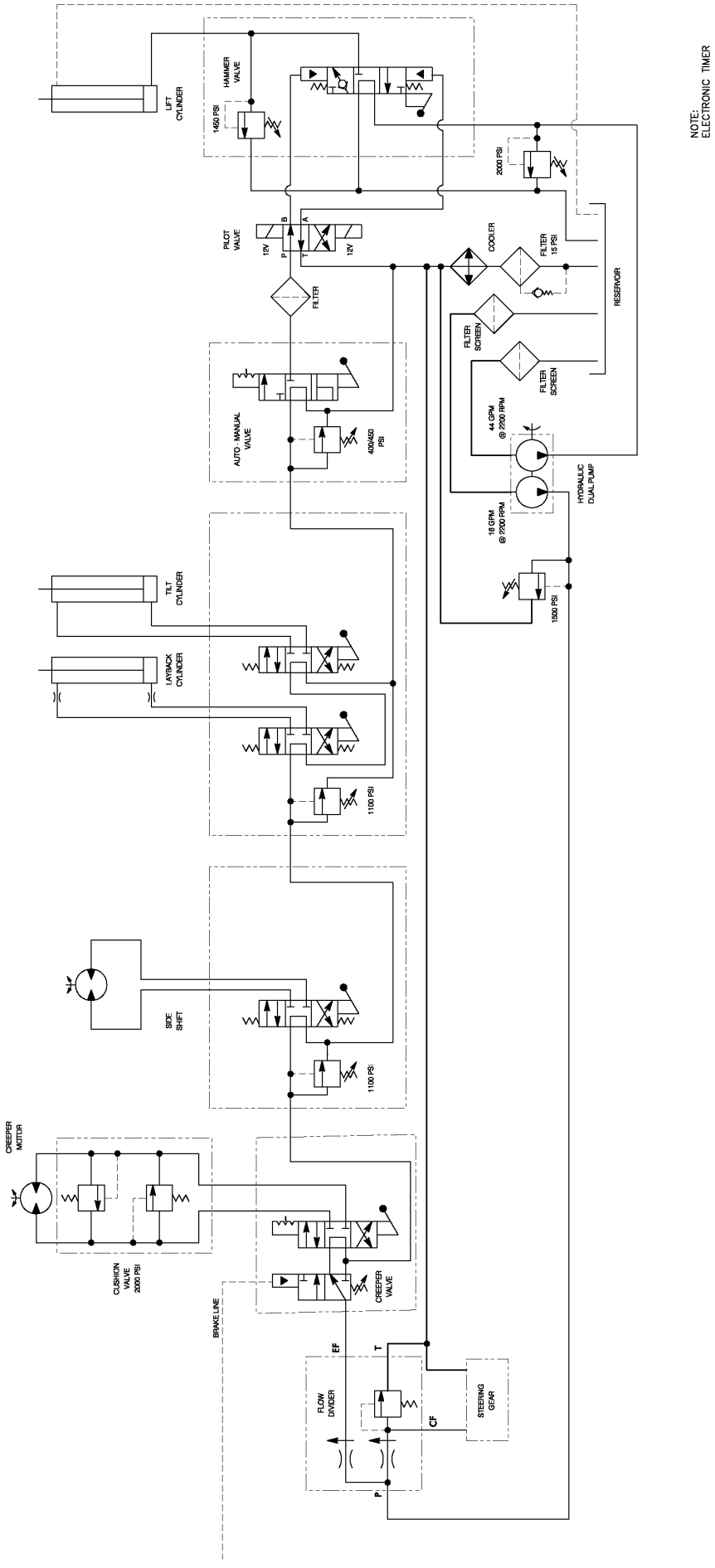



*Figure 10-28B*
*Hydraulic Diagram*
*Electronic Stroke Control*

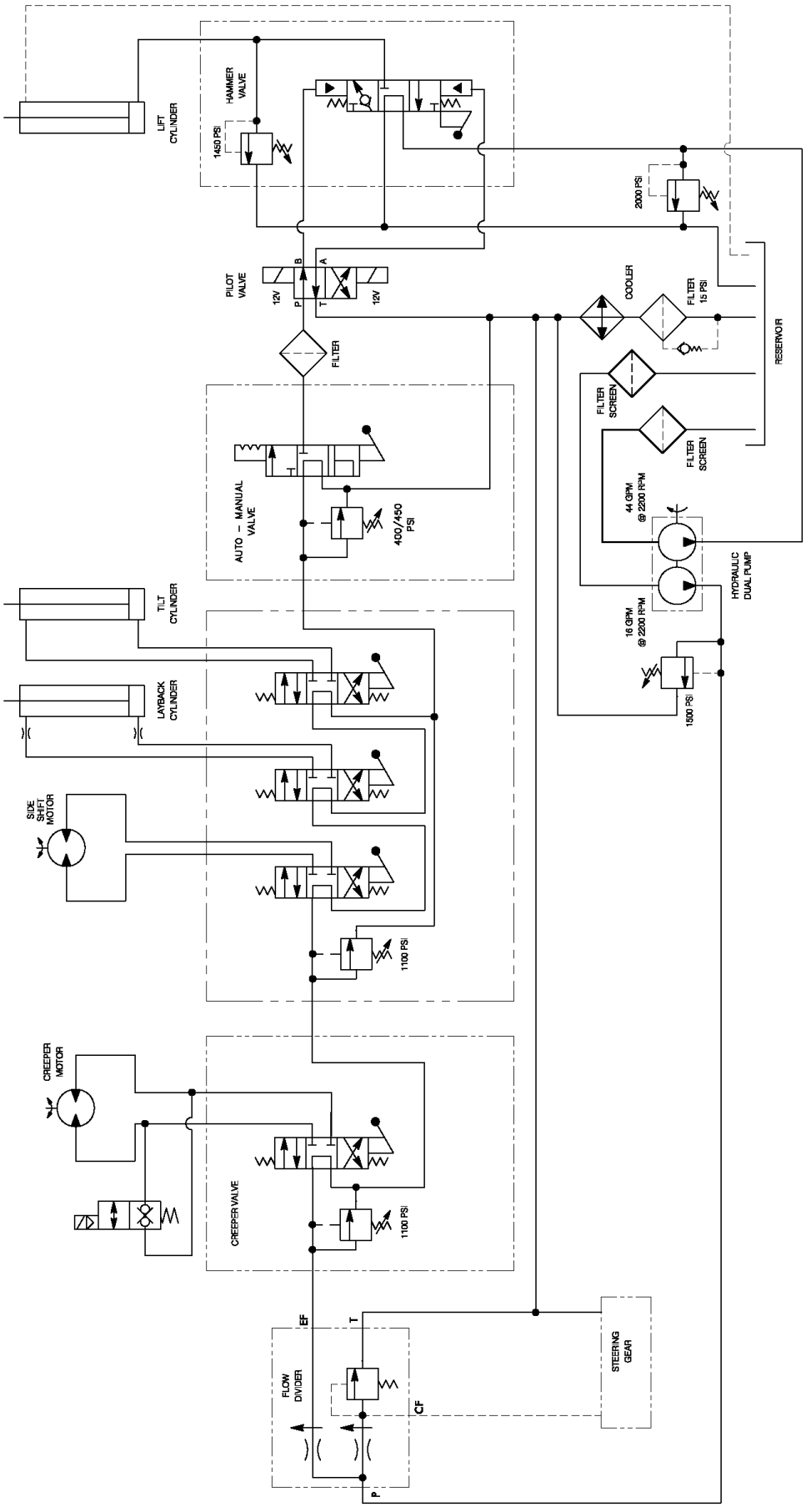



*Figure 10-28C*
*Hydraulic Diagram (S/N 7050 - )*
*Electric Stroke Control*

# Electrical System

## ELECTRONIC CONTROL STATION

### Electronic Control Station Replacement

1. Remove the screws securing the Electronic Control Station to the control panel.
2. Pull the Electronic Control Station back and out of the panel.
3. Unscrew the electrical connector from the back of the Electronic Control Station.
4. Reinstall the new Electronic Control Station by reversing the above procedure.
5. The old Electronic Control Station may be returned to Arrow for repair.

## PROXIMITY SENSOR

The procedures for replacing and adjusting the proximity sensor are located in the "Adjustments" section.

**Used on S/N 6300 - 6909**

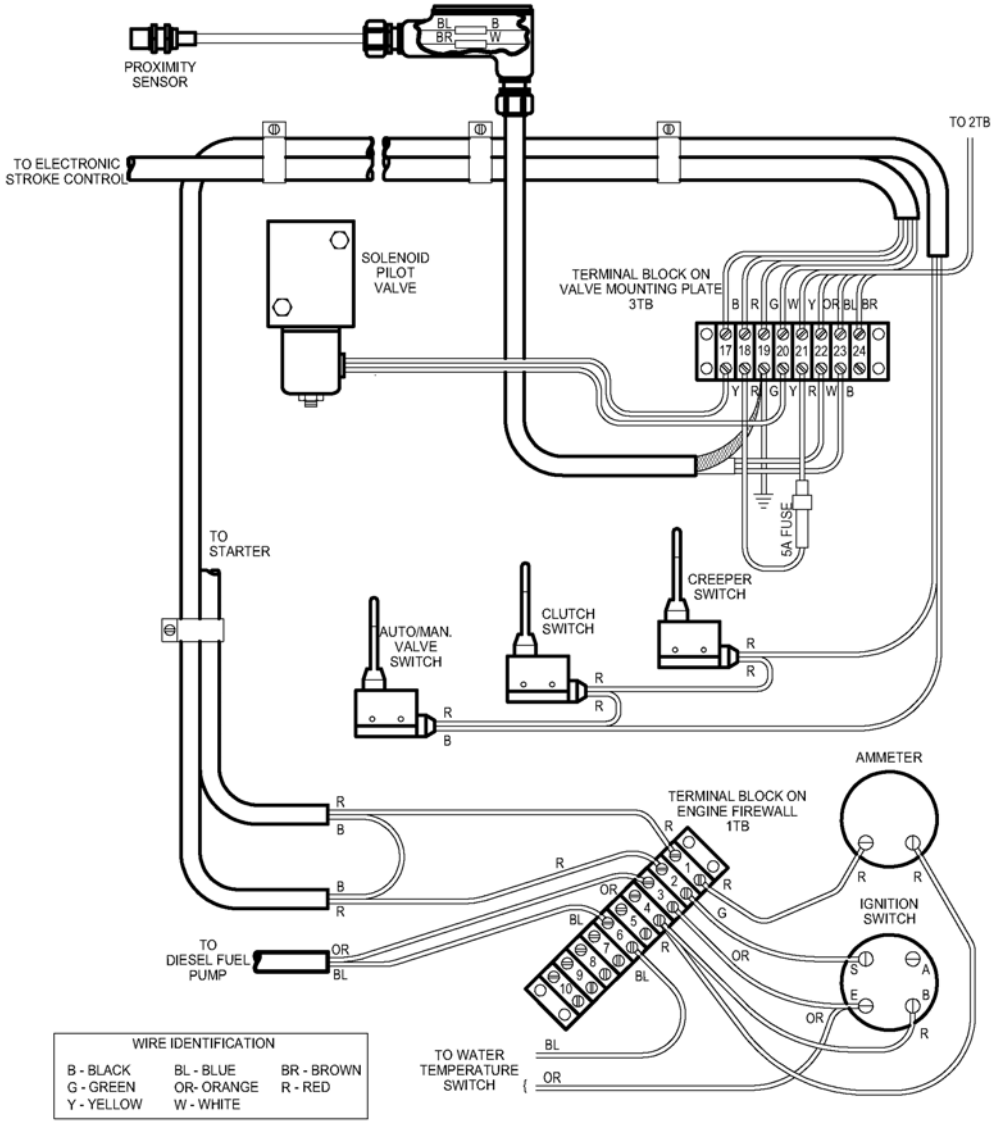



*Figure 11-1*
*Wiring Connections - Starter Interlock and Electronic Control Station*

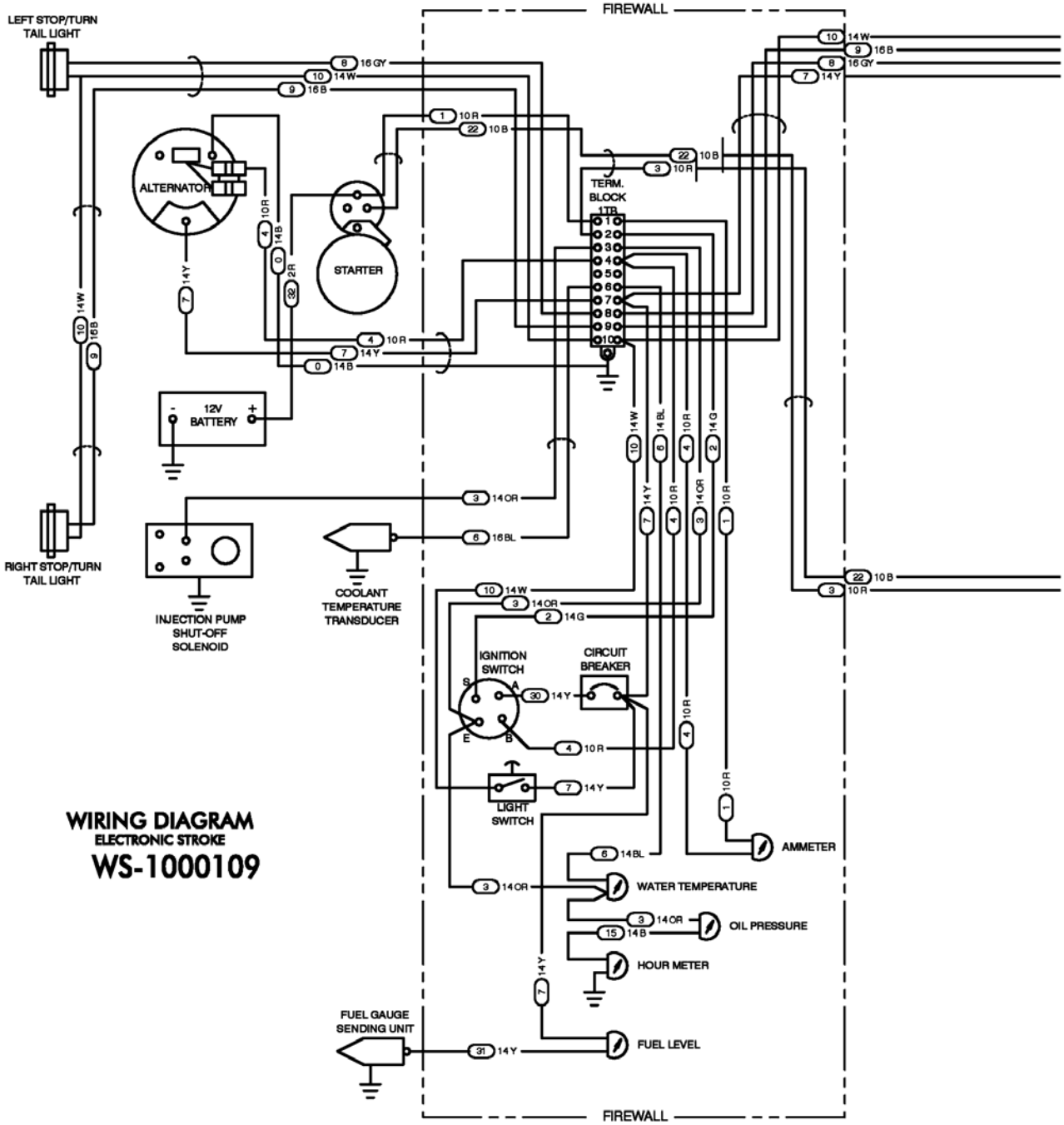
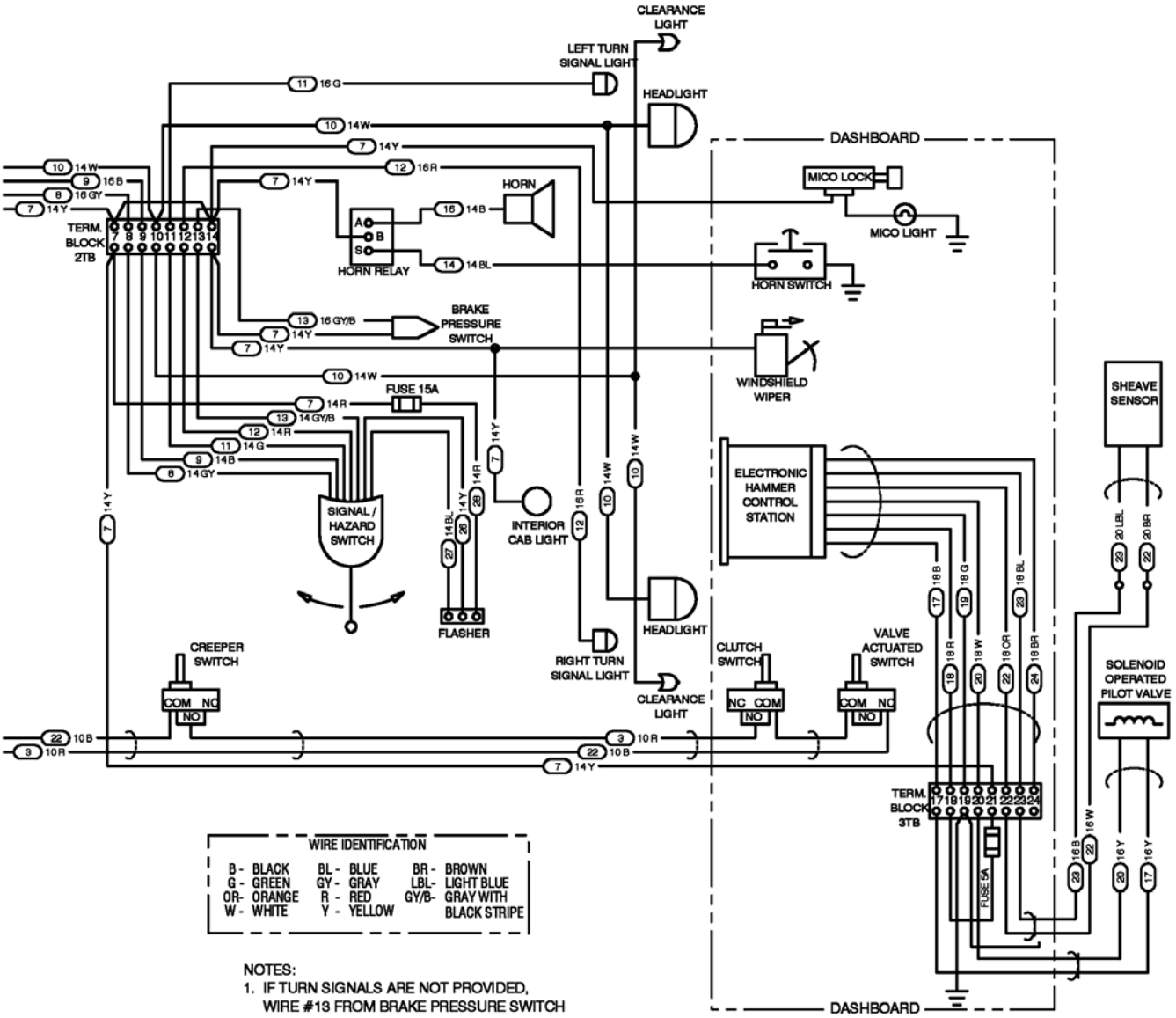



*Figure 11-2*
*Electrical Diagram*
*Firewall Mounted Gauges*




| WIRE IDENTIFICATION | | | | | |
|---|---|---|---|---|---|
| B - | BLACK | BL - | BLUE | BR - | BROWN |
| G - | GREEN | GY - | GRAY | LBL - | LIGHT BLUE |
| OR - | ORANGE | R - | RED | GY/B - | GRAY WITH BLACK STRIPE |
| W - | WHITE | Y - | YELLOW | | |

NOTES:
1. IF TURN SIGNALS ARE NOT PROVIDED, WIRE #13 FROM BRAKE PRESSURE SWITCH IS CONNECTED TO TERMINAL 9 ON THE TERMINAL BLOCK. TERMINALS 8 & 9 ARE ALSO JUMPERED TOGETHER.
2. FOR SHUTDOWN GAUGE SET WIRING SEE 7000169.
3. FIRST USED ON S/N 6300 - 6909

**WIRING DIAGRAM**
**ELECTRONIC STROKE**
**WS-1000109**

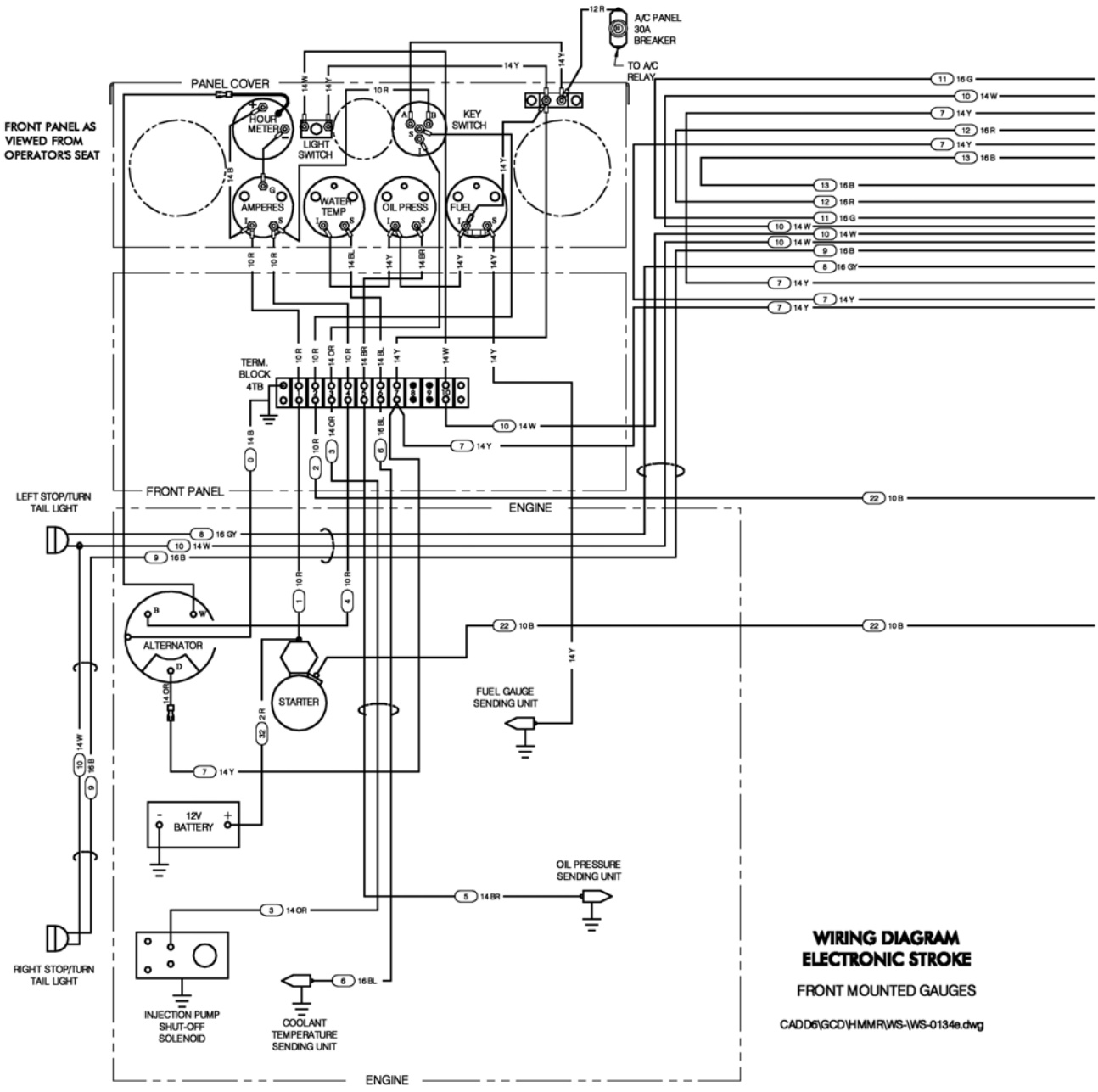
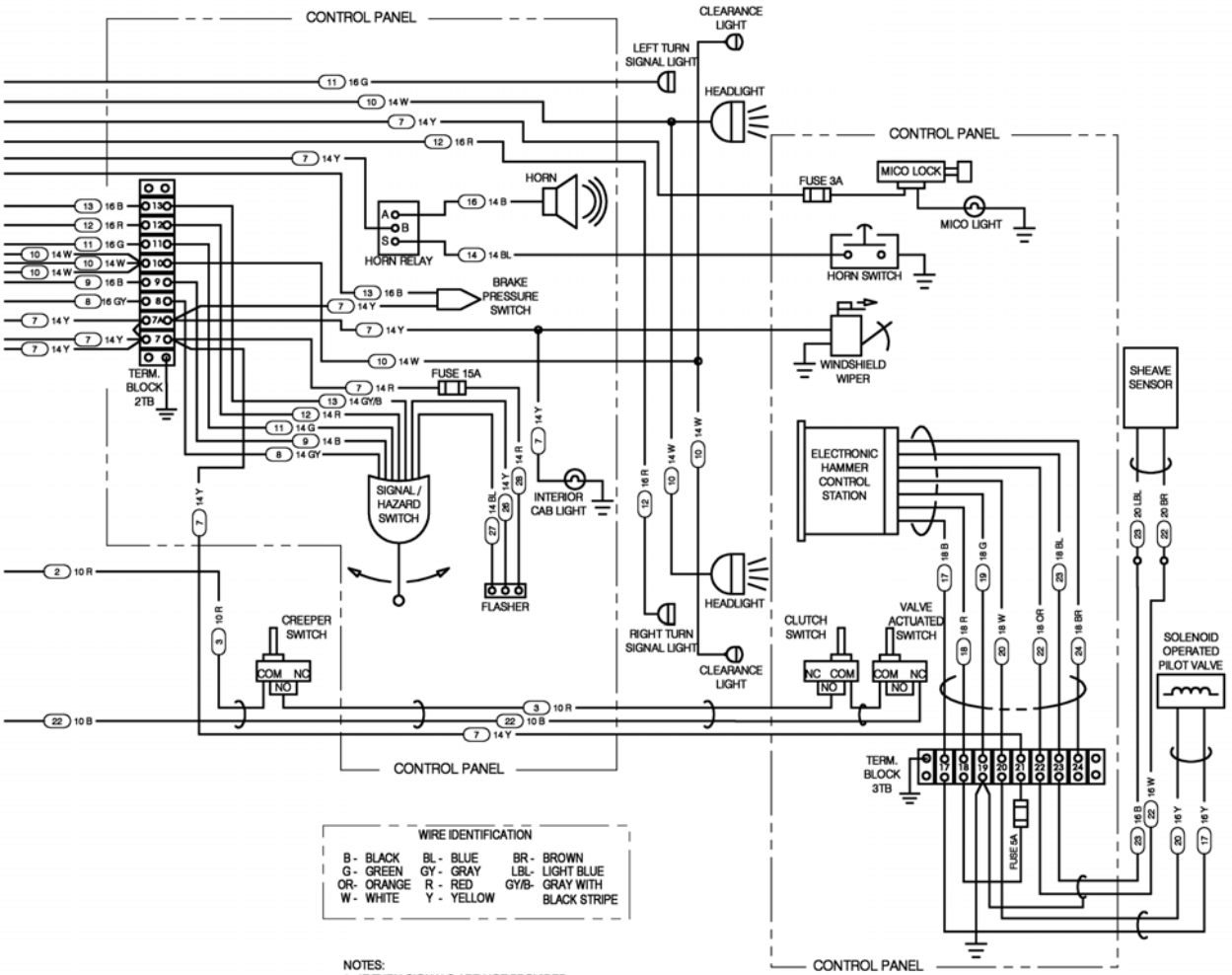



*Figure 11-3*
*Electrical Diagram*




**WIRING DIAGRAM**
**ELECTRONIC STROKE**

FRONT MOUNTED GAUGES

CADD6\GCD\HMMR\WS-\WS-0134e.dwg

# Trouble Shooting

Table 12-1
General Trouble Shooting

| PROBLEM | POSSIBLE CAUSE | REMEDY |
|---|---|---|
| Engine will not crank. | Interlock switch actuated. | Check starting circuit interlock switches. (Automatic stroke control lever must be in the "man/start" position, creeper drive must be disengaged, and the clutch pedal must be depressed). |
| | Defective interlock switch. | Check and replace interlock switch. |
| | Defective valve switch. | Check and replace valve switch. |
| | Defective starter relay on firewall. | Check and replace starter relay. |
| | Improper connection or blown fuse. | Check all connections. Check and replace blown fuse(s). |
| | | Refer to Engine Manufacturer's Service Manual for additional information on engine starting problems and general service requirements. |
| Noisy hydraulic system | Low oil level. | Add oil to correct level. |
| | Cold oil. | Allow machine to idle until oil has warmed up sufficiently. |
| | Improper oil. | Refer to Hydraulic Fluid - Recommendations in the Fuels, Fluids, & Lubricants section of the Operator's Manual. |
| | Contaminated oil. | Replace with new oil and new filter cartridge. NEVER USE GASOLINE FOR SYSTEM CLEANING OR FLUSHING THE HYDRAULIC SYSTEM. |
| | Valve left in operating position and oil is passing over relief valve. | Center control valve to neutral position. |
| | Air is entering the hydraulic system. | Tighten connectors. |
| | Air can enter intake hoses at clamps or defective hoses between the oil reservoir and pump. Air entering the intake side of the pumps will make them very noisy. Air in the system can be detected by the milky appearance of the oil. Sometimes, oil will foam. Air can enter a pump intake without a visible oil leak. | |
| | Defective or worn hydraulic pumps. | Replace pumps. |

Table 12-1
General Trouble Shooting - (cont'd.)

| PROBLEM | POSSIBLE CAUSE | REMEDY |
|---|---|---|
| Hydraulic creeper will not work. | Creeper engaging lever or linkage not in the correct position. | Engage the creeper lever. Operate the creeper control to engage the gears. Check for missing pins, key, and spring. |
| | Creeper interlock is not engaged. | Engage the creeper interlock (transmission must be in neutral position). |
| | Creeper valve is not operating properly. | Check the creeper valve cam and linkage. Release the parking brake. |
| | Low or no hydraulic pressure. | Replace defective hoses. Check for proper oil level and fill as needed. Refer to the "Hydraulic Pressure Adjustment" section of this manual for adjustment procedures. |
| | Creeper bypass valve is sticking. | Remove and disassemble. Check for broken or sticking parts. |
| | Defective hydraulic parking brake. | Repair or replace. |
| | Defective creeper motor. | Repair or replace. |
| | Defective internal mechanism. | Remove and inspect the creeper motor. Repair or replace. |
| Side shift will not work. | Defective or worn side shift motor. | Replace defective motor. Refer to the following procedures to check for a worn or scored side shift motor.<br>a. Make certain the control valve pressure is correct and the oil temperature is normal.<br>b. Set the engine speed control lever to the "FAST" position and push the side shift control lever forward until the carriage reaches the extreme right end travel (if the side shift will move).<br>c. Remove the bottom hose from the side shift motor. This is a non-pressure hose when the control lever is pushed forward. Screw a pipe cap on the end of the removed hose, and install a length of clean, low-pressure drain hose in the bottom port of the motor. Place the other end of the hose in a clean, 5-gallon container.<br>d. With the engine speed control lever in the "FAST" position, hold the side shift control lever forward. If the motor fills the 5-gallon container in less than one minute, the motor is defective and should be replaced.<br>NOTE: REPLACEMENT OF THE HYDRAULIC MOTOR IS RECOMMENDED INSTEAD OF ATTEMPTING TO MAKE FIELD REPAIRS. |

Table 12-1
General Trouble Shooting - (cont'd.)

| PROBLEM | POSSIBLE CAUSE | REMEDY |
|---|---|---|
| Side shift will not work - cont'd. | Seized motor. | It is possible for a motor to be seized and not show up as defective in the procedure above.<br><br>If the side shift motor does not appear to rotate against the chain, remove the chain and attempt to rotate the motor by actuating the control lever. If it will not rotate, the motor bearings are probably seized and the motor must be replaced. |
| | Cross-slide bearings too tight. | Adjust cross-slide bearings according to the instructions in the "Adjustments" section of the Operator's Manual. |
| | Cross tubes bent or misaligned. | Repair or replace. |
| | Improper lubrication of the ways. | Clean ways with a suitable solvent and lubricate. |
| | Low or no hydraulic pressure. | Replace defective hoses.<br><br>Repair or replace control valve<br><br>Check for proper oil level and fill as needed. Refer to the "Hydraulic Pressure Adjustment" section of this manual for adjustment procedures. |
| Lead cannot be raised to working position. | Hammer weight not in proper position to raise lead. | Weight should be carried in locked position. At this point, the hydraulic system can easily raise the lead. If the lead are accidently laid down with the hammer weight at the top of the lead, the weight can be slid forward by allowing a small amount of slack in the cable and stopping the machine abruptly while moving slowly forward.<br><br>CAUTION: DO NOT ALLOW AN EXCESSIVE AMOUNT OF SLACK IN THE CABLE. |
| | Low or no hydraulic pressure. | Replace defective hoses. Check for proper oil level and fill as needed. Refer to the "Hydraulic Pressure Adjustment" section of this manual for adjustment procedures. |
| Rapid and erratic layback action of the lead. | Air in the hydraulic lines. | If the oil has been drained for any reason, and no oil is present in either side of the cylinder, the operator should carefully actuate the layback cylinder a small amount in each direction until the air has been expelled. An orifice fitting must be installed on the cylinder to maintain a safe control speed. The layback safety latch must be raised manually to lay the lead down.<br><br>NOTE: THIS SAFETY LATCH IS FOR THE OPERATOR'S PROTECTION AND SHOULD NEVER BE MADE INOPERATIVE. |

Table 12-1
General Trouble Shooting - (cont'd.)

| PROBLEM | POSSIBLE CAUSE | REMEDY |
|---|---|---|
| Lead will not tilt. | Lead center pin is stuck. | Disassemble the lead from the cross-slide carriage and repair.<br><br>Dress off pin, if necessary.<br><br>Check and replace center pin bushings if worn.<br><br>Lubricate. |
| | Low or no hydraulic pressure. | Replace defective hoses.<br><br>Repair or replace defective valve<br><br>Check for proper oil level and fill as needed. Refer to the "Hydraulic Pressure Adjustment" section of this manual for adjustment procedures. |
| Tilt cylinder will not hold. | The control valve is not centering to the hold position. | Spring-assembly bolt (refer to the Parts Manual) is loose - check and tighten the bolt. |
| | Worn or defective cylinder. | Repair or replace. To check for a leaky cylinder use the following procedure:<br><br>a. Tilt the top of the lead to the right and disconnect the lower hose from the tilt cylinder.<br><br>b. Cap the hose and apply pressure VERY SLOWLY to tilt the lead to the right, by metering the valve as slowly as possible. If oil does not discharge from the cylinder-rod end port, the cylinder is OK. Both hoses must be connected to reposition the lead.<br><br>Tilt the lead to the left, reversing the previous step, to test the cylinder in the opposite direction. Testing the cylinder in both directions insures that the piston-rod nut is secure. With a loose piston-rod nut, it is possible to seal in one direction, while leaking in the opposite direction. Also, a cylinder barrel can be defective at one end of the stroke and be perfect at the other end. Testing in this manner checks both ends of the cylinder barrel. |

Table 12-1
General Trouble Shooting - (cont'd.)

| PROBLEM | POSSIBLE CAUSE | REMEDY |
|---|---|---|
| Layback cylinder will not hold. | The control valve is not centering to the hold position. | Spring-assembly bolt (refer to the Parts Manual) is loose - check and tighten the bolt. |
| | Worn or defective cylinder. | Repair or replace. To check for a leaky cylinder use the following procedure:<br>a. Push forward on the layback control lever until the lead is as far forward as possible.<br>b. Disconnect the hose from the anchor end of the cylinder cap.<br>c. Apply pressure VERY SLOWLY by moving the layback control lever slowly forward. If the cylinder is defective, oil will discharge out of the anchor-end cylinder port. Both hoses must be connected to reposition the lead.<br>d. Reconnect the hose to the anchor end of the cylinder. Lay the lead down on the lead support by pulling back on the layback control lever.<br>e. To test the other end of the cylinder, remove and cap the hose at the rod end of the cylinder.<br>f. Apply pressure VERY SLOWLY by pulling back on the layback control lever. If oil discharges from the cylinder rod-end port, the cylinder is defective. Remove and repair the defective cylinder. Inspect bore finishes, replace rings and seals. If the cylinder barrel is rough, replace the barrel. |
| Premature cable breakage. | Not using proper cable. | Install proper cable. |
| | Cable is too dry. | Lubricate the cable sparingly with standard cable lubricant. |
| | Cable is improperly threaded. | Rethread the cable. See the Adjustments section of the Operator's Manual. |
| | Defective sheave bearings. | Replace the sheave bearings. |
| | Hammer relief pressure is too high. | Reset the pressure in the hammer lift circuit. See Hydraulic Pressure Adjustment section. |
| | Worn cable sheaves. | Replace cable sheaves. |
| | Stopping the hammer weight on the downstroke with the hydraulic control. | Avoid stopping the weight whenever possible, this stresses the cable. Allow the tool to strike the ground. Avoid allowing the hammer weight to fall through the end of the cylinder travel. |

Table 12-1
General Trouble Shooting - (cont'd.)

| PROBLEM | POSSIBLE CAUSE | REMEDY |
|---|---|---|
| On down stroke the valve does not reverse and raise the hammer weight. | Defective pilot valve. | Replace pilot valve. |
| | Broken spring on pilot valve. | Replace spring. |
| | Downstroke trip finger is not actuating the lever on the pilot valve (mechanical stroke and cable adjust models). | Reset trip finger or adjust cable length. |
| | Stroke length set to short. | Adjust stroke length. |
| Hammer weight drifts down. | Damaged or defective hammer control valve handle linkage. | Repair or replace handle linkage. |
| | Hammer control valve spool is binding. | Inspect and clean the hammer control valve.<br>Excessively tightened mounting hardware can deflect the valve body enough to bind the spool. Loosen the mounting hardware and retighten. Torque to 25 ft/lbs. |
| | Check valve and seat are worn and leaking. | Replace check valve and seat. |
| | Broken or weak hammer control valve spool return spring. | Replace spring. |
| | Leaking seals in hammer lift cylinder. | To test for leaking seals, raise the cylinder to maximum stroke with the hammer weight at the top of the lead. Allow the hammer lift control valve to remain in the center position until the hammer weight reaches the ground. Disconnect the line from the top of the hammer lift cylinder (rod end). Slowly raise the hammer weight. If oil discharges from the disconnected cylinder port, the seals may need to be replaced. If the cylinder barrel surface is rough or grooved, the cylinder and base should be replaced. |
| | Worn hammer control valve spool. | Replace the hammer control valve.<br>NOTE: Some leakage is normal and necessary for every type hydraulic valve and should not be cause for alarm. |

Table 12-1
General Trouble Shooting - (cont'd.)

| PROBLEM | **POSSIBLE CAUSE** | **REMEDY** |
|---|---|---|
| When raising the weight, the weight settles before starting upward. | Worn or defective check valve.<br>Defective relief valve seat. | Repair or replace entire check valve.<br>Seal or replace. |
| Hammer weight sticks in the UP position. | Broken spring on pilot valve.<br>Defective pilot valve.<br>Upstroke trip finger is not actuating the lever on the pilot valve (mechanical stroke and cable adjust models). | Replace spring.<br>Replace pilot valve.<br>Reset trip finger position or adjust cable length. |
| Erratic Strokes. Premature reversals both up and down. | Loose electrical connection.<br>Defective valve switch. | Check and tighten loose connections.<br>Replace valve switch. |
| Excessive stroke (hammer weight hits the cross member on the lead). | Improper cable length.<br>Stroke length set too high (mechanical stroke and cable adjust models).<br>Engine speed set to high. | Adjust cable length.<br>Reset trip finger position or adjust cable length.<br>Reset engine speed. |
| Weight fails to raise after the tool strikes the ground. | Trip fingers improperly set (mechanical stroke and cable adjust models).<br>Stroke length set too short (mechanical stroke and cable adjust models). | Reset trip fingers.<br>Adjust stroke length. |

# ELECTRONIC STROKE CONTROL TROUBLE SHOOTING

## Refer to Table 12-2

### General

A correctly operating stroke-control system is evidenced by a repetitive stroke length, independent of terrain. Having set the stroke length, there should be no further requirement to change it. The hammer should be able to operate as long as necessary, without making further adjustments. It should be clearly understood that the stroke-length adjustment knob sets the total stroke length, not the height to which the hammer rises on the lead. The controller references stroke length from the striking point of the tool. Obviously, if the tool is striking 3 feet below the road level, the high point on the lead will be 3 feet lower than if the tool is striking at road level.

### Sensor Problems

If the hammer is operating within the stroke capability, there should be no cable "snatching". Cable "snatching" usually indicates a problem with the proximity sensor or its associated cable. If the cable is "snatched" infrequently, the proximity sensor is probably set too far from the sheave. Setting the sensor 1/32" closer to the sheave will probably cure the problem. If the cable is "snatched" frequently, or if the hammer weight has a tendency to crawl up the lead on short strokes, the sensor or its associated cable is faulty. The system has no ground reference without a sensor, so the timer free-runs. In other words, the controller doesn't know where the hammer weight is. The sensor and its cable can be checked most conveniently at the sensor itself. Following are a List of Checks:

- Mark the adjustment on the threads of sensor for convenient replacement, and remove the sensor.
- Check the end of the sensor for damage. If the sheave hits or rubs the end of the sensor, it's probably ruined and must be replaced.
- Check the sheave for excessive side play - (1/32" maximum side play.)

### Replacing the Sensor

Pay attention to wire colors - the sensor won't work if the lead are reversed. Set the sensor at the proper spacing. The end of the sensor should clear the sheave by 1/8 inch. Refer to the "Adjustments" section of this manual.

### Voltage Check

If the sensor appears to be physically sound, make the following electrical checks before replacing the sensor. *Note: Do not disconnect the sensor lead.*

1. Check the blue sensor wire with respect to ground. Move the sensor to and from metal. There should be a definite meter movement from approximately 0.8 volts when away from the metal, to less than 0.1 volts when the sensor is very near, or touching metal.
2. If the sensor doesn't react as described above, open the blue sensor lead from the black cable lead and make a continuity check of the black lead with respect to ground. The black lead should measure 100 ohms with respect to ground. If it reads 0 ohms, the black lead is shorted somewhere. If it reads open, the black lead is open somewhere in the cable. If the cable lead are ok according to the above checks, the sensor is bad.
3. If a cable problem is indicated, remove the cowling over the controls for access to the terminal strip. Locate wire numbers 23 and 24 (refer to the Electrical Diagram, Figure 11-2). Remove the white and black cable lead going up to the sensor. Check for a short to ground on either lead going to the sensor. Both lead should read open with respect to ground. Check wire 23, or the terminal block. It should read 8 volts ± 0.2 volts. Check the continuity of wire 24 going back to the timer. It should read 100 ohms. An open in the sensor cable can be checked out by connecting the white and black wires together at the sensor end and reading continuity at the terminal strip end.

Table 12-2
Electronic Stroke Control Trouble Shooting

| PROBLEM | POSSIBLE CAUSE | REMEDY |
|---|---|---|
| Electronic Control Station power lamp does not turn ON (power lamp does not light). | Power switch turned "OFF". | Turn power switch to "ON". |
| | Power lamp is defective. | Check and replace bulb. |
| | Loose electrical connection, broken wire, or blown fuse. | Check all connections. Check and replace fuse. |
| | Defective valve switch. | Eliminate switch. Consult factory for rewiring procedure. |
| | Defective Electronic Control Station. | Replace Electronic Control Station. |
| Erratic stroke at all settings of the Electronic Control Station. | Defective or improperly adjusted sheave sensor. | Check the sensor lead and connections. Replace defective sheave sensor. Check adjustment and make sure sensor is positioned 1/8" from the sheave spokes. |
| | Disconnected or defective sensor cable | Check all cable connections. Test sensor cable for broken wires and replace if necessary. |
| | Excessive side play of the lead sheave. | Shim the lead sheave as necessary to reduce sideplay. Badly worn lead sheaves must be replaced. |
| | Lead sheave not properly installed. | Check and make sure the casting letters on the lead sheave are positioned on the side opposite to the sheave sensor. Remove the lead sheave and reinstall properly. |
| | Defective or improperly adjusted safety switch on the automatic valve. | Eliminate switch. Consult factory for rewiring procedure. |
| | Loose electrical connection. | Check and tighten loose connections. |
| | Defective or improper wiring connection. | Consult factory for rewiring procedure. |
| | Defective Electronic Control Station. | Replace Electronic Control Station. |
| Pressure settings correct. Servo on the hammer valve is not shifting properly. | Defective solenoid valve | Replace solenoid valve |
| | Solenoid valve filter is plugged. | Replace solenoid valve filter. |
| Hammer weight sticks in the UP position. Solenoid valve has power. | Defective solenoid valve. | Replace defective solenoid valve. |
| | Solenoid-valve spool sticking. | Disassemble and clean solenoid valve. |
| Weight does not immediately raise after the tool strikes the ground (excessive dwell time). | Defective Electronic Control Station. | Replace Electronic Control Station. |

Table 12-2
Electronic Stroke Control Trouble Shooting - (cont'd.)

| PROBLEM | POSSIBLE CAUSE | REMEDY |
|---|---|---|
| Excessive stroke (hammer weight hits the cross member on the lead). | Improper cable length.<br>Stroke length set too high.<br>Engine speed set to high.<br>Defective Electronic Control Station. | Adjust cable length.<br>Stroke is approximately 8' at maximum setting on the stroke control dial. If a very long tool is used, there may not be enough stroke available. Set the stroke control dial to a lower value.<br>Reset engine speed.<br>Replace Electronic Control Station. |
| Weight fails to raise after the tool strikes the ground. | Improper connection or defective Electronic Control Station.<br>Sheave sensor out of adjustment.<br>Defective sensor or sensor cable.<br>Stroke length set too short. | Check cable for proper connection. Replace defective Electronic Control Station.<br>Adjust sensor. See "Adjustments" section.<br>Check and replace sensor and/or cable.<br>Adjust stroke length. |
| Hammer reverses before the downstroke is completed. | Sheave sensor out of adjustment.<br>Defective sensor or sensor cable.<br>Improper connection or defective Electronic Control Station. | Adjust sensor. See "Adjustments" section.<br>Check and replace sensor and/or cable.<br>Check cable for proper connection. Replace defective Electronic Control Station. |
| Short Strokes. | Defective Electronic Control Station. | Replace Electronic Control Station. |
| Hammer not getting full stroke. Pressure settings correct. | Engine rpm too low. | Increase engine rpm with the engine speed control hand throttle. |

Additional notes:

1. Low pilot pressure is usually indicated by premature reversals during side shift operation. If the pilot pressure is low, the side shift operation lowers it below critical levels, causing the hammer valve to shift prematurely.

2. The pilot valve spool can stick, or the seals on the spool can fail. If the Electronic Control Station is supplying the voltage to the solenoid valve (as measured across the solenoid coil), but the hammer weight is not reversing, a bad pilot valve is indicated. If, with the engine turned "OFF" and the Electronic Control Station cycling, a clicking sound is heard from the pilot valve, the solenoid is operating but the spool is defective.

## Solenoid Valve

The most common failure of a pilot valve is a sticky spool, usually caused by dirt in the system. If the spool sticks, the hammer valve receives no pilot signal. As a result, the hammer goes either to the top of the lead and stays, or goes to the bottom of the lead and won't lift. If this condition occurs, turn on the Electronic Control Station and allow it to free run (engine off). Observe the up/down lamps to assure the Electronic Control Station is cycling. Audible checks should be heard each time the timer switches from up to down and visa versa. If the checks are not heard, the valve spool is sticking and should be either repaired or replaced.
*Note that in-line filters should be found with every solenoid pilot valve.*

## Valve Switch

On older Arrow hammers, the automatic valve has a power-shutoff switch mounted on the valve body. The switch can get out of adjustment, causing intermittent power loss to the Electronic Control Station. The result is an abrupt stop of the hammer weight. That action will be accompanied by blinking of the power on lamp on the Electronic Control Station. The switch can get so far out of adjustment that it cuts the power completely, in which case, the entire electronic stroke control system will be dead. Check the switch out, if it is suspect. Adjust the switch so that it properly follows the manual control-valve handle.

## Electronic Control Station

The Electronic Control Station can fail in a way that can cause all of the above malfunctions. The easiest way to check the Electronic Control Station is to replace the suspected unit with a known good one. If the problem is corrected, the suspected unit is bad. Return it to the factory for repair. If replacement of the Electronic Control Station is not possible, check out the following features:

- **Power lamp (red)** - The red lamp should be on when the unit is turned on. If the lift lamp (yellow) is blinking properly with the free-running timer, and the power lamp is not lit, the power lamp is probably burned out and should be replaced.
  *Note that a burned out bulb does not affect the operation of the unit.*
- **Lift lamp (yellow)** - Switching of this lamp (blinking on and off) should be accompanied by the clicking sound of the solenoid pilot valve as it is actuated. If the lift lamp does not blink while the solenoid pilot valve is cycling, the bulb is probably burned out.
  *Note that a burned out bulb does not affect the operation of the unit.*
- **Valve Driver Transistor Switch** - If the solenoid pilot valve doesn't click, but the lights blink in synch with the free-running timer, the valve driver transistor may be bad. Check the voltage at the solenoid pilot valve and at terminal 20 on the terminal board. The voltage should swing between 12 volts and approximately 0 volts in synch with the lift lamp. If the voltage cycles as described, the solenoid valve coil may be burned out - check the coil for continuity. If the voltage doesn't cycle as described, the transistor switch in the Electronic Control Station is probably bad. Before replacing either the Electronic Control Station or the solenoid valve, visually inspected the wiring between the solenoid valve and Electronic Control Station. Be sure that all connectors and terminals on the terminal block are tight.

## Stroke Length Control

The stroke length is adjustable by means of the control knob on the front face of the Electronic Control Station. The stroke length should be at the maximum when the knob is set to the no. 8 on the dial. The stroke shortens proportionately as the knob is rotated counter-clockwise. The stroke is adjustable to any desired length between maximum and minimum stroke. Minimum stroke should be approximately one foot. If stroke control can't be achieved, the Electronic Control Station is bad and should be replaced.

## Governor Setting

If the governor speed is too far off from 2200 rpm, the stroke length will vary from the 8 ft. maximum stroke normally expected. The Electronic Control Station times the up stroke. Therefore, if the engine runs faster than 2200 rpm - causing more oil to be pumped - the stroke length will be increased for any given setting of the stroke-length control knob. Conversely, the stroke length will be decreased if the engine runs slower than 2200 rpm.

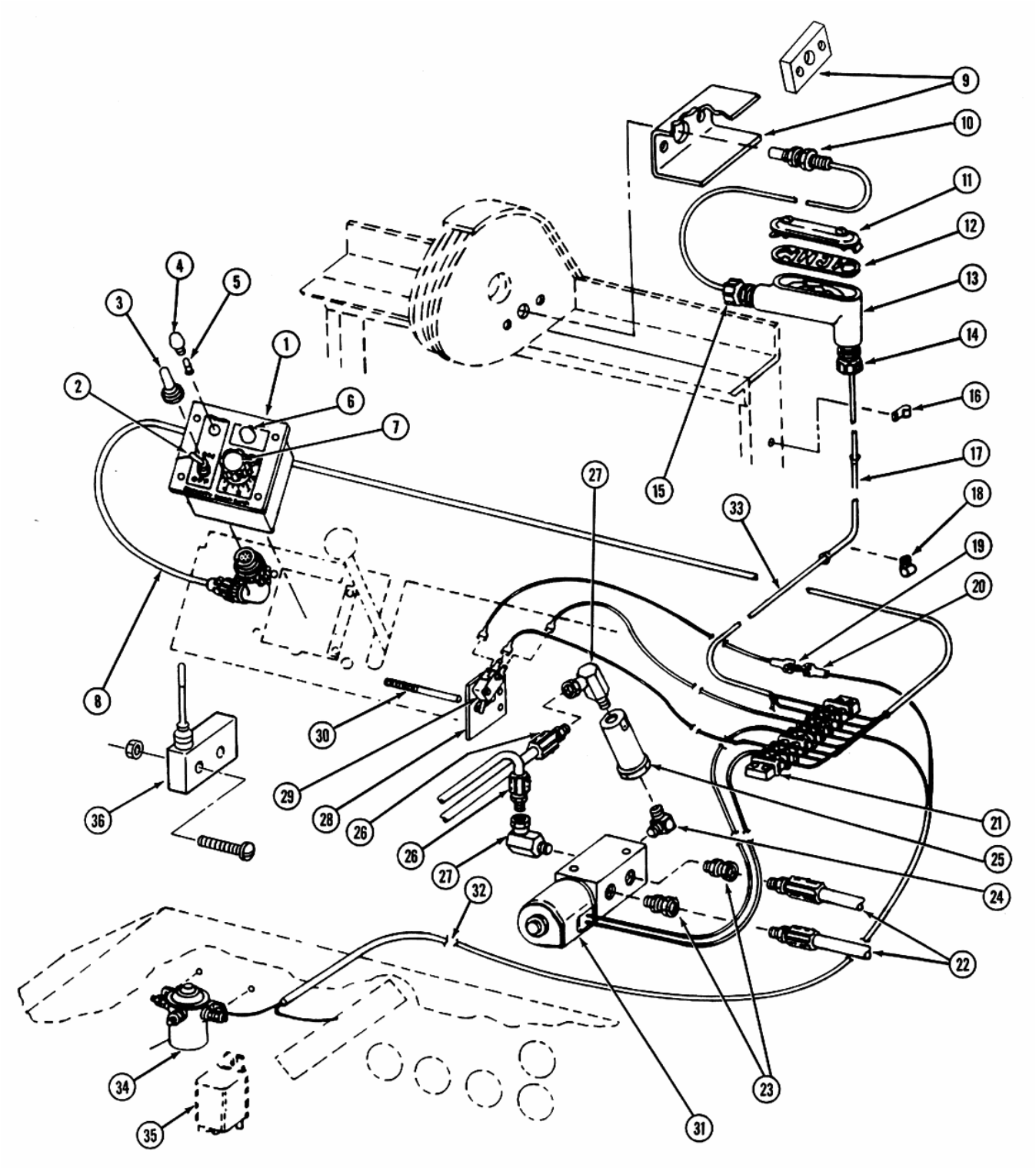



*Figure 12-1*
*Electronic Stroke Control*

# Electronic Stroke Control

| Item | Part Number | Description |
|---|---|---|
| 1 | 2000608 | Controller |
| 2 | 4001852 | Toggle Switch |
| 3 | 4001853 | Boot |
| 4 | 4001724 | Red Lens |
| 5 | 4001723 | Lamp (2) |
| 6 | 4001725 | Amber Lens |
| 7 | 4001721 | Knob |
| 8 | 2000609 | Control Cable |
| 9 | 3001827 | 14mm Sensor Bracket (1982-87) |
| | 3002003 | 18mm Sensor Bracket (1987- . . .) |
| 10 | . . . . . | |
| | 4001890 | 18mm Sensor w/Nuts (1987- . . .) |
| 11 | 4001791 | Cover |
| 12 | 4001790 | Gasket |
| 13 | 4001789 | Conduit Body |
| 14 | 4001788 | Cord Grip |
| 15 | 4001782 | Cord Grip |
| 16 | 4000584 | J-Clip (4) |
| 17 | 3001895 | Conduit |
| 18 | 4000686 | Clamp (2) |
| 19 | 4001779 | 5-Amp Fuse |
| 20 | 4001778 | Fuse Holder |
| 21 | 4001234 | Terminal Block |
| 22 | 4001421 | 3/8" x 30" Hose (2) |
| 23 | 4001296 | 1/4" x 3/8" Swivel (2) |
| 24 | 4001891 | Male Elbow |
| 25 | 4001812 | Oil Filter |
| 26 | 4001306 | 3/8" x 40" Hose (2) |
| 27 | 4001806 | 1/4" x 3/8" 90°- Swivel |
| 28 | 3001887 | Switch Bracket (Thru S/N: 6021) |
| | 3002161 | Switch Bracket (S/N: 6022 - 6299) |
| 29 | 4001786 | Valve Switch (Thru S/N: 6021) |
| | 4002081 | Valve Switch (S/N: 6022 - 6299) |
| 30 | 3001858 | Actuating Rod (Thru S/N: 6021) |
| 31 | 4001805 | Solenoid Valve |
| 32 | 2000626 | Relay Wiring Harness |
| 33 | 2000625 | Shielded Cable |
| 34 | 4001849 | Solenoid (Discontinued 1995) |
| 35 | 4001722 | Solenoid (Discontinued 1985) |
| 36 | 4002143 | Safety Switch |
| | 5503071 | #6-32 x 1-1/8" Screw |
| | 5550402 | #6-32 Locknut |

CALIFORNIA

Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, and other reproductive harm.