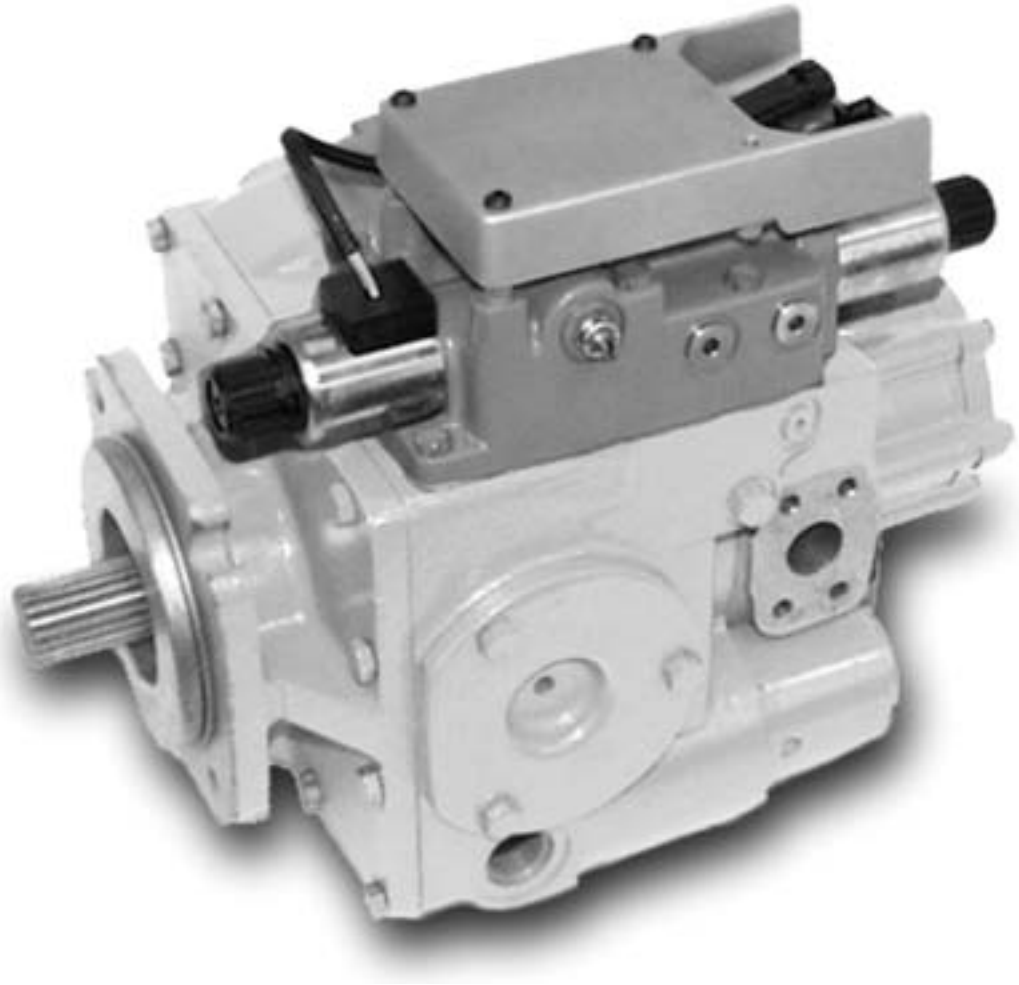
EATON | Hydraulics

# Electronic Proportional (EP) Control for Heavy Duty Series 0/1 Piston Pumps

Model 33
Model 39
Model 46
Model 54
Model 64
Model 76



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The purpose of this manual is to provide the necessary information to troubleshoot and repair the EP Control for Eaton® Heavy Duty Series 0/1 piston pumps.

The EP Control consists of two main parts, the valve assembly and the electronic module.

Note: Many EP Control components are not repairable, i.e., the EP Control electronic module has internal circuitry that is environmentally encapsulated into its housing. Replacing the electronic module with a new one is necessary if the module is the source of a fault. Complete kits are listed along with individual components should you choose to replace individual components.

## ⚠CAUTION

**In order to assure the most reliable installation and operation of any electronic control, proper component selection and installation procedures must be followed with respect to interconnection wiring harnesses, input command signal devices, fusing, and input power switching.**

**Appropriate industry practices must be followed to prevent damage of and shorting of all electrical and electronic components caused by environmental hazards and application specific hazards. Typical hazards that damage the wiring harnesses or other components are abrasion, moving objects, and heat from the engine or exhaust system. Moisture can damage poorly sealed connectors and/or components, causing short circuits and other problems like corrosion.**

**A switch must be installed in line with (+ battery) power to the electronic module, so that power may quickly be disconnected in case of emergency (component failure or inadvertent commands). A fuse rated at the maximum module operating current (3 Amp) must be installed in the + battery line to the electronic module.**

**All the electrical connections to the EP Control electronic module must be disconnected prior to performing any electrical welding on the vehicle or machine. The electronic module and/or the hydraulic pump are not to be used as a connection point for electrical welding equipment.**

**During initial start-up and/or checkout of the machine after service, the machine must be placed on jack stands to prevent inadvertent movement.**

**The reliable operation and suitability of this product is dependent upon how it is applied and the other components used in the system. The system integrator must review all aspects of the application and all of the components used to assure proper operation and reliability.**

Information contained in this publication is accurate as of the publication date and is subject to change without notice. Performance values are typical values. Customers are responsible for selecting products for their applications using normal engineering methods.

## Parts List

| ITEM | PART NO. | QTY. | DESCRIPTION |
|---|---|---|---|
| 1 | 111520-016 | 1 | Electronic Module - 1-6 V Input - 12/24 V |
| 1 | 111520-020 | 1 | Electronic Module - ±4-20 mA Input - 12/24 V |
| 2 | 101673-175 | 3 | 10-24 Button Head Cap Screw (1/8 hex key) - 1.75" |
| 3 | 16045-203 | 3 | #10 Lockwasher |
| 4 | 95862-275 | 2 | 5/16"-18 Hex Head Bolt - 2.75" |
| 5 | 95862-225 | 1 | 5/16"-18 Hex Head Bolt - 2.25" |
| 6 | 95862-100 | 3 | 5/16"-18 Hex Head Bolt - 1" |
| 7 | 111501-000 | 2 | Solenoid Tube Subassembly* |
| 8 | 114241-012 | 1 | Solenoid Coil Subassembly - 12 V (includes 2 coils and wiring harness) |
| 8 | 114241-024 | 1 | Solenoid Coil Subassembly - 24 V (includes 2 coils and wiring harness) |
| 9 | 4993055-000 | 1 | Valve Assembly - 33-39-46 Displacement - (includes items 7 & 8 - 12 V Solenoid Coil & Tube Subassemblies) |
| 9 | 4993055-001 | 1 | Valve Assembly - 54-64 Displacement - (includes items 7 & 8 - 12 V Solenoid Coil & Tube Subassemblies) |
| 9 | 4993055-002 | 1 | Valve Assembly - 76 Displacement - (includes items 7 & 8 - 12 V Solenoid Coil & Tube Subassemblies) |
| 9 | 4993055-003 | 1 | Valve Assembly - 33-39-46 Displacement - (includes items 7 & 8 - 24 V Solenoid Coil & Tube Subassemblies)** |
| 9 | 4993055-004 | 1 | Valve Assembly - 54-64 Displacement - (includes items 7 & 8 - 24 V Solenoid Coil & Tube Subassemblies)** |
| 9 | 4993055-005 | 1 | Valve Assembly - 76 Displacement - (includes items 7 & 8 - 24 V Solenoid Coil & Tube Subassemblies)** |
| 10 | 25083-006 | 2 | O-Ring Plug Socket Head Subassembly* |
| 11 | 8835-000 | 1 | Control Valve Gasket |

* Includes necessary O-Rings ** For use only with customer-supplied electronics

## EP Control Kits

| KIT NO. | MODEL CODE REFERENCE | KIT DESCRIPTION | INPUT SIGNAL | VALVE ASSEMBLY | ELECTRONIC MODULE | VOLTAGE |
|---|---|---|---|---|---|---|
| 9900024-000 | EL | EP Ctrl Kit HD Series 1 33/46: 1-6 V input | 1-6 V | 4993055-000 | 111520-016 | 12/24 V |
| 9900026-000 | EN | EP Ctrl Kit HD Series 1 33/46: ±4-20 mA input | ±4-20 mA | 4993055-000 | 111520-020 | 12/24 V |
| 9900027-000 | EL | EP Ctrl Kit HD Series 1 54/64: 1-6 V input | 1-6 V | 4993055-001 | 111520-016 | 12/24 V |
| 9900029-000 | EN | EP Ctrl Kit HD Series 1 54/64: ±4-20 mA input | ±4-20 mA | 4993055-001 | 111520-020 | 12/24 V |
| 9900030-000 | EL | EP Ctrl Kit HD Series 0 76: 1-6 V input | 1-6 V | 4993055-002 | 111520-016 | 12/24 V |
| 9900032-000 | EN | EP Ctrl Kit HD Series 0 76: ±4-20 mA input | ±4-20 mA | 4993055-002 | 111520-020 | 12/24 V |
| 9900033-000 | EJ | EP Ctrl Kit HD Series 1 33/46: 12 V coils w/o electronic module | — | 4993055-000 | — | 12 V |
| 9900034-000 | EJ | EP Ctrl Kit HD Series 1 54/64: 12 V coils w/o electronic module | — | 4993055-001 | — | 12 V |
| 9900035-000 | EJ | EP Ctrl Kit HD Series 0 76: 12 V coils w/o electronic module | — | 4993055-002 | — | 12 V |
| 9900036-000 | EK | EP Ctrl Kit HD Series 1 33/46: 24 V coils w/o electronic module | — | 4993055-003 | — | 24 V |
| 9900037-000 | EK | EP Ctrl Kit HD Series 1 54/64: 24 V coils w/o electronic module | — | 4993055-004 | — | 24 V |
| 9900038-000 | EK | EP Ctrl Kit HD Series 0 76: 24 V coils w/o electronic module | — | 4993055-005 | — | 24 V |
| 990830-000 | | EP Ctrl Electronic Module 1-6 V | 1-6 V | — | 111520-016 | — |
| 990832-000 | | EP Ctrl Electronic Module ±4-20 mA | ±4-20 mA | — | 111520-020 | — |

Note: All kits using Eaton EP Control Electronic Modules use 12 V coils.

## EP Control Connector Kits

### Electronic Module Mating Connector Kit

| KIT NO. | | PART (QTY.) | DELPHI PACKARD P/N |
|---|---|---|---|
| 990762-000 | **Command Input Signal** | Connector (1) | 1211 0293 |
| | | Terminal (3) | 1204 8074 |
| | | Cable Seal (3) | 1204 8086 |
| | | Cavity Plug (1) | 1205 9168 |
| | | Secondary Lock (1) | 1205 2845 |
| | **Power Supply** | Connector (1) | 1205 2641 |
| | | Terminal (2) | 1204 8074 |
| | | Cable Seal (2) | 1204 8086 |
| | | Secondary Lock (1) | 1205 2634 |

Recommended wire size: 16 - 18 AWG
Recommended cable diameter: 2.03 - 2.80 mm
Alternate reference source: Pioneer Standard Electronics 1-800-257-6613
www.pios.com

### Solenoid Coil Mating Connector Kit

(not needed when using an Eaton Electronic Module)

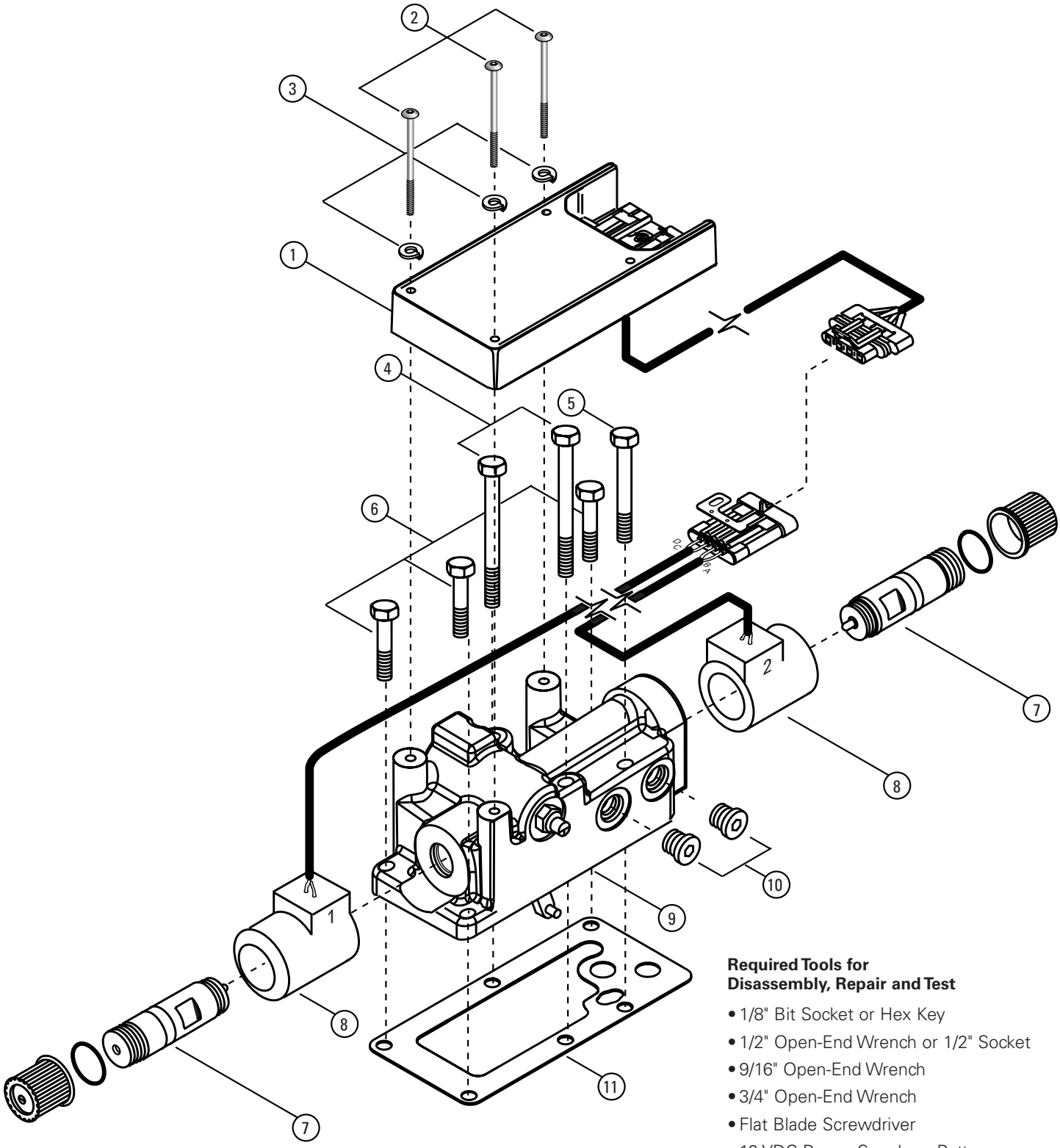
| KIT NO. | PART (QTY.) | DELPHI PACKARD P/N |
|---|---|---|
| 9900023-000 | Connector (1) | 1218 6568 |
| | Terminal (4) | 1204 8074 |
| | Cable Seal (4) | 1204 8086 |
| | Secondary Lock (1) | 1204 7948 |

Recommended wire size: 16 - 18 AWG
Recommended cable diameter: 2.03 - 2.80 mm
Alternate reference source: Pioneer Standard Electronics 1-800-257-6613
www.pios.com

### Solenoid Connector Update Kit

| KIT NO. | PART (QTY.) | DELPHI PACKARD P/N |
|---|---|---|
| 9900045-000 | Tool (1) | 1209 4429 |
| | 4-Pin Housing Connector (Female) (1) | 1218 6568 |
| | 4-Pin Housing Connector (Male) (1) | 1218 6271 |

# Parts




**Required Tools for Disassembly, Repair and Test**

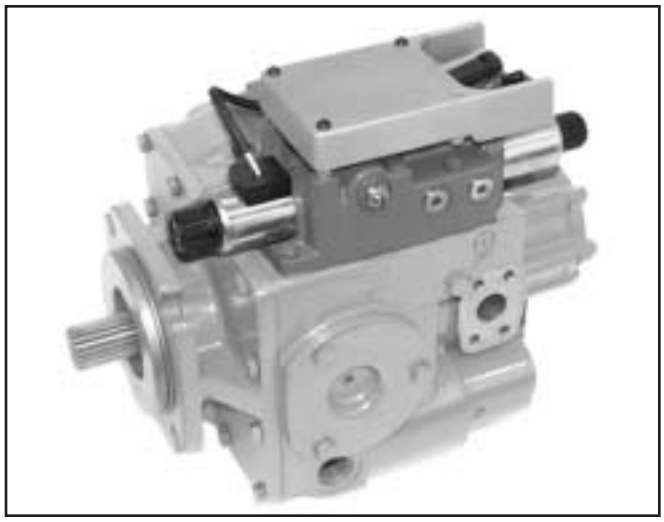
- 1/8" Bit Socket or Hex Key
- 1/2" Open-End Wrench or 1/2" Socket
- 9/16" Open-End Wrench
- 3/4" Open-End Wrench
- Flat Blade Screwdriver
- 12 VDC Power Supply or Battery
- Voltage Ohm Meter (VOM)
- Charge Pressure Gauge

## Disassembly

**Step 1**

Disconnect all power to the input device. Carefully disconnect the three-pin connector between the command input device and the EP Control electronics module by releasing the connector latches.

Thoroughly clean the outside of the EP Control and surrounding pump surface.

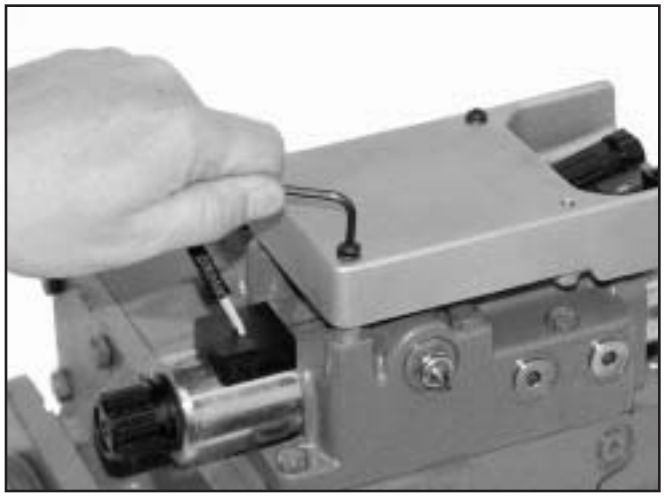


**Step 2**

Disconnect the four-pin connector between the EP Control electronic module and the solenoid coils. Caution must be used when disconnecting these connectors as they are latched with keepers.

**Step 3**

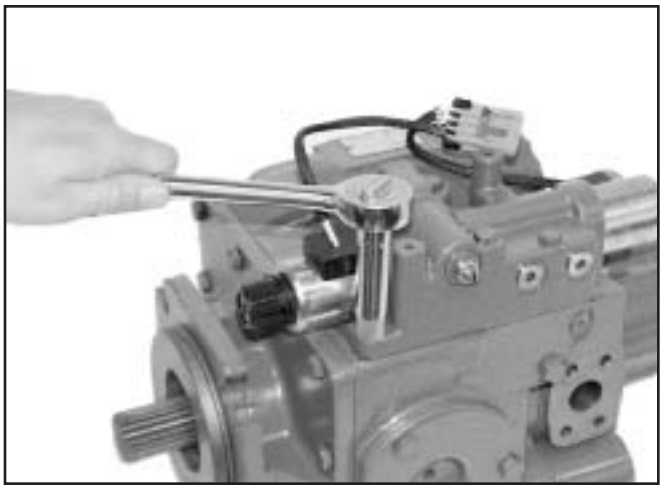
Using a 1/8" bit socket or hex key, remove the three 10-24 button head cap screws and lockwashers.



**Step 4**

The solenoid coils can be removed by turning each solenoid tube knob counterclockwise. Remove the knob and associated O-ring. Slide the coil off the tube subassembly. Repeat for other coil.

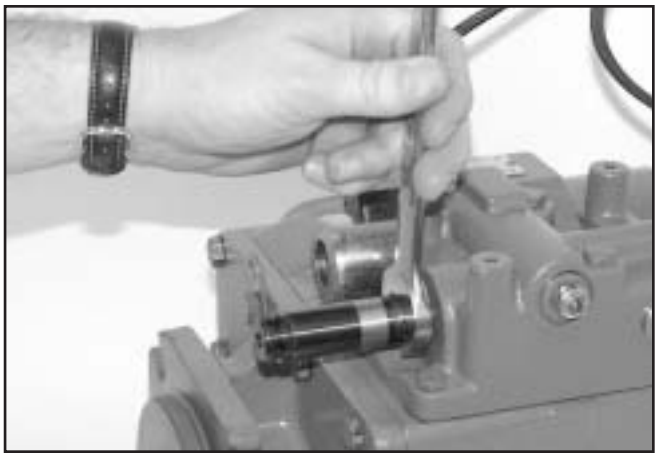
**Note:** Each coil is stamped with a position number "1" and "2" and the voltage "12V" or "24V". There are also numbers stamped on the valve assembly indicating positions #1 and #2. When reassembling the coils, the stamped coil numbers and position numbers must match. Refer to page 3.



**Step 5**

Using a 3/4" open-end wrench, remove each tube subassembly by turning counterclockwise.

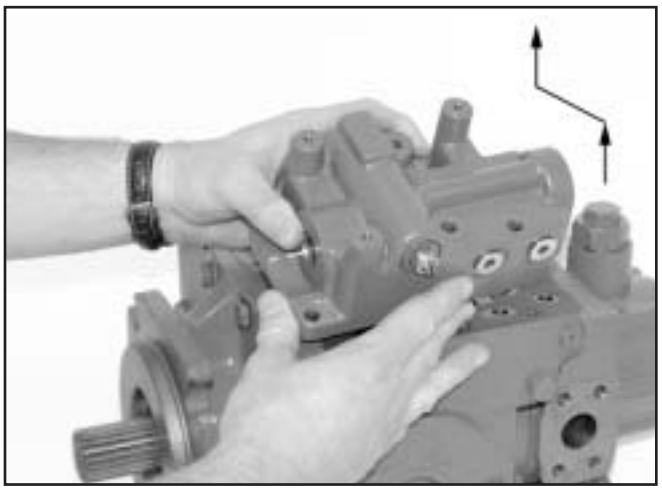
If only replacing the coils and tube subassemblies, skip to Reassembly, Step 11.



**Step 6**

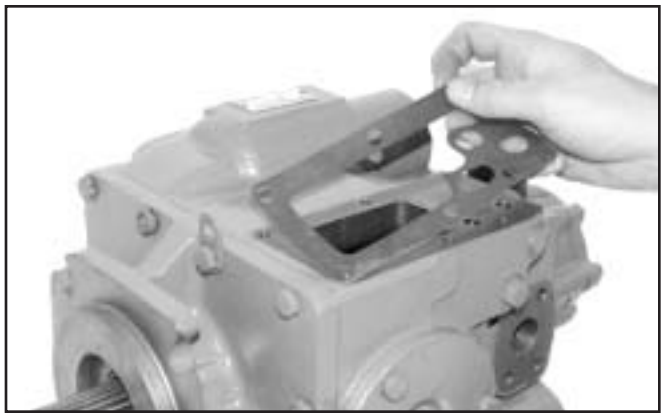
Using a 1/2" socket or end wrench, remove the six 5/16"-18 hex head retaining bolts.

Carefully lift the valve assembly upward and slide it away from the pump to disengage the control feedback link from the swashplate link.



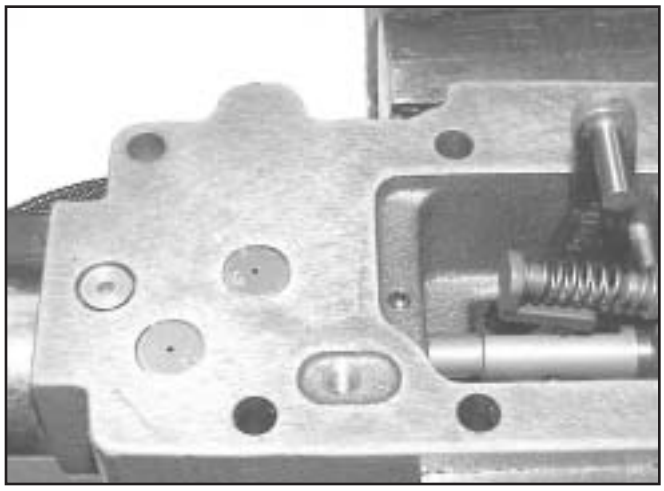
**Step 7**

Remove and discard the control valve gasket.



**Step 8**

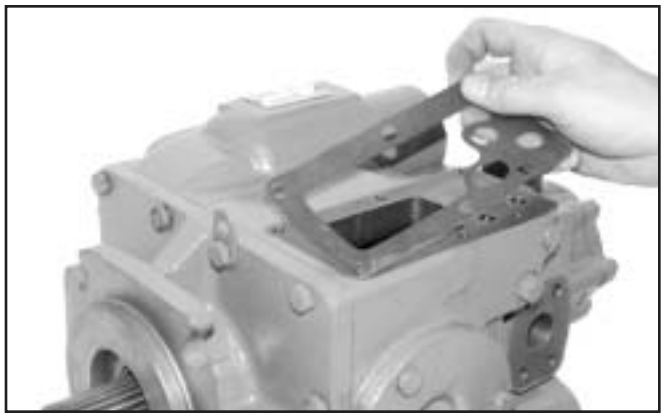
In most cases it will not be necessary to remove the control orifices that are staked in the pump housing. Only remove if the orifice size needs to be changed. The orifice size is stamped on the flat plate orifices in the pressure and servo-1 ports. If there is an orifice in the servo-2 port it is a threaded screw-in orifice.



## Reassembly

**Step 9**

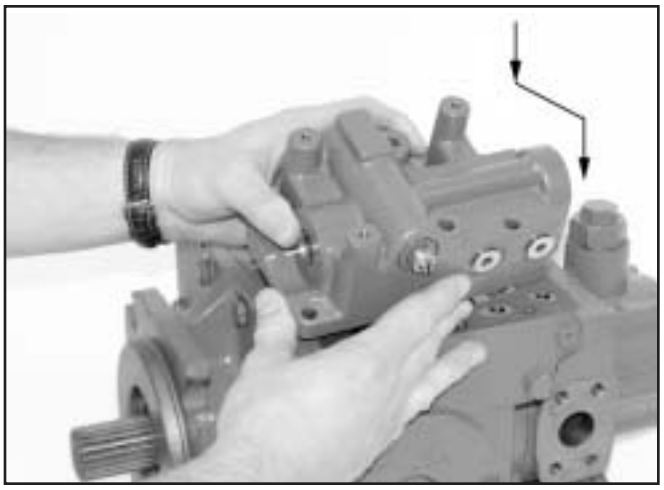
Clean the control mounting surface. Install a new control valve gasket by aligning with bolt and porting holes.



**Step 10**

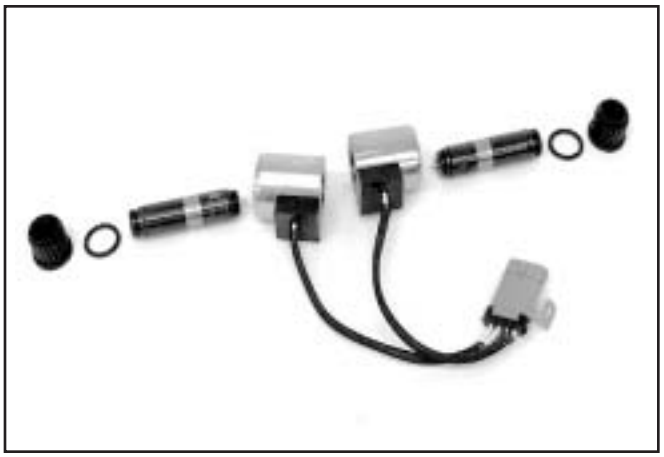
Carefully install the EP Control valve assembly on the pump housing, using a sideways motion to insert the feedback link into the swash-plate link and aligning the control. Replace and hand tighten the six 5/16"-18 hex head bolts.

**Note:** There are three different retaining bolt lengths. Refer to page 3 for proper placement.



**Step 11**

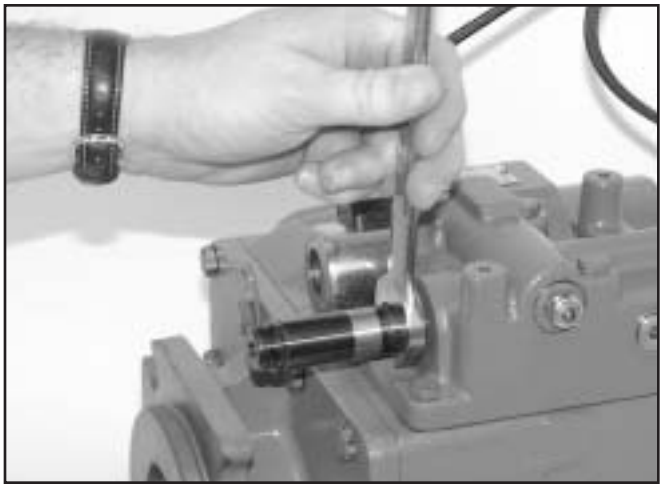
Locate the new solenoid tube and coil subassemblies. Each solenoid tube subassembly comes with new O-rings. The tube subassemblies are interchangeable. Refer to the drawing on page 3 for detail.



**Step 12**

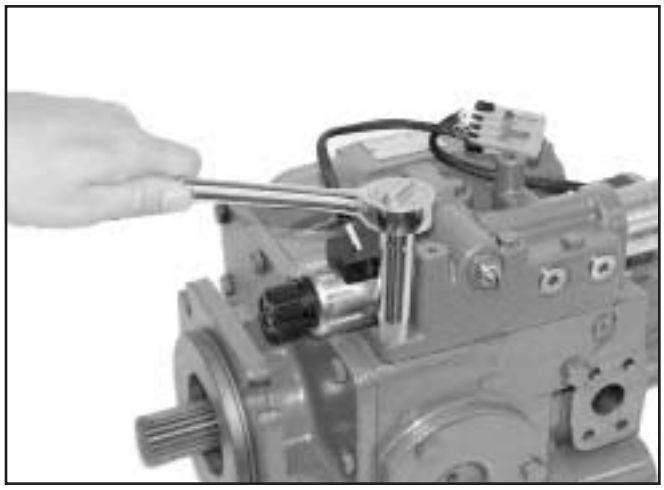
Using a 3/4" open-end wrench, intstall each tube subassembly by turning clockwise. Torque the solenoid tubes to 20±2 lbf·ft.

Install the two solenoid coils. The coil position numbers stamped on each coil subassembly and on the valve assembly should match. Refer to page 3 for detail.



**Step 13**

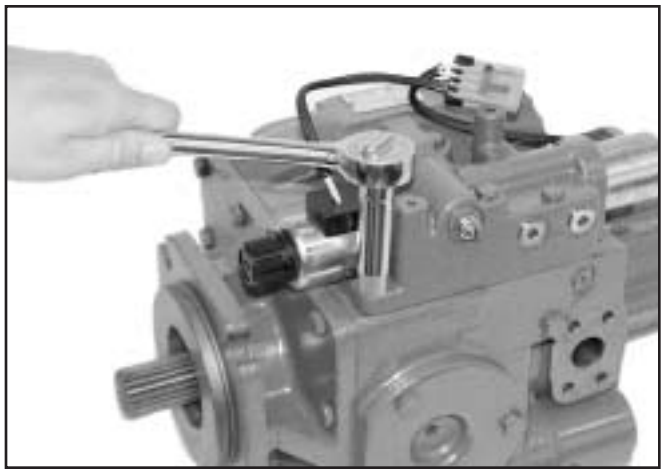
Attach the retaining knob and hand tighten.



**Step 14**

Using a 1/2" socket or end wrench, install the six 5/16"-18 hex head retaining bolts. Torque the bolts to 16 lbf·ft.

**Note:** There are three different bolt lengths. Refer to page 3 for proper placement.



**Step 15**

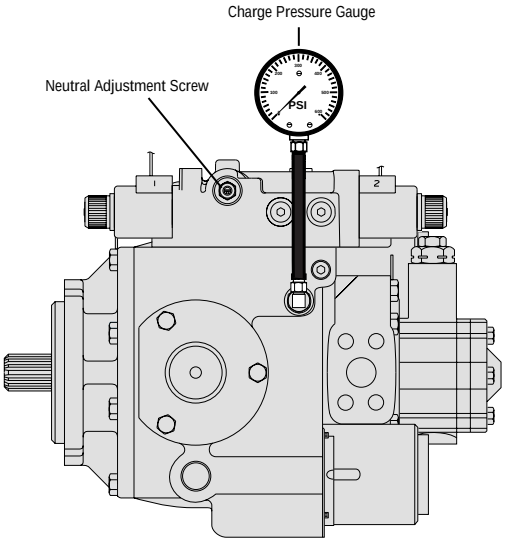
## Neutral Adjustment

**Caution:** All hoses and fittings must be connected, and the pump ready for operation before attempting to check neutral adjustment. Electrical wiring harnesses for the solenoid coils and command input should be left disconnected while adjusting neutral.

A. Disengage the input drive to vehicle or elevate wheels.

B. Install charge pressure gauge. A 0-1000 psi or 0-1500 psi pressure gauge is recommended.

C. Start the prime mover.



D. Loosen the locknut holding the neutral adjustment screw until it is just snug enough that the threaded screw can be rotated. Use a 9/16" end wrench to hold the locking nut while rotating the neutral adjustment screw.

E. Note the number stamped on the cap of the low pressure relief valve. -022 is 220 psig (15 bar), -030 is 305 psig (21 bar), etc. This will be the high setting. Settings can vary from 220 psig (15 bar) to 410 psig (28 bar).

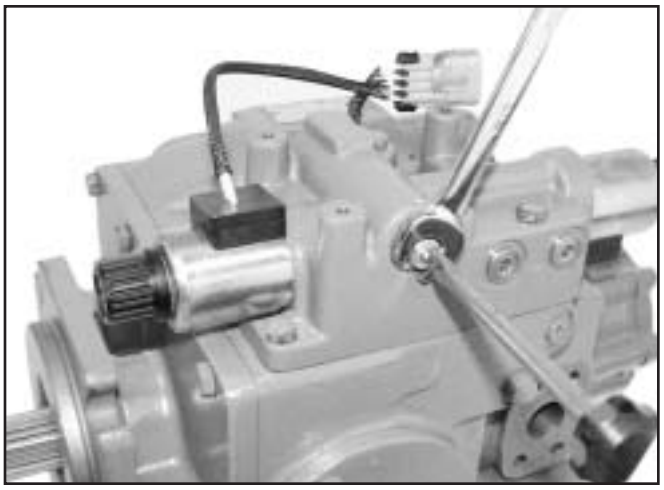
F. Slowly rotate the neutral adjustment screw clockwise until charge pressure drops to its low setting. Mark the neutral adjustment screw location.

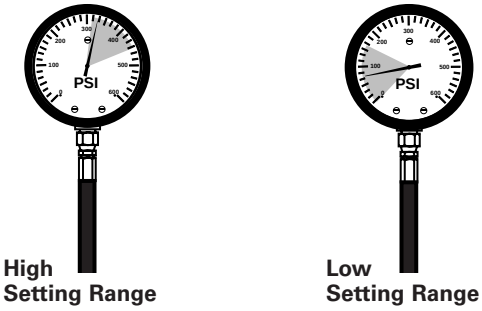
**Note:** The charge pressure low setting is usually 40-60 psig lower than the high setting.

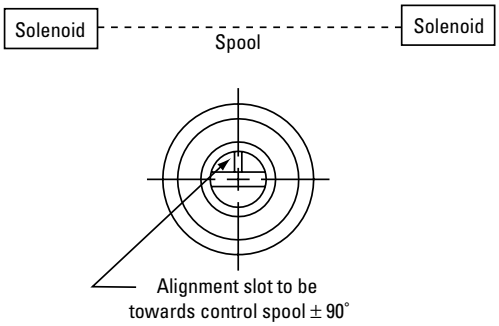
G. Rotate the neutral adjustment screw counterclockwise. The charge pressure will rise. Continue turning counter-clockwise until the pressure drops again to its low setting. Mark the neutral adjustment screw location.

H. Rotate the neutral adjustment screw to the position between the two marks.

I. Carefully hold adjustment screw while torquing locknut. Torque locknut to 10±1 lbf·ft. Neutral adjustment is completed.





**Step 16**

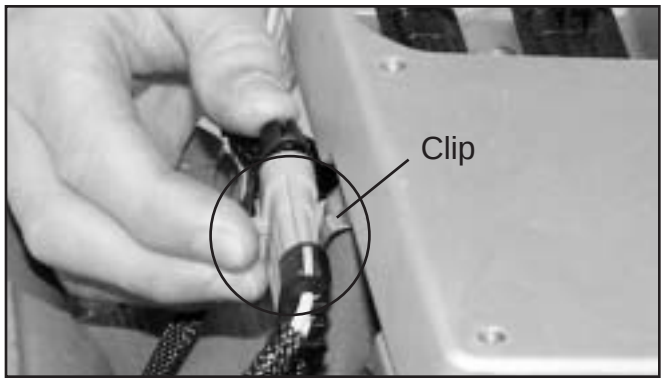
Carefully position the EP Control electronic module, tucking all cables under the module.

**Caution:** Avoid pinching cables at mounting points.

**Step 17**

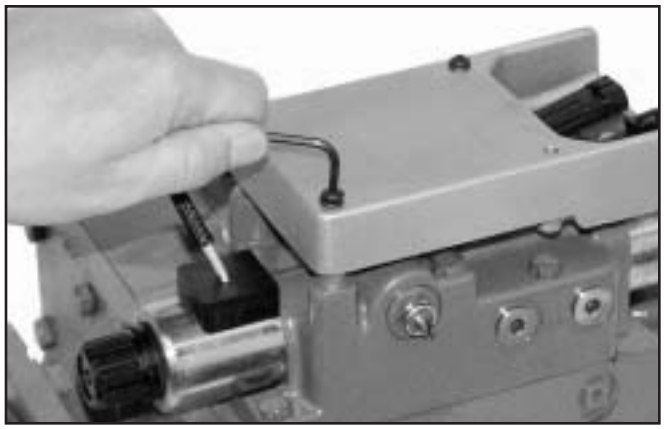
Position the clip on the cable from the solenoid coils between the mounting post and the electronic module.

Install one lockwasher and 10-24 button head cap screw through the electronic module, through the cable clip and into the valve assembly.




**Step 18**

Install the two remaining lock-washers and 10-24 button head cap screws. Torque to 40-48 lbf·in.



**Step 19**

Connect the four-pin connector between the EP Control electronic module and the solenoid coils. The connectors must be latched securely.

**Step 20**

Power should still be disconnected to the input device. Connect the command input device to the three-pin connector on the EP Control electronic module.

**Step 21**

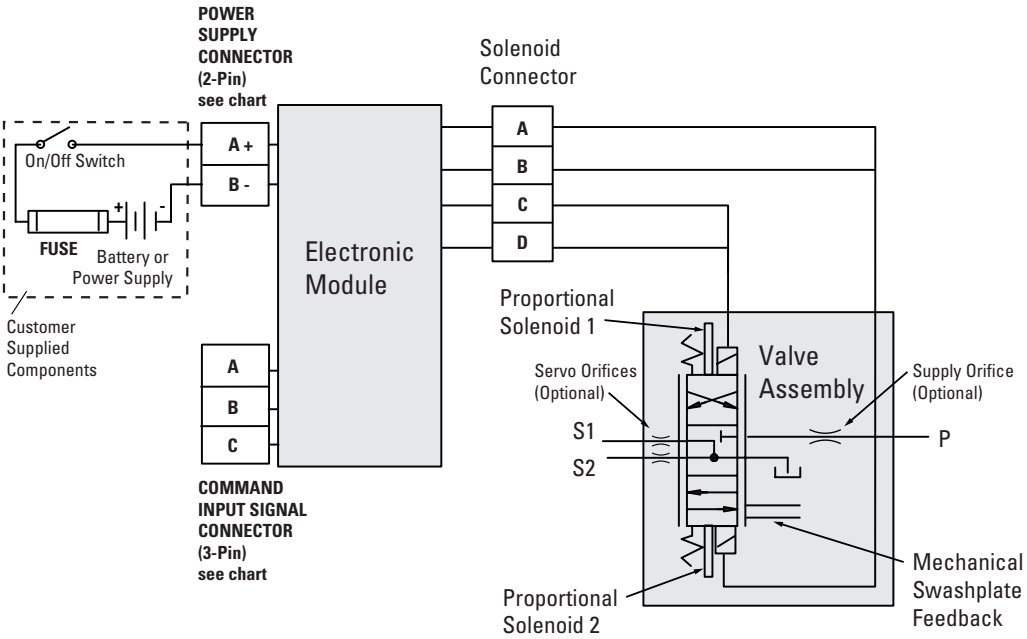
Connect the electrical power source to the two-pin connector on the EP Control electronic module. Install a 3 amp SLO-BLO® fuse. Refer to Interconnect Schematic on page 13.

Recheck your work and then reconnect the power to the vehicle or system.

**Step 22**

The pump is now ready to return to operation.

# Interconnect Schematic




### Command Input Signal Connector

| COMMAND INPUT SIGNAL | PINS | WIRE COLOR | SIGNAL |
|---|---|---|---|
| 1 to 6 Vdc Potentiometric | A | Black | Ref Low - 1 Vdc |
| | B | Green | Command (wiper) |
| | C | Red | Ref Hi - 6 Vdc |
| 4 to 20 mA Current Loop | A | Orange | Loop Return |
| | B | White | Loop In |
| | C | No Connection Required* | |

*EP Control Electronic Module Mating Connector Kit 990762-000 contains plug used to seal mating end connector.

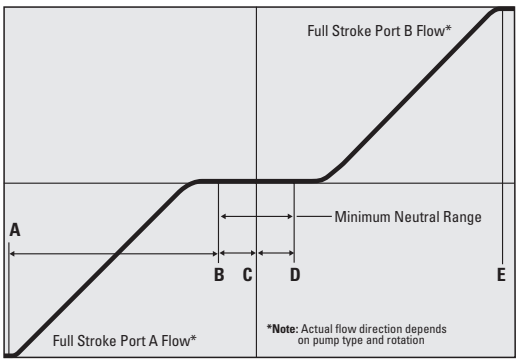
### Power Supply Connector

| PINS | WIRE COLOR | SIGNAL |
|---|---|---|
| A | Red | + Supply Voltage |
| B | Black | Supply Return |

### Fuse Rating

3 Amp SLO-BLO® (Time Delay) fuse for 12-24 Vdc system - customer supplied

## Pump Displacement vs. Input Signal




**Typical Control Characteristics**

| | A (MAX) | B (MIN) | C | D (MIN) | E (MAX) |
|---|---|---|---|---|---|
| **Command Input Signal** | | | | | |
| 1-6 Vdc | 1.5 Vdc | 3.3 Vdc | 3.5 Vdc | 3.7 Vdc | 5.5 Vdc |
| ±4-20 mA | -20 mA | -4.5 mA | 0 mA | +4.5 mA | +20 mA |
| **Shaft Rotation** | | | | | |
| CCW | Solenoid #2 | | Neither | Solenoid #1 | |
| | Flow OUT port "B" | | No flow | Flow OUT port "A" | |
| CW | Solenoid #2 | | Neither | Solenoid #1 | |
| | Flow OUT port "A" | | No Flow | Flow OUT port "B" | |

Note: The +20 mA command input signal configuration operates the pump in one direction. The customer has to change the polarity on the -20 mA signal to operate the pump in the opposite direction.

| SYMPTOM | CAUSE | ACTION |
|---|---|---|
| **No Flow in Either Direction** | Defective Power Connection, or Loose Wires | Check Power Input. Disconnect the two-pin connector from the power supply to the EP Control electronic module. Inspect the two connectors for corrosion, loose wires or broken wires. Measure the DC voltage across pins "A" and "B" at the connector. The reading should be between 9 to 30 Vdc. |
| | Command Signal Missing | Check Command Input Signal. Disconnect the three-pin connector from the command input device to the EP Control electronic module. Inspect the two connectors for corrosion, loose contacts, loose wires and broken wires.<br>If 1-6 Vdc joystick or potentiometer is used, measure the DC voltage across pins "A" and "B" at the connector. Move the joystick or potentiometer position. The voltage reading will be approximately 2.5 volts DC at joystick neutral or the half range position of the potentiometer. The DC voltage will be approximately 5 volts at one end of the joystick or potentiometer travel. At the opposite end of travel the DC voltage will be approximately zero.<br>If ±4-20 mA current loop input is used, measure the DC voltage across pins "A" and "B" at the connector. The DC voltage reading should be approximately zero at zero input current which occurs at command input neutral. The DC voltage reading should be approximately ±5 volts for input command currents of ±20 mA respectively. |
| | Defective Solenoid Coil | Check Solenoid Coil. Disconnect the two-pin power supply and the three-pin command input device connectors from the EP Control electronic module. Inspect the connectors for corrosion, loose contacts, loose wires and broken wires. Remove the EP Control electronic module. Refer to instructions on page 5. Disconnect the two mating four-pin connectors. Measure the coil resistance across the designated pins at the solenoid four-pin connector. Refer to the Solenoid 4-pin Connector chart on page 18 for typical readings. |
| | Defective Electronic Module | Check Electronic Module. Disconnect the two-pin power supply and the three-pin command input device connectors from the EP Control electronic module. Inspect the connectors for corrosion, loose contacts, loose wires and broken wires. Remove the EP Control electronic module. Refer to instructions on page 5. **Caution:** The engine or motor driving the pump should not be running. Connect command input device and power to the module. Measure the current to the coil at the four-pin connector. Activate the input device end to end and at neutral. Monitor the current on one coil, and then on the other. Refer to Command Input Device chart on page 18 for typical readings. |
| | Manual Override Does Not Function | Check Manual Override. Disconnect two-pin power supply and the three-pin command input device connectors from the EP Control electronic module. Inspect the connectors for corrosion loose contacts, loose wires and broken wires. Remove the valve assembly. Refer to instructions on page 6. Use a small Phillips screwdriver to push on the manual override of the solenoid tube's solenoid tube actuator pin. |
| **Flow Only in One Direction** | Command Signal Incorrect | Check Command Input Signal. Disconnect the three-pin command input device connector from the EP Control electronic module. Inspect the two connectors for corrosion, loose contacts, loose wires and broken wires.<br>If 1-6 Vdc joystick or potentiometer is used, measure the DC voltage across pins "A" and "B" at the connector. Move the joystick or potentiometer position. The voltage reading will be approximately 2.5 volts DC at joystick neutral or the half range position of the potentiometer. The DC voltage will be approximately 5 volts at one end of the joystick or potentiometer travel. At the opposite end of travel the DC voltage will be approximately zero.<br>If ±4-20 mA current loop input is used, measure the DC voltage across pins "A" and "B" at the connector. The DC voltage reading should be approximately zero at zero input current which occurs at command input neutral. The DC voltage reading should be approximately ±5 volts for input command currents of ±20 mA respectively. |

| SYMPTOM: | CAUSE: | ACTION: |
|---|---|---|
| **Flow Only in One Direction (con't)** | Defective Solenoid Coil | Check Solenoid Coil. Disconnect the two-pin power supply and the three-pin command input device connectors from the EP Control electronic module. Inspect the connectors for corrosion, loose contacts, loose wires and broken wires. Remove the EP Control electronic module. Refer to instructions on page 5. Disconnect the two mating four-pin connectors. Measure the coil resistance across the designated pins at the solenoid four-pin connector. Refer to the Solenoid 4-pin Connector chart on page 18 for typical readings. |
| | Defective Solenoid Tube Subassembly | Check Solenoid Tube Subassembly. Disconnect the two-pin power supply and the three-pin command input device connectors from the EP Control electronic module. Inspect the connectors for corrosion, loose contacts, loose wires and broken wires. Remove the two solenoid tube subassemblies. Visually inspect the actuator pin in the tube subassembly. The pin should be free to move. |
| | Defective Electronic Module | Check Electronic Module. Disconnect the two-pin power supply and the three-pin command input device connectors from the EP Control electronic module. Inspect the connectors for corrosion, loose contacts, loose wires and broken wires. Remove the EP Control electronic module. Refer to instructions on page 5. **Caution:** The engine or motor driving the pump should not be running. Connect command input device and power supply to the electronic module. Measure the current to the coil at the four-pin connector. Activate the input device end to end and at neutral. Monitor the current on one coil, and then on the other. Refer to Command Input Device chart on page 18 for typical readings. |
| **Flow in Neutral** | Command Signal Incorrect | Check Command Input Signal. Disconnect the three-pin command input device connector from the EP Control electronic module. Inspect the two connectors for corrosion, loose contacts, loose wires and broken wires.<br>If 1-6 Vdc joystick or potentiometer is used, measure the DC voltage across pins "A" and "B" at the connector. Move the joystick or potentiometer position. The voltage reading will be approximately 2.5 volts DC at joystick neutral or the half range position of the potentiometer. The DC voltage will be approximately 5 volts at one end of the joystick or potentiometer travel. At the opposite end of travel the DC voltage will be approximately zero.<br>If ±4-20 mA current loop input is used, measure the DC voltage across pins "A" and "B" at the connector. The DC voltage reading should be approximately zero at zero input current which occurs at command input neutral. The DC voltage reading should be approximately ±5 volts for input command currents of ±20 mA respectively. |
| | Neutral Out of Adjustment | Check Neutral Adjustment. Disconnect the two-pin power supply and the three-pin command input device connectors from the EP Control electronic module. Inspect the connectors for corrosion, loose contacts, loose wires and broken wires. Remove the EP Control electronic module. Refer to instructions on page 5. Disconnect the two four-pin solenoid connectors. Follow instructions for setting neutral on page 10 Step 15. |
| **Flow Limited, Cannot Achieve Full Pump Stroke** | Command Signal Incorrect | Check Command Input Signal. Disconnect the three-pin command input device connector from the EP Control electronic module. Inspect the two connectors for corrosion, loose contacts, loose wires and broken wires.<br>If 1-6 Vdc joystick or potentiometer is used, measure the DC voltage across pins "A" and "B" at the connector. Move the joystick or potentiometer position. The voltage reading will be approximately 2.5 volts DC at joystick neutral or the half range position of the potentiometer. The DC voltage will be approximately 5 volts at one end of the joystick or potentiometer travel. At the opposite end of travel the DC voltage will be approximately zero.<br>If ±4-20 mA current loop input is used, measure the DC voltage across pins "A" and "B" at the connector. The DC voltage reading should be approximately zero at zero input current which occurs at command input neutral. The DC voltage reading should be approximately ±5 volts for input command currents of ±20 mA respectively. |

| SYMPTOM: | CAUSE: | ACTION: |
|---|---|---|
| **Flow Limited, Cannot Achieve Full Pump Stroke (con't)** | Defective Electronic Module | Check Electronic Module. Disconnect the two-pin power supply and the three-pin command input device connectors from the EP Control electronic module. Inspect the connectors for corrosion, loose contacts, loose wires and broken wires. Remove the EP Control electronic module. Refer to instructions on page 5. **Caution:** The engine or motor driving the pump should not be running. Connect command input device and power supply to the electronic module. Measure the current to the coil at the four-pin connector. Activate the input device end to end and at neutral. Monitor the current on one coil, and then on the other. Refer to Command Input Device chart on page 18 for typical readings. |
| | Manual Override Does Not Function | Check Manual Override. Disconnect the two-pin power supply and the three-pin command input device connectors from the EP Control electronic module. Inspect the connectors for corrosion loose contacts, loose wires and broken wires. Remove the valve assembly. Refer to instructions on page 6. Use a small Phillips screwdriver to push on the manual override of the solenoid tube's actuator pin should move the spool. |
| **Does Not Return to Neutral** | Command Signal Incorrect | Check Command Input Signal. Disconnect the three-pin command input device connector from the EP Control electronic module. Inspect the two connectors for corrosion, loose contacts, loose wires and broken wires.<br>If 1-6 Vdc joystick or potentiometer is used, measure the DC voltage across pins "A" and "B" at the connector. Move the joystick or potentiometer position. The voltage reading will be approximately 2.5 volts DC at joystick neutral or the half range position of the potentiometer. The DC voltage will be approximately 5 volts at one end of the joystick or potentiometer travel. At the opposite end of travel the DC voltage will be approximately zero.<br>If ±4-20 mA current loop input is used, measure the DC voltage across pins "A" and "B" at the connector. The DC voltage reading should be approximately zero at zero input current which occurs at command input neutral. The DC voltage reading should be approximately ±5 volts for input command currents of ±20 mA respectively. |
| | Neutral Out of Adjustment | Check Neutral Adjustment. Disconnect the two-pin power supply and the three-pin connectors from the EP Control electronic module. Inspect the connectors for corrosion, loose contacts, loose wires and broken wires. Remove the EP Control electronic module. Refer to instructions on page 5. Disconnect the two solenoid four-pin connectors. Follow instructions for setting neutral on page 10 Step 15. |

## Troubleshooting Reference Settings

### Solenoid 4-Pin Connector

| PINS | SOLENOID | 12 VOLT COIL | 24 VOLT COIL |
|---|---|---|---|
| A & B | Coil 1 | 5 ohms | 21 ohms |
| C & D | Coil 2 | 5 ohms | 21 ohms |
| Note: Only 12 volt coils are used with EP Control electronics module | | | |

### Joystick Position

| | DC VOLTAGE MEASURED ACROSS DESIGNATED PINS AT THE CUSTOMER THREE-PIN CONNECTOR |
|---|---|
| | A to B |
| Full-Forward | 5 Vdc |
| Neutral | 2.5 Vdc |
| Full-Reverse | 0 Vdc |

### Command Input Device – 12/24 Volt Systems (5 Ω coils)

| | CURRENT TO COIL 1 PINS A & B YELLOW & WHITE WIRES | CURRENT TO COIL 2 PINS C & D ORANGE & BLACK WIRES |
|---|---|---|
| Max command in one direction | Minimum 1.5 A<br>Maximum 2.0 A | 0 A<br>0 A |
| Neutral | 0 A | 0 A |
| Max command in the same direction | 0 A<br>0 A | Minimum 1.5 A<br>Maximum 2.0 A |

Eaton
14615 Lone Oak Road
Eden Prairie, MN 55344
Telephone: 952 937-9800
Fax: 952 974-7130
www.hydraulics.eaton.com

Eaton
20 Rosamond Road
Footscray
Victory 3011
Australia
Tele: (61) 3 9319 8222
Fax: (61) 3 9318 5714

Eaton
46 New Lane, Havant
Hampshire PO9 2NB
England
Tele: (44) 23 92 486 451
Fax: (44) 23 92 487 110

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