



REPAIR MANUAL

FENNER
POWER UNIT
PLOW SERIAL NUMBERS
(AFTER 7999)

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INTRODUCTION

This manual was written for the Repair and Maintenance of the Motor, Pump and Valve Assembly mounted on plows with serial numbers 7999 and up.

We ask that you read and understand the contents of this manual COMPLETELY especially the chapter on SAFETY before attempting any procedure contained in this book.



The Society of Automotive Engineers has adopted this SAFETY ALERT SYMBOL to pinpoint characteristics that, if NOT carefully followed, can create a safety hazard. When you see this symbol in this manual or on the machine itself, BE ALERT!, your personal safety and the safety of others, is involved.

• Defined in the next column, are the SAFETY ALERT messages and how they will appear in this manual.



WARNING

Information, that if not carefully followed, can cause serious personal injury or death!



CAUTION

Information, that if not carefully followed, can cause minor injury or damage to equipment!

NOTE: Additional information concerning the equipment or the procedure that may or may not be contained elsewhere in this manual.

BE AWARE! It is illegal to remove, deface or otherwise alter the safety placards mounted on this equipment.

We reserve the right to make changes or improve the design or construction of any part(s) without incurring the obligation to install such parts or make any changes on any unit previously delivered.



SAFETY



BEFORE ATTEMPTING ANY PROCEDURE IN THIS BOOK, READ AND UNDERSTAND ALL THE SAFETY INFORMATION CONTAINED IN THIS SECTION. IN ADDITION, ENSURE ALL INDIVIDUALS WORKING WITH YOU ARE ALSO FAMILIAR WITH THESE SAFETY PRECAUTIONS.

ALWAYS inspect lift system bolts and pins whenever attaching or detaching the plow, and before traveling. Worn or damaged components could result in the plow dropping to the pavement while driving, causing an accident.

NEVER place fingers in A-frame or mount lug holes to check alignment when attaching snow plow. Sudden motion of the plow could severely injure a finger.

NEVER stand between the vehicle and blade or directly in front of blade when it is being raised, lowered or angled. Clearance between vehicle and blade decreases as blade is operated and serious injury or death can result from blade striking a body or dropping on hands or feet.

NEVER work on the vehicle without having a fully serviced fire extinguisher available. A 5 lb. or larger CO² or dry chemical unit specified for gasoline, chemical or electrical fires, is recommended.

NEVER smoke while working on the vehicle. Gasoline and battery acid vapors are extremely flammable and explosive.

ALWAYS operate vehicle in a well-ventilated area. The carbon monoxide in exhaust gas is highly toxic and can cause serious injury or death.

NEVER allow hands, hair or clothing to get near any moving parts such as fan blades, belts and pulleys. Never wear neckties or loose clothing when working on the vehicle.

NEVER wear wrist watches, rings or other jewelry when working on the vehicle or individual equipment. These things can catch on moving parts or cause an electrical short circuit that could result in serious personal injury.

ALWAYS wear safety goggles when working the vehicle to protect your eyes from battery acid, gasoline, and dust or dirt from flying off of moving engine parts.

ALWAYS be aware of and avoid contact with hot surfaces such as engine, radiator, and hoses.

ALWAYS wear safety glasses with side shields when striking metal against metal! In addition, it is recommended that a softer (non-chipable) metal material be used to cushion the blow. Failure to heed could result in serious injury to the eye(s) or other parts of the body.

NEVER use your hands to search for hydraulic fluid leaks; escaping fluid under pressure can be invisible and can penetrate the skin and cause a serious injury! If any fluid is injected into the skin, see a doctor at once! Injected fluid **MUST BE** surgically removed by a doctor familiar with this type of injury or gangrene may result.

REMEMBER it is the owner's responsibility for communicating information on the safe use and proper maintenance of this machine.

THEORY OF OPERATION

General:

The hydraulic power unit consists of a 12VDC Motor, a Hydraulic pump rated at 1.3 GPM @ 1400 PSI, and a Valve Body containing three Electric Solenoids, two Hydraulic Valves and three adjustable Pressure Relief Valves. The fluid supply line for the pump is submerged in a 1.5 quart capacity reservoir and is filtered by a 149 micron screen.

The valve body directs hydraulic fluid to operate four hydraulic circuits, raise, lower, angle left and angle right. The angle and lift circuits receive fluid under pressure, and the lower circuit does not, however, pressure is generated in the lower circuit as fluid returns to the reservoir.

The angle left or angle right hydraulic circuits receive priority over the raise hydraulic circuit. If the raise circuit is operated while angling the blade left or right, the blade will angle left or right but will not raise until the Angle Switch is released. Angling the blade left or right while lowering the blade will still allow the blade to angle and to lower because hydraulic pressure is not needed to lower the blade.

Raise Mode Of Operation:

Operating the Raise Switch energizes the 12VDC Motor and de-energizes the Raise/Lower Solenoid. Hydraulic fluid under pressure is then directed through the Neutral position of the angle left/right spool valve, and a one way check valve to the raise side of the lift cylinder.

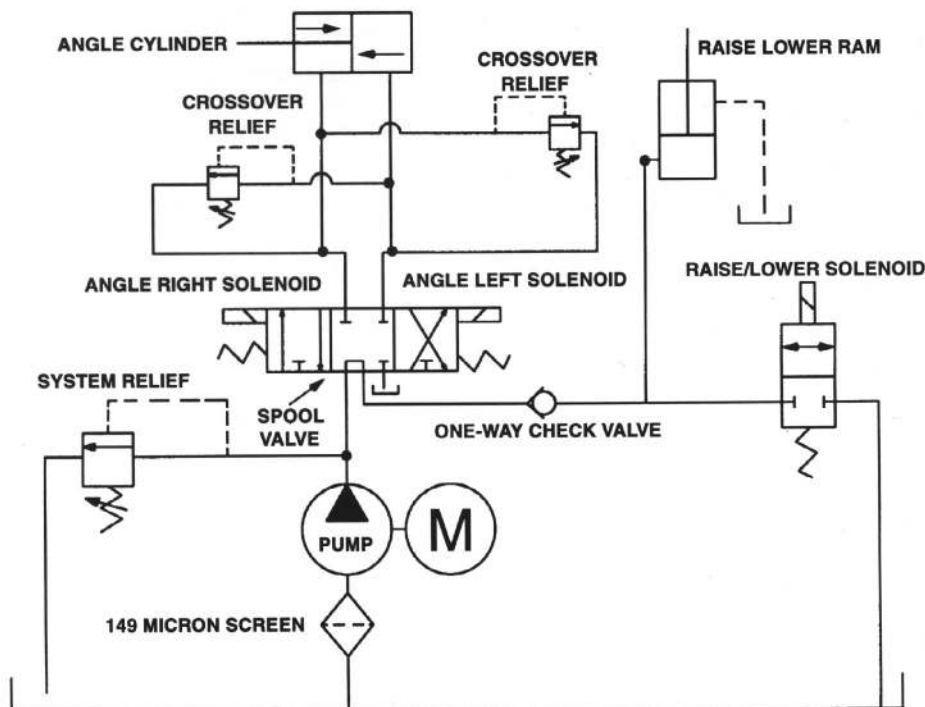
Releasing the Raise switch de-energizes the 12 VDC motor. The raise circuit is protected by a pressure relief valve set to relieve system pressure at approximately 1750 PSI. Typically, pressure is relieved when the hydraulic lift cylinder reaches the full UP position.

Lower Mode Of Operation:

Operating the Lower Switch energizes the Raise/Lower Solenoid, lowers the blade and establishes a Float Circuit. The Float Circuit allows fluid to enter or exit the Raise Cylinder allowing the blade to follow the contours of the ground.

Angle Left or Right Mode Of Operation:

Operating the Angle Switch energizes the 12 VDC Motor and either the Angle Left Solenoid or Angle Right Solenoid. Both solenoids are located on either side of a spool valve (spring loaded to the center position) that directs hydraulic fluid, under pressure, to the hydraulic ram(s) to angle the blade left or right. The angle circuit is protected by two pressure relief valves (crossover valves) set to relieve system pressure at approximately 2000 PSI. Typically, pressure is relieved when the hydraulic angle cylinder(s) reaches the FULL LEFT or FULL RIGHT position.



TROUBLESHOOTING

| PROBLEM | PROBABLE CAUSE | CORRECTIVE ACTION |
|---|--|-----------------------------------|
| Unit will not lift (Motor runs) | Hydraulic fluid level low | See Maintenance Section |
| | Defective Raise/Lower Switch | Refer to Plow Manual |
| | Improper Main Pressure Relief Valve Pressure setting, debris causing valve to stick | See Tests and Adjustments Section |
| | Breather Cap plugged | See Maintenance Section |
| | Faulty Raise/Lower Solenoid Coil | See Tests and Adjustments Section |
| | Raise/Lower Solenoid Valve Stuck in Lower position | See Tests and Adjustments Section |
| | Raise/Lower Ram Frozen or binding | Refer to Plow Manual |
| | Pick-up tube filter plugged | See Maintenance Section |
| | Pick-up tube is not submerged in fluid | See Maintenance Section |
| | Machine failure | Refer to Plow Manual |
| Unit lifts slowly | Hydraulic fluid level low | See Maintenance Section |
| | Breather Cap plugged | See Maintenance Section |
| | Improper Main Crossover Pressure setting, debris causing valve to stick | See Tests and Adjustments Section |
| | Pick-up tube filter plugged | See Maintenance Section |
| | Improper oil viscosity for outside air temperature, unit not at normal operating temperature | See Maintenance Section |
| | Machine failure | Refer to Plow Manual |
| Unit will not angle (Motor runs) <i>NOTE: If the unit moves Up when any button is depressed (except Down), the Spool Valve is stuck in the NEUTRAL position.</i> | Hydraulic fluid level low | See Maintenance Section |
| | Crossover Pressure Relief Valve setting to low | See Tests and Adjustments Section |
| | Spool Valve sticking | See Repair Section |
| | Low or no current available at Angle Solenoid | See Tests and Adjustments Section |
| | Angle Cylinder binding or frozen | Refer to Plow Manual |
| | Pick-up tube not submerged in fluid | See Maintenance Section |
| | Defective Angle Solenoid | See Tests and Adjustments Section |
| | Machine failure | Refer to Plow Manual |

TROUBLESHOOTING

| PROBLEM | PROBABLE CAUSE | CORRECTIVE ACTION |
|--|--|-----------------------------------|
| Unit angles in one direction only <i>NOTE: If the unit angles in one direction only when any button (except Down) is depressed, either the Spool Valve is stuck in that position or one of the Solenoid Valves is stuck and holding the Spool Valve in that position.</i> | Spool Valve sticking | See Repair Section |
| | Crossover Relief Valve defective or sticking | See Tests and Adjustments Section |
| | Defective Angle Solenoid | See Tests and Adjustments Section |
| | Low or no current available at angle solenoid | See Tests and Adjustments Section |
| | Crossover Relief Valve pressure setting to low | See Tests and Adjustments Section |
| | Angle Cylinder defective allowing movement in one direction only | Refer to Plow Manual |
| | Machine failure | Refer to Plow Manual |
| Unit angles very slowly | Hydraulic fluid level low | See Maintenance Section |
| | Crossover Relief Valve defective or sticking | See Tests and Adjustments Section |
| | Crossover Relief Valve pressure setting to low | See Tests and Adjustments Section |
| | Improper oil viscosity for outside air temperature, unit not at normal operating temperature | See Maintenance Section |
| | Dirt or debris in Spool Valve | See Repair Section |
| Unit does not hold angle <i>NOTE: This problem is usually noted when pushing snow or when the vehicle is being transported.</i> | Crossover Relief Valve pressure setting to low | See Tests and Adjustments Section |
| | Crossover Relief Valve defective or sticking | See Tests and Adjustments Section |
| | Dirt or debris in Spool Valve | See Repair Section |
| Unit lifts but does not hold | Dirt or debris in Check Valve | See Repair Section |
| | Check Valve Spring broken | See Repair Section |
| | Raise/Lower Solenoid Valve sticking | See Tests and Adjustments Section |
| | Seals O-ring(s) on Raise/Lower Solenoid Valve damaged | See Repair Section |
| | Current available at Raise/lower Solenoid without switch function | Refer to Plow Manual |
| | Raise Lower Ram defective allowing movement in one direction only | Refer to Plow Manual |
| | Machine failure | Refer to Plow Manual |

TROUBLESHOOTING

| PROBLEM | PROBABLE CAUSE | CORRECTIVE ACTION |
|--|---|-----------------------------------|
| Unit will not lower | Plugged Breather Cap | See Maintenance Section |
| | Low or no current available at Raise/Lower Solenoid | Refer to Plow Manual |
| | Raise/Lower Solenoid Valve sticking | See Repair Section |
| | Raise/Lower Solenoid Coil defective | See Tests and Adjustments Section |
| | Raise Lower Ram defective allowing movement in one direction only | Refer to Plow Manual |
| | Machine failure | Refer to Plow Manual |
| Motor will not run | Motor Brushes worn/Commutator worn or dirty | See Repair Section |
| | Seal between Motor and Pump defective allowing oil to enter motor housing | See Repair Section |
| | Motor seized | See Repair Section |
| | Machine failure | Refer to Plow Manual |
| Motor continues to run and will not shut-off | Machine defective | Refer to Plow Manual |
| Fluid leaking at Pump Assembly | Hydraulic Fittings not torqued properly (too tight, too loose) | Refer to Plow Manual |
| | O-rings between Valve Block and Endhead are worn or not seating properly | See Repair Section |
| | O-rings between Endhead and Reservoir worn or not seating properly | See Repair Section |
| | Reservoir over-full | See Maintenance Section |
| | O-ring on Solenoid Adaptor Plate defective | See Repair Section |
| | Endhead cracked | See Repair Section |
| | Valve body cracked | See Repair Section |

TESTS & ADJUSTMENTS

Test Equipment Required To Test DC Powered Hydraulic Systems:

- **Direct Reading Pressure Gauge**

A small 0-3000 PSI pressure gauge, preferably glycerine filled, is a very valuable and relatively inexpensive tool for checking pressure in the various hydraulic circuits

- **DC Voltmeter**

The DC Voltmeter, as used in the automotive repair business, is a good investment for troubleshooting problems that are related to low voltage. They are used in two ways. First; the Black probe is grounded while the Red probe is used to measure voltage at the "HOT" lead. Second; it can be used to measure voltage drop in a wire. The Red probe is connected to the end of the wire closest to the power source and the Black probe to the end closest to the component being tested, the respective reading is the voltage drop.

- **OHM Meter**

An Ohmmeter is used to measure resistance in an electrical circuit. Follow the instructions supplied with the meter when performing tests.



Read all Warnings and Safety messages prior to performing any operation or repair to avoid personal injury or damage to equipment.

Some test procedures require that the blade be lowered and/or angled. Stand clear of the blade when it is being raised, lowered or angled. Failure to heed this Warning can result in serious personal injury.

Remove all jewelry, chains, watches, rings, etc. before working with the electrical system and use care to avoid electrical shock and burns.

Main Relief Valve



Never disconnect any hydraulic line or fitting with the unit in the raised position. Always lower the unit and relieve pressure before removing any lines or caps.

Allow the system to cool down before draining oil or handling system components. Serious burns can result from contact with hot oil.

Testing:

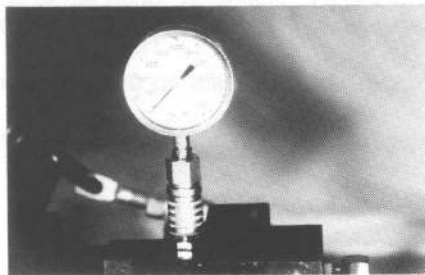


Figure 1-1

1. Carefully disconnect the hydraulic fitting located at the top of the U-Valve assembly.
2. Using the proper fittings, install a pressure gauge as shown. See Figure 1-1.
3. Start the vehicle. While holding the Raise switch in the FULL UP position, record the pressure reading.
4. A change in pitch from the hydraulic motor should be heard and a pressure of 1750 PSI should be indicating on the pressure gauge. If pressure readings are high or low, refer to the following adjustment procedures.

Adjustment:

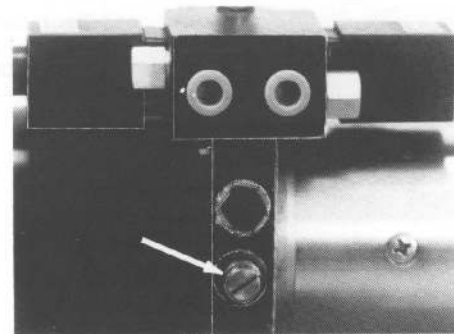


Figure 1-2

NOTE: 1/2 turn on the slotted screw will change the pressure relief setting approximately 100 PSI.

1. Remove the hex cap located on the rear of the valve assembly.

2. The slotted screw underneath the cap is for adjusting the relief valve pressure setting. Turning the screw clockwise increases the pressure and turning the screw counterclockwise decreases the pressure. Adjust pressure to relieve at 1750 PSI. See Figure 1-2.

NOTE: If no increase in pressure is observed when turning the adjustment screw clockwise, either the pump is weak, the valve has dirt between the valve ball and seat, or the spring is weak or broken. See Removal, Cleaning and Installation.

3. Ensure the hex cap threads and O-ring are clean and serviceable and re-install cap. See Figure 1-2.

NOTE: If the hex cap does not screw onto the adjustment screw easily by finger, it is possible that the adjustment screw is turning with the hex cap and the pressure setting has changed.

4. See Testing procedure to ensure the adjustment setting has not changed.

Removal, Cleaning and Installation



Never disconnect any hydraulic line or fitting with the unit in the raised position. Always lower the unit and relieve pressure before removing any lines or caps.

Allow the system to cool down before draining oil or handling system components. Serious burns can result from contact with hot oil.

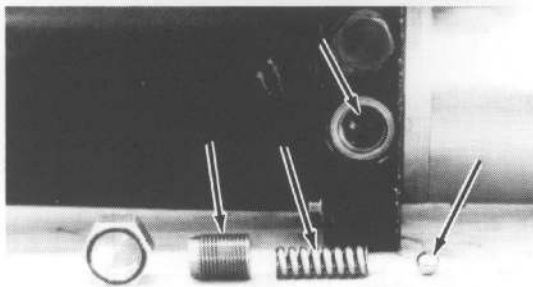


Figure 1-3

1. Disconnect the Vehicle Negative (-) battery terminal.
2. Remove the hex head cap.
3. Remove the slotted screw, spring and ball. See figure 1-3.
4. Inspect the spring, ball and ball seat for dirt accumulation, distortion, or wear, clean or replace as necessary.
5. Clean the adjustment screw threads and apply a thin coat of anti-seize compound to the threads.
6. Re-install the ball, spring and adjustment screw. (the adjustment screw should be turned in approximately five full turns). See Figure 1-3.

7. Accomplish the adjustment procedure. See Main Relief Valve, Testing, and Adjustment.

Crossover Relief Valve



Never disconnect any hydraulic line or fitting with the unit in the raised position. Always lower the unit and relieve pressure before removing any lines or caps.

Allow the system to cool down before draining oil or handling system components. Serious burns can result from contact with hot oil.

Testing:

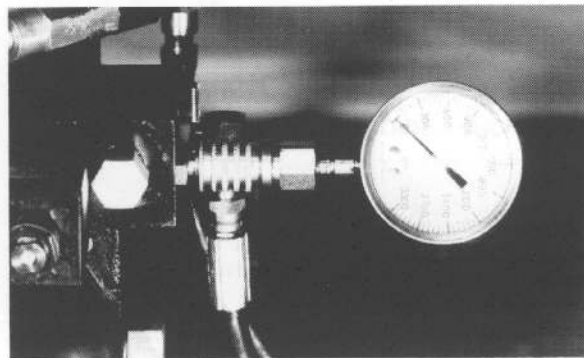


Figure 1-4

1. Carefully disconnect the hydraulic fitting located next to the angle solenoid assembly.
2. Using the proper fittings, install a pressure gauge as shown. See Figure 1-4.
3. Start the vehicle. While holding the Angle switch in the FULL LEFT or RIGHT position, record the pressure reading.
4. A change in pitch from the hydraulic motor should be heard and a pressure of 2000 PSI should be indicating on the pressure gauge. If pressure readings are high or low, refer to the following adjustment procedures.

Adjustment:

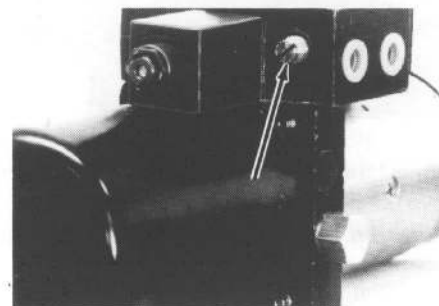


Figure 1-5

NOTE: 1/2 turn on the slotted screw will change the pressure relief setting approximately 100 PSI.

1. Remove the hex cap located next to the Angle Solenoid assembly.
2. The slotted screw underneath the cap is for adjusting the relief valve pressure setting. Turning the screw clockwise increases the pressure and turning the screw counterclockwise decreases the pressure. Adjust pressure to relieve at 2000 PSI. See Figure 1-5.

NOTE: If no increase in pressure is observed when turning the adjustment screw clockwise, either the pump is weak, the valve has dirt between the valve ball and seat, or the spring is weak or broken. See Removal, Cleaning and Installation.

3. Ensure the hex cap threads and O-ring are clean and serviceable and re-install cap.

NOTE: If the hex cap does not screw onto the adjustment screw easily by finger until seated, it is possible that the adjustment screw is turning with the hex cap and the pressure setting has changed.

4. See Testing procedure to ensure the adjustment setting has not changed.

Removal, Cleaning and Installation



Never disconnect any hydraulic line or fitting with the unit in the raised position. Always lower the unit and relieve pressure before removing any lines or caps.

Allow the system to cool down before draining oil or handling system components. Serious burns can result from contact with hot oil.

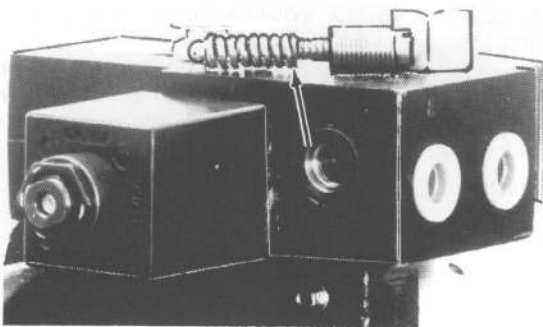


Figure 1-6

1. Disconnect the Vehicle Negative (-) battery terminal.
2. Remove the hex head cap.
3. Remove the slotted screw, springs and ball. See Figure 1-6.
4. Inspect the spring, ball and ball seat for dirt accumulation, distortion, or wear, clean or replace as necessary.

5. Clean the adjustment screw threads and apply a thin coat of anti-seize compound to the threads.
6. Re-install the ball, spring and adjustment screw. (the adjustment screw should be turned in approximately five full turns). See Figure 1-6.
7. Accomplish the adjustment procedure. See Crossover Relief Valve, Testing, and Adjustment.

Angle & Raise/Lower Solenoids



Never disconnect any hydraulic line or fitting with the unit in the raised position. Always lower the unit and relieve pressure before removing any lines or caps.

Allow the system to cool down before draining oil or handling system components. Serious burns can result from contact with hot oil.

Testing:

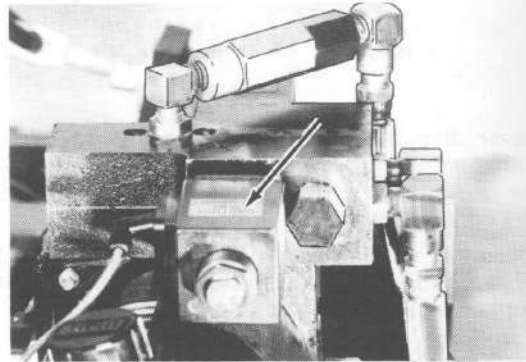


Figure 1-7



Do Not stand between the blade and the vehicle when it is being angled. Failure to heed can result in serious personal injury.

NOTE: There are four possible failures that could cause the angling solenoids not to operate. They are; Switch or associated wiring, solenoid coil, plunger or spool valve.

1. Hold the metal end of a screwdriver about one inch from the solenoid coil being tested. See Figure 1-7.
2. Actuate the angle switch. The metal end of the screwdriver should be pulled to the coil when the switch is actuated.
3. If not, use a voltmeter to test for battery voltage at the coil terminal when the switch is actuated.
4. If battery voltage is present, replace the coil.

5. If no voltage is indicated, check wiring, switch and grounds, repair as necessary.
6. If the above tests are satisfactory, see Spool Valve, Removing and Cleaning in the Repair Section.
7. Replace plunger assembly (cartridge) if the Spool Valve moves freely in its bore.

Hydraulic Pump.



Never disconnect any hydraulic line or fitting with the unit in the raised position. Always lower the unit and relieve pressure before removing any lines or caps.

Allow the system to cool down before draining oil or handling system components. Serious burns can result from contact with hot oil.

Testing:

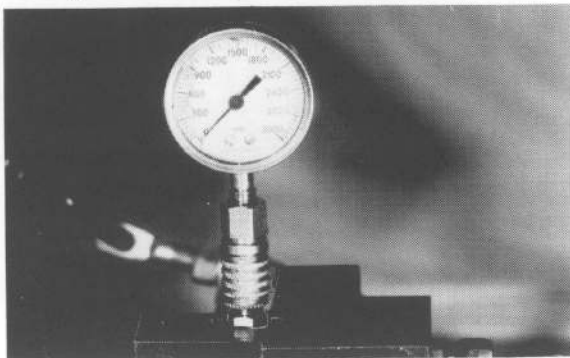


Figure 1-8

Test Conditions:

- Vehicle battery is fully charged
- Hydraulic reservoir is full

1. Remove the hydraulic fitting located at the top of the U-Valve assembly (remove the UP hose connected to the fitting first). See Figure 1-8.
2. Install an adaptor and hydraulic test gauge.
3. Turn ignition switch ON and hold the UP switch to the UP position. The gauge should be indicating 1750 PSI.

If gauge indicates less than 1750 PSI, test the following before replacing the pump:

- Ensure DOWN solenoid is not energized.
 - Ensure Main Relief Valve pressure setting is correct.
 - Test DC Motor current draw.
4. Replace pump if necessary. See Repair Section.

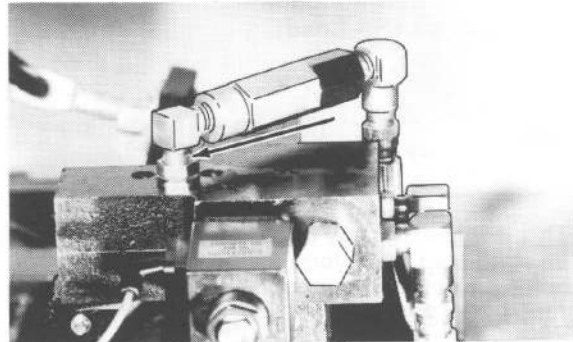


Figure 1-9

5. Remove test gauge and adaptor fitting.
6. Install hydraulic fitting as shown, allow at least two threads to be exposed above the jam nut when tight. See Figure 1-9.
7. Attach the hydraulic hose. See Figure 1-9.
8. Check reservoir fluid level, See Maintenance Section, and operate all controls to check for leaks.

DC Motor

Current Draw (Full Load)



Do Not stand between the blade and the vehicle while it is being tested. Failure to heed can result in serious personal injury.

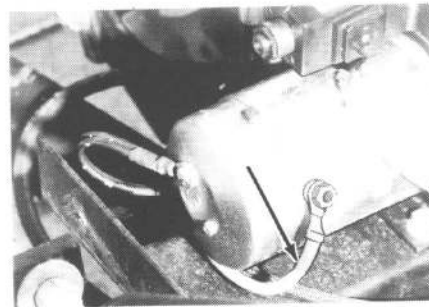


Figure 1-10

1. Install an Inductive Pick-up Amp meter around the terminal lead wire of the motor. See Figure 1-10.
2. Raise the plow to the FULL UP position and hold it there while reading the amperage draw of the motor.
3. If amperage draw exceeds 300 Amps, perform the Current Draw (No-Load) test.
4. If amperage draw is within limits, test the hydraulic pump for possible failure.

Current Draw (No-Load)



WARNING

This test is extremely dangerous and should not be attempted by anyone that is not familiar with testing electrical components capable of High Amp Draw!

Do Not attempt to perform this procedure unless adequate safety precautions are taken to prevent injury in case of fire or explosion!

1. Remove DC Motor, See Repair Section.

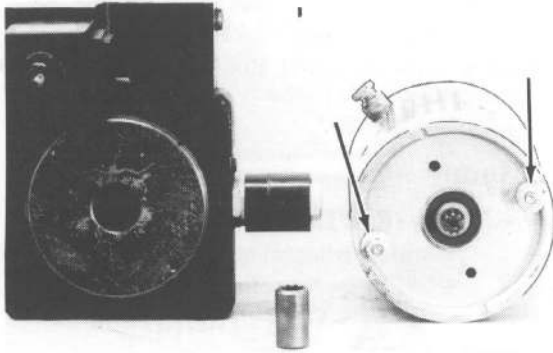


Figure 1-11

NOTE: Use care when handling the motor, the motor can separate into three pieces and will require additional time to reassemble the motor to test it.

2. Install two nuts with washers onto the motor mounting bolts as shown to keep the motor assembly together for testing. See Figure 1-11.

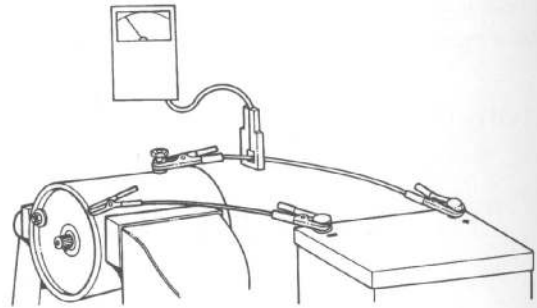


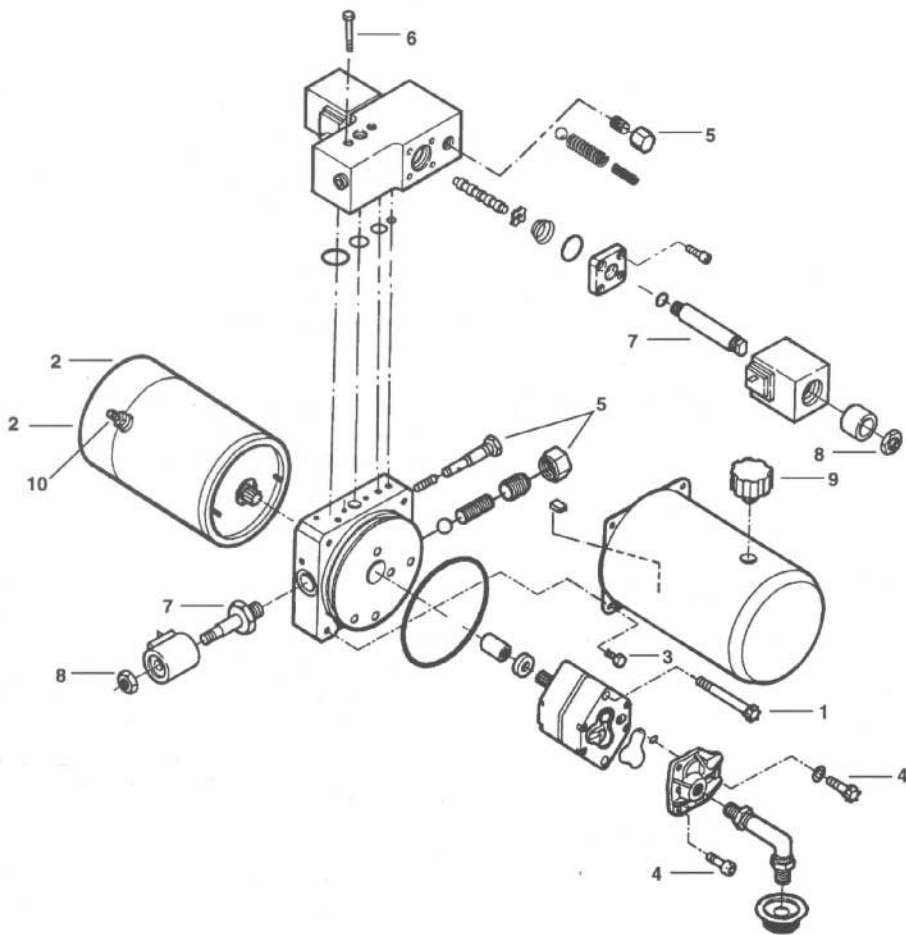
Figure 1-12

3. Secure the motor to a bench or stand (Do Not distort or damage the motor housing).
4. Using a fully charged battery and jumper cables connect the POS (+) jumper lead to the battery POS (+) post and the other end to the terminal nut on the motor. See Figure 1-12.
5. Install an Inductive Pick-up Amp meter around the POS (+) jumper lead. See Figure 1-12.
6. Connect the jumper NEG (-) lead to the battery NEG (-) post. See Figure 1-12.
7. Carefully connect the NEG (-) jumper lead the motor housing while observing the amperage on the amp meter. (Do Not exceed a 5 sec. time limit for this step) See Figure 1-12.
8. Replace the motor if amperage exceeds 105 - 110 Amps.
9. Refer to the Repair Section to re-install the motor.

REPAIR

Torque Table

| APPLICATION | BOLT THREAD | TORQUE |
|---------------------------------|-------------|--------------|
| 1- Pump Mounting Bolts | 5/16-24 | 15-18 lb-ft. |
| 2- DC Motor Mounting Bolts | 1/4 -20 | 5-8 lb-ft. |
| 3- Reservoir Mounting Bolts | 12-24 | 3-5 lb-ft. |
| 4- Suction Cover Mounting Bolts | 5/16 -18 | 12-14 lb-ft. |
| 5- Check & Release Valve Cap | ~ | 10-15 lb-ft. |
| 6- U-Valve Mounting Bolts | 1/4-20 | 9-10 lb-ft. |
| Cartridge Valve | | |
| 7- Body | ~ | 10-15 lb-ft. |
| 8- Coil Nut | ~ | 5-10 lb-in. |
| 9- Breather/Filler | 3/8 NPT | Finger Tight |
| 10- DC Motor Terminal Nut | 5/16 -18 | 25-35 lb-in. |



DC Motor Brush Replacement



Disconnect Vehicle Battery prior to performing this procedure to avoid electrical shock or burns.

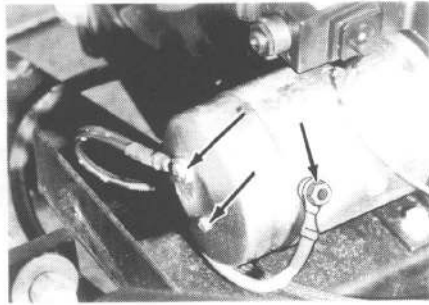


Figure 2-1

1. Disconnect the Vehicle Negative (-) battery terminal.
2. Remove two screws and remove the POS terminal and motor protective cover. See Figure 2-1.

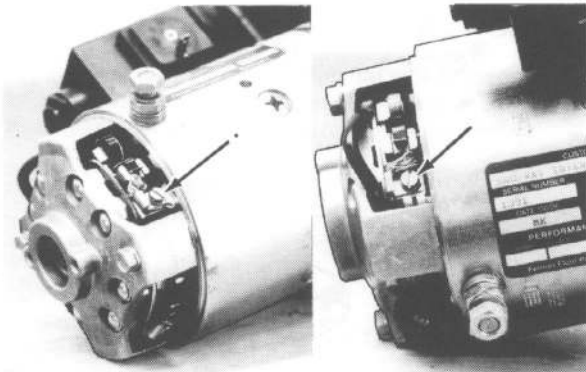


Figure 2-2

3. Make note of the terminal position and placement and remove terminal screws. See Figure 2-2.

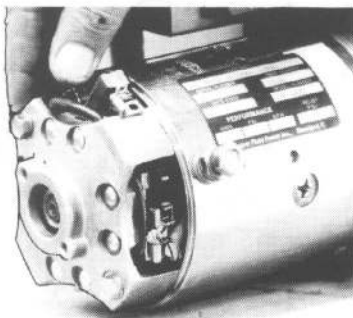


Figure 2-3

4. Carefully pry back the tension spring and remove the brush. See Figure 2-3.
5. Measure the length of the brush. Replace it if it is $\frac{1}{8}$ or less.
6. Using a spray electrical contact cleaner, clean the motor commutator before installing brushes.
7. Carefully pry back the tension spring and install brush. See Figure 2-3.
8. Install terminal screw through both terminals, ensure terminals are in position shown. See Figure 2-3.
9. Place tension spring end into slot of brush.

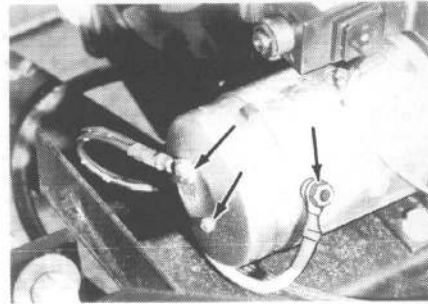


Figure 2-4

10. Position motor end cap and secure with two screws, ground strap and POS terminal. See Figure 2-4.
11. Reconnect vehicle Negative (-) battery terminal.

U-Valve Replacement



Never disconnect any hydraulic line or fitting with the unit in the raised position. Always lower the unit and relieve pressure before removing any lines or caps.

Allow the system to cool down before draining oil or handling system components. Serious burns can result from contact with hot oil.

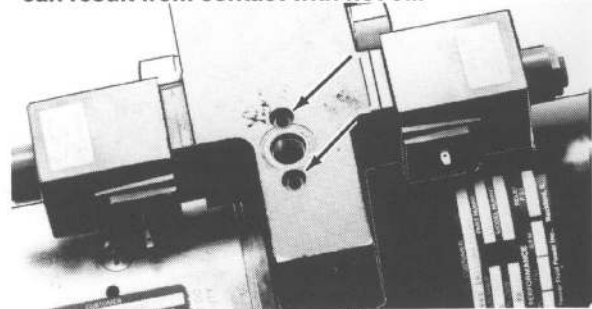


Figure 2-5

NOTE: If the U-Valve obtained for replacement does not have the Solenoid Valves or Crossover valves mounted to it, refer to the applicable Repair and Adjustment procedures to install and adjust them after mounting the U-Valve to the Endhead.

1. Mark, for reinstallation, the hydraulic fittings and remove them.
2. Remove two Allen head bolts securing the U-Valve to the Endhead and remove U-Valve. See Figure 2-5.

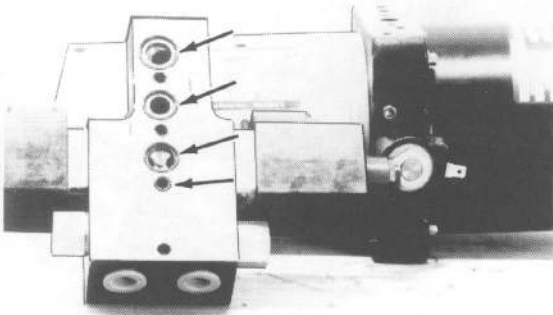


Figure 2-6

3. Install the four O-ring seals into the proper cavities (apply a light film of Petroleum jelly to hold them in place). See Figure 2-6.

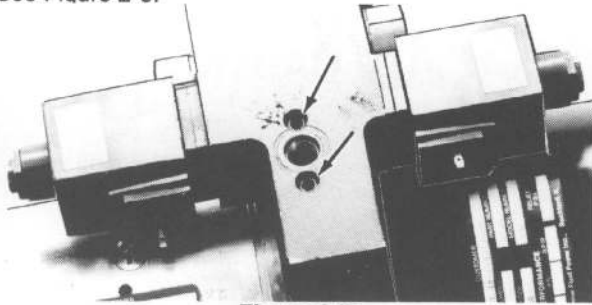


Figure 2-7

4. Carefully position the U-Valve onto the Endhead being careful not to dislodge the seals from their position.
5. Secure the U-Valve to the Endhead with two Allen head bolts. Tighten to 9-10 lb-ft. See Figure 2-7.
6. Reinstall the Hydraulic fittings previously removed and tighten to specifications.

One-way Check Valve Replacement



Never disconnect any hydraulic line or fitting with the unit in the raised position. Always lower the unit and relieve pressure before removing any lines or caps.

Allow the system to cool down before draining oil or handling system components. Serious burns can result from contact with hot oil.

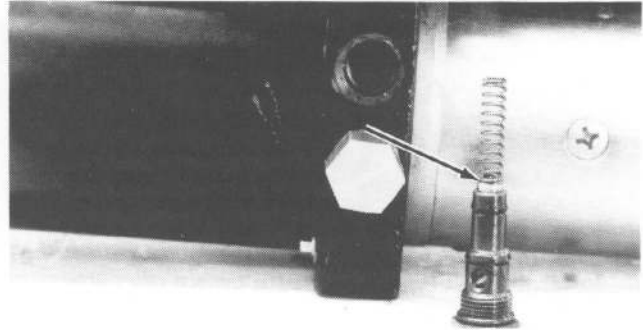


Figure 2-8

1. Remove the check valve, ball and spring. See Figure 2-8.
2. Inspect the ball for wear, gouges or pitting, replace as necessary.
3. Inspect the spring for distortion, replace as necessary.
4. Inspect the ball seat for wear, pitting or distortion, replace as necessary.

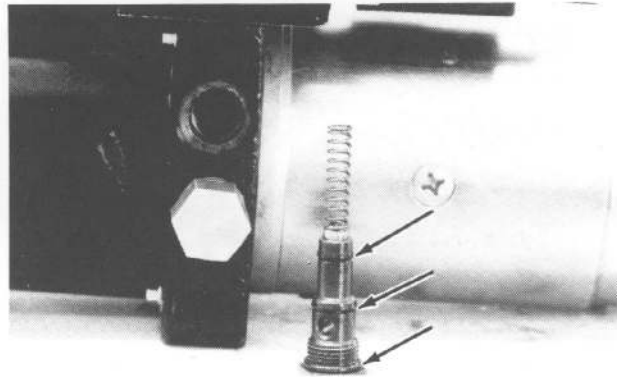


Figure 2-9

5. Install O-ring seals (3) into grooves in the check valve body. 2-9.

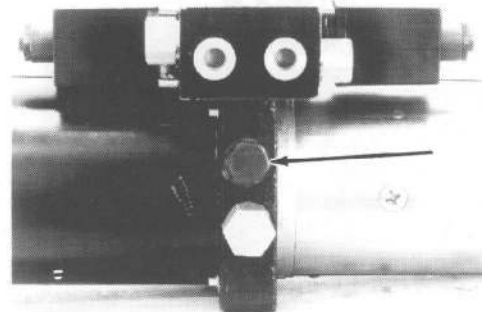


Figure 2-10

6. Install ball and spring (ball facing outside of Endhead). Lubricate O-rings and install check valve body, tighten to 10-15 lb-ft. See Figure 2-10.

Angle Solenoid Replacement



WARNING

Never disconnect any hydraulic line or fitting with the unit in the raised position. Always lower the unit relieve pressure before removing any lines or caps.

Allow the system to cool down before draining oil or handling system components. Serious burns can result from contact with hot oil.

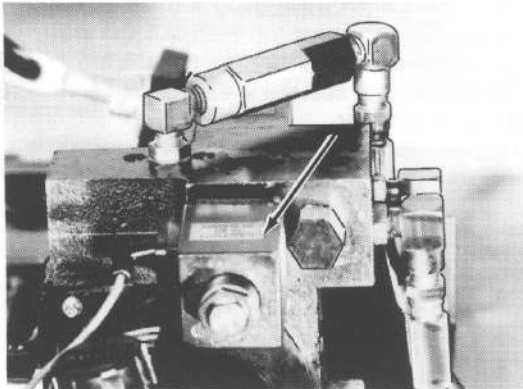


Figure 2-11

1. Mark or make note of the Solenoid Coil position for reinstallation.
2. Remove nut, spacer and coil. See Figure 2-11.

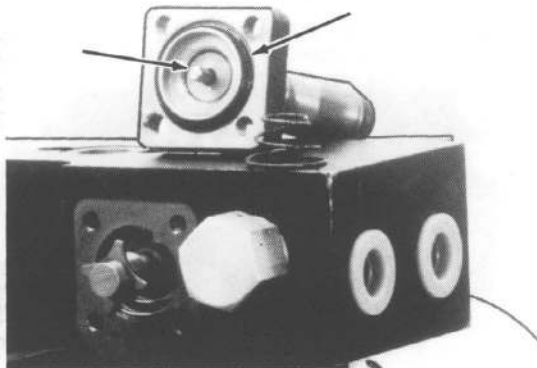


Figure 2-12

3. Remove cartridge valve (ensure hex head plunger is removed also). See Figure
4. Install O-ring into groove on cartridge valve.
5. Install hex head plunger.

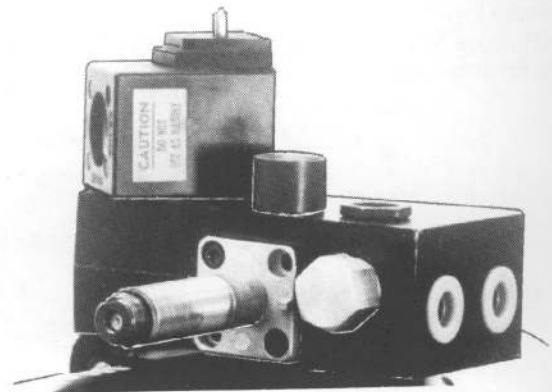


Figure 2-13

6. Install cartridge valve, torque to 10-15 lb-ft. See Figure 2-13.



CAUTION

DO NOT overtighten the coil nut. The coil and shaft can be easily damaged requiring replacement.

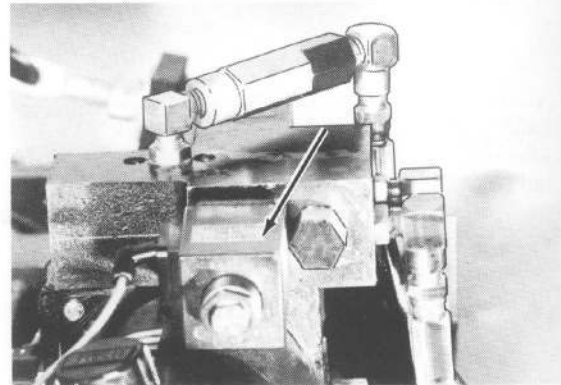


Figure 2-14

7. Install coil, spacer (chamfered end towards coil), and nut, torque nut to 5-10 lb-in. See Figure 2-14.

Raise/Lower Solenoid Replacement



Never disconnect any hydraulic line or fitting with the unit in the raised position. Always lower the unit and relieve pressure before removing any lines or caps.

Allow the system to cool down before draining oil or handling system components. Serious burns can result from contact with hot oil.

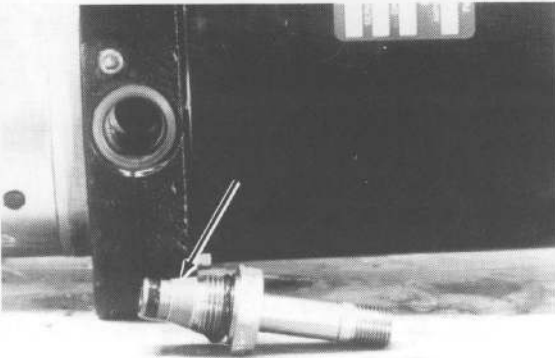


Figure 2-15

1. Remove nut, coil and cartridge valve (ensure the plunger inside the cartridge valve is not left inside the valve housing). See Figure 2-15.
2. Clean the screen on the cartridge valve.
3. Lubricate and install O-rings onto cartridge valve.
4. Install cartridge valve and torque to 10-15 lb-ft. .



DO NOT overtighten the coil nut. The coil and shaft can be easily damaged requiring replacement.

5. Install coil and nut, torque nut to 5-10 lb-in.

Spool Valve, Removal and Cleaning



Never disconnect any hydraulic line or fitting with the unit in the raised position. Always lower the unit and relieve pressure before removing any lines or caps.

Allow the system to cool down before draining oil or handling system components. Serious burns can result from contact with hot oil.

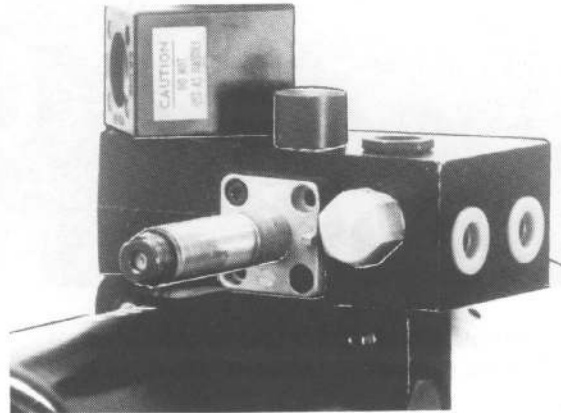


Figure 2-16

6. Mark for reassembly and remove both Angle solenoids. See Angle Solenoid Replacement.
7. Remove two backing plates (one each side of the U-Valve). See Figure 2-16

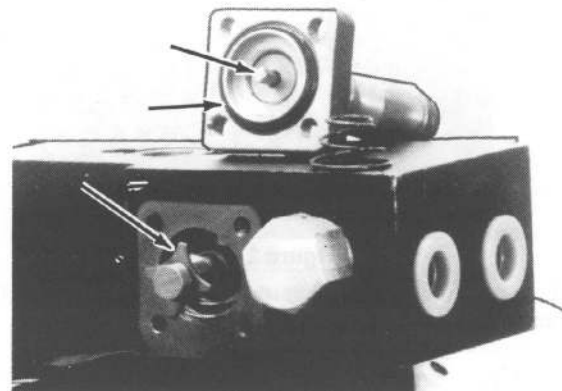


Figure 2-17

8. Remove two conical springs and two spacers (one set each side of valve stem) and the valve stem. See Figure 2-17.

9. Clean and inspect all parts for wear or damage.

NOTE: If the valve stem or the bore in the U-Valve is worn or damaged, replacement of the U-Valve and valve stem assembly is necessary.

10. Clean the bore in the U-Valve with a brush and solvent to remove varnish and debris. (A brush similar to that used for cleaning gun barrels is satisfactory). Use compressed air to remove excess solvent.

11. Insert the valve stem into the bore. Slide it back and forth in the bore with your fingers, it must move smoothly without sticking or binding.

NOTE: Replacement of the U-Valve and valve stem, as an assembly, is required if it is clean and does not move freely in the bore.

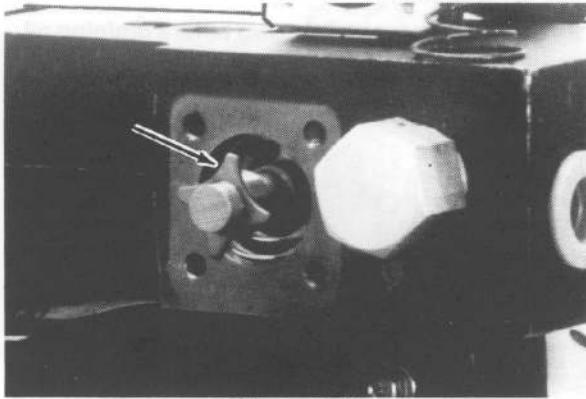


Figure 2-18

12. Lubricate and install the Spool valve in the bore.

13. Position the spacer onto the Spool Valve. See Figure 2-18.

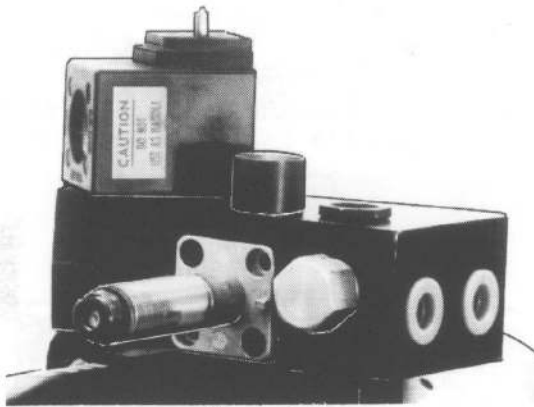


Figure 2-19

14. Install the O-ring into the groove and install the conical spring into the cavity of the backing plate.

15. Install the backing plate with spring (ensure the locating pin on the backing plate faces the relief valve) onto the end of the Spool Valve, and next to the spacer, and secure with two Torx head bolts. Tighten evenly until snug.

16. Repeat steps 8-10 on the other side of the Spool Valve.

17. See Angle Solenoid Replacement to install solenoids.

Hydraulic Pump Replacement



WARNING

Never disconnect any hydraulic line or fitting with the unit in the raised position. Always lower the unit and relieve pressure before removing any lines or caps.

Allow the system to cool down before draining oil or handling system components. Serious burns can result from contact with hot oil.

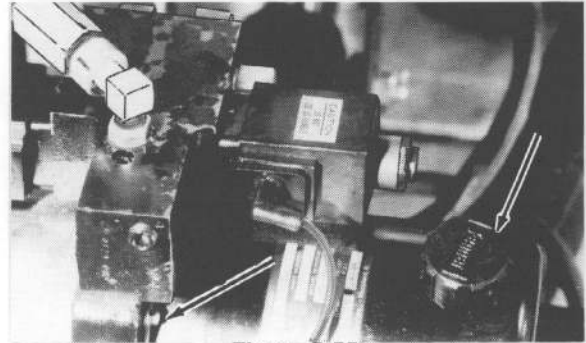


Figure 2-20

1. Remove the two (2) mounting bolts securing the Power unit to the plow.
2. Remove the filler/breather cap from the reservoir.
3. Carefully drain the fluid from the reservoir into a suitable container.
4. Remove the four cap screws securing the reservoir to the pump assembly and remove the reservoir. See Figure 2-20.

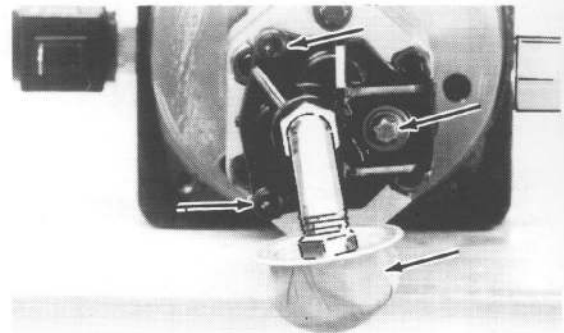


Figure 2-21

5. Unscrew the filter screen (hold it by the metal cover, not by the screen) and clean it with a suitable solvent. Blow dry with compressed air from the inside. See Figure 2-21.
6. Remove the pump inlet suction cover (two screws, one bolt). See Figure 2-21.
7. Remove two bolts securing the pump to the valve body and remove pump.

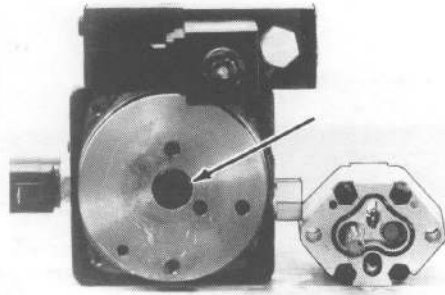


Figure 2-22

8. Remove the shaft seal and the coupler from the valve body. See Figure 2-22.

9. Clean and inspect all machined surfaces for wear or distortion, especially sealing surfaces. Repair or replace as necessary.

10. Inspect the inlet suction cover and tube for cracks or distortion, replace if necessary.

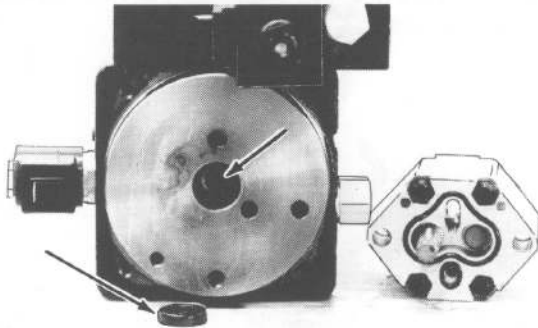


Figure 2-23

11. Install the coupler on the motor output shaft. See Figure 2-23.

12. Lubricate and install the pump input shaft seal (seal lip facing away from pump, smooth end towards pump).

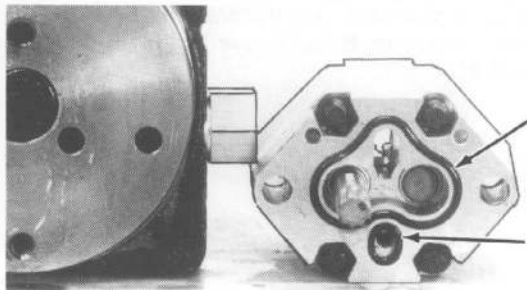


Figure 2-24

13. Install O-ring seals into pump cavities (apply a light film of Petroleum jelly to hold them in place).

NOTE: The pump input shaft will be properly engaged with the coupler when the pump body is flat against the valve body. Do Not use the pump mounting bolts to force the pump against the valve body.

14. Lubricate the smooth machined surface of the pump input shaft with hydraulic fluid and guide the pump input shaft through the shaft seal and into the coupler. Be careful not to damage the shaft seal.

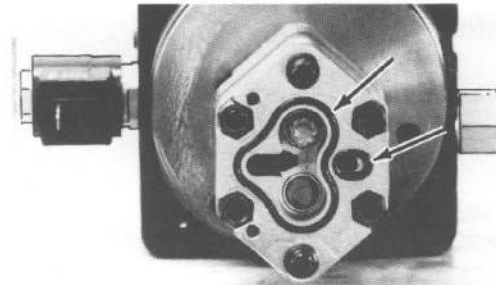


Figure 2-25

15. Install O-ring seals into pump cavities (apply a light film of Petroleum jelly to hold them in place). See Figure 2-25.

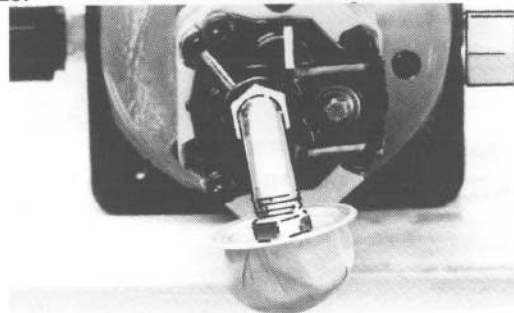


Figure 2-26

16. Secure the inlet suction cover to the pump body and torque mounting bolts to 4-6 lb-ft. See Figure 2-26.

17. Carefully reinstall the filter screen. Tighten it by hand to avoid damaging the threads on the nylon inlet pick-up tube. See Figure 2-26.

18. Visually check that the inlet pick-up tube and suction screen face down (towards bottom of reservoir), if not, loosen the nylon jam nut at the pump body, rotate the pick-up tube and tighten the jam nut until snug.

19. Clean the reservoir inside and out with a suitable solvent, carefully remove any metal particles from the magnet inside the reservoir.

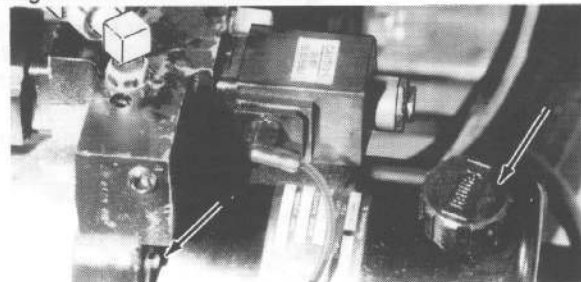


Figure 2-27

20. Inspect the O-ring seal for damage, replace if needed, lubricate the seal with fresh oil and re-install reservoir carefully to avoid damaging the O-ring. Tighten cap screws to 3-5 lb-ft. See Figure 2-27.

21. Position the Hydraulic control unit on the frame and install the two (2) mounting bolts. Torque mounting bolts to 23-25 lb-ft.

DC Motor Replacement



WARNING

Disconnect Vehicle Battery prior to performing this procedure to avoid electrical shock or burns.

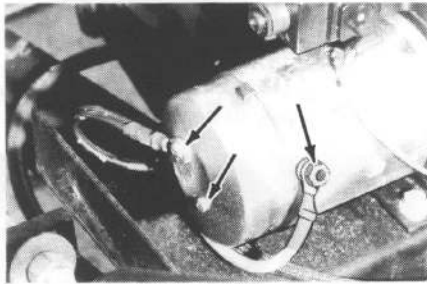


Figure 2-28

1. Disconnect the Vehicle Negative (-) battery terminal.
2. Remove the motor terminal nut and remove power lead. See Figure 2-28.
3. Remove two screws and remove the motor protective cover. See Figure 2-28.

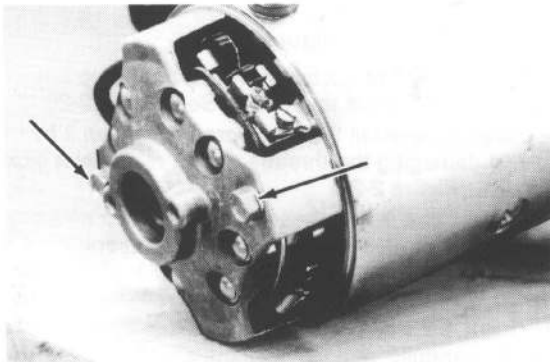


Figure 2-29

NOTE: Use care when removing the motor from the end head, the motor can separate into three pieces and will require additional time to reassemble the motor for testing.

1. Remove two bolts securing the motor to the valve housing and remove motor. See Figure 2-29.



CAUTION

If oil is found in the cavity of the valve assembly where the coupling is located, replacement of the oil pump shaft seal is necessary before the unit can be put back into service.

2. Inspect the area around the coupler, if any oil is present, refer to the Hydraulic Pump Replacement procedure to replace the pump shaft seal.

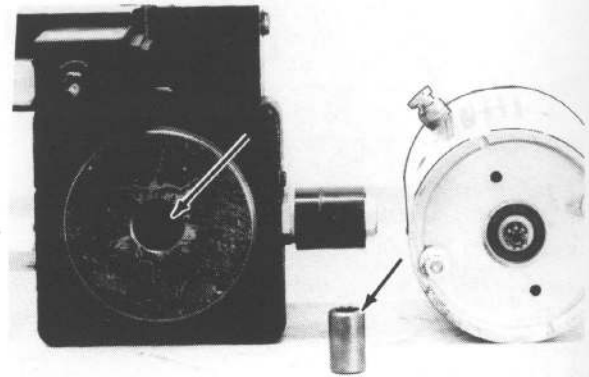


Figure 2-30

3. Install coupler onto pump input shaft. See Figure 2-30.
4. Install bolts through the bolt holes in the motor to align the bolt holes in the face plate, face plate can be rotated to align the holes.

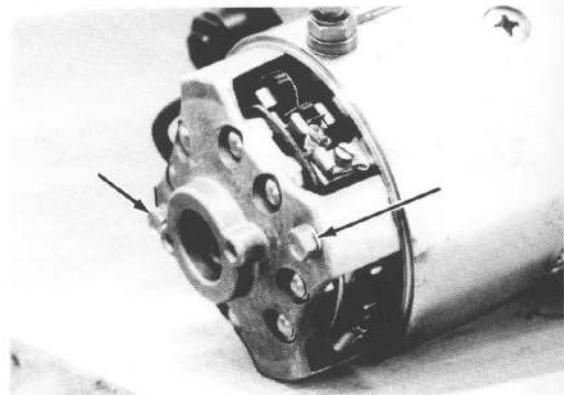


Figure 2-31

5. Position the motor against the valve housing and insert the motor output shaft into the coupler, align motor and install the mounting bolts. Torque bolts to 5-8 lb-ft. See Figure 2-31.

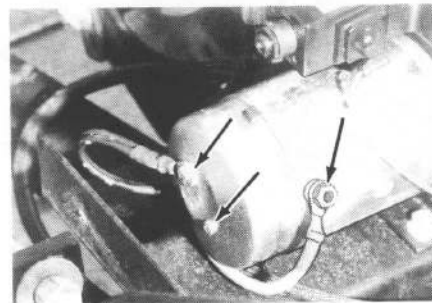


Figure 2-32

6. Install motor cover and secure with two screws and ground strap. See Figure 2-32.
7. Reconnect the vehicle Negative (-) battery terminal.

MAINTENANCE

General:

- Before operating, perform a thorough visual inspection of the equipment. Look for fluid leaks, cracked, bent or broken components, loose nuts, bolts or attachments and proper fluid levels.

- A clean hydraulic system is essential to long pump life and proper performance.

When adding oil to the reservoir, wipe the area around the filler port clean before removing the breather cap. Use clean oil and a clean funnel, (DO NOT use a cloth or rag to strain the oil).

- The operational environment for snow plows is an extremely harsh and corrosive one.

Ensure all electrical connections are clean and tight. To prevent rust from forming, clean and repaint exposed metal surfaces. NEVER operate the equipment with the protective covers or guards removed.

Service Intervals:

For the commercial user it is recommended to change the fluid in the hydraulic system once a season. For the home owner and light commercial user, once every two seasons.

Fluid Requirements:



Using the proper oil increases the life expectancy of the most expensive part of your plow; the Hydraulic power unit.

Use the following chart to determine the correct viscosity/grade of oil to use based on the ambient (outside) air temperature at the time of start-up.

Failure to use the proper oil can cause extensive damage to the power unit, seals and hydraulic rams.

Viscosity vs. Temperature

| Viscosity/Type | °F | °C |
|----------------|-----|-----|
| UNIVIS J26 | -70 | -60 |
| MIL-5606 | -70 | -60 |
| SAE 5 | -20 | -30 |
| ISO VG 22 | 0 | -20 |
| SAE 10 | 0 | -20 |
| ATF | 0 | -20 |
| SAE 5W20 | 10 | -10 |
| SAE 10W30 | 10 | -10 |
| SAE 10W40 | 20 | -7 |
| SAE 20 | 30 | 0 |

Changing Oil and Cleaning Filter Screen:



Using the proper oil increases the life expectancy of the most expensive part of your unit; the Hydraulic power unit.

NOTE: We recommend cleaning the filter screen at every oil change, this will help ensure maximum life and maximum performance from the pump assembly.



Allow the system to cool down before draining oil or handling system components. Serious burns can result from contact with hot oil.

1. Remove the plow from the vehicle following the plow manufacturers' instructions.
2. Remove the pump cover.
3. Remove the two (2) mounting bolts securing the power unit to the plow.

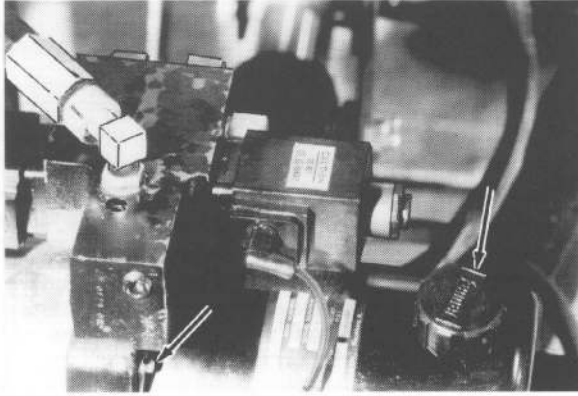


Figure 3-1

4. Remove the filler/breather cap from the reservoir.
5. Carefully drain the fluid from the reservoir into a suitable container.
6. Remove the four cap screws securing the reservoir to the pump assembly and remove the reservoir. See Figure 3-1.

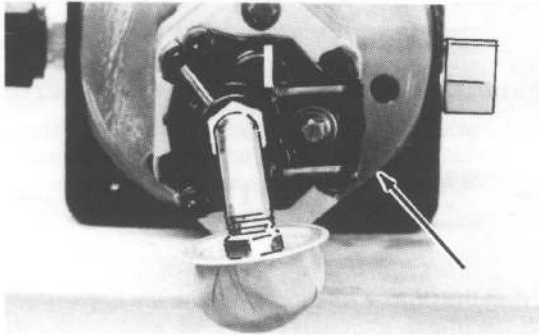


Figure 3-2

7. Unscrew the filter screen (hold it by the metal cover, not by the screen) and clean it with a suitable solvent. Blow dry with compressed air from the inside. See Figure 3-2.
8. Carefully reinstall the filter screen. Tighten it by hand to avoid damaging the threads of the nylon pick-up tube.
9. Visually check that the pick-up tube and filter face down, if not, loosen the nylon jam nut at the pump body, rotate the pick-up tube and tighten the jam nut until snug.
10. Clean the reservoir inside and out with a suitable solvent, carefully remove any metal particles from the magnet inside the reservoir.

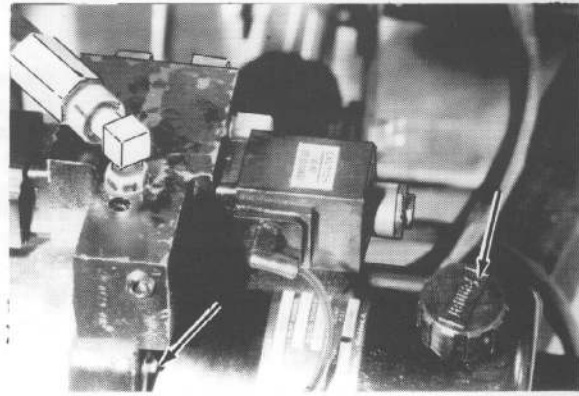


Figure 3-4

11. Inspect the O-ring seal for damage, replace if needed, lubricate with fresh oil and re-install reservoir carefully to avoid damaging the O-ring. Tighten cap screws to 4-6 lb-ft. See Figure 3-3.
12. Position the Hydraulic control unit on the frame and install the two (2) mounting bolts.



WARNING

Never disconnect any hydraulic line or fitting with the unit in the raised position. Always lower the unit and relieve pressure before removing any lines or caps.

Allow the system to cool down before draining oil or handling system components. Serious burns can result from contact with hot oil.

13. Mark hydraulic fittings for position and location on both angle and lift cylinders and carefully disconnect them.
14. Compress the chrome rod portion of both angle and lift cylinders to drain the fluid remaining in the cylinders.
NOTE: Do Not use Teflon tape on hydraulic fittings. The tape can dislodge and jam valves in the hydraulic system.
15. Reconnect hydraulic fittings in their correct position and tighten according to specifications.
16. Reconnect the plow according to the plow manufacturers' instructions.
17. Fill the hydraulic reservoir until the fluid level is 5/8"-3/4" from filler opening.
18. Refer to the manufacturers' instructions and operate the plow to purge all air from the hydraulic system.
19. Replenish the fluid in the reservoir until the fluid level is 5/8"-3/4" from the filler opening.
20. Operate system and check for leaks, repair or tighten as necessary.

