HAGAN POWER POSITIONER TORQUE TYPE 8 x 14

Instruction Bulletin IB-102-208 Rev. 1

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ROSEMOUNT WARRANTY

Rosemount warrants that the equipment manufactured and sold by it will, upon shipment, be free of defects in workmanship or material. Should any failure to conform to this warranty become apparent during a period of one year after date of shipment, Rosemount shall, upon prompt written notice from the purchaser, correct such nonconformity by repair or replacement, F.O.B. factory of the defective part or parts. Correction in the manner provided above shall constitute a fulfillment of all liabilities of Rosemount with respect to the quality of the equipment.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES OF QUALITY WHETHER WRITTEN, ORAL, OR IMPLIED (INCLUDING ANY WARRANTY OF MERCHANTABILITY OF FITNESS FOR PURPOSE).

The remedy(ies) provided above shall be purchaser's sole remedy(ies) for any failure of Rosemount to comply with the warranty provisions, whether claims by the purchaser are based in contract or in tort (including negligence).

Rosemount does not warrant equipment against deterioration due to environment. Factors such as corrosive gases and solid particulates can be detrimental and can create the need for repair or replacement as part of normal wear and tear during the warranty period.

Equipment supplied by Rosemount Analytical Inc. but not manufactured by it, will be subject to the same warranty as is extended to Rosemount by the original manufacturer.

PURPOSE

The purpose of this manual is to provide a comprehensive understanding of the Hagan 8 x 14 Power Positioner, components, functions, installation, and maintenance.

This manual is designed to provide information about the Hagan 8 x 14 Power Positioner. We recommend that you thoroughly familiarize yourself with the Description and Installation sections before installing your power positioner.

The overview presents the basic principles of the power positioner along with it's performance characteristics and components. The remaining sections contain detail procedures and information necessary for installation and servicing of the power positioner.

Before contacting Rosemount concerning any questions, first consult this manual. It describes most situations encountered in your equipment's operation and details necessary action.

DEFINITIONS

The following definitions apply to WARNINGS, CAUTIONS, and NOTES found throughout this publication.

WARNING

Highlights an operation or maintenance procedure, practice, condition, statement, etc., if not strictly observed, could result in injury, death, or long-term health hazards of personnel.

CAUTION

Highlights an operation or maintenance procedure, practice, condition, statement, etc., if not strictly observed, could result in damage to or destruction of equipment, or loss of effectiveness.

NOTE

Highlights an essential operating procedure, condition, or statement.

NOTE TO USERS

The P_____ number in the lower right corner of the illustrations in this publication are manual illustration numbers. They are not part numbers and are not related to the illustration in any technical manner.

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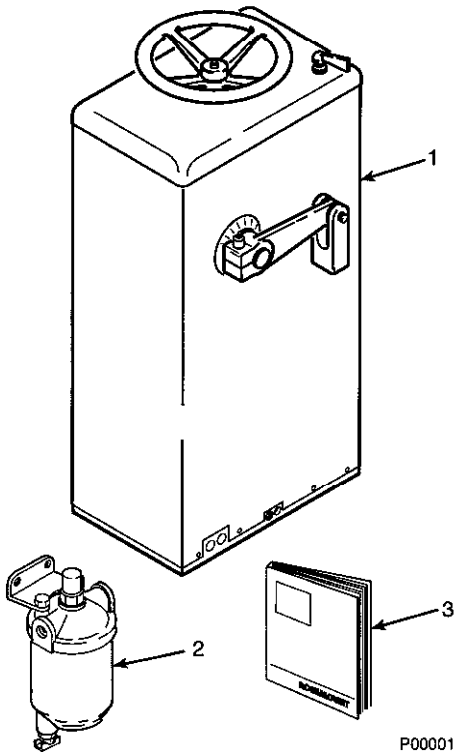
SECTION I. DESCRIPTION

1-1. COMPONENT CHECKLIST OF TYPICAL SYSTEM. A typical Rosemount 8 x 14 Power Positioner package should contain the items shown in Figure 1-1.



ITEM	DESCRIPTION
1	Model PP814T Power Positioner
2	Air Filter
3	Instruction Bulletin

Figure 1-1. Typical System Package

1-2. MODEL NUMBER MATRIX. The PP814T has a piston 8 inches in diameter and a maximum stroke of 14 inches. Use model number matrix, Table 1-1, to verify your style number. The first part of the matrix defines the model. The last part defines the various options and features of the power positioner. Copy your model number from data plate located on back of power positioner, compare this to Table 1-1. Check your code model number against the features and options of the power positioner, making sure the options specified by this number are on this unit. Use this complete number for any correspondence with Rosemount.

1-3. SYSTEM OVERVIEW.

a. Scope. This Instruction Bulletin has been designed to supply details needed to install, operate, and service the Rosemount 8 x 14 Torque Type Power Positioner (Figure 1-1). The power positioner can be configured with optional manual operator wheel, transfer valve, air lock, bypass valve, supply air filter, clevis and dust cover. Options for the power positioner include electric position transmitter, limit switches, heater/thermostat and current to pneumatic (I/P) converter.

b. Power Positioner Features. The fully featured model 8 x 14 power positioner includes the following features:

1. The manual operator wheel can be used by the operator to manually change the position of the device being controlled. In the event of a power loss, continued operation of power positioner is possible through manual operator wheel.

2. The transfer valve is a two position valve that allows the operator to simultaneously engage the air lock and manual operator, and open the bypass valve. In the manual position, air lock is engaged, manual operator is engaged and bypass valve is open. In automatic position, air lock is disengaged, manual operator is disengaged and bypass valve is closed.

   (a) The air lock allows the operator to lock the piston and output shaft assembly in any position. This is done by moving the transfer valve on top of the positioner to the manual position. When in the manual position, the transfer valve cuts off air pressure to the air lock diaphragms, allowing the fail-safe air lock to engage. When the transfer valve is in the automatic position, air pressure causes the air lock diaphragms to disengage the air lock.

Table 1-1. Model Number Matrix.

Includes air filter style 372538-2 and Clevis, style 274472

Code	Manual Operator	Dust Cover	Air Lock	Heater and Thermostat		Shp Wgt lbs/kgs
452167		X				850/385,9
457696		X		X		860/390,4
452593	X		X			880/399,5
443700	X	X	X			900/408,6
457031	X	X	X	X		910/413,1

Accessories

Code	Description	
7362C69G02	Electric Position Transmitter	20/9,1
7362C69G03	Limit Switches (2) DPDT - Nema 4, 13, Factory wired to terminal box	5/2,3
7362C69G04	Electric Positioner Transmitter and Limit Switches (2) DPDT - Nema 4, 13, Factory wired to terminal box	25/11,4

I/P 4 - 20 mA Input

Code	Description	
9885A31H01	Current/Pneumatic Converter	
275431-007	Pressure gage	
4505C21G01	Filter regulator	

Fail-Safe Option (4)

Code	Description	
SKI - 63580	(2) Check Valves, (2) Diaphr. Valves (1) 2.2 Ft. Tank, (1) Press. Switch (1) Solenoid Valve. Mtd. & Piped	50/22,7

Master Slave Positioners

Code	Description	
6630D09G01	Master - Man. Oper., Dust Cover Air Lock, Heater	920/417,7
6630D08G01	Slave - Man. Oper., Dust Cover Air Lock, Heater	800/363,2

To Order, Specify:
1. Desired input signal [3 - 15, 0 - 30 psig (21-103, 0-207 kPa), or 4-20 mA - See Accessories].
2. If 4 - 20 mA input is required, also order I/P from accessories.

(b) When the bypass valve is open it provides a passage between the top and bottom of the piston; this equalizes air pressure on both sides of the piston, allowing manual positioning of device being controlled. This valve is operated by moving the transfer valve to the manual position. When the transfer valve is in the automatic position, air pressure causes bypass valve to close off passage between top and bottom of cylinder.

3. The supply air filter removes water and oil droplets from the supply air. Supply air must be free of oil and water to prevent pilot valve sticking.

4. The clevis provides a connection from power positioner to linkage so movement can be transferred to the device being controlled.

5. A dust cover provides a NEMA type 3 enclosure. It is removable and splash proof.

c. **Operational Description.** The Model PP814T Torque Type Power Positioner is a pneumatic driven, double acting piston type power cylinder in which the linkage lever is positioned to a specific setting for each input signal. The power positioner is mounted on a steel floor stand. The unit is covered and protected by a splash proof metal dust cover. The power positioner is used to position devices such as inlet vanes, control valves, and dampers.

1. Automatic Operation. Figure 1-2 depicts a direct acting power positioner. In this type of positioner, an increase in signal air pressure to the receiver causes the diaphragm to overcome the tension of the calibration spring and move downward. The downward motion is transmitted to the pilot valve through a connecting link. This positions the pilot valve stem to send supply air below the piston, forcing the piston, piston rod, and cylinder lever upward. Air from above the piston is exhausted through the pilot valve exhaust tubing and then through the open exhaust blocking valve.

NOTE

Figure 1-2 depicts the model 8 x 14 power positioner with the optional handwheel and airlock. The 8 x 14 power positioner can be configured without these items. Refer to Table 1-1.

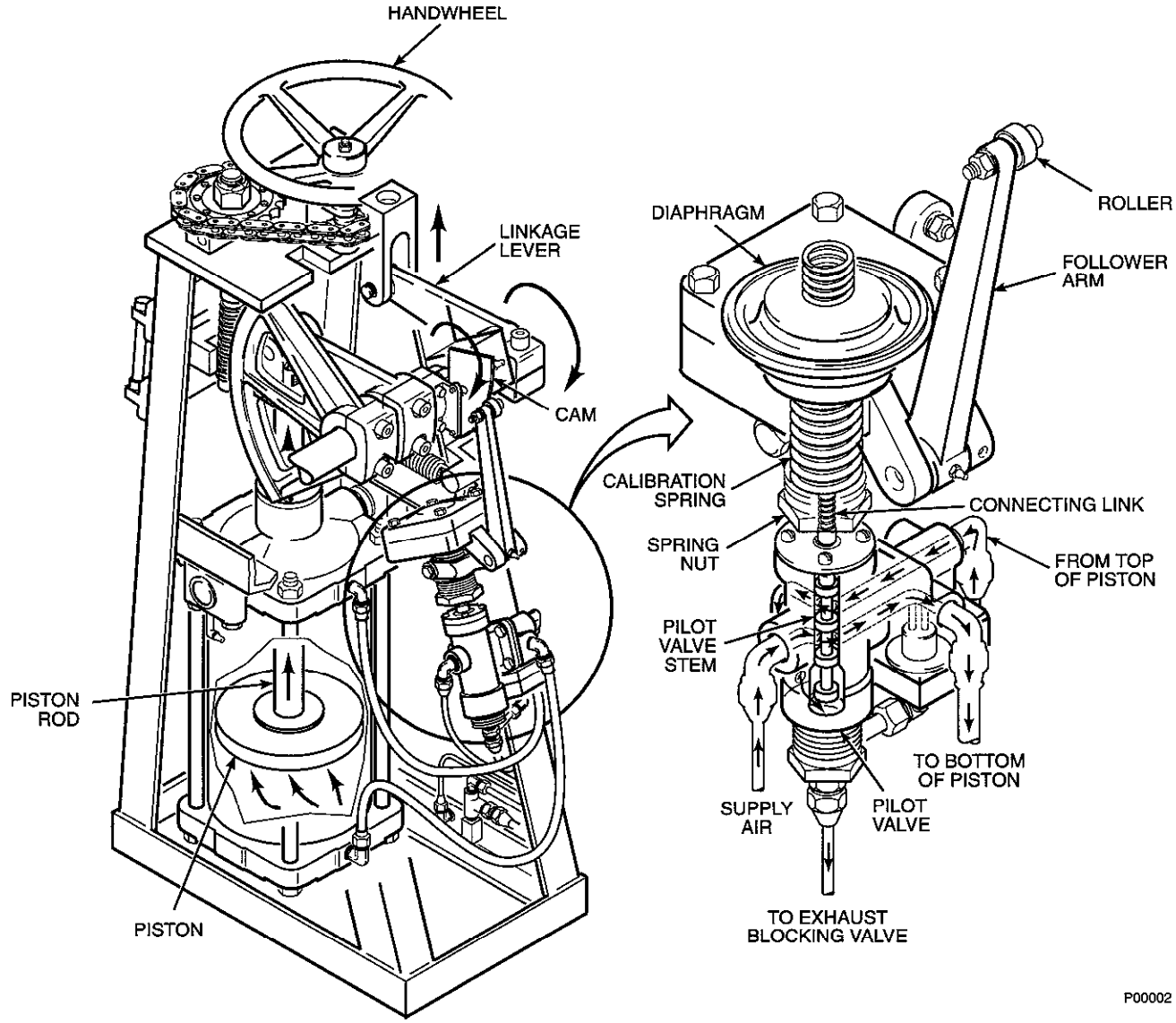


Figure 1-2. Power Positioner Operation

The upward movement of the piston rod moves the cam downward. This causes the follower arm, riding on the cam, to lift the spring nut, increasing pressure on the calibration spring. This increased pressure on the calibration spring returns the diaphragm to its neutral position, closing the pilot valve air ports. Without additional air pressure, piston movement is stopped.

As signal air decreases the calibration spring pressure moves the diaphragm up. The upward movement of the diaphragm moves the pilot valve stem up, directing air above the piston. This forces the piston, piston rod, and linkage lever downward. The downward movement of the piston rod, working through the cam and follower arm, lowers the calibration spring socket and reduces pressure on the calibration spring. This decreased pressure on the calibration spring returns the receiver's diaphragm to a neutral position closing the pilot valve air ports.

2. Cam. The standard cam from Rosemount produces a linear relationship between input signal and the distance the operating lever is moved. Additional cams can be purchased from Rosemount to produce either a squared (x^2) relationship or a square root ($\sqrt{x}$) relationship. Custom cam shaping in the field can produce other relationships needed. Refer to Section II, Installation for procedures to custom shape a cam.

3. Inverse Operation. On inverse acting power positioners, the cylinder air hoses and the cam position are reversed. This causes the supply air to be directed to the top of the piston when signal air pressure is increased, and to the bottom of the piston when signal air pressure is decreased. In this type of installation, piston movement is inversely related to the signal — as signal pressure decreases, the piston raises, as signal pressure raises, the piston lowers.

4. Manual Operation. The power positioner can be controlled manually through the manual operator handwheel. The handwheel is connected to a sprocket and chain which turns a worm shaft when the wheel is rotated. This worm shaft moves a sector gear attached to the power positioner shaft. The sector gear movement is transferred to the linkage lever to control the position of the device being controlled. To place the power positioner in manual operation move the transfer valve to the manual position.

d. **<u>System Considerations</u>.** Prior to installation of your Rosemount 8 x 14 Power Positioner, check that you have all the components necessary to make the complete system installation.

Once you have verified that you have all the components, select mounting location. A typical installation is illustrated in Figure 1-3. Determine where power positioner will be placed in terms of serviceability, available power supply, ambient temperatures, environmental considerations, and convenience. Power positioner operating specifications are listed in Table 1-2. Become familiar with Section II, Installation, before installing unit.

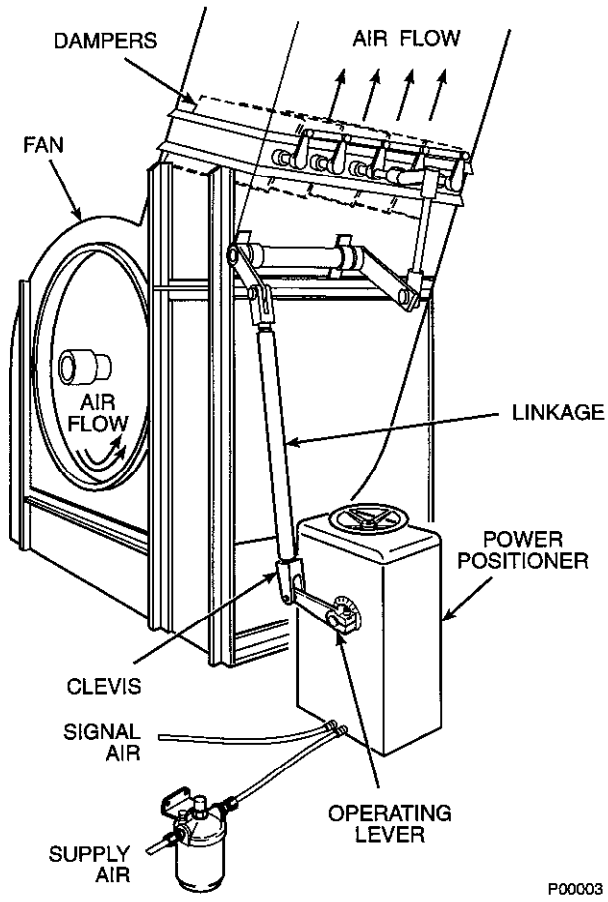


Figure 1-3. Typical Power Positioner Installation

Table 1-2. Specifications for Model PP814T Power Positioner.

Signal Requirements	
Inputs: 4-20 mA/3-15 psig/0-30 psig	
Performance	
Repeatability	1% of full stroke or better
Full Stroke Time (unloaded)	2.5 seconds
Maximum Cylinder Air Pressure	120 psig
Supply Air Consumption	2 scfm steady state
Control Torque	2700 ft-lbs
Maximum Friction Load	1100 ft-lbs
Stall Torque	4600 ft-lbs
Outputs	80° shaft rotation
Physical Characteristics	
Weight	900 lbs
Dust Cover	Designed to meet NEMA type 3
Requirements	
Supply Air Input Fitting	3/8 inch NPT
Signal Air Input Fitting	1/4 inch NPT
Environmental Requirements	
Ambient Temperature Limits:	40°F to 140°F (4.4°C to 60°C)
Air Supply Requirements	
Operating Air Supply Pressure	45-120 psig
Recommended Air Supply Pressure	100 psi

1-4. MODEL PP814T SPECIFICATIONS. Model PP814T Power Positioner specifications contain information about the operating characteristics of the power positioner. Use Table 1-2 to make sure that available conditions are suitable for the power positioner before choosing mounting location.

1-5. STORAGE INSTRUCTIONS. Use the following guidelines for storage of the power positioner.

a. Storage Environment. Store power positioner in a warehouse environment that maintains the following conditions:

1. Ambient temperature above 45°F (7°C).
2. Humidity below 80% RH.

b. Power Positioner Preparation for Storage. Coat all non-painted surfaces and exposed metal with a rust-preventive compound (Tectyl 506 or a substitute with similar properties).

WARNING

Keep Tectyl 506 away from heat, sparks, and open flames and use with adequate ventilation. Ventilation is required for cure and to prevent an explosive atmosphere from forming.

CAUTION

Use only approved thinning methods when applying rust-preventive compounds. Do not apply heat to compound. Fire or explosion may result. Refer to manufacturer of rust-preventive compound for specific application, thinning, clean-up and removal instructions.

c. **Storage Preventive Maintenance.** If storing power positioner longer than six months, observe the following preventive maintenance guidelines.

1. Cycle cylinder and piston either manually or by air every six months.
2. Perform General Cleaning and Lubrication (paragraph 6-3), and Cylinder and Piston, Cleaning and Lubrication (paragraph 6-9), before installing power positioner.

SECTION II. INSTALLATION

2-1. OVERVIEW. The power positioner is designed to be installed upright. The floor stand is bolted to a prepared horizontal foundation. A minimum of 45 psig to a maximum of 120 psig supply air pressure is needed at mounting location. The power positioner must be controlled by either an electrical signal, when using an I/P signal converter, or by an air signal. All wiring must conform to local and national codes.

2-2. SPECIAL INSTALLATION CONSIDERATIONS.

a. Foundation. The power positioner's torque is transmitted to operating arm of device being positioned. This torque is also transferred to power positioner's mass and it's foundation. The foundation must be designed to handle the torque produced to keep power positioner stationary. Refer to paragraph 2-3 for detailed foundation requirements.

b. Supply Air. A supply air pressure of 45 psig to 120 psig, minimum of 2 scfm, is required. Supply air must be free of oil and water to prevent pilot valve sticking.

c. Linkage Design. Final control components play a large part in a control system. Special characteristics of device being controlled affect system response and must be regarded in design and setup of a power positioning system.

Control valves and damper drives regularly allow large flow rate changes, compared to valve movement, near the closed position. Smaller flow rate changes, compared to valve movement, occur near the fully open position. In normal damper application, there may be no flow rate changes after damper has reached 70% open. This characteristic is represented by the following equation:

$$\text{Flow} = k\,(\text{Position})^2$$
$$k = \text{Constant}$$

This equation means that flow is proportional to the square of valve position. As damper or valve opens, the rate at which flow changes per valve position is increased. As valve or damper closes, the rate at which flow changes per valve position is increased. The constant is a number that allows the equation to work for different flow control devices.

Conduct flow tests before attempting to limit damper opening. Testing is necessary to confirm actual damper characteristics and to make sure control response is proportionate to input signal throughout the flow range. When installing a new power positioning system, take care to properly design the system for linkage size and action. In a properly designed system, a percentage change in control signal produces the same percentage change in flow rate. Refer to paragraph 2-6 for detailed information on design and installation of a linearized control action power positioning system.

2-3. POWER POSITIONER MOUNTING INSTRUCTIONS.

a. Working Clearance Requirements. Make sure area is clear of obstructions that will interfere with power positioner operation and maintenance. For standard unit, allow an open area of 24 inches (side to side) by 23 inches (front to back) by 49 inches (vertically from foundation) plus enough room to operate handwheel. This will allow for removal of dust cover, maintenance, and operation of handwheel (Figure 2-1).

b. Location Selection.

1. Select location for power positioner as near to the device being controlled as possible, making sure necessary clearance for operation and maintenance, as specified in paragraph 2-3a, is available.

2. Use Specifications for Model PP814T Power Positioner, Table 1-2, to make sure environmental conditions are suitable for the power positioner.

3. Become familiar with all of Section II, Installation, before actual installation is started.

NOTE: DIMENSIONS ARE IN INCHES.

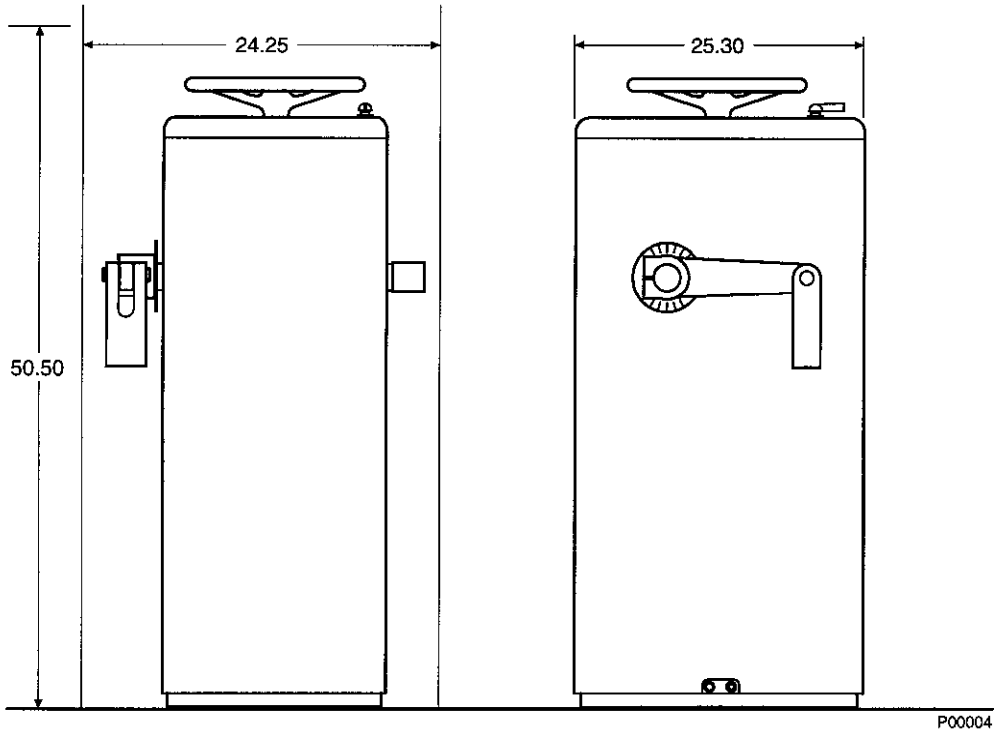


Figure 2-1. Clearance Requirements

c. **Mounting Procedure.**

1. Design and Manufacture Foundation. Foundation must be able to withstand at least 1670 ft-lbs torque plus 900 lbs weight. Refer to Figure 2-2 for footprint dimensions of power positioner. Use this footprint as a guide to design foundation to match base of power positioner. Mounting holes in base are drilled for 3/4 inch foundation bolts. Decide which foundation material is best suited for your application, steel or concrete, and design and manufacture foundation.

2. Installation.

   (a) Install power positioner on foundation with 3/4 inch bolts and standard flat washers.

   (b) Make sure power positioner is level. Check by measuring side to side and front to back with a level.

   (c) If power positioner is not level, remove 3/4 inch bolts that secure power positioner to foundation and install shims between the power positioner and foundation. Continue this process until power positioner is level when 3/4 inch mounting bolts are tightened. This will prevent distortion of power positioner stand.

   (d) If installed on a concrete foundation, grout foundation with additional concrete to prevent distortion of power positioner stand.

NOTE: DIMENSIONS ARE IN INCHES.

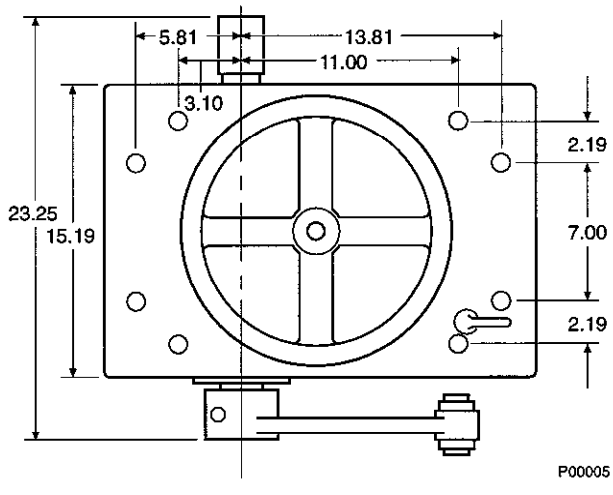


Figure 2-2. Mounting Dimensions

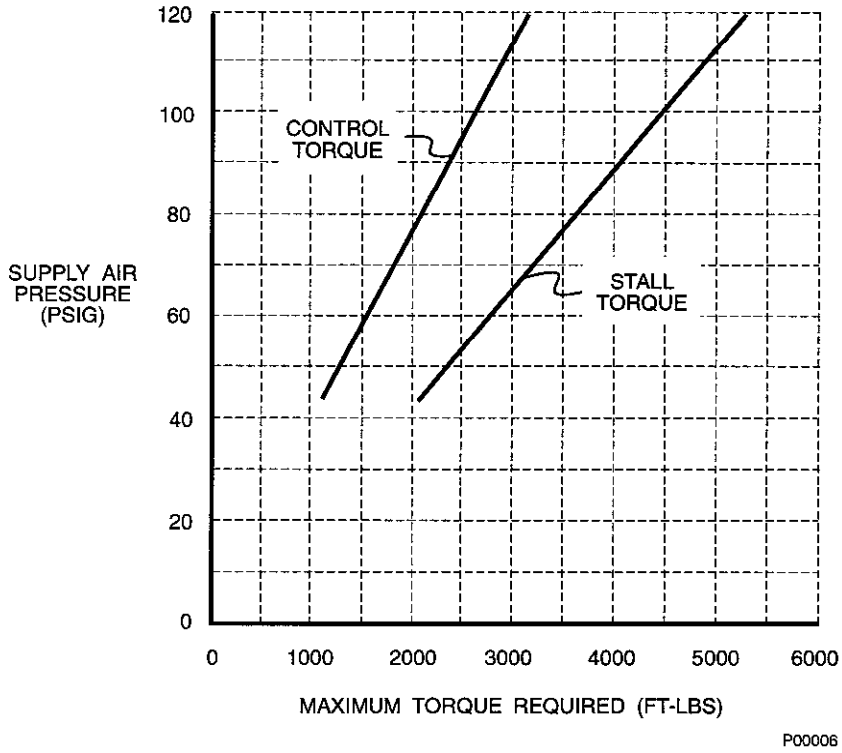


Figure 2-3. Power Positioner Torque Chart

2-4. **AIR SUPPLY INSTALLATION.** Using Figure 2-3, match the torque load needed to position your device to the "maximum torque required" axis along the bottom of the graph. From this point, move vertically up to the control torque curve. From the point that intersects control torque curve, move horizontally to the left scale labeled "supply air pressure". This is the minimum supply air required to develop the required control torque. The stall torque curve represents the maximum amount of torque the power positioner will produce for given supply air pressure before stalling out.

a. **Air Line Requirements.** Installation of air filter is necessary for proper power positioner operation. A manual shutoff valve should be installed in the air supply line before the air filter, Figure 2-4. The air filter will remove finely dispersed water or oil droplets, preventing pilot valve stem from sticking.

If your unit is not equipped with an I/P signal converter, install a separate signal line as shown in Figure 2-4 View B. The power positioner can accept different ranges of signal air pressures. Refer to your model number and model number matrix (Table 1-1) to determine signal air pressure required.

b. **Supply Air and Signal Air Connections.** Basic schematics are shown in Figure 2-4. The installation of the air filter is as follows:

1. Mount bracket for air filter directly on the back of the stand assembly. If this is unsuitable, mount air filter within 15 feet of power positioner.

NOTE

Prior to connecting supply air line or signal air line, purge air system until all moisture and debris are blown out.

2. Purge air supply system and connect air supply line to the air filter inlet. Run a second line from the air filter outlet to the power positioner supply air inlet connection. Supply air fitting is 3/8 inch NPT.

3. Purge signal air line and connect to signal air connection on power positioner. Signal air fitting is 1/4 inch NPT.

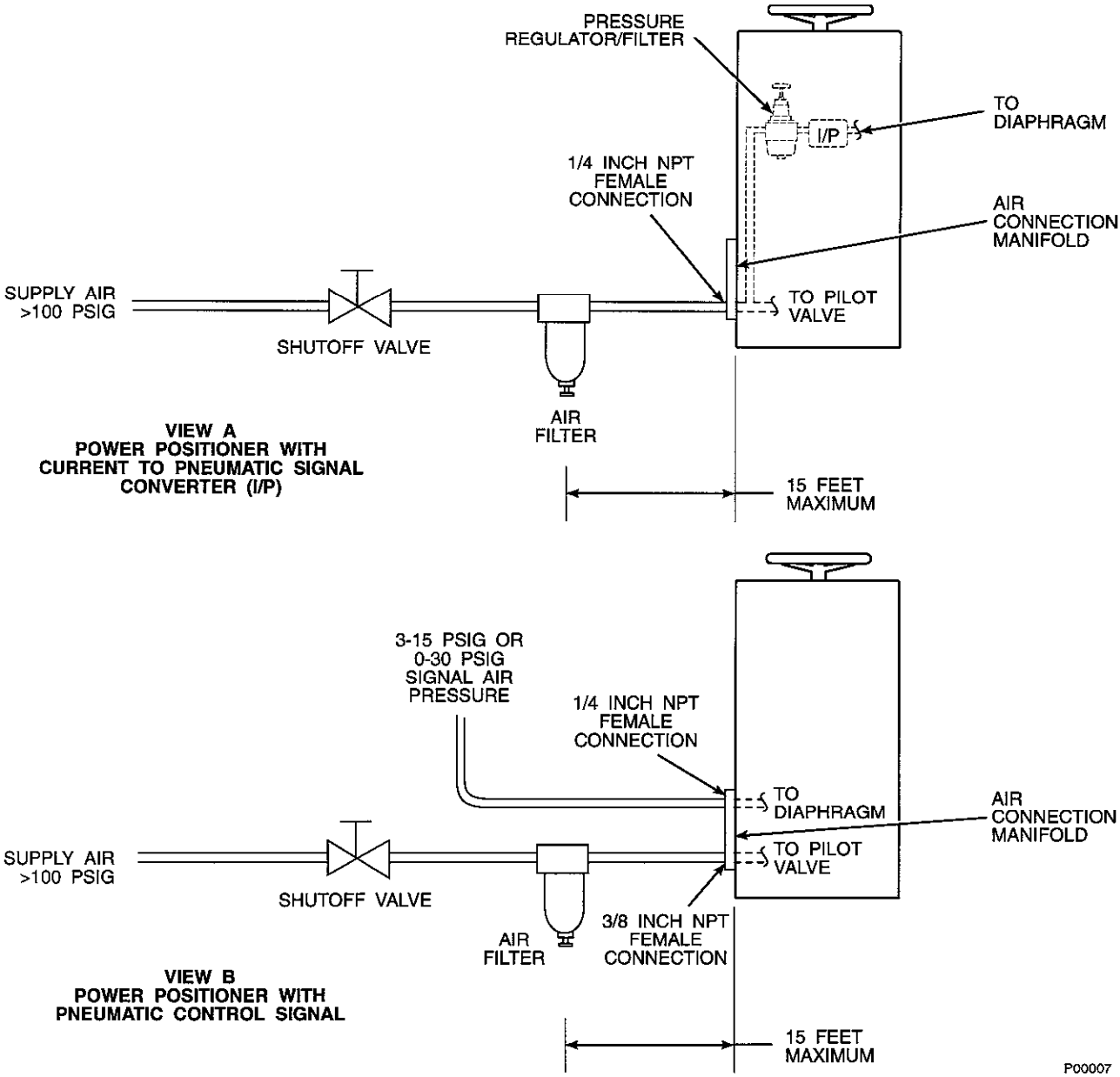


Figure 2-4. Air Piping Schematic

2-5. CURRENT TO PNEUMATIC SIGNAL CONVERTER (I/P) ELECTRICAL CONNECTIONS. Connect electrical signal input to I/P converter and calibrate if necessary. Refer to paragraph 4-3 for calibration procedures. The connections must be made by screw terminals. If the I/P has pigtail leads instead of screw terminals, the connection must be made at a terminal block. Gage of wire required is 18 gage signal wire. The signal that will control the I/P should have a range of 4 to 20 mA at a voltage of 24 Vdc.

2-6. LINKAGE INSTALLATION. In a normal installation, most customers install the linkage with both the drive arm and damper driven arm positioned so that both arms establish an approximate right angle (90°) to the drive line at mid range of travel as illustrated in Figure 2-5.

For more detailed information on linkage arrangement and options refer to Appendix A - LINKAGE INSTALLATION FOR EITHER A CHARACTERIZED FLOW CONTROL DEVICE, OR A LINEAR FLOW CONTROL DEVICE.

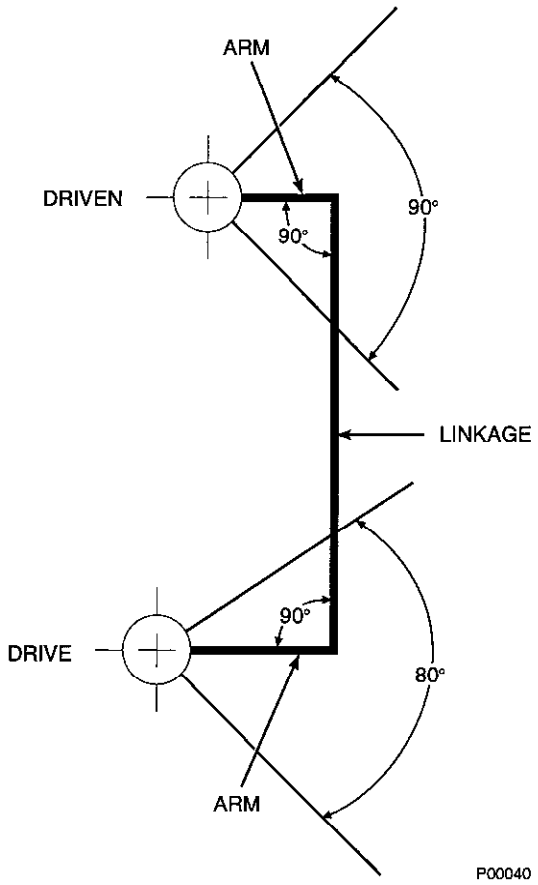
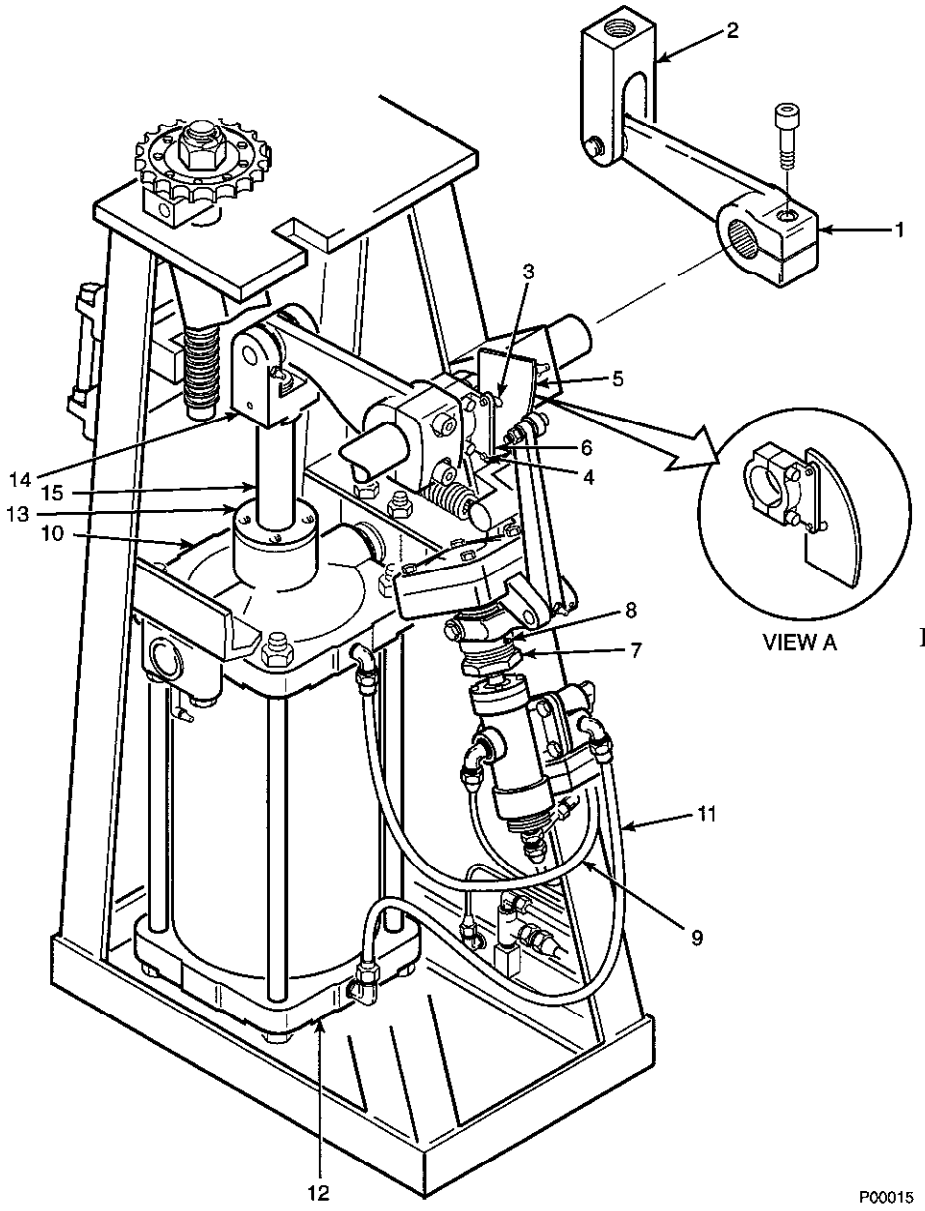


Figure 2-5. Angular Relationship of Drive and Driven Arms

SECTION III. REVERSE OPERATION

3-1. OPERATIONAL DESCRIPTION. In reverse acting positioners, the piston and piston rod operate the same as when set up for direct acting (Figure 1-2). The cam is reversed front to back and the cylinder air hoses are exchanged. These alterations cause supply air to be directed to the top of piston when signal air pressure is increased and to the bottom of piston when signal air pressure is decreased. In this case, piston movement is inversely related to the signal. A falling signal air pressure raises the piston and an increasing signal air pressure lowers the piston.

3-2. PROCEDURES FOR REVERSING OPERATION. To reverse the operation of the cylinder, refer to Figure 3-1 and use the following procedures.



ITEM	DESCRIPTION
1	Linkage Lever
2	Clevis
3	Stroke Adjustment Lock Screw
4	Pivot Screw
5	Cam
6	Cam Mounting Bracket
7	Spring Nut
8	Set Screw
9	Upper Cylinder Hose
10	Upper Cylinder Head
11	Lower Cylinder Hose
12	Lower Cylinder Head
13	Gland Cap
14	Clevis Head
15	Piston Rod

Figure 3-1. Reverse Operation

a. Reverse Compensating Assembly.

WARNING

Before performing any maintenance or repair action on the power positioner, shut off supply air, signal air, and any electrical supply or electronic signals to the power positioner. Isolate power positioner from all connected systems. Severe injury or death may result form large torque power positioner is capable of producing.

1. Remove power positioner from service.
2. Close the supply air valve.
3. Set signal air to 0.
4. Remove pivot screw (4) and stroke adjustment lock screw (3) securing cam (5) to cam mounting bracket (6) and remove cam.
5. Invert cam as shown in Figure 3-1, View A. Install pivot screw (4) and stroke adjustment lock screw (3) through cam into cam mounting bracket.

b. Exchange Cylinder Hoses.

1. Tag and remove upper cylinder hose (9) and lower cylinder hose (11) from cylinder heads.
2. Install upper cylinder hose into lower cylinder head (12). Install lower cylinder hose into upper cylinder head (10).

c. Calibrate Stroke.

1. Disconnect linkage lever (1, Figure 3-1) at clevis (2) from device being controlled.

WARNING

Use caution when applying supply air to the pilot valve. The pressure will cause the piston, rod, and linkage lever to move when the piston travels to the top of its stroke. Personal injury or damage to equipment may occur during sudden application of compressed air.

2. Open supply air valve. This will cause piston rod (15) to move to top of its stroke. Set signal air to minimum.
3. Using an allen wrench, loosen set screw (8) holding spring nut (7).
4. Turn spring nut counterclockwise until piston rod (15) starts to move downward.
5. Turn spring nut (7) slowly clockwise until piston rod reaches maximum position.
6. Tighten set screw (8) to hold spring nut firmly in place.
7. Set signal air to maximum amount and check movement of piston rod (15) for full stroke. The piston rod should just reach bottom of stroke with maximum signal to pilot valve. If necessary, loosen stroke adjustment lock screw (3) and move cam (5) away from shaft until full stroke is reached.
8. Reconnect linkage lever (1) at clevis (2) to device being controlled.

SECTION IV. CALIBRATION

4-1. CHECK POWER POSITIONER CALIBRATION. Use the following procedure to check calibration of power positioner. Figure 4-1, Calibration Flowchart is provided as a quick reference guide.

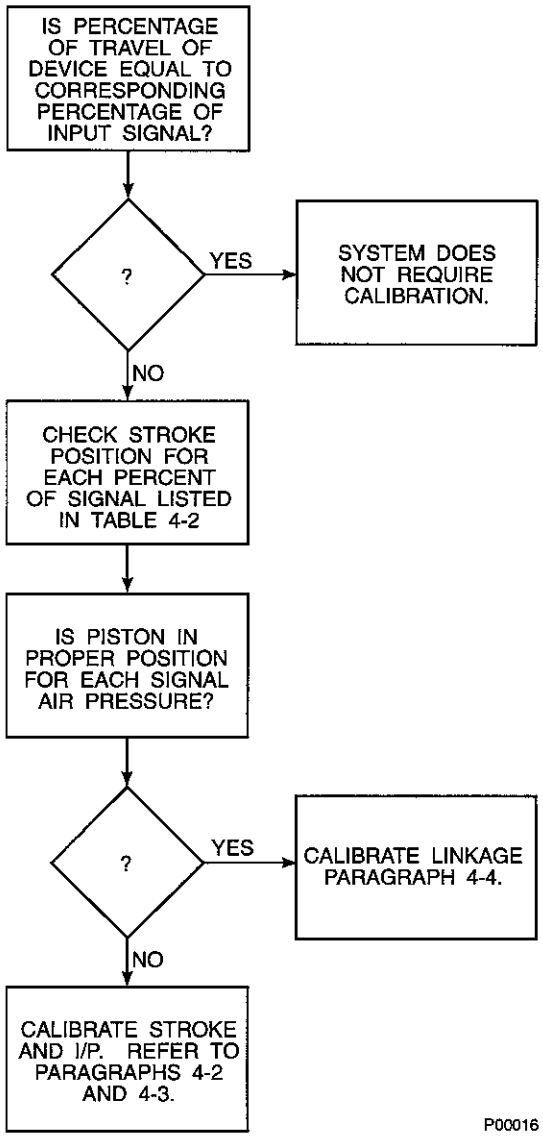


Figure 4-1. Calibration Flowchart

NOTE

If cam was shaped (characterized), values of percent output desired must be recorded upon installation in Table 4-1, Schedule D. This is necessary to check calibration. If values were not recorded, refer to Appendix A, paragraph A-2.b and calculate correct positions using formulas.

a. Device Travel.

1. Measure distance that the controlled device's driven lever arm travels from 0% signal air to 100% signal air. Record this as total distance.

2. Set signal air to 0%.

3. Measure controlled device's driven lever arm travel from 0% to 10% signal air. Divide measurement by total distance measured in step a. Record this as the percentage of output travel for 10% signal air. Measure and record percentage of output travel in the same fashion in 10% increments up to 100% signal air.

4. Compare recorded readings with percent driven lever travel in Table 4-1. Use respective columns for characterized systems, linear, square root, or square cams. If recorded percentages of travel are equal to those in Table 4-1, the system does not need calibration. If recorded readings do not equal those in Table 4-1 continue checking procedure.

Table 4-1. Device Travel (%).

PERCENT SIGNAL AIR PRESSURE	PERCENT DRIVEN LEVER TRAVEL			
	LINEAR	SQUARE ROOT ($\sqrt{x}$)	SQUARE (x^2)	CHARACTERIZED
0	0	0.0	0.0	
10	10	31.6	1.0	
20	20	44.8	4.0	
30	30	54.8	9.0	
40	40	63.25	16.0	
50	50	70.7	25.0	
60	60	77.5	36.0	
70	70	83.7	49.0	
80	80	89.4	64.0	
90	90	94.9	81.0	
100	100	100.0	100.0	

b. Piston Travel.

1. Set signal air to 0%.

2. Measure distance from top surface of gland cap (13, Figure 3-1) to bottom surface of clevis head (14). Label this distance "A".

3. Increase signal to 100%.

4. Measure distance from surface of gland cap (13) to bottom surface of clevis head (14). Label this distance "B".

5. Subtract distance "A" from distance "B". This is total stroke travel of the power positioner. Record this distance as total stroke travel.

6. Set signal air to 0%.

7. Measure the piston travel (stroke) when a 10% signal is sent to the power positioner. Record this as stroke travel for 10% signal air. Measure and record percentage of output travel in the same fashion in 10% increments up to 100% signal air.

NOTE

Values for characterized stroke measured in inches and percent corresponding to input pressures are recorded in Table 4-2, Schedule D. If values were not recorded, refer to Appendix A, paragraph A-2.b., and calculate correct positions using formulas.

8. Compare actual stroke movement with desired stroke movement. Desired stroke movements appear in Table 4-2, Calibration Schedule. Schedule "A" is for a linear cam, "B" for a square root cam, "C" for a square cam, and "D" for a characterized cam. If actual stroke of power positioner is equal to desired value in Table 4-2, refer to paragraph 4-4 and calibrate linkage. If it is not equal, calibrate stroke (paragraph 4-2) and then calibrate I/P (paragraph 4-3).

Table 4-2. Piston Travel (Stroke) Calibration Schedule.

CALIBRATION SCHEDULE "A" - LINEAR CAM				
INPUT SIGNAL			**DESIRED STROKE**	
3-15 psig (I/P)	0-30 psig	Percent of Signal	Inches	Percent of Full Stroke
3.0	0	0	0.00	0
4.2	3	10	1.40	10
5.4	6	20	2.80	20
6.6	9	30	4.20	30
7.8	12	40	5.60	40
9.0	15	50	7.00	50
10.2	18	60	8.40	60
11.4	21	70	9.80	70
12.4	24	80	11.20	80
13.8	27	90	12.60	90
15.0	30	100	14.00	100
CALIBRATION SCHEDULE "B" - SQUARE ROOT CAM				
3.0	0	0	0.00	0.0
4.2	3	10	4.43	31.6
5.4	6	20	6.28	44.8
6.6	9	30	7.68	54.8
7.8	12	40	8.72	62.25
9.0	15	50	9.90	70.70
10.2	18	60	10.85	77.50
11.4	21	70	11.72	83.70
12.4	24	80	12.52	89.40
13.8	27	90	13.29	94.90
15.0	30	100	14.00	100.00
CALIBRATION SCHEDULE "C" - SQUARE CAM				
3.0	0	0	0.00	0
4.2	3	10	0.14	1
5.4	6	20	0.56	4
6.6	9	30	1.26	9
7.8	12	40	2.24	16
9.0	15	50	3.50	25
10.2	18	60	5.04	36
11.4	21	70	6.86	49
12.4	24	80	8.96	64
13.8	27	90	11.34	81
15.0	30	100	14.00	100
CALIBRATION SCHEDULE "D" - CHARACTERIZED CAM				
3.0	0	0		
4.2	3	10		
5.4	6	20		
6.6	9	30		
7.8	12	40		
9.0	15	50		
10.2	18	60		
11.4	21	70		
12.4	24	80		
13.8	27	90		
15.0	30	100		

4-2. STROKE CALIBRATION. Use the following procedures to adjust power positioner stroke.

a. Purge air lines to remove any water or debris.

b. Move transfer valve to automatic position and set signal air to minimum stroke position (0%).

c. Loosen set screw (3, Figure 4-2) holding spring nut (2) in place. Turn spring nut counterclockwise until piston rod (4) begins moving up from bottom of stroke. Turn spring nut slowly clockwise until piston rod moves to lowest position. Tighten set screw.

d. Increase signal air to maximum (100%). Refer to Table 4-3 for percent to signal air conversion.

e. Loosen stroke adjustment lock screw (1). Move loose end of cam toward shaft until piston rod (4) moves downward. Slowly move cam away from shaft until piston rod moves to maximum position or to desired length of travel. Tighten lock screw.

ITEM	DESCRIPTION
1	Stroke Adjustment Lock Screw
2	Spring Nut
3	Set Screw
4	Piston Rod
5	Cam

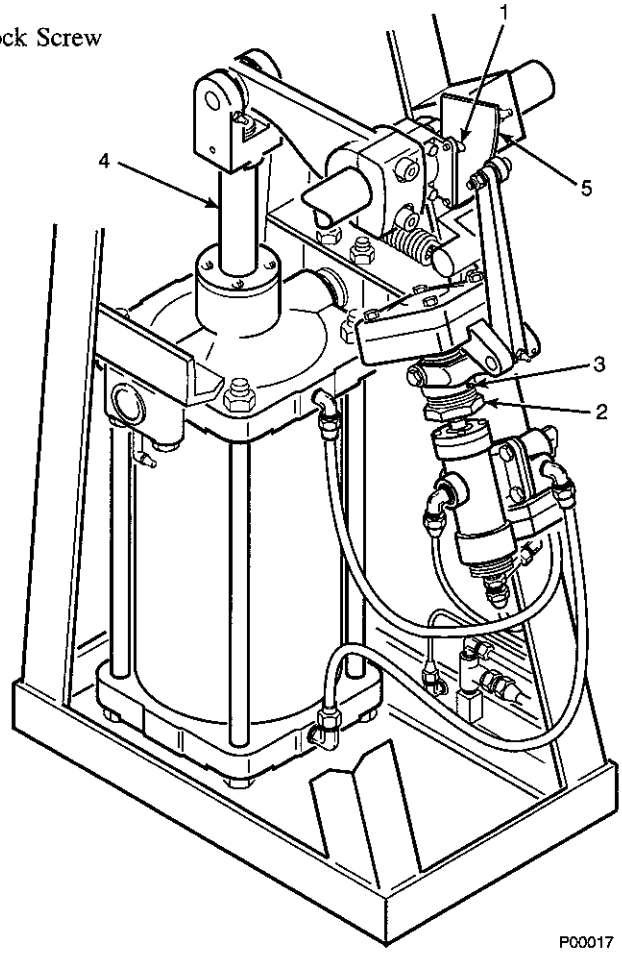


Figure 4-2. Stroke Adjustment

Table 4-3. Calibration Signal Pressures.

STROKE POSITION	SIGNAL AIR	
	3-15 psig (I/P)	0-30 psig
0%	3	0
100%	15	30

4-3. CURRENT TO PNEUMATIC (I/P) SIGNAL CONVERTER CALIBRATION. Calibrate current to pneumatic signal converter after mounting, changing mounted position, or when loss of control is noticed (refer to Section V, Troubleshooting). Use the following procedures to calibrate the signal converter:

a. Remove protective plastic caps from "Zero" and "Span" adjustment screws (Figure 4-3).

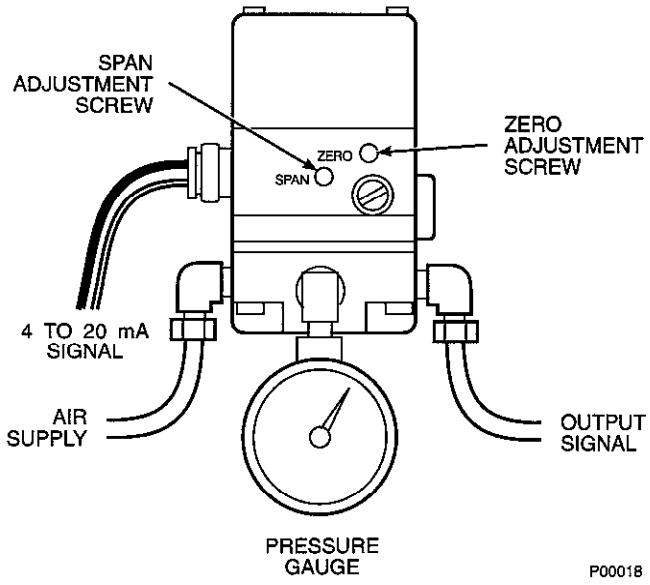


Figure 4-3. Current to Pneumatic Converter

NOTE

Make sure the input pressure rating of the power positioner is the same as the pressure rating stamped on the current to pneumatic signal converter.

b. Set signal value to 4 mA and adjust "Zero" screw until output pressure is at 3 psig. Turn screw counterclockwise to increase pressure, clockwise to decrease pressure. If output pressure does not change when screw is turned, turn screw counter-clockwise until pressure starts to rise.

c. Set signal value to 20 mA. Adjust "Span" screw until output pressure is at 15 psig.

d. Repeat steps b. and c. until no further adjustment is needed.

e. Replace protective caps.

4-4. LINKAGE CALIBRATION.

a. **Linear.** Check angular travel of power positioner drive lever at clevis. Compare this to device driven lever angular travel. If angular distances are not the same, use the following procedure to adjust offset of power positioner drive lever to the same angle as the device driven lever. When adjustment is complete, both operating levers must be parallel with each other.

1. Measure angle β_1 from vertical line extending from shaft hub, to power positioner drive lever (Figure 4-4). This is the power positioner drive lever offset.

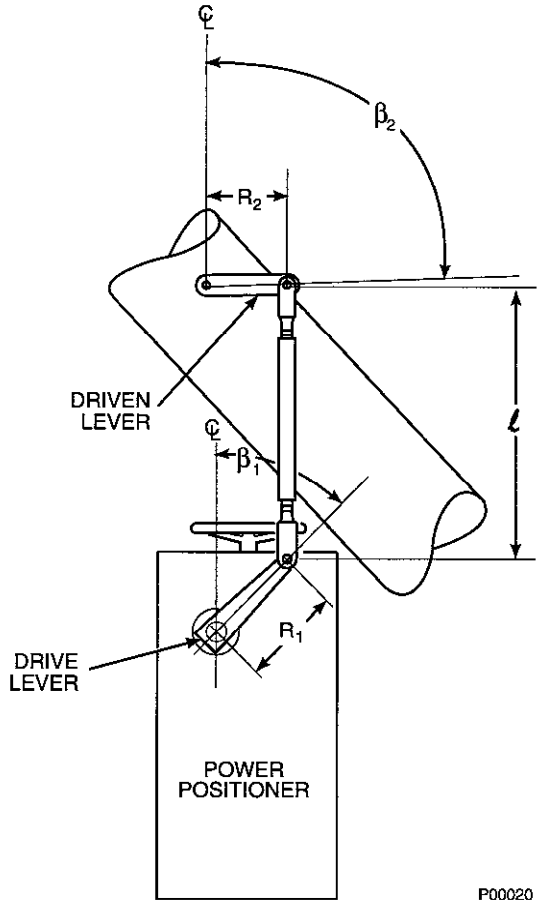


Figure 4-4. Linear Linkage Calibration

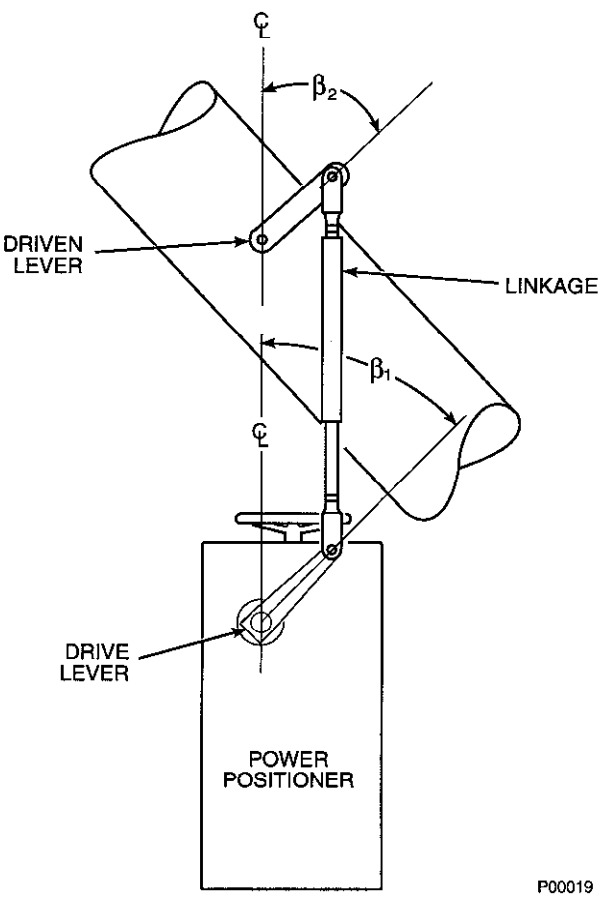


Figure 4-5. Characterized Linkage Calibration

2. Measure angle β_2 from vertical line extending from device lever hub, to driven lever of device being controlled. This is the driven lever offset.

3. Compare angle β_1 and angle β_2. Adjust length of linkage for minor adjustments by threading pipe in or out of clevis. Change drive lever angle β_1 for major adjustments by repositioning on shaft.

b. **Characterized.** Verify linkage design angles and length against actual installation. Use the following procedure and Figure 4-5, and adjust angles and lengths as necessary.

1. Measure angle β_1 from vertical line extending from shaft hub to power positioner drive lever. This is the power positioner drive lever offset.

2. Measure angle β_2 from vertical line extending from device lever hub to drivenlever of device being controlled. This is the driven lever offset.

3. Measure length between connecting levers. This distance is represented by the letter ℓ.

4. Measure length of power positioner drive lever (R_1) from shaft to center of clevis pin.

5. Measure length of device driven lever (R_2) from shaft center to center of clevis pin.

6. Compare angle β_1, β_2, distance ℓ, and length R_1 and R_2 with setup dimensions and angles recorded in Appendix A, Figure A-4. If setup dimensions and angles were not recorded, use formulas in Section II to calculate correct design for the positioning system and record in Appendix A, Figure A-4. Adjust length of linkage for minor adjustments by threading pipe in or out of clevis. Change drive lever angle β_1 for major adjustments.

SECTION V. TROUBLESHOOTING

5-1. OVERVIEW. Troubleshooting of common problems is provided for in troubleshooting chart (Table 5-1). The chart describes common problems, followed by the related probable cause, and finally by what action is necessary to correct the defect.

5-2. TROUBLESHOOTING CHART. Refer to Table 5-1.

Table 5-1. Troubleshooting Chart.

PROBLEM	CAUSE	CORRECTION
1. Erratic operation	Pilot valve sticking.	Clean or replace pilot valve. Refer to paragraph 6-4 for cleaning procedures and paragraph 7-2.a for replacement procedures.
	Linkage binding or loose.	Linkage pivot joints corroded, dirty, or worn. Clean and lubricate or replace parts.
2. No response from power positioner to a signal air pressure change	Manual lock engaged.	Disengage manual lock.
	Air supply shutoff valve closed.	Open air supply valve.
	Ruptured receiver diaphragm.	Replace diaphragm. Refer to paragraph 7-2.c.
3. Power positioner does not remain at setpoint; continues to cycle	Cylinder head gasket leak.	Replace leaking gasket. Refer to paragraph 7-2.e.
	Bypass valve air connection loose.	Tighten or replace air connection.
	Bypass valve leaking internally.	Replace bypass valve.
4. System over shoots or under shoots setpoint	I/P out of calibration.	Calibrate I/P. Refer to paragraph 4-3.
	I/P failure.	Replace I/P per paragraph 8-3.b.
	Piston stroke travel not properly set.	Calibrate stroke travel of piston. Refer to paragraph 4-2.
	Cam not shaped properly.	Replace cam. Refer to paragraph 7-2.g.
	Pin hole in diaphragm.	Replace diaphragm. Refer to paragraph 7-2.c.
5. Sluggish operation	Air filter/separator full of water, oil, or sediment.	Drain air filter/separator. Refer to paragraph 6-5.
	Air filter dirty.	Replace filter element. Refer to paragraph 7-2.b.
	Ambient temperature is lower than the power positioner is designed for.	Install power positioner heater.
6. Power positioner operates normally but flow that is being controlled remains unchanged	Device being controlled has a broken valve stem or connection to the linkage.	Repair or replace controlled device.
7. Power positioner locks up and won't operate with transfer valve in automatic mode	Hole in air lock diaphragm(s).	Replace air lock diaphragm(s).

SECTION VI. PERIODIC MAINTENANCE

6-1. **OVERVIEW.** This section describes preventive maintenance for the Rosemount Model PP814T Power Positioner. Preventive maintenance is necessary at specific intervals to reduce wear and tear on the power positioner.

WARNING

Before performing any maintenance or repair action on the power positioner, shut off supply air, signal air, and any electrical supply or electronic signals to the power positioner. Isolate power positioner from all connected systems. Severe injury or death may result from large torque power positioner is capable of producing, or from electrical shock.

6-2. **MAINTENANCE SCHEDULE.** Use the maintenance schedule, Table 6-1, as a guideline for preventive maintenance. The frequency of this maintenance varies directly with plant conditions and operational load on the power positioner. Extremely dusty conditions or high temperatures will require more frequent maintenance on the power positioner.

6-3. **GENERAL CLEANING AND LUBRICATION.** Clean power positioner exterior of all grease buildup with commercial dry cleaning solvent. To lubricate power positioner, refer to Figure 6-1, Lubrication Chart.

Table 6-1. Maintenance Schedule.

TIME INTERVAL (APPROXIMATE)	MAINTENANCE ACTION
6 months	Perform general cleaning and lubrication. Refer to paragraph 6-3.
6 months	Clean and inspect pilot valve. Refer to paragraph 6-4.
6 months	Clean and drain air filter. Refer to paragraph 6-5.
2 years	Clean and inspect diaphragm. Refer to paragraph 6-6.
2 years	Clean and inspect air lock diaphragm. Refer to paragraph 6-7.
2 years	Clean and inspect exhaust blocking valve. Refer to paragraph 6-8.
2 years	Lubricate, clean and inspect cylinder and piston assemblies. Refer to paragraph 6-9.
2 years	Lubricate, clean and inspect mechanical linkage. Refer to paragraph 6-10.

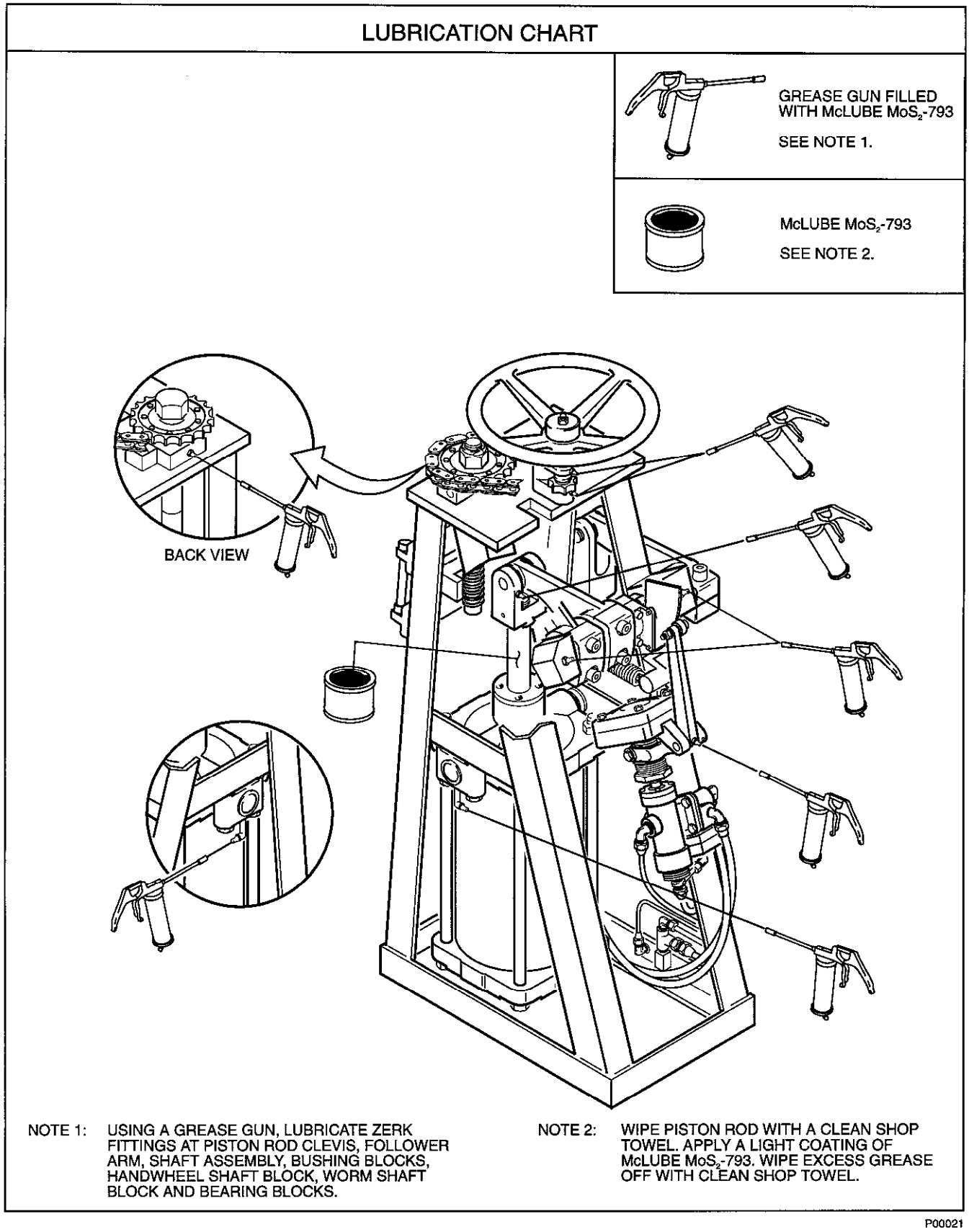
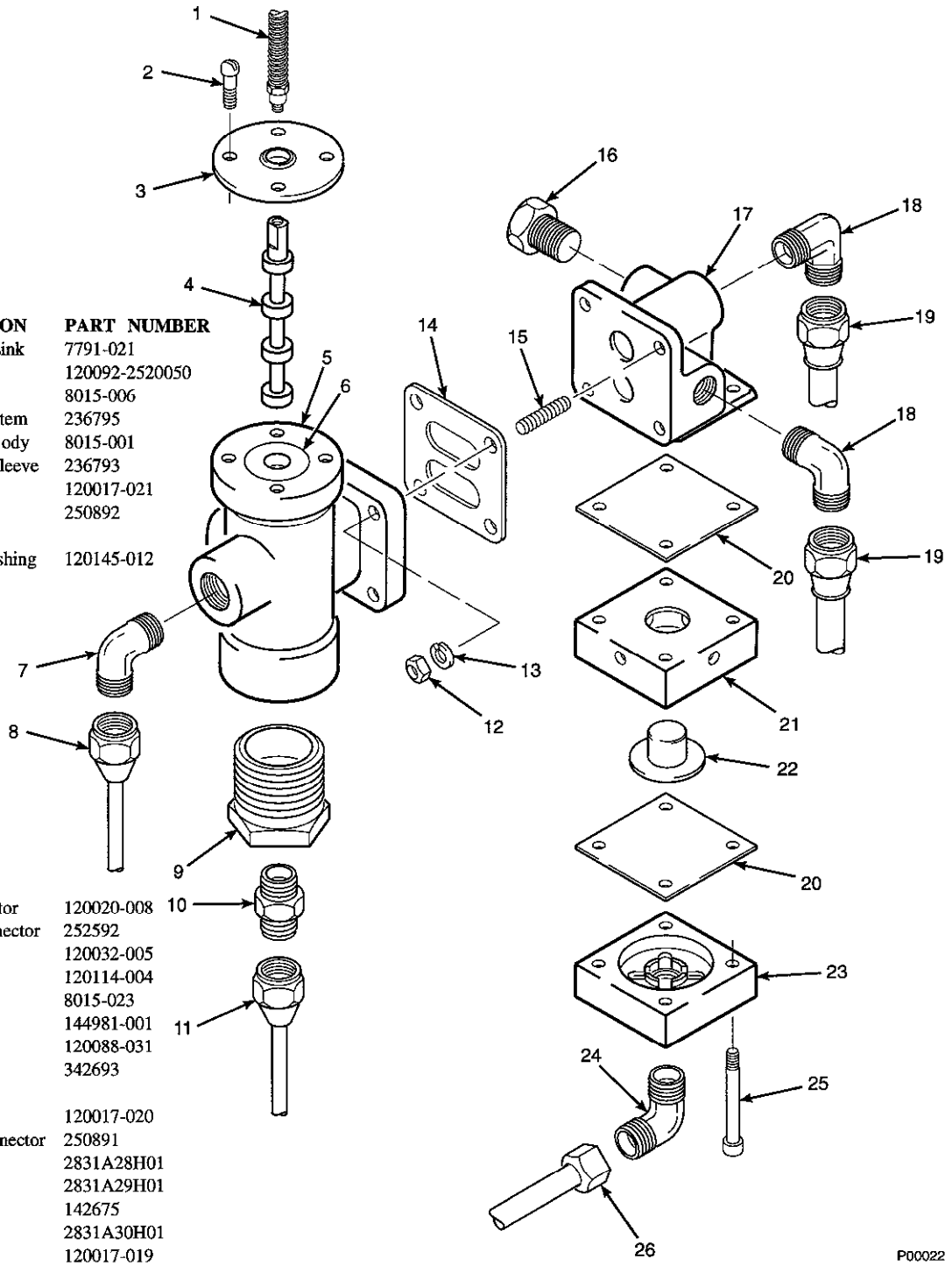


Figure 6-1. Lubrication Chart

6-4. PILOT VALVE CLEANING AND INSPECTION.

In normal service, the pilot valve assembly (Figure 6-2) requires cleaning and inspection at intervals of approximately six months, or upon any indication of sticking.



ITEM	DESCRIPTION	PART NUMBER
1	Connecting Link	7791-021
2	Screws	120092-2520050
3	Valve Cap	8015-006
4	Pilot Valve Stem	236795
5	Pilot Valve Body	8015-001
6	Pilot Valve Sleeve	236793
7	Elbow	120017-021
8	Air Supply Connector	250892
9	Reducing Bushing	120145-012
10	Tube Connector	120020-008
11	Exhaust Connector	252592
12	Nut	120032-005
13	Lock Washer	120114-004
14	Cork Gasket	8015-023
15	Stud	144981-001
16	Screw	120088-031
17	Pilot Valve Manifold	342693
18	Elbow	120017-020
19	Cylinder Connector	250891
20	Diaphragm	2831A28H01
21	Body	2831A29H01
22	Thrust Plate	142675
23	End Cover	2831A30H01
24	Elbow	120017-019
25	Screw	120103-1632175
26	Connector	252590

Figure 6-2. Pilot Valve Exploded View

WARNING

Before performing any maintenance or repair action on the power positioner, shut off supply air, signal air, and any electrical supply or electronic signals to the power positioner. Isolate power positioner from all connected systems. Severe injury or death may result from large torque power positioner is capable of producing, or from electrical shock.

a. Remove power positioner from service.

b. Carefully hold upper end of pilot valve stem (4, Figure 6-2) with a 5/16 inch open end wrench. Free connecting link (1) from pilot valve stem by turning connecting link lower ball socket nut counterclockwise.

c. Disconnect air supply tubing (8) from elbow (7). Disconnect exhaust connector (11) from tube connector (10).

d. Remove nuts (12) and lock washers (13) that secure pilot valve to threaded studs (15) on pilot valve manifold (17). Remove pilot valve and cork gasket (14) from pilot valve manifold.

CAUTION

Do not use an abrasive for cleaning the valve stem assembly or valve body. Abrasives even as fine as crocus cloth will cause scratches in the stem assembly and air leakage from pilot valve stem assembly.

e. Remove screws (2) and valve cap (3) from pilot valve.

f. Remove pilot valve stem (4) from pilot valve.

g. Remove reducing bushing (9) from pilot valve.

WARNING

Clean pilot valve in a well ventilated area. Avoid inhalation of solvent fumes and prolonged exposure of skin to cleaning solvent. Follow all instructions on the Material Safety Data Sheet (MSDS) of the solvent being used. Severe injury or death may result from improper usage.

h. Thoroughly clean pilot valve body (5), valve cap (3) and pilot valve stem (4) in commercial dry cleaning solvent. Allow pilot valve to completely air dry. Do not use abrasive of any kind on pilot valve stem. Thoroughly clean reducing bushing (9) in commercial dry cleaning solvent.

NOTE

Pilot valve stem and valve body sleeve are a matched set. If either is damaged or worn to a non-serviceable condition, entire pilot valve must be replaced.

i. Inspect pilot valve stem (4) and pilot valve sleeve (6) for scoring. If any signs of wear or damage are found, replace pilot valve.

j. Install pilot valve stem (4) into valve body.

k. Install reducing bushing (9) in pilot valve body.

l. Install valve cap (3) on valve body with screws (2).

m. Install assembled pilot valve with new cork gasket (14), securing with nuts (12) and lock washers (13).

n. Connect air supply connector (8) to elbow (7). Connect exhaust connector (11) to tube connector (10).

o. Carefully hold upper end of pilot valve stem (4). Attach connecting link (1) to pilot valve stem by turning connecting link lower ball socket nut clockwise.

p. Return power positioner to service.

6-5. AIR FILTER CLEANING AND DRAINING. In normal service, supply air filter and signal air filter/regulator require draining of water and debris at least every 6 months. The frequency of this maintenance will depend upon supply air quality. After installation, drain both filters by slowly opening filter and filter/regulator petcock valve. Initially drain monthly, gradually increasing time between draining. Schedule periodic draining when filters are approximately 1/4 full. Continue draining water and debris at this interval unless plant supply air conditions change. If element in air filter is dirty, refer to Section VII for replacement procedure.

6-6. DIAPHRAGM CLEANING AND INSPECTION. Disassemble, clean, and inspect diaphragm assembly approximately every two years or if power positioner is not reaching setpoint. Refer to Figure 6-3 and use the following procedure.

ITEM	DESCRIPTION	PART NUMBER
1	Screw	120088-033
2	Diaphragm Cover	242687
3	Diaphragm Housing	342731
4	Zero Balance Spring	175464-348
5	Diaphragm	9351-002

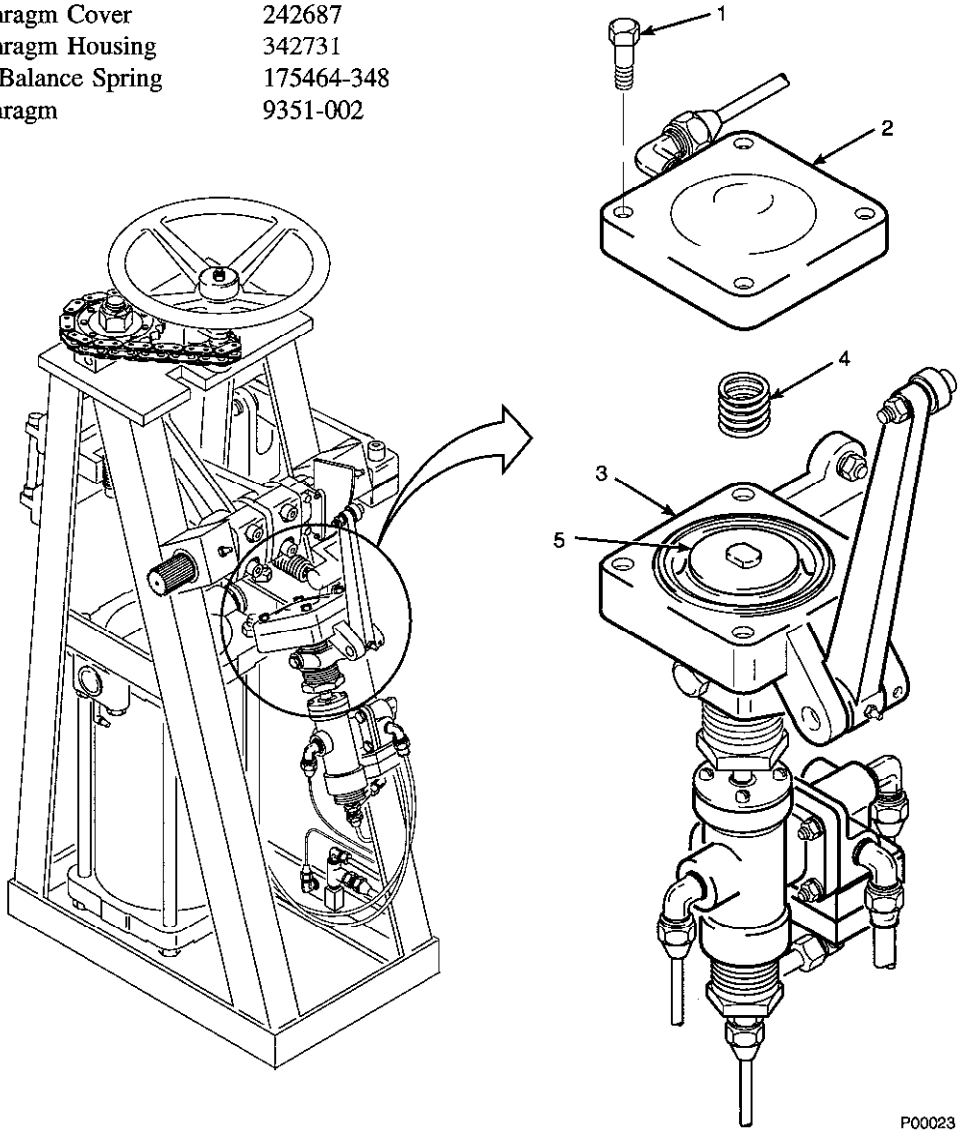


Figure 6-3. Diaphragm Exploded View

WARNING

Before performing any maintenance or repair action on the power positioner, shut off supply air, signal air, and any electrical supply or electronic signals to the power positioner. Isolate power positioner from all connected systems. Severe injury or death may result from large torque power positioner is capable of producing, or from electrical shock.

a. Remove power positioner from service.

b. Remove screws (1, Figure 6-3) securing diaphragm cover (2) to diaphragm housing (3). Remove diaphragm cover.

c. Remove zero balance spring (4) from top of diaphragm.

d. Using a clean, damp shop towel, thoroughly wipe off any dirt or debris on upper side of diaphragm (5). Allow diaphragm to air dry completely before reassembling.

e. Visually inspect diaphragm (5). Replace if nicks, cuts, or hardened rubber areas (from excess heat) are visible. Refer to Section VII for replacement procedures.

f. Clean diaphragm cover (2) and zero balance spring (4) with commercial dry cleaning solvent and allow to air dry.

g. Align the edges of diaphragm (5) with diaphragm housing (3) to make an air tight seal. Replace zero balance spring (4).

h. Making sure the diaphragm (5) is not folded or pinched, replace diaphragm cover (2) on top of diaphragm.

i. Secure diaphragm cover (2) with screws (1). Snug up all screws evenly then tighten in a criss cross pattern. Make sure all screws are tightened equally to prevent distortion of diaphragm.

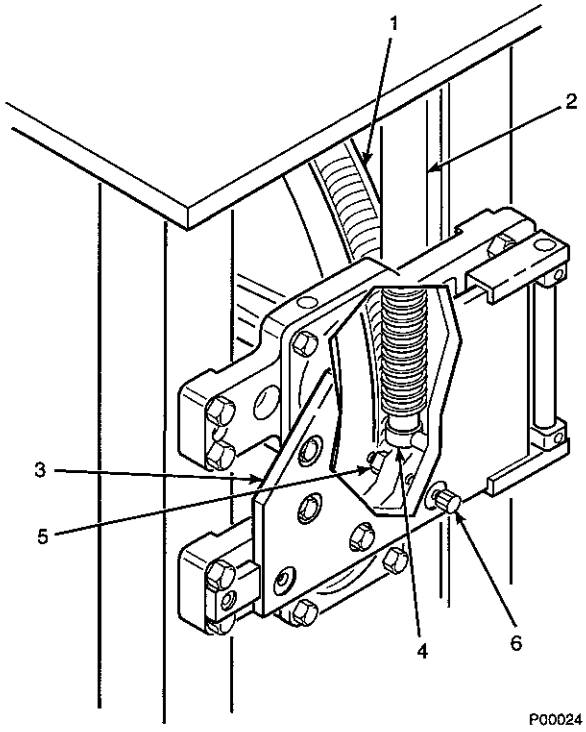
j. Test for air leakage around diaphragm cover (2) and diaphragm housing (3). Using a leak detector, such as "Snoop", apply an air signal to power positioner. If leak is detected, repair as necessary.

6-7. AIR LOCK ADJUSTMENT. Use the following procedure for adjustment of the air lock.

WARNING

Before performing any maintenance or repair action on the power positioner, shut off supply air, signal air, and any electrical supply or electronic signals to the power positioner. Isolate power positioner from all connected systems. Severe injury or death may result from large torque power positioner is capable of producing, or from electrical shock.

a. Remove power positioner from service. Reduce signal air to 0%. Move transfer valve to automatic position so clapper lever (3, Figure 6-4) opens. Prop clapper lever open.



ITEM	DESCRIPTION	PART NUMBER
1	Worm Gear Sector	341183
2	Worm Shaft	341156-001
3	Clapper Lever	357720
4	Shaft Bearing	141168-008
5	Lock Nut	120036-002
6	Stop Bolt	120090-052

Figure 6-4. Air Lock Diaphragm

b. Measure clearance between worm shaft (2) and worm gear sector (1). Clearance should be between 1/8 to 3/16 inch. If clearance is not in this range, loosen lock nut (5) and adjust stop bolt (6) until worm shaft to gear sector clearance is between 1/8 and 3/16 inch. Tighten lock nut.

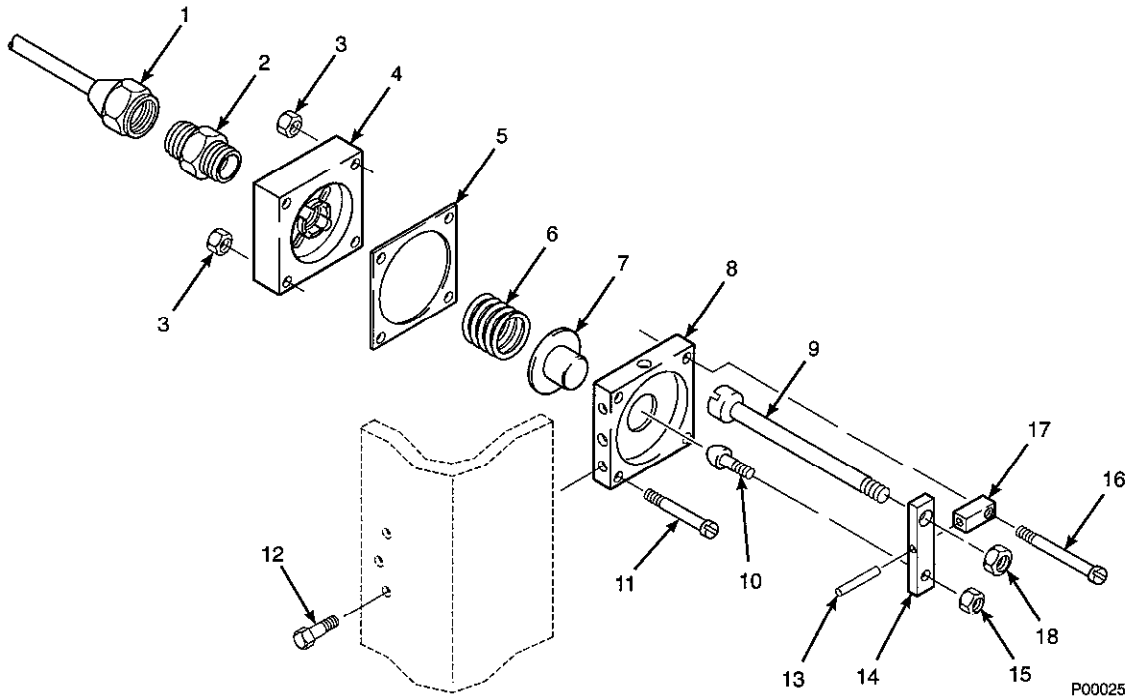
c. Remove prop from clapper lever (3). Move transfer valve to manual position and check to ensure worm shaft (2) engages gear sector (1).

d. Return power positioner to service.

6-8. EXHAUST BLOCKING VALVE CLEANING AND INSPECTION. Disassemble, clean and inspect exhaust blocking valve every two years, or upon indication of leakage.

a. Remove power positioner from service.

b. Release residual exhaust air pressure by pulling on exhaust valve link nut (18, Figure 6-5). Disconnect exhaust connector (1) from exhaust blocking valve assembly.



ITEM	DESCRIPTION	PART NUMBER	ITEM	DESCRIPTION	PART NUMBER
1	Exhaust Tubing	252592	10	Studscrew	142677
2	Adapter	120020-007	11	Screw	120093-090
3	Nut	120033-006	12	Screw	120088-004
4	End Cover	2831A30H01	13	Pin	141181-002
5	Gasket	142674	14	Valve Lever	141181-003
6	Spring	140914	15	Nut	120033-002
7	Thrust Plate	142675	16	Screw	120093-092
8	Exhaust Valve Body	2831A29H01	17	Fulcrum Block	142676
9	Link	141181-005	18	Link Nut	120033-002

Figure 6-5. Exhaust Blocking Valve

c. Remove link nut (18) from exhaust valve link (9) and remove exhaust valve link.

d. Remove screws (12) securing exhaust blocking valve assembly from frame and remove exhaust blocking valve assembly.

e. Remove four screws (11 and 16) and nuts (3) from exhaust blocking valve assembly. Remove end cover (4) from exhaust valve body (8).

f. Remove gasket (5) and discard. Remove thrust plate (7) and spring (6). Inspect contact surfaces of exhaust valve body (8) and thrust plate for pitting and wear. Replace as required.

g. Using a sharp putty knife, prepare gasket surfaces on end cover and exhaust valve body by removing any old gasket material or dirt.

h. Place new gasket (5) on end cover (4). Install spring (6) and thrust plate (7).

i. Assemble end cover (4) with exhaust valve body (8) and install screws (11 and 16) and nuts (3).

j. Mount exhaust blocking valve assembly in frame and install screws (12).

k. Install exhaust valve link (9) through diaphragm base and clapper lever. Replace link nut (18) on exhaust valve link only enough to keep it in place.

l. Reattach exhaust connector (1) to exhaust valve assembly.

m. Adjust exhaust valve link nut (18).

1. Move transfer valve to automatic position so clapper lever opens and prop clapper lever open.

CAUTION

Do not overtighten exhaust valve link nut. Exhaust valve link nut only needs to provide enough tension to open exhaust valve. Over tightening nut will damage exhaust valve and hinder performance of positioner.

2. Draw exhaust valve link nut (18) onto exhaust valve link (9) until it comes into contact with clapper lever.

3. Carefully move valve lever (14) toward frame to open exhaust valve. Holding valve lever in open position, gently tighten link nut (18) against clapper lever.

4. Remove prop from clapper lever.

n. Restore signal air pressure and return power positioner to service.

6-9. CYLINDER AND PISTON, CLEANING AND INSPECTION. Disassemble, clean and lubricate piston and cylinder assembly approximately every two years. Refer to Figure 6-6 and use the following procedure.

a. Remove power positioner from service.

b. Shut supply air valve and set signal air pressure to 0 psig. Set transfer valve on top of machine to manual.

c. Loosen cylinder upper hose and cylinder lower hose to bleed residual air from cylinder.

d. Remove cylinder upper hose from upper cylinder head and cylinder lower hose from lower cylinder head.

e. Remove cylinder clevis pin set screw (1) and cylinder clevis pin (3). Disconnect cylinder lever (2) from cylinder clevis (4).

f. Support cylinder assembly with 2 x 4 inch board long enough to provide leverage. This will prevent cylinder from falling to floor when cylinder support nuts (10) are removed from bearing block (12) and frame.

g. Remove nuts (10) and lock washers (11) from screws (13) securing bearing blocks (12) to frame assembly. Remove cylinder from frame assembly. Remove bearing blocks from cylinder head.

h. Remove nuts (7) from studs (18) securing upper cylinder head (9) to lower cylinder head (19). Full piston assembly and cylinder head out of cylinder assembly. Remove and discard upper cylinder gasket (14).

ITEM	DESCRIPTION	PART NUMBER
1	Set Screw	120083-021
2	Cylinder Lever	324357
3	Clevis Pin	146009
4	Clevis	242370
5	Screw	120093-023
6	Gland Cap	142367
7	Nut	120032-012
8	Rod Packing	2831A95G01
9	Upper Cylinder Head	242407
10	Nut	120032-012
11	Lock Washer	120114-008
12	Bearing Block	142645
13	Screw	120088-125
14	Gasket	141279
15	Piston Rod	242369
16	Piston	241282
17	Cylinder	242405
18	Cylinder Stud	243252
19	Lower Cylinder Head	342372

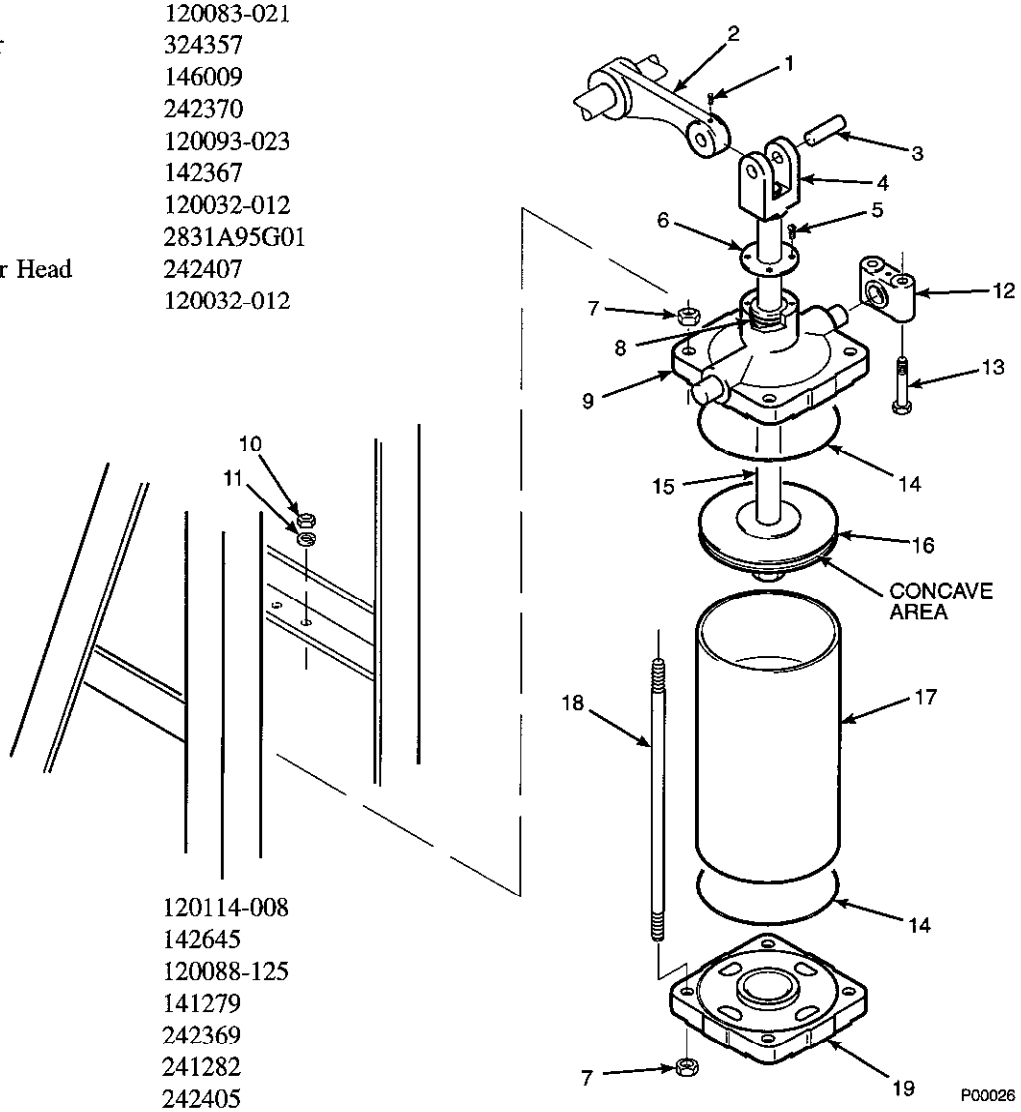


Figure 6-6. Cylinder Exploded View

i. Clean old grease off of piston assembly and piston rod. Wipe piston and piston rod with dry cleaning solvent. Replace piston if it appears damaged or worn. Inspect piston rod area where it passes through rod packing; replace if it appears pitted. Refer to Section VII for replacement procedures.

j. Remove screws (5) securing rod packing gland cap (6) and remove rod packing cover plate. Replace rod packing (8) if torn or causing air to leak. Refer to Section VII for replacement procedures.

k. Carefully wipe away old grease from rod packing (8). Pack area around rod packing with McLube MoS_2-793.

l. Place gland cap (6) onto upper cylinder head (9) and secure with screws (5).

m. Wipe piston rod (15) with a clean shop towel and apply a light coating of McLube MoS_2-793.

n. Pack concave area of piston with McLube MoS_2-793.

o. With a clean shop towel and commercial dry cleaning solvent, wipe interior surface of cylinder (17). Inspect cylinder for cracks or scoring. Replace cylinder if it appears damaged. Refer to Section VII for replacement procedures. Allow to air dry completely before reassembling cylinder.

p. Install upper cylinder head (9) and piston assembly into cylinder (17) with new cylinder gasket (14). Secure upper cylinder head to lower cylinder head (19) with cylinder studs (18) and nuts (7).

q. Place bearing blocks (12) on upper cylinder head (9). Place cylinder assembly in frame assembly onto 2 x 4 inch board for support. Secure bearing blocks to frame assembly with screws (13), lock washers (11) and nuts (10). Remove 2 x 4 inch board.

r. Insert end of cylinder lever (2) into slot of clevis (4).

s. Align holes in clevis (4) with hole in cylinder lever (2) and drive clevis pin (3) in securing clevis to cylinder lever. Secure clevis pin with set screw (1).

t. Open supply air valve and test for air leakage around cylinder head. Use a leak detector, such as "Snoop", and send an air signal to power positioner. If leak is detected, repair as necessary.

u. Using grease gun filled with MoS_2-793, lubricate clevis and bearing blocks.

v. Calibrate power positioner stroke; refer to Section IV. Return power positioner to service.

6-10. MECHANICAL LINKAGE SYSTEM CLEANING AND INSPECTION. Clean power positioner mechanical linkage of all grease buildup and inspect for damage and wear every two years. Refer to Figure 6-7 and use the following procedure.

a. Remove power positioner from service.

b. Shut off supply air valve.

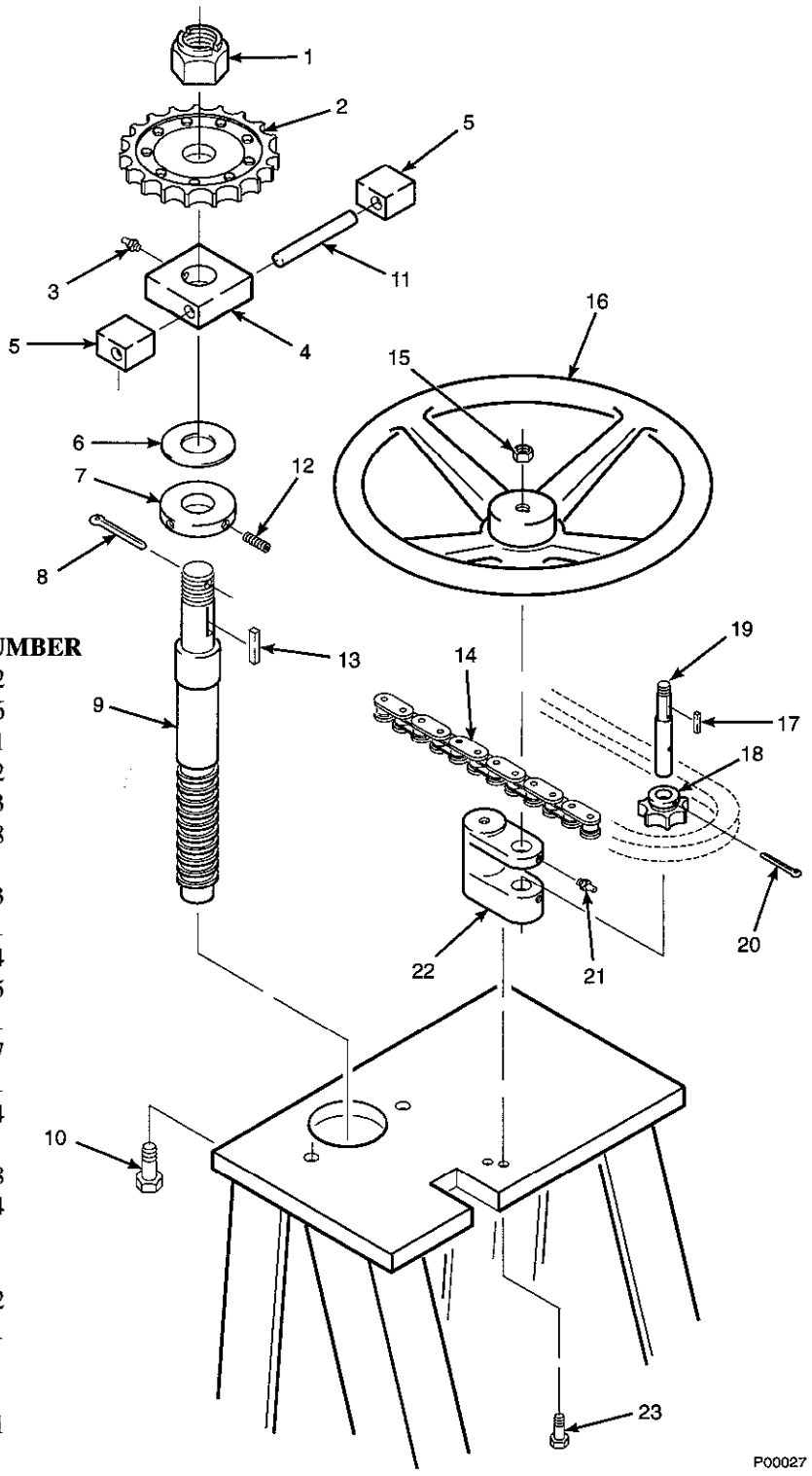
c. Clean all grease off of handwheel sprocket (18) and worm sprocket (2). Inspect sprockets for damage or missing teeth.

d. Wipe old grease from chain (14) and inspect chain for damaged links.

e. Ensure handwheel shaft block (22) and worm shaft blocks (5) are tight and secure.

f. Rotate handwheel (16) and inspect worm shaft (9) for damage.

g. Lubricate worm shaft block (4) and handwheel shaft block (22) with grease gun filled with MoS_2-793. Wipe chain (14) with MoS_2-793.



ITEM	DESCRIPTION	PART NUMBER
1	Nut	138006-002
2	Worm Sprocket	141156-006
3	Grease Fitting	139656-001
4	Block	141156-002
5	Worm Shaft Block	141156-003
6	Thrust Washer	141156-008
7	Collar	152371
8	Cotter Pin	120010-013
9	Worm Shaft	141156-001
10	Screw	120088-064
11	Pin	141156-005
12	Set Screw	120083-021
13	Key Bar	141156-007
14	Chain	141186-001
15	Nut	129074-004
16	Handwheel	343495
17	Key	141173-008
18	Handwheel Sprocket	141156-004
19	Sprocket Shaft	152292
20	Pin	120175-022
21	Grease Fitting	139656-001
22	Handwheel Shaft Block	142644
23	Screw	120090-021

Figure 6-7. Mechanical Linkage

SECTION VII. CORRECTIVE MAINTENANCE

7-1. OVERVIEW. This section describes corrective maintenance of the Rosemount PP814T Power Positioner. If specific cause of a problem is not known, refer to Section V, Troubleshooting. Spare parts referred to are available from Rosemount. Refer to Section VIII of this manual for part number and ordering information.

WARNING

Before performing any maintenance or repair action on the power positioner, shut off supply air, signal air, and any electrical supply or electronic signals to the power positioner. Isolate power positioner from all connected systems. Severe injury or death may result from large torque power positioner is capable of producing, or from electrical shock.

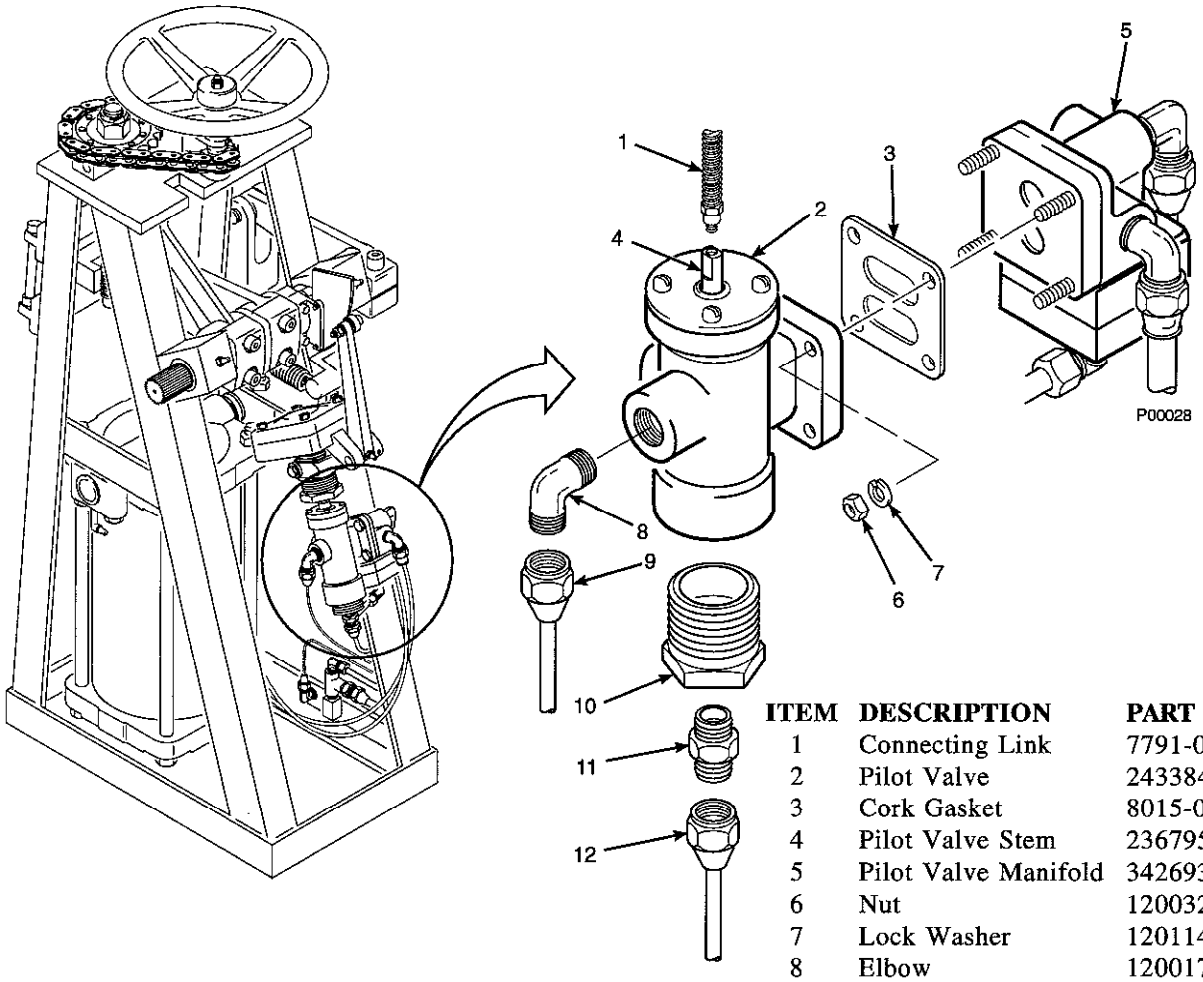
7-2. PARTS REPLACEMENT.

a. Pilot Valve. Use the following procedure to replace the pilot valve.

WARNING

Before performing any maintenance or repair action on the power positioner, shut off supply air, signal air, and any electrical supply or electronic signals to the power positioner. Isolate power positioner from all connected systems. Severe injury or death may result from large torque power positioner is capable of producing, or from electrical shock.

1. Remove power positioner from service.
2. Carefully hold upper end of pilot valve stem (4, Figure 7-1) with a 5/16 inch open end wrench. Free connecting link (1) from pilot valve stem by turning lower connecting link ball socket nut counterclockwise.
3. Tag and disconnect air supply connector (9) from elbow (8). Tag and disconnect exhaust connector (12) from connector (11).
4. Remove nuts (6) and lock washers (7) that secure pilot valve (2) to pilot valve manifold (5). Remove pilot valve body and cork gasket (3) from pilot valve manifold.
5. Using a sharp putty knife, prepare gasket surface of pilot valve manifold (5) and pilot valve (2) for new cork gasket by removing any old gasket material or dirt. Use a clean shop towel and solvent to clean gasket surfaces.
6. Install pilot valve with new cork gasket (3), securing with nuts (6) and lock washers (7).
7. Connect air supply connector (9) to elbow (8). Connect exhaust connector (12) to connector (11).
8. Carefully hold upper end of pilot valve stem (4). Attach connecting link (1) to pilot valve stem by turning lower connecting link ball socket nut clockwise.
9. Return power positioner to service.

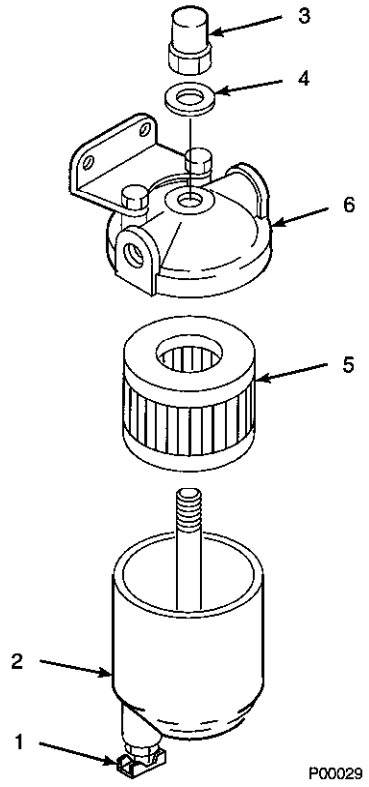


ITEM	DESCRIPTION	PART NUMBER
1	Connecting Link	7791-021
2	Pilot Valve	243384
3	Cork Gasket	8015-023
4	Pilot Valve Stem	236795
5	Pilot Valve Manifold	342693
6	Nut	120032-005
7	Lock Washer	120114-004
8	Elbow	120017-021
9	Air Supply Connector	250892
10	Reducing Bushing	120145-012
11	Connector	120020-008
12	Exhaust Connector	252592

Figure 7-1. Pilot Valve Replacement

b. **Air Filter.** Regularly inspect disposable filter elements as needed according to plant air supply quality. If filter element needs to be replaced, new elements are available from the factory. Use the following procedure to replace the filter element.

1. Remove power positioner from service.
2. Open air filter drain valve (1, Figure 7-2) and bleed any air pressure and moisture remaining in the system.
3. Remove air filter sump (2) by removing cap nut (3) and cap nut gasket (4) on top of air filter. Save cap nut gasket for installation.
4. Remove used filter element (5) by grasping and pulling it downward.
5. Install new filter element (5).
6. Install air filter sump (2) onto body. Secure sump with cap nut (3) and cap nut gasket (4).



ITEM	DESCRIPTION
1	Drain Valve
2	Sump
3	Cap Nut
4	Cap Nut Gasket
5	Filter Element
6	Filter Housing

Figure 7-2. Air Filter

7. Open supply air shutoff valve and check for leaks.

8. Return system to service.

c. **Diaphragm and Calibration Spring**. Use the following procedure for replacement of the receiver diaphragm and replacement of the calibration spring. If replacing the diaphragm only, skip steps 7 and 12. If replacing calibration spring only skip steps 8 through 11.

WARNING

Before performing any maintenance or repair action on the power positioner, shut off supply air, signal air, and any electrical supply or electronic signals to the power positioner. Isolate power positioner from all connected systems. Severe injury or death may result from large torque power positioner is capable of producing, or from electrical shock.

1. Remove power positioner from service.

2. Disconnect signal connector (3, Figure 7-3) from elbow (2) and remove elbow.

3. Remove bolts (1) securing diaphragm cover (4) to diaphragm housing (11).

4. Remove zero balance spring (5) from top of thrust plate (6).

5. Carefully hold upper end of pilot valve stem (17) with a 5/16 inch open end wrench. Free spring connecting link (10) from pilot valve stem by turning lower connecting link ball socket nut counterclockwise.

6. Remove thrust plate (6), diaphragm (7) and connecting link (10) from the diaphragm housing (11).

7. Remove calibration spring (14) through top of diaphragm housing (11).

8. Remove connecting link (10) from diaphragm (7) by turning upper ball socket nut counterclockwise.

9. Disassemble diaphragm assembly by removing nut (9) from thrust plate (6). Separate diaphragm (7), diaphragm seat (8) and thrust plate.

ITEM	DESCRIPTION	PART NUMBER
1	Bolt	120088-033
2	Elbow	120017-003
3	Signal Connector	250893
4	Diaphragm Cover	242687
5	Zero Balance Spring	175464-348
6	Thrust Plate	142680
7	Diaphragm	9351-002
8	Diaphragm Seat	142729
9	Nut	120036-003
10	Connecting Link	7791-021
11	Diaphragm Housing	342731
12	Set Screw	120121-1924025
13	Trunnion Ring	5015-007
14	Calibration Spring	142733
15	Spring Washer	141161-006
16	Spring Nut Cup	142720
17	Pilot Valve Stem	236795
18	Grease	139656-001
19	Trunnion Screw	5015-015
20	Follower Arm	342686
21	Nut	129074-005
22	Bearing	142033
23	Screw	120090-016
24	Shaft	142705
25	Set Screw	120083-013
26	Screw	120088-056
27	Lock Washer	120114-007
28	Nut	120032-010

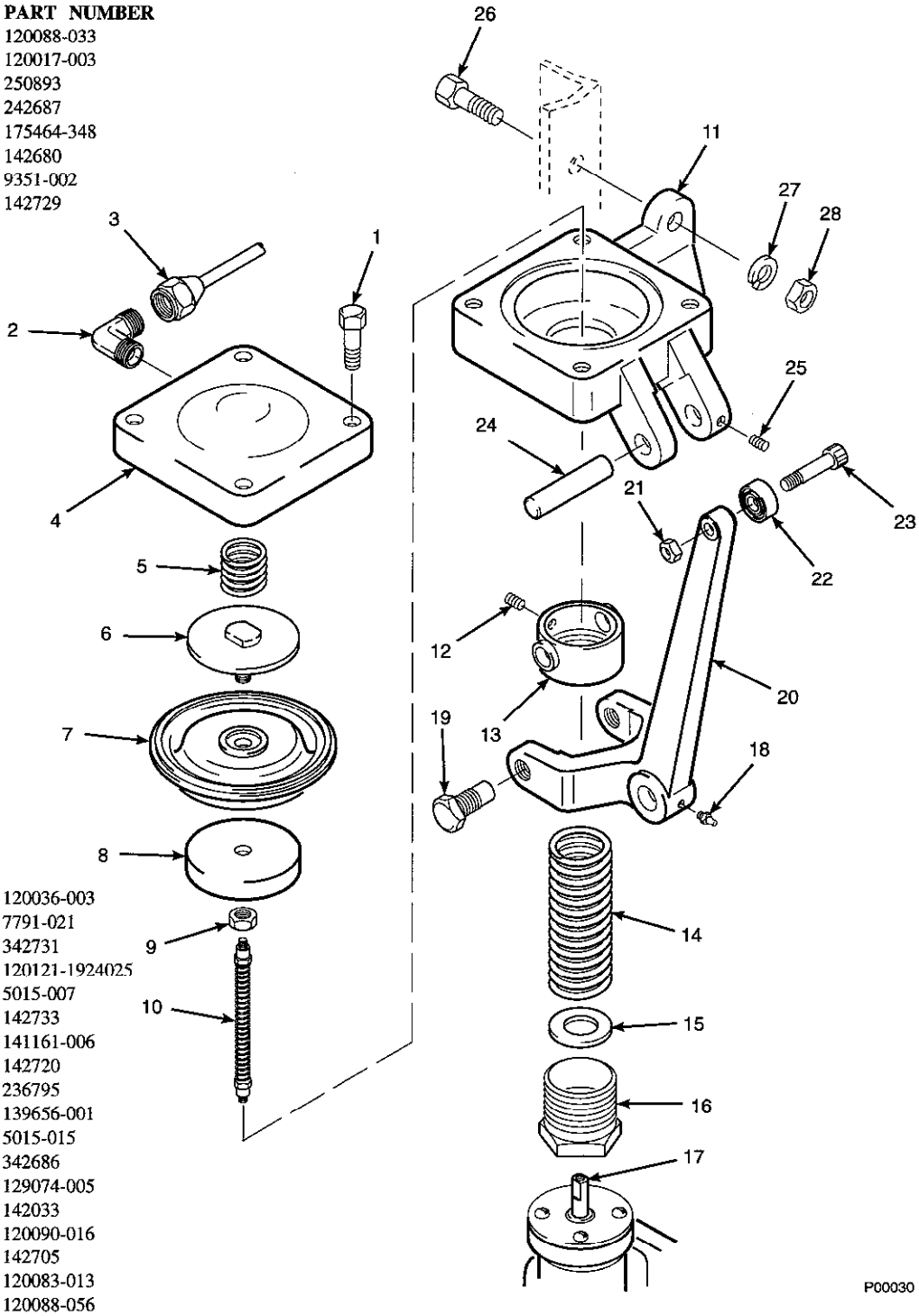


Figure 7-3. Receiver Exploded View

10. Assemble new diaphragm (7) with diaphragm seat (8) and thrust plate (6). Secure in place with nut (9).

11. Screw connecting link (10) upper ball socket nut into thrust plate (6) stud.

12. Ensure spring washer (15) is in bottom of spring nut cup (16) and install new calibration spring (14).

13. Place diaphragm assembly and connecting link in diaphragm housing so connecting link (10) is aligned with pilot valve stem (17).

14. Align the edges of diaphragm (7) with the diaphragm housing (11) to make an air tight seal.

15. Place zero balance spring (5) over thrust plate (6).

16. Making sure the diaphragm (7) is not folded or pinched, replace diaphragm cover (4) and align sealing edge of diaphragm cover on top edge of diaphragm.

17. Secure diaphragm cover (4) with bolts (1). Tighten all bolts hand tight. Tighten bolts down making sure that all are tightened evenly.

18. Connect connecting link (10) to pilot valve stem (17) with lower link ball socket nut.

19. Reinstall elbow (2) and signal connector (3).

20. Test for air leakage around diaphragm cover (4) and diaphragm housing (11). Use a leak detector such as "Snoop", and send an air signal to power positioner. If leak is detected, repair as necessary.

21. Refer to Section IV and calibrate power positioner.

22. Return power positioner to service.

d. <u>Air Lock Diaphragm.</u> Use the following procedure for replacement of the air lock diaphragm.

1. Remove power positioner from service.

2. Disconnect connector (18, Figure 7-4) from tee (20).

3. Loosen nut (2) and remove screw (4) and washer (3) from spring nut (1).

4. Hold exhaust blocking valve link (9, Figure 6-5) with a screwdriver and remove nut (38, Figure 7-4). Remove exhaust valve link.

5. Remove air lock stop bolt (43), washer (42) and nut (25).

6. Remove screw (24) securing shaft bearing (23) to bottom end of worm shaft (48).

7. Remove screws (41) securing clapper lever (40) from couplings (32).

8. Swing clapper lever (40) out of the way.

9. Remove screws (34) securing diaphragm plate (33) to diaphragm chamber (22) and remove diaphragm plate.

10. Pulling on coupling (32), remove diaphragm assembly from diaphragm chamber (22).

11. Remove coupling (32) from diaphragm stud (29). Separate diaphragm stud, diaphragm (30) and shield (31).

12. Assemble new diaphragm (30) with stud (29) and shield (31). Secure together with coupling (32).

13. Place diaphragm assembly in diaphragm chamber (22) and install diaphragm plate (33).

14. Swing clapper lever (40) over diaphragm and install screws (41) into couplings (32).

15. Attach shaft bearing (23) to worm shaft (48) with screw (24).

16. Install air lock stop bolt (43), washer (42) and nut (25).

17. Install exhaust blocking valve link through frame and clapper lever. Install nut (38) on exhaust blocking valve link.

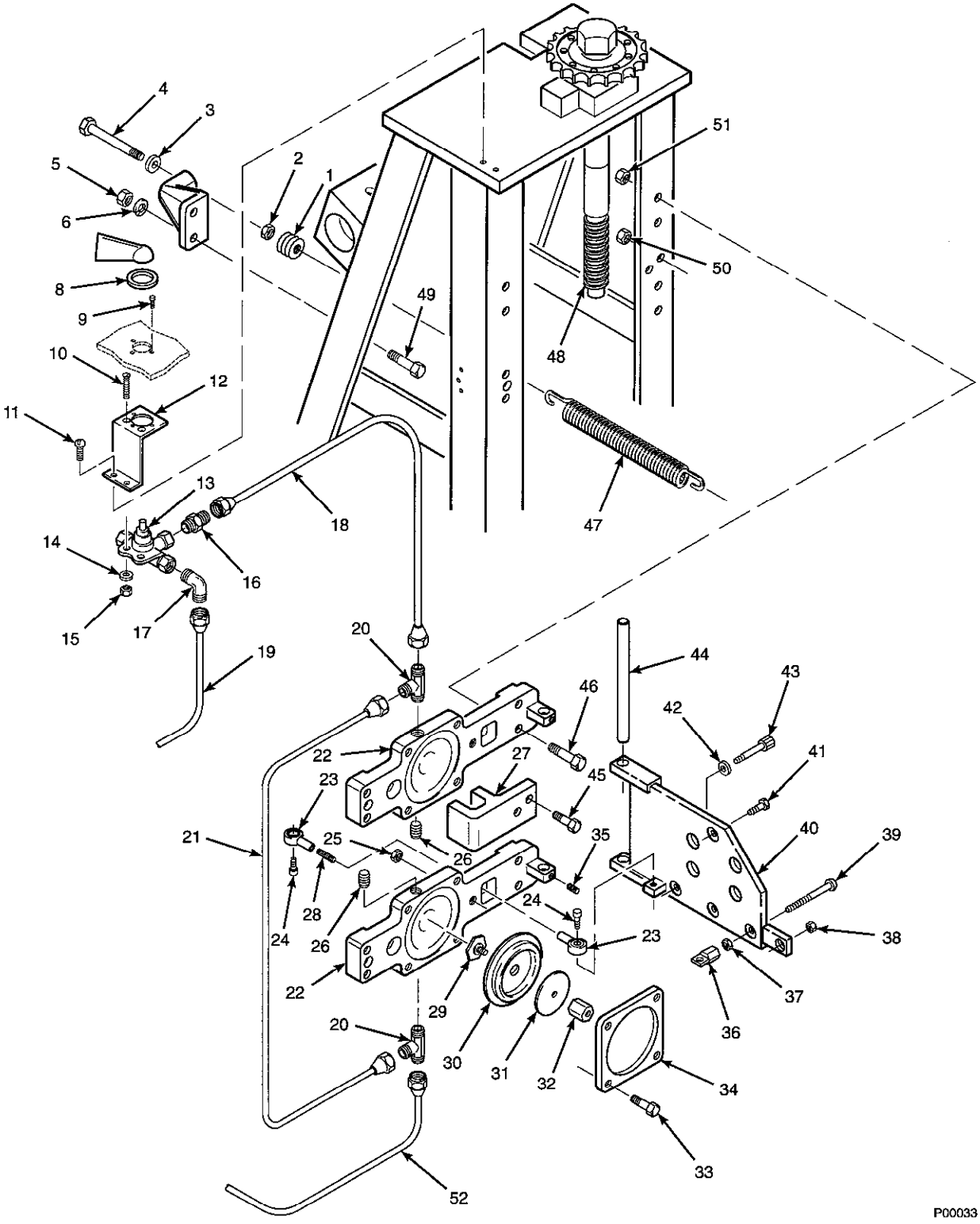


Figure 7-4. Air Lock Diaphragm

LEGEND FOR FIGURE 7-4

ITEM	DESCRIPTION	PART NUMBER
1	Spring Nut	140903
2	Nut	120036-003
3	Washer	120197-003
4	Screw	174306
5	Nut	120032-010
6	Washer	120114-007
7	Spring Bracket	242647
8	Seal	141173-010
9	Screw	120093-058
10	Screw	120094-012
11	Screw	120088-003
12	Valve Bracket	141176-003
13	Transfer Valve	141187
14	Washer	120110-006
15	Nut	120032-005
16	Adapter	120020-007
17	Elbow	120117-003
18	Connector	125368-009
19	Supply Air Connector	252588
20	Tee	120019-015
21	Connector	125368-007
22	Diaphragm Chamber	342376
23	Bearing	141168-008
24	Screw	120090-079
25	Nut	120036-002
26	Plug	120042-002
27	Worm Guide	142646
28	Stud	141168-006
29	Stud	141168-005
30	Diaphragm	9351-003
31	Shield	141168-004
32	Coupling	141168-003
33	Diaphragm Plate	242406
34	Screw	120088-031
35	Set Screw	120083-014
36	Spring Connector	140904
37	Nut	120036-002
38	Nut	120033-002
39	Screw	140905
40	Clapper Lever	357720
41	Screw	120088-084
42	Washer	1200197-010
43	Stop Bolt	120090-052
44	Pivot Pin	157704
45	Screw	120088-034
46	Screw	120088-036
47	Spring	140895
48	Worm Shaft	341156-001
49	Screw	120088-056
50	Nut	120032-008
51	Nut	120032-008
52	Connector	252592

18. Connect air lock spring nut (1) with screw (4) and washer (3). Tighten nut (2) against spring nut.

19. Connect connector (18) to tee (20).

20. Adjust air lock spring tension.

    (a) Apply supply air pressure of 30 psi to positioner.

    (b) Move transfer valve to manual position.

    (c) Loosen nut (2, Figure 7-4) by turning counterclockwise and tighten screw (4) until clapper lever is held closed by spring (47). Tighten nut (2).

    (d) Move transfer valve to automatic position. If clapper lever does not open, loosen nut (2) and decrease spring tension with screw (4) until clapper lever is fully open. Tighten nut (2) against spring nut (1).

21. Return power positioner to service.

e. Cylinder Head Gaskets, Piston and Rod Packing. Use the following procedures to replace upper and lower cylinder head gaskets, cylinder piston cup and rod packing. If not replacing piston and rod packing, skip steps 10 through 16. If replacing piston, complete entire procedure.

WARNING

Before performing any maintenance or repair action on the power positioner, shut off supply air, signal air, and any electrical supply or electronic signals to the power positioner. Isolate power positioner from all connected systems. Severe injury or death may result from large torque power positioner is capable or producing, or from electrical shock.

1. Remove power positioner from service.

2. Shut off supply air valve and set signal air pressure to 0 psig.

WARNING

Residual air must be bled off of piston cylinder before removal of cylinder head. If air is not bled off, pressurized air could cause debris and metal particles to be blown about, resulting in possibility of eye injury.

3. Bleed residual air from cylinder by loosening upper and lower cylinder head air connections.

4. Disconnect cylinder upper hose from upper cylinder head and cylinder lower hose from lower cylinder head.

5. Remove set screw (1, Figure 7-5) securing cylinder lever to clevis pin.

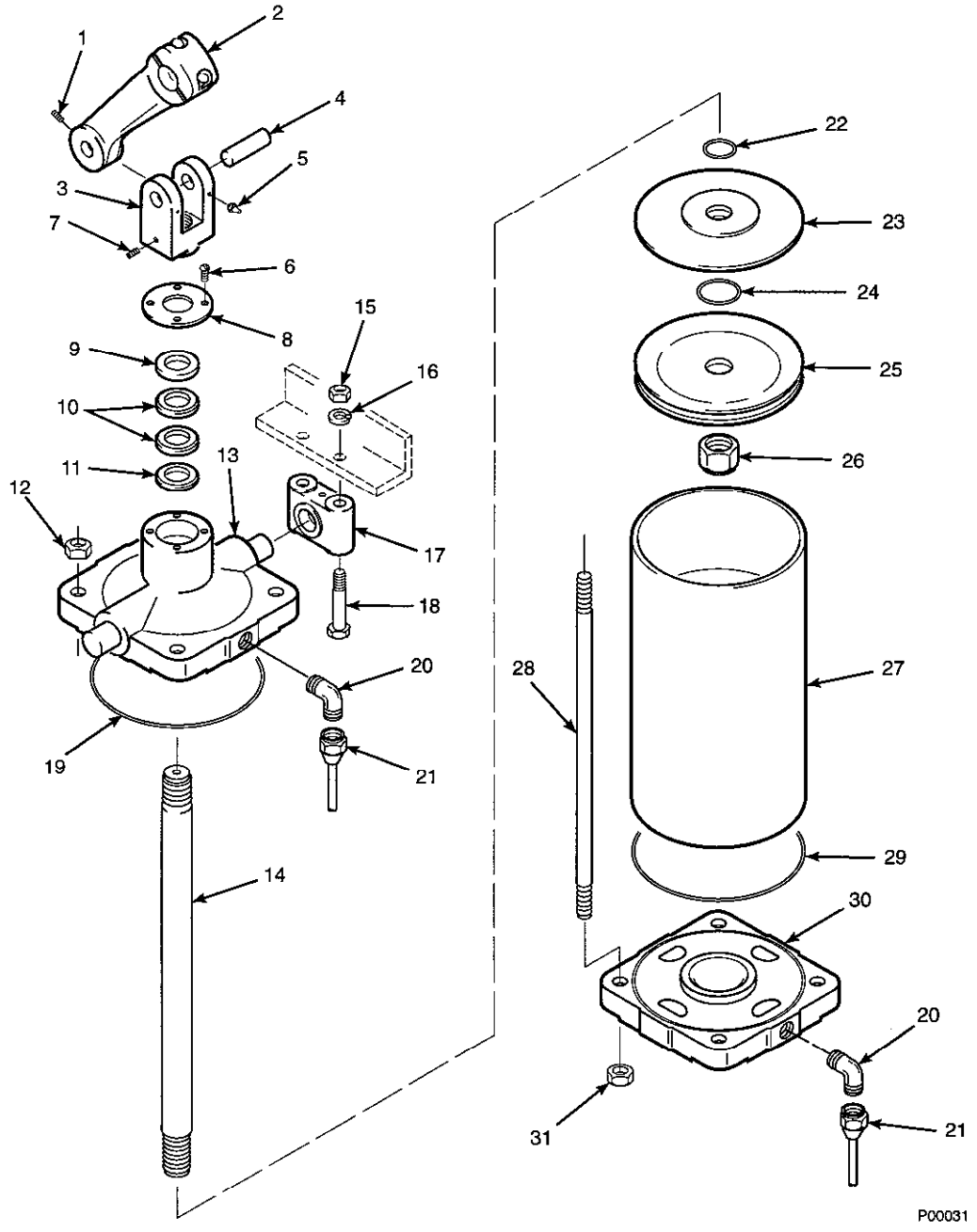


Figure 7-5. Cylinder Exploded View

LEGEND FOR FIGURE 7-5

ITEM	DESCRIPTION	PART NUMBER
1	Set Screw	120083-021
2	Cylinder Lever	342375
3	Clevis	242370
4	Clevis Pin	146009
5	Grease Fitting	139656-001
6	Gland Cap Screws	120093-023
7	Set Screw	120083-022
8	Gland Cap	142367
9	Rod Packing Female Adapter	2831A92H01
10	V-Ring Packing	2831A94H01
11	Rod Packing Male Adapter	2831A93H01
12	Nut	120032-012
13	Upper Cylinder Head	242407
14	Piston Rod	242369
15	Nut	120032-012
16	Washer	120114-008
17	Bearing Block	142645
18	Screws	120088-125
19	Gasket	141279
20	Elbow	120017-020
21	Cylinder Connector	250891
22	Upper Piston O-Ring	120039-016
23	Piston Follower	342371
24	Lower Piston O-Ring	120039-032
25	Piston	241282
26	Stop Nut	129074-006
27	Cylinder	242405
28	Cylinder Stud	243252
29	Gasket	141279
30	Lower Cylinder Head	342372
31	Nut	120032-012

6. Remove cylinder clevis pin (4) and move cylinder lever (2) out of the way.

WARNING

Before removing cylinder bearing block nuts, make sure full weight of cylinder is supported on 2 x 4's. If not supported loose cylinder may fall over and cause personal injury.

7. Support cylinder assembly with 2 x 4 inch board long enough to provide leverage. This will prevent it from falling to floor when cylinder bearing block nuts are removed.

8. Remove nuts (15) and washers (16) from screws (18) securing cylinder bearing blocks (17) to frame assembly. Remove cylinder from frame assembly. Remove cylinder bearing blocks from upper cylinder head (13).

9. Remove nuts (12) from cylinder studs (28) securing upper cylinder head (13) to lower cylinder head (30). Pulling on cylinder clevis (3), pull piston assembly and upper cylinder head out of cylinder (27). Remove and discard upper cylinder head gasket (19). Remove lower cylinder head (30) and discard lower cylinder head gasket (29).

10. Remove gland cap screws (6) securing gland cap (8) and move gland cap up piston rod. Remove and discard old rod packings (9, 10 and 11).

11. Remove stop nut (26) securing piston assembly to piston rod (14). Remove piston assembly from piston rod.

12. Wipe piston rod (14) and inside of cylinder (27) with clean shop cloth and spray with a light coat of dry film lubricant (molybdenum disulfide spray lubricant).

CAUTION

Do not allow piston rod threads to damage rod packing. Rod packing leakage may occur.

13. Place gland cap (8) over piston rod so top of gland cap faces clevis (3). Pack new rod packing female adapter (9), V-ring packing (10) and rod packing male adapter (11) with MoS_2-793 and carefully place over piston rod in order shown in Figure 7-5.

14. Insert piston rod (14) into upper cylinder head (13) from top of cylinder head.

15. Carefully press new rod packing components (9, 10 and 11) into opening in upper cylinder head (13). Secure gland cap (8) to cylinder head with gland cap screws (6).

16. Insert new upper piston O-ring (22) into piston follower (23). Screw piston follower on piston rod (14). Insert new lower piston o-ring (24) into bottom side of piston follower. Place new piston (25) on piston rod with machined side of piston toward piston follower. Secure piston assembly to piston rod with stop nut (26). Pack concave area of piston seal with McLube MoS_2-793.

17. Using a putty knife, prepare gasket surfaces of cylinder (27) and cylinder heads (13 and 30) for new gaskets by removing any old gasket material or dirt. Wipe with a clean shop towel.

18. Place new upper cylinder head gasket (19) on upper cylinder head (13). Place new lower cylinder head gasket (29) on lower cylinder head (30).

19. Install upper cylinder head (13) and piston assembly onto cylinder (27). Install lower cylinder head (30) on cylinder.

20. Secure upper cylinder head (13) to lower cylinder head (30) with cylinder studs (28) and nuts (12).

21. Place cylinder bearing blocks (17) onto upper cylinder head (13). Place cylinder assembly in frame assembly and secure cylinder bearing blocks to frame assembly with screws (18), washers (16) and nuts (15).

22. Insert end of cylinder lever (2) into slot of clevis (3).

23. Align holes in clevis (3) with hole in cylinder lever (2). Drive clevis pin (4) in securing clevis to cylinder lever. Tighten cylinder lever set screw (1).

24. Open supply air valve and test for air leakage around cylinder head. Use a leak detector, such as "Snoop", and send an air signal to power positioner. If leak is detected, repair as necessary.

25. Calibrate power positioner stroke; refer to Section IV. Return power positioner to service.

f. **Cylinder Replacement.** To replace the assembled cylinder with a new cylinder follow the procedures outlined in paragraph 7-2.e, Cylinder Head Gaskets, Piston and Rod Packing. Steps 1 through 9 cover cylinder removal, and steps 17 through 25 provide installation procedures.

g. **Cam.** Use the following procedure to replace cam.

WARNING

Before performing any maintenance or repair action on the power positioner, shut off supply air, signal air, and any electrical supply or electronic signals to the power positioner. Isolate power positioner from all connected systems. Severe injury or death may result from large torque power positioner is capable of producing, or from electrical shock.

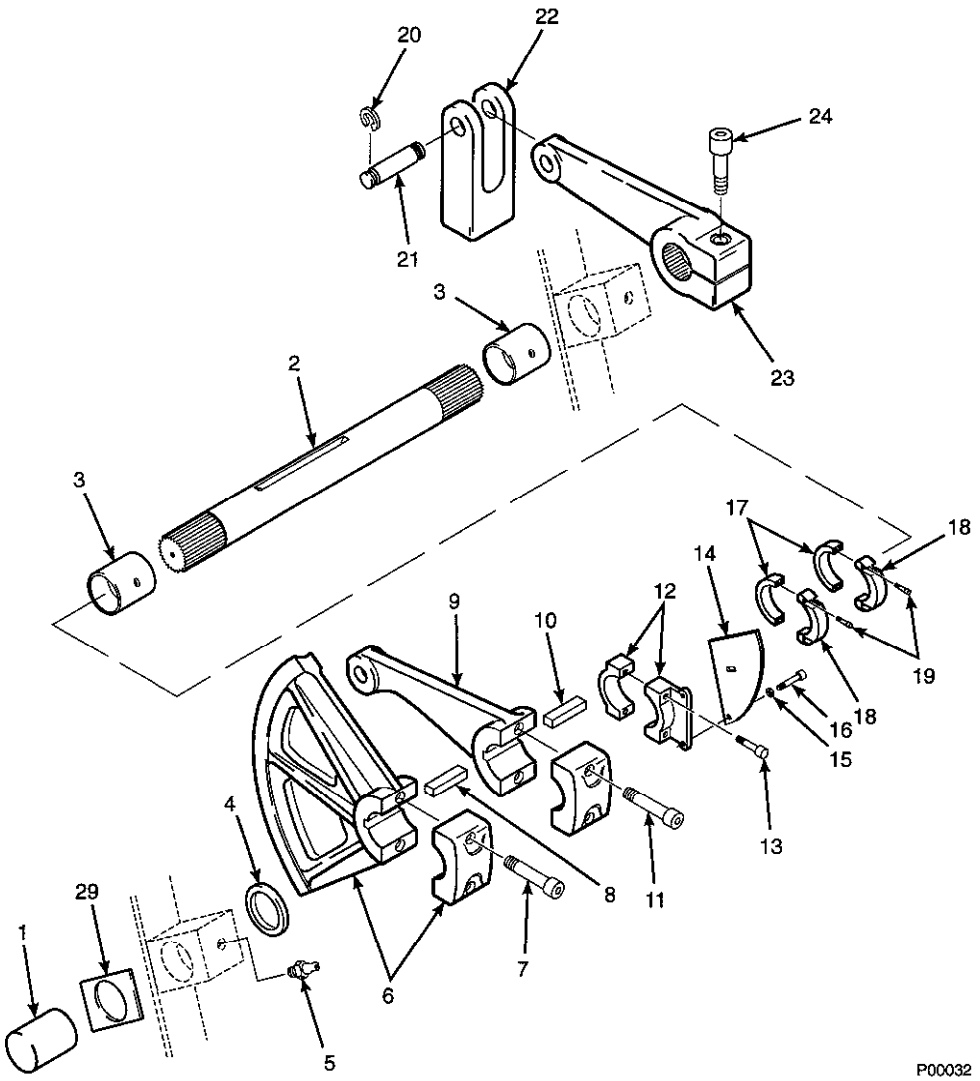
1. Remove power positioner from service.

2. Remove screws (16, Figure 7-6), washers (15) and cam (14) from cam mounting bracket (12).

3. Place new cam (14) against cam mounting bracket (12). Secure in place with screws (16) and washers (15).

4. Refer to Section IV and calibrate power positioner.

5. Return power positioner to service.



ITEM	DESCRIPTION	PART NUMBER	ITEM	DESCRIPTION	PART NUMBER
1	Tube Sleeve	141193	16	Screw	120090-011
2	Shaft	441157	17	Cam Shoe	6292A89H02
3	Shaft Bushing	177488	18	Cam Cap	6292A88H01
4	Spacer	2829A77H03	19	Screw	120090-1638075
5	Grease Fitting	139656-001	20	Retaining Ring	120079-012
6	Sector Gear	341183	21	Clevis Pin	174358-004
7	Screw	140905	22	Clevis	243914
8	Key	141201-006	23	Linkage Lever	342648
9	Cylinder Lever	342375	24	Screw	120090-101
10	Key	141201-006	25	Screw	120088-033
11	Screw	120090-101	26	Spring Screw	174306
12	Bracket	242730	27	Washer	120197-008
13	Screw	120090-016	28	Spring Bracket	242647
14	Cam	342736	29	Felt Gasket	141173-006
15	Washer	120197-008			

Figure 7-6. Shaft Exploded View

h. **Shaft Bushings.** Use the following procedure to replace shaft bushings.

WARNING

Before performing any maintenance or repair action on the power positioner, shut off supply air, signal air, and any electrical supply or electronic signals to the power positioner. Isolate power positioner from all connected systems. Severe injury or death may result from large torque power positioner is capable of producing, or from electrical shock.

1. Remove power positioner from service. Set signal air to zero.

2. Move transfer valve to automatic position and prop air lock clapper lever open.

3. Remove screws (7, Figure 7-6) securing sector gear (6) and remove sector and key (8) from shaft (2).

4. Remove screws (11) securing cylinder lever (9) and remove cylinder lever and key (10) from shaft.

5. Remove screw (24) securing linkage lever (23) and remove linkage lever from shaft.

6. Remove screws (13) securing cam mounting bracket (12) and remove cam mounting bracket from shaft.

7. Remove screws (19) securing limit switch cam shoes (17) from cam caps (18) and remove cams from shaft.

8. Pulling one end of shaft (2), remove shaft from bushing blocks and remove spacer (4).

9. Remove grease fitting (5) from bushing block.

10. Break Loctite seal by pounding on shaft bushing (3). Remove shaft bushing from bushing block.

WARNING

Use caution and appropriate safety equipment when applying Loctite. Make sure all specific instructions on Material Safety Data Sheet (MSDS) are followed. Failure to do so may cause severe eye injury.

CAUTION

Care must be used when applying Loctite primer or adhesive to bushings to make sure it is applied only to the outer surface. Bushing life may be reduced.

NOTE

Bushings are secured to stand assembly with a coating of Loctite applied to the outside of bushings. Insertion of new bushings and complete installation of shaft assembly must be completed before Loctite sets. This is needed to line up bushings properly. The Loctite will set in approximately 3 minutes. Complete installation of shaft assembly within 15 minutes from when adhesive was applied.

11. Apply Loctite primer (11NA7901A30), to outside surface of shaft bushing (3) and allow primer to set for three to five minutes.

12. After primer has set 3 to 5 minutes, apply Loctite adhesive #680 and slide shaft bushing (3) in bushing block within three minutes.

13. Insert shaft (2) through both bushing blocks to align bushings.

14. Allow Loctite to set for 15 minutes. Remove shaft (2) and drill 5/16 inch hole into new shaft bushing (3) through bushing block.

15. Insert shaft (2) through both bushing blocks and spacer (4) as shown in Figure 7-6.

16. Install limit switch cam shoes (17) and cam caps (18) on shaft (2) with screws (19).

17. Position cam mounting bracket (12) on shaft so mark at tip of cam aligns with center of follower arm roller bearing. Tighten cam mounting bracket screws (13).

18. Install linkage lever (23) with screw (24).

19. Install cylinder lever (9) with key (10) and screws (11).

20. Install sector gear (6) with key (8) and screws (7). Remove prop from clapper lever.

21. Refer to Section VI and lubricate power positioner shaft bushings.

22. Refer to Section IV and calibrate power positioner.

23. Return power positioner to service.

i. Transfer Valve. Use the following procedure to replace the transfer valve.

1. Remove power positioner from service.

2. Close supply air shutoff valve.

3. Remove transfer valve knob from transfer valve.

4. Remove screws (9, Figure 7-4) and dust cover.

5. Remove supply air connector (19) from elbow (17). Remove elbow from transfer valve (13).

6. Remove connector (18) from adapter (16). Remove adapter from transfer valve (13).

7. Remove screws (10) securing transfer valve (13) from valve bracket (12) and remove valve.

8. Install adapter (16) and elbow (17) in new transfer valve. Install new valve on valve bracket with screws (10).

9. Connect air supply connector (19) to elbow (17). Connect connector (18) to adapter (16).

10. Open air supply shutoff valve and test for leakage around transfer valve with a leak detector such as "Snoop".

11. Reinstall top cover and screws (9). Install transfer valve knob.

12. Return power positioner to service.

ITEM	DESCRIPTION	PART NUMBER
1	I/P Inlet Piping	
2	I/P Outlet Piping	
3	Screws	
4	Signal Leads	
5	Screws	
6	Regulator Inlet Piping	
7	Regulator Outlet Piping	
8	Mounting Bracket	
9	I/P Converter	9885A31H01
10	Filter/Regulator	4505C21G01

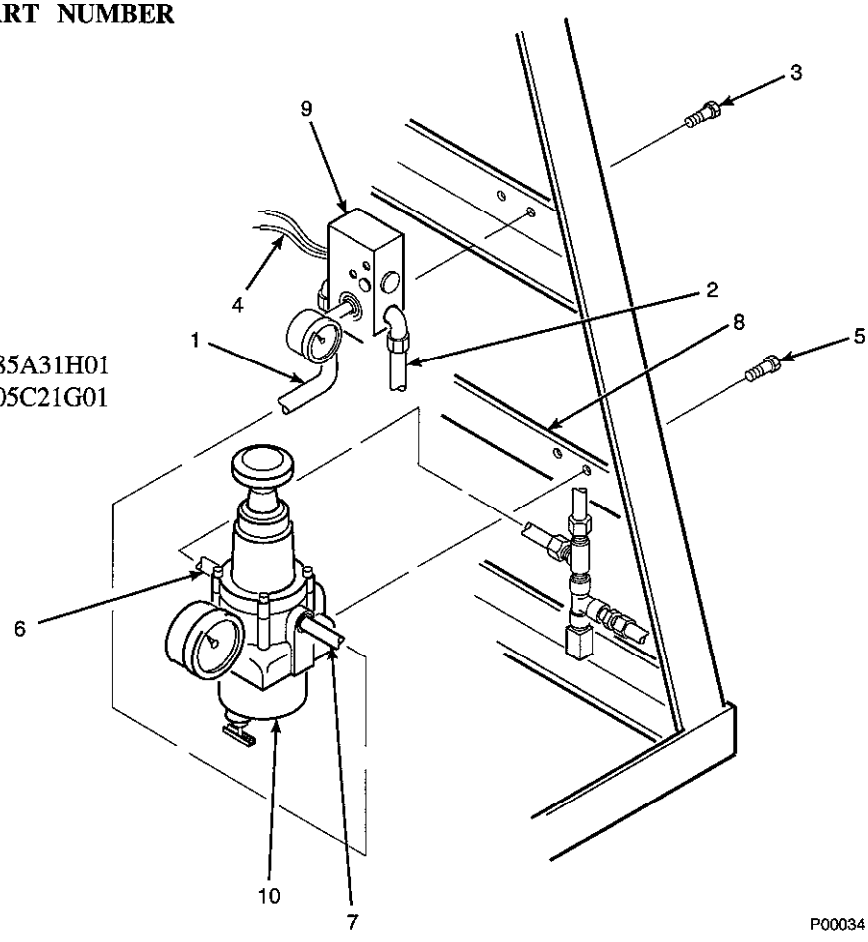


Figure 8-1. Current to Pneumatic Converter and Regulator Replacement

SECTION VIII. OPTIONS

8-1. **OVERVIEW.** This section of the manual provides service information on the 8 x 14 power positioner standard options. These options include Electric Positioner Transmitter (EPT), Current to Pneumatic (I/P) Converter, Limit Switches, and Heater/Thermostat.

8-2. **ELECTRIC POSITION TRANSMITTER.** For information on the EPT for PP814T Power Positioner, refer to IB-102-208A, Field Retrofit Kit Electric Position Transmitter.

8-3. **CURRENT TO PNEUMATIC (I/P) CONVERTER AND REGULATOR.**

a. **I/P Adjustment.** Refer to Section 4-3 and calibrate converter.

b. **I/P Replacement.** Use the following procedure for replacement of the current to pneumatic (I/P) signal converter.

WARNING

Before performing any maintenance or repair action on the power positioner, shut off supply air, signal air, and any electrical supply or electronic signals to the power positioner. Isolate power positioner from all connected systems. Severe injury or death may result from large torque power positioner is capable of producing, or from electrical shock.

1. Remove power positioner from service.
2. Turn electrical signal transmitter off and make sure no voltage or current is being applied to the I/P.
3. Bleed off air pressure through connection of I/P inlet piping (1, Figure 8-1) to I/P converter (9).
4. Remove I/P inlet piping (1) and I/P outlet piping (2) from I/P.
5. Remove screws securing signal leads (4) from I/P screw connectors. If screw connectors are not installed on I/P, remove I/P pigtails from screw connectors.
6. Remove screws (3) securing old I/P converter from frame and discard I/P.
7. Install new I/P to same mounting location securing with screws.
8. Connect signal leads.
9. Attach I/P inlet piping (1) and I/P outlet piping (2) to respective ports on I/P.
10. Open supply air valves and test for leaks using "Snoop" type leak detector.
11. Refer to Section 4-3 and calibrate I/P.
12. Return power positioner to service.

c. **Regulator Replacement.**

1. Remove power positioner from service.
2. Shut off air supply to regulator.
3. Slowly bleed off pressure from both sides of regulator and remove regulator inlet piping (6, Figure 8-1) connector and regulator outlet piping (7) connector.
4. Remove screws (5) securing regulator from mounting bracket (8) and remove old regulator.
5. Install new regulator on mounting bracket with screws (5).
6. Attach regulator inlet piping (6) connector and regulator outlet piping (7) connector to appropriate ports on regulator.
7. Open supply air valves and test for leaks using "Snoop" type leak detector.
8. Adjust regulator and calibrate positioner.
9. Return positioner to service.

d. Regulator Adjustment.

1. Remove positioner from service. Disconnect electrical power from I/P converter.

2. Using adjusting knob on top of regulator, adjust pressure until pressure gauge on regulator reads 20 to 22 psi.

3. Connect electrical power to I/P converter.

4. Return power positioner to service.

8-4. LIMIT SWITCH.

a. Adjustment.

WARNING

Before performing any maintenance or repair action on the power positioner, shut off supply air, signal air, and any electrical supply or electronic signals to the power positioner. Isolate power positioner from all connected systems. Severe injury or death may result from large torque power positioner is capable of producing, or from electrical shock.

1. Remove power positioner from service, close supply air shutoff valve, and isolate electrical power from power positioner. Move transfer valve to manual position.

2. Loosen screws (1, Figure 8-2) securing upper limit switch cam assembly (2) to shaft (3).

3. Use manual operator wheel to position linkage lever to desired upper limit stopping position.

4. Rotate upper limit switch cam in counterclockwise direction when viewed from left of positioner. When cam shoe engages upper limit switch (4), secure cam assembly (2) against shaft (3) with screws (1).

5. Loosen screws (5) securing lower limit switch cam assembly (6) to shaft (3).

6. Use manual operator wheel to position linkage lever to lower limit stopping position.

7. Rotate lower limit switch cam assembly (6) in counterclockwise direction when viewed from left of positioner. When cam shoe engages lower limit switch (7), secure cam assembly (6) to shaft (3) with screws (5).

b. Replacement.

1. Remove power positioner from service.

2. Close supply air shutoff valve. Disconnect electrical power from positioner.

3. Disconnect limit switch wires from terminals 1 through 8 on buses 2 and 3 in junction box.

4. Remove nuts (9, Figure 8-2) from studs (8) and remove studs.

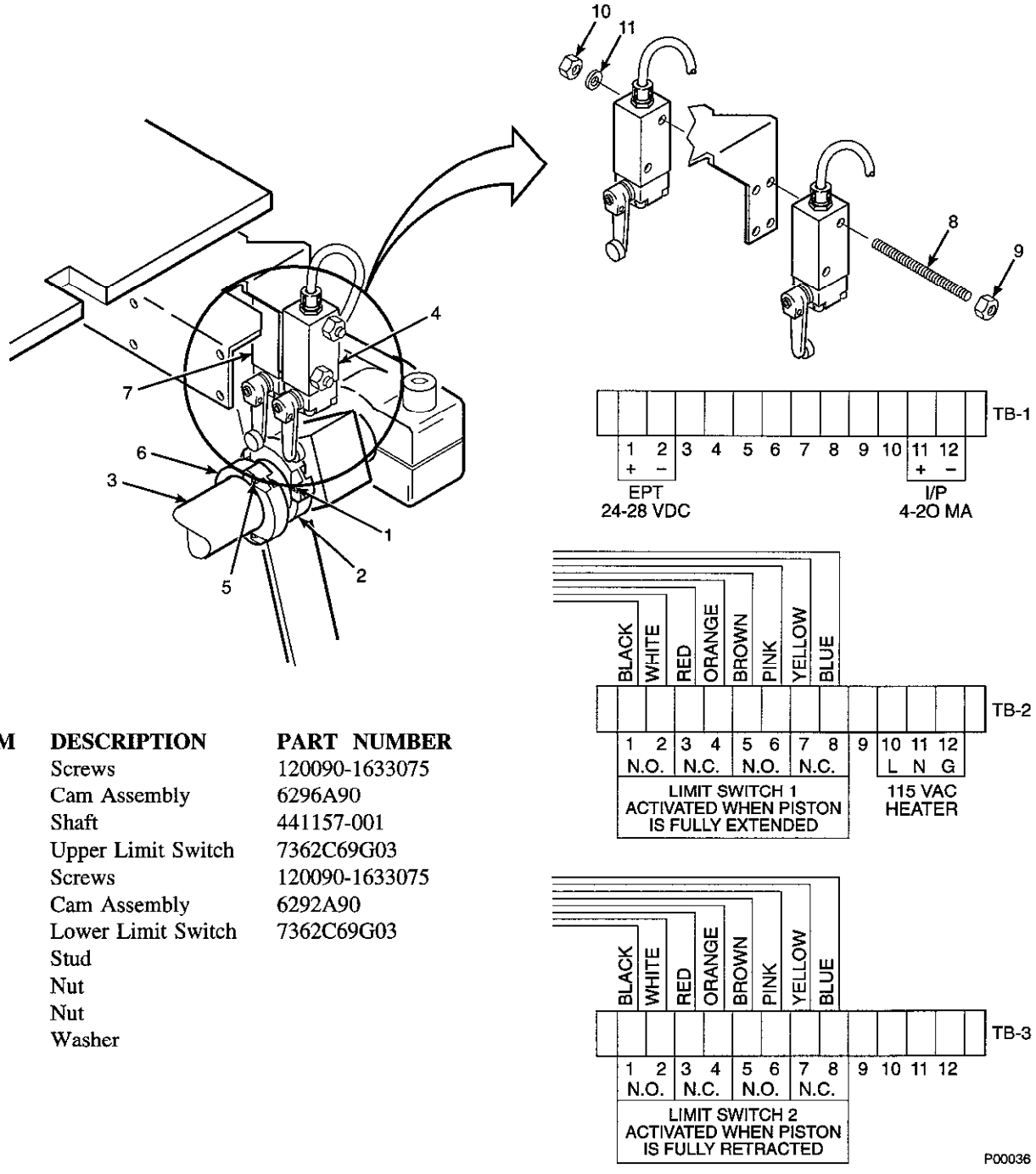
5. Remove lower limit switch (7) and upper limit switch (4) from bracket.

6. Install new switches on bracket with studs (8) and nuts (9).

7. Route wires along same path as old limit switches. Connect wires from new switches to terminal buses 2 and 3 according to Figure 8-2.

8. Restore electrical power to positioner. Open supply air shutoff valve.

9. Refer to Section 8-4.a and adjust limit switches. Return power positioner to service.



ITEM	DESCRIPTION	PART NUMBER
1	Screws	120090-1633075
2	Cam Assembly	6296A90
3	Shaft	441157-001
4	Upper Limit Switch	7362C69G03
5	Screws	120090-1633075
6	Cam Assembly	6292A90
7	Lower Limit Switch	7362C69G03
8	Stud	
9	Nut	
10	Nut	
11	Washer	

Figure 8-2. Limit Switch Exploded View

8-5. HEATER/THERMOSTAT.

a. Heater Replacement.

WARNING

Before performing any maintenance or repair action on the power positioner, shut off supply air, signal air, and any electrical supply or electronic signals to the power positioner. Isolate power positioner from all connected systems. Severe injury or death may result from large torque power positioner is capable of producing, or from electrical shock.

1. Remove power positioner from service, close supply air shutoff valve, and isolate electrical power from power positioner.
2. Remove heating element (18, Figure 8-3) from heater socket (16) by turning counterclockwise.
3. Install new heating element (18) into socket (16).
4. Return power positioner to service.

b. Thermostat Replacement.

WARNING

Before performing any maintenance or repair action on the power positioner, shut off supply air, signal air, and any electrical supply or electronic signals to the power positioner. Isolate power positioner from all connected systems. Severe injury or death may result from large torque power positioner is capable of producing, or from electrical shock.

1. Remove power positioner from service, close supply air shutoff valve, and isolate electrical power from power positioner.
2. Remove terminal cover screws (7, Figure 8-3) and terminal cover (8). Remove thermostat lead (9) from terminal 1 on terminal block (12).
3. Remove screws (17) and heater socket (16) from mounting plate (10). Remove thermostat lead (15) from heater socket
4. Remove screws (1), lock washers (2), nuts (4) and thermostat (3) from frame.
5. Install new thermostat (3) with screws (1), lock washers (2) and nuts (4) on frame.
6. Connect thermostat lead (9) to terminal 1 on terminal block (12).
7. Connect thermostat lead (15) to heater socket (16) and reinstall heater socket with screws (17).
8. Install terminal cover (8) with screws (7).
9. Restore electrical power and return positioner to service.

ITEM	DESCRIPTION	PART NUMBER
1	Screw	120093-009
2	Lock Washer	120114-002
3	Thermostat	153408
4	Nut	120032-004
5	Lock Washer	120114-004
6	Screw	120093-009
7	Screw	120092-1432063
8	Terminal Cover	114656
9	Thermostat Lead	181268-162222
10	Mounting Plate	157030
11	Terminal Marker Strip	143650-006
12	Terminal Block	181403
13	Screw	120092-1432044
14	Wire Terminal	157458-001
15	Thermostat Lead	181268-162222
16	Heater Socket	256996
17	Screw	120092-1632063
18	Heating Element	153407-001
19	Nut	120032-005

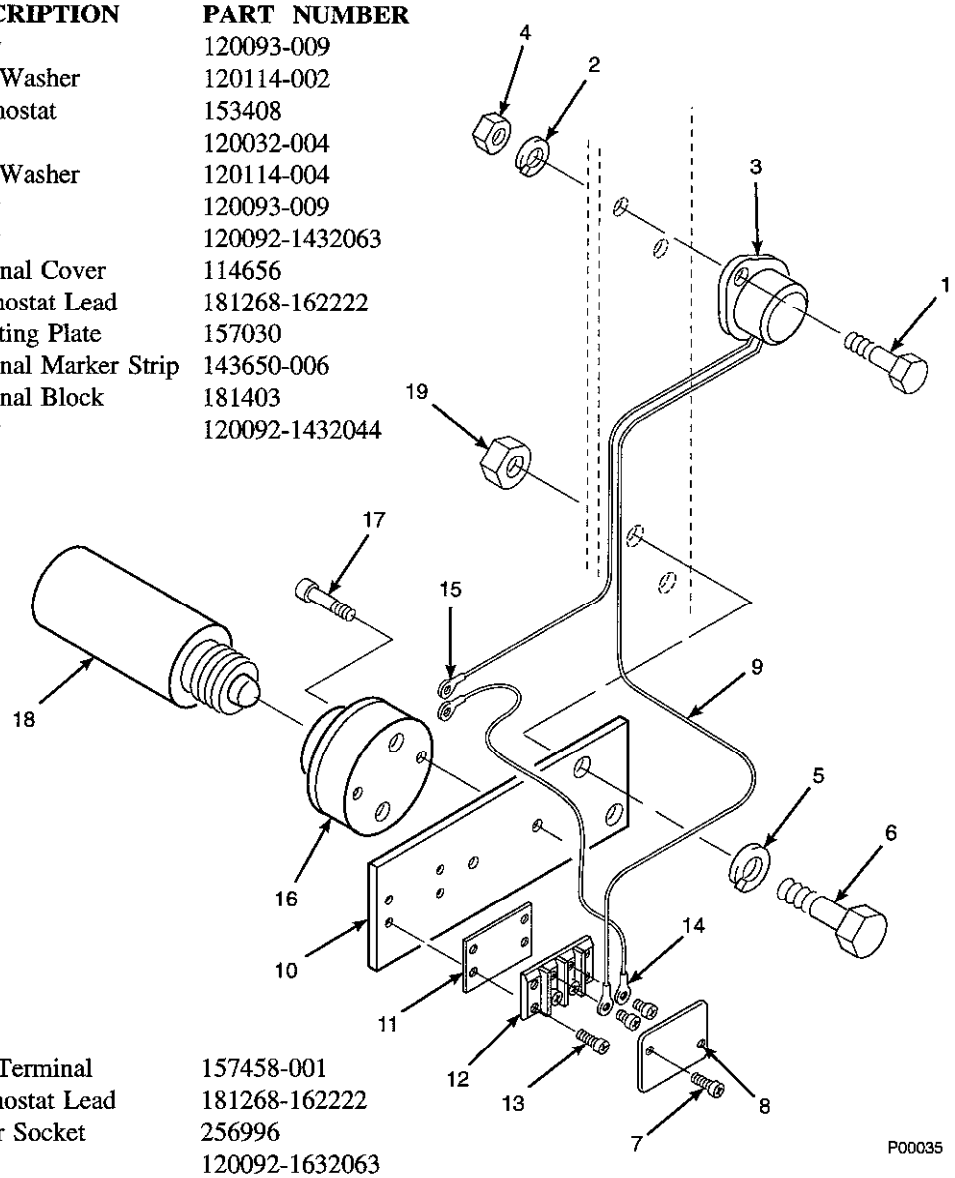


Figure 8-3. Heater/Thermostat Replacement

SECTION IX. RECOMMENDED SPARE PARTS

Table 9-1. Recommended Spare Parts for PP814T 8 x 14 Power Positioner.

FIGURE and INDEX No.	PART NUMBER	DESCRIPTION	QTY
	1A97803G02	Spare Parts Kit 8 x 14 Power Positioner	
7-5, 22		O-ring (120039-016)	1
7-5, 22		O-ring (120039-032)	1
		Gasket (141173-005)	1
6-6, 14		Gasket (141279)	2
6-6, 16		Piston (241282)	1
6-2, 20		Diaphragm (2831A28H01)	2
6-6, 8		Rod Packing Parts (2831A95G01)	1
6-2, 14; 7-1, 3		Cork Gasket (8015-023)	1
7-3, 7; 6-3, 5		Diaphragm (9351-002)	1
7-4, 30		Diaphragm (9351-003)	2
	1A97803G04	Spare Parts Kit 8 x 14 Power Positioner	
6-6, 16		Piston (241282)	3
	1A97803G05	Spare Parts Kit 8 x 14 Power Positioner	
6-6, 8		Rod Packing Parts (2831A95G01)	15
	1A97803G06	Spare Parts Kit 8 x 14 Power Positioner	
7-4, 30		Diaphragm (9351-003)	16
	1A97803G07	Spare Parts Kit 8 x 14 Power Positioner	
		Gasket (141173-005)	75
	1A97803G08	Spare Parts Kit 8 x 14 Power Positioner	
7-5, 22		2-211 Buna-n-Rubber O-ring (120039-016)	50
	1A97803G09	Spare Parts Kit 8 x 14 Power Positioner	
7-5, 24		O-ring Buna-n-Rubber #2 (120039-032)	50
	1A97803G10	Spare Parts Kit 8 x 14 Power Positioner	
6-6, 14		Gasket (141279)	25
	1A97803G11	Spare Parts Kit 8 x 14 Power Positioner	
6-2, 14; 7-1, 3		Cork Gasket (8015-023)	50
	1A97863G01	Replacement Kit PP814T	
		Bulletin (IB-102-208)	1
		Service Bulletin (SB-102-208-A)	1
6-5, 9		Link (141181-005)	1
		Valve Assembly (142682)	1
7-3, 14		Calibration Spring (142733)	1
7-6, 12		Bracket (242730)	1
7-5, 21		Cylinder Connector (250891)	2
7-1, 9; 6-2, 8		Air Supply Connector (250892)	1
7-3, 3		Signal Connector (250893)	1
6-2, 11		Exhaust Connector (252592)	1
7-6, 14		Cam (342736)	1
		8 x 14 Compensator 3-15 (442738-007)	1
	183512	Grease, Mo_2-793 4 lb/can	
7-1, 2	243384	Pilot Valve	
7-5, 23	342371	Piston Follower	
6-2, 1; 7-1, 1	7791-021	Connecting Link	

Table 9-2. Spare Parts for Options (PP814T 8 x 14 Power Positioner Only).

FIGURE and INDEX No.	PART NUMBER	DESCRIPTION	QTY
8-3, 18	153407-001	Heating Element	1
8-3, 3	153408	Thermostat	1
8-3, 16	256996	Heater Socket	1
	7362C69G02	Electric Position Transmitter	1
8-2, 4 and 7	7362C69G03	Limit Switches	2
8-1, 9	9885A31H01	Current to Pneumatic (I/P) Converter	1
	275431-007	Pressure Gauge	1
8-1, 10	4505C21G01	Filter Regulator	1
	SKI-63580	Check Valves	2
		Diaphragm Valves	2
		2.2 Ft. Tank	1
		Pressure Switch	1
		Solenoid Valve Mounted and Piped	1

NOTE

Table 9-3, Bill of Material for PP814T 8 X 14 Power Positioner, includes part numbers and descriptions that are keyed to Figure and Index Number references. This listing provides information on all basic PP814T power positioner parts with the exception of hardware.

Table 9-3. Bill of Material for PP814T 8 x 14 Power Positioner.

FIGURE and INDEX No.	PART NUMBER	DESCRIPTION	QTY
	543383	Stand Assembly	1
6-6, 14; 7-5, 19	141279	Gasket	2
6-6, 6; 7-5, 8	142367	Gland Cap	1
6-6, 16; 7-5, 25	241282	Piston	1
6-6, 15; 7-5, 14	242369	Piston Rod	1
6-6, 4; 7-5, 3	242370	Clevis	1
6-6, 17; 7-5, 27	242405	Cylinder	1
6-6, 9; 7-5, 13	242407	Cylinder Head Assembly	1
6-6, 18; 7-5, 28	243252	Cylinder Stud	4
7-5, 9	2831A92H01	Female Adapter	1
7-5, 11	2831A93H01	Male Adapter	1
7-5, 10	2831A94H01	V-Ring Packing	2
7-5, 23	342371	Piston Follower	1
7-5, 30	324372	Lower Cylinder Head	1
6-6, 12; 7-5, 17	142645	Bearing Block	2
7-6, 2; 8-2, 3	441157-001	Shaft	1
7-6, 17-19	6292A90G02	Cam	1
7-5, 2; 7-6, 9	342375	Cylinder Lever	1
7-6, 12	242730	Bracket	1
7-6, 14	342736	Cam	1
7-5, 4	146009	Clevis Pin	1
7-6, 23	342648	Linkage Lever	1
7-6, 22	243914	Clevis	1
7-6, 21	174358-004	Clevis Pin	1
7-6, 1	141193	Tube Sleeve	1
7-1, 9	250892	Air Supply Connector	1
7-3, 3	250893	Signal Connector	1
	126198	Serial Number Plate	1
	126172	Name Plate	1
7-4, 22	342376	Diaphragm Chamber	2
7-4, 33	242406	Diaphragm Plate	2
7-4, 30	9351-003	Cupped Diaphragm	2
7-4, 29	141168-005	Stud	2
7-4, 31	141168-004	Shield	2
7-4, 40	357720	Clapper Lever	1
7-4, 44	157704	Pivot Pin	1
6-5, 14	141181-003	Valve Lever	1
6-5, 13	141181-002	Pin	1
6-5, 17	142676	Fulcrum Block	2
6-5, 6	140914	Spring	1
6-5, 7	142675	Thrust Plate	1
6-5, 4	2831A30H01	End Cover	1
6-5, 5	142674	Gasket	1
6-5, 8	2831A29H01	Exhaust Valve Body	1
7-6, 4	2829A77H03	Spacer	1
7-6, 6	341183	Sector Gear	1
7-4, 47	140895	Air Lock Spring	1
7-4, 1	140903	Spring Nut	1
7-4, 13	141187	Transfer Valve	1
7-4, 12	141176-003	Valve Bracket	1

Table 9-3. Bill of Material for PP814T 8 x 14 Power Positioner (Continued).

FIGURE and INDEX No.	PART NUMBER	DESCRIPTION	QTY
7-4, 7	242647	Spring Bracket	1
7-4, 27	142646	Worm Guide	1
6-7, 16	343495	Handwheel	1
6-7, 22	142644	Handwheel Shaft Block	1
6-7, 19	152292	Sprocket Shaft	1
6-7, 5	141156-003	Worm Shaft Block	2
6-7, 11	141156-005	Pin	1
6-7, 2	141156-006	Worm Sprocket	1
6-7, 7	152371	Collar	1
6-7, 4	141156-002	Block	1
6-7, 9	141156-001	Worm Shaft	1
7-4, 23	141168-008	Bearing	2
7-4, 19	252588	Supply Air-Transfer Valve Connector	1
6-2, 26	252590	Connector	1
6-5, 1	252592	Pilot Valve-Exhaust Valve Connector	1
7-4, 8	141173-010	Seal	1
	149904-001	Right Side Cover	1
	149904-002	Left Side Cover	1
	343994-001	Top Cover	1
	141173-005	Gasket	1
7-6, 29	141173-006	Felt Gasket	2
	141173-009	Felt Seal	4
	349918	Cover Assembly	2
	143234	Indicator Disc	1
7-4, 21	125368-007	Connector	1
7-3, 22	142033	Bearing	1
7-3, 20	342686	Follower Arm	1
7-3, 11	342731	Diaphragm Housing	1
6-2, 15	144981-001	Stud	4
7-1, 3	8015-023	Cork Gasket	1
6-2, 17	342693	Pilot Valve Manifold	1
6-2, 21	2831A29H01	Body	1
6-2, 22	142675	Thrust Plate	1
6-2, 23	2831A30H01	End Cover	1
6-2, 20	2831A28H01	Diaphragm	1
7-1, 2	243384	Pilot Valve	1
7-3, 16	142720	Spring Nut Cup	1
7-3, 24	142705	Shaft	1
7-3, 10	7791-021	Connecting Link	1
7-3, 13	5015-007	Trunnion Ring	1
7-3, 14	142732	Calibration Spring 0-15#	1
	(142733 shown)		
7-3, 14	142733	Calibration Spring 0-30#	1
7-3, 14	161149	Calibration Spring 3-15#	1
	(142733 shown)		
7-3, 8	142729	Diaphragm Seat	1
7-3, 6	142680	Thrust Plate	1
7-3, 5	175464-348	Zero Balance Spring	1
7-3, 4	242687	Diaphragm Cover	1
7-3, 7	9351-002	Diaphragm	1

SECTION X. RETURNING EQUIPMENT TO THE FACTORY

10-1. If factory repair of defective equipment is required, proceed as follows:

a. Secure a return authorization from a Rosemount Analytical Sales Office or Representative before returning the equipment. Equipment must be returned with complete identification in accordance with Rosemount instructions or it will not be accepted.

In no event will Rosemount be responsible for equipment without proper authorization and identification.

b. Carefully pack defective unit in a sturdy box with sufficient shock absorbing material to insure that no additional damage will occur during shipping.

c. In a cover letter, describe completely:

1. The symptoms from which it was determined that the equipment is faulty.

2. The environment in which the equipment has been operating (housing, weather, vibration, dust, etc.).

3. Site from which equipment was removed.

4. Whether warranty service or nonwarranty service is requested.

5. Complete shipping instructions for return of equipment.

d. Enclose a cover letter and purchase order and ship the defective equipment according to instructions provided in Rosemount Return Authorization, prepaid, to:

American

Rosemount Analytical Inc.
RMR Department
1201 N. Main Street
Orrville, Ohio 44667

European

Rosemount Ireland
Equipment Return Repair Dept.
Site 7 Shannon Industrial Estate
Co. Clare
Ireland

If warranty service is requested, the defective unit will be carefully inspected and tested at the factory. If failure was due to conditions listed in the standard Rosemount warranty, the defective unit will be repaired or replaced at Rosemount's option, and an operating unit will be returned to the customer in accordance with shipping instructions furnished in the cover letter.

For equipment no longer under warranty, the equipment will be repaired at the factory and returned as directed by the purchase order and shipping instructions.

APPENDIX A. LINKAGE INSTALLATION FOR EITHER A CHARACTERIZED FLOW CONTROL DEVICE, OR A LINEAR FLOW CONTROL DEVICE.

Linkage installed for a characterized flow control device will result in rapid flow changes near the closed position. A linear flow control device will provide linear changes in flow in relation to changes in control signal.

Characterized flow control device results from linear linkage and linear power positioner. Linear flow control device results from characterizing linkage or from characterizing power positioner.

Linkage described is 1-1/2 inch diameter pipe.

A-1. LINKAGE INSTALLATION FOR A CHARACTERIZED FLOW CONTROL DEVICE.

a. Measure length of driven lever (R_1) on device to be controlled (Figure A-1).

b. Attach the linkage clevis to the power positioner's drive lever so that distance R_2 is equal to R_1.

c. Close damper of device being controlled to minimum flow position.

d. Measure angle (θ_1) of device's driven lever from vertical center line.

c. Install power positioner's drive lever so its angle (θ_2) is the same as the device's driven lever (θ_1).

f. Measure distance (ℓ) between drive and driven levers connection holes. Allowing for clevis length, cut pipe to fit this measurement. Install clevises.

g. Install linkage pipe between drive and driven levers. Check for freedom of movement by operating power positioner's handwheel. Make minor adjustments to linkage length by turning linkage clevis fitting in or out as necessary.

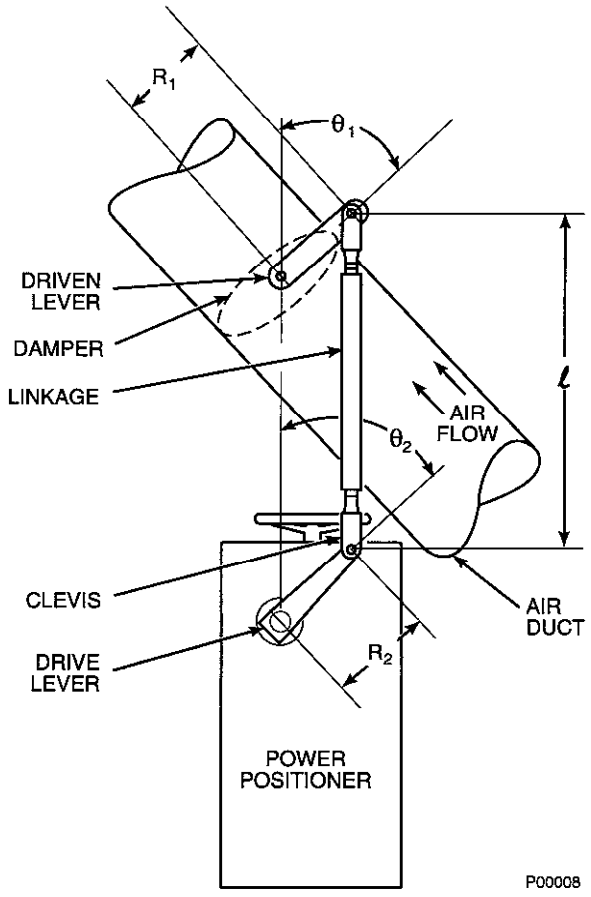


Figure A-1. Linear Linkage Design

A-2. LINKAGE INSTALLATION FOR A LINEAR FLOW CONTROL DEVICE.

Linear flow control devices require a characterized control system. This can be accomplished by either characterizing linkage or characterizing power positioner.

If greater torque is required at start of power positioner movement, characterize the linkage system. This is covered in step a. below.

If this additional starting torque is not required, a linear linkage can be installed. The power positioner cam must be shaped to characterize power positioner. This is covered in step b.

NOTE

Linkage installation described in this section of the manual is for direct acting power positioners.

a. Characterized Linkage System.

1. Make sure a linear cam is installed to get linear outputs from power positioner.

2. Figure out how far vertically the operating lever travels using Figure A-2 and the following equation:

$$Y=2R_1[Sin((\theta_1+\beta_1)/2.0)]^2-[Sin\beta_1/2.0]^2$$

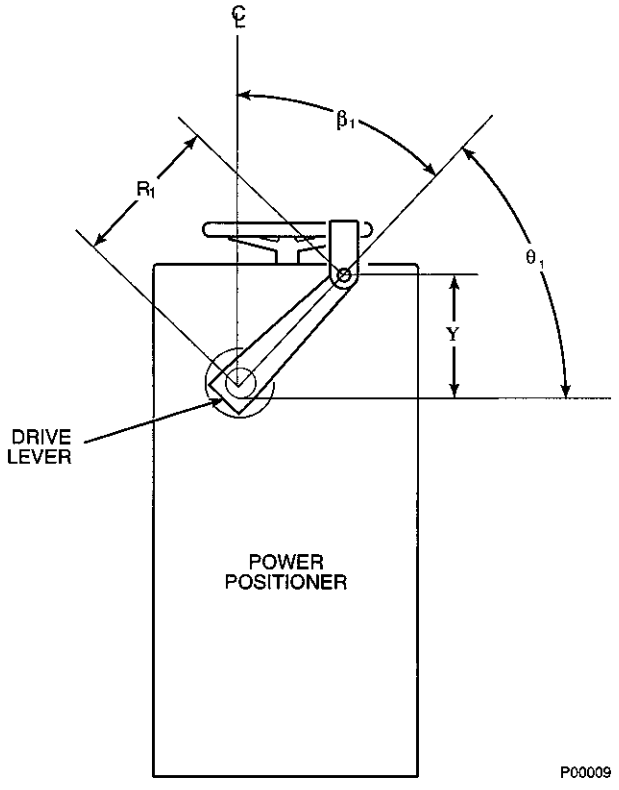


Figure A-2. Vertical Arm Travel

NOTE

The following known values are used to calculate the vertical distance travelled by the drive lever; "Y".

R_1 = Length of drive lever (from shaft center to clevis pin center) measured in inches.

θ_1 = Total angular rotation of drive lever. If power positioner is at full stroke, this measurement is 80°.

β_1 = Angular measurement of drive lever from vertical centerline with piston fully extended.

To perform the following procedure, a calculator with basic functions, plus the following scientific functions, is necessary:

-Sine Function (SIN)
-Square Function (x^2)

Use the following procedure to determine **Y**, the vertical distance travelled by drive lever:

(a) Add value of θ_1 to value of β_1.

(b) Divide answer from step (a) by 2.0.

(c) Enter answer from step (b) and press sine key (SIN).

(d) Press square key (x^2).

(e) Multiply answer from step (d) by length of drive lever ($\mathbf{R_1}$).

(f) Multiply answer from step (e) by 2.

(g) Write down answer from step (f) and label it (f) for use later on.

(h) Clear calculator.

(i) Enter value of β_1.

(j) Press sine key (SIN).

(k) Divide answer from step (j) by 2.0.

(l) Press square key (usually key marked x^2).

(m) Write down answer from step (l) and label it (l).

(n) Clear calculator.

(o) Enter value marked (f) and subtract value marked (l).

(p) The value in step (o) is equal to vertical distance travelled by drive lever "Y".

3. Figure out angular rotation of driven lever. This is done in terms of drive lever rotation. The angular rotation follows Figure A-3 and the relationship:

$$\theta_2=2[Sin^{-1}(R_1/R_2(Sin(\beta_1+\theta_1)/2)^2-(Sin\beta_1/2)^2+(Sin\beta_2/2)^2)^{0.5}-\beta_2/2]$$

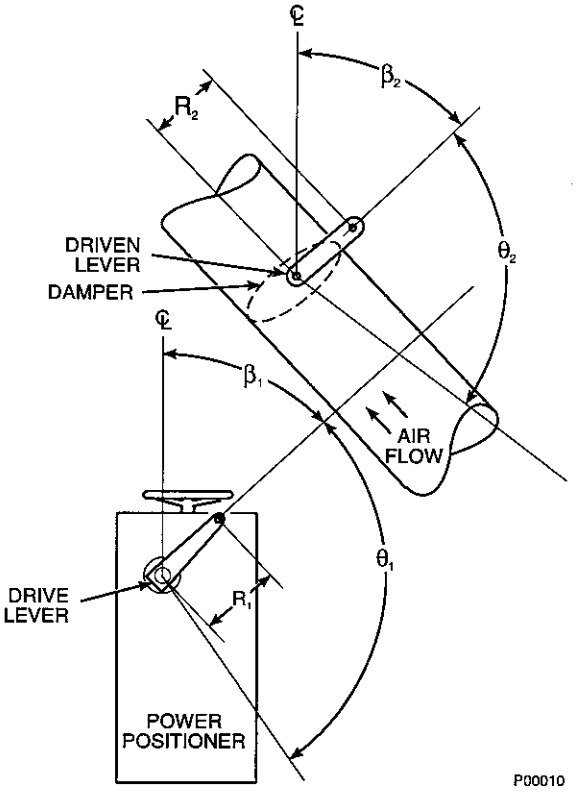


Figure A-3. Driven Shaft Angular Rotation

NOTE

The following known values are used to calculate the total angular rotation of the driven lever; θ_2.

- θ_1 = **Total angular rotation of the drive lever. If power positioner is at full stroke, this measurement is 80°.**
- R_1 = **Length of the drive lever (from shaft center to clevis pin center) measured in inches.**
- R_2 = **Length of the driven lever (from shaft center to clevis pin center) measured in inches.**
- β_1 = **Angular measurement of drive lever from vertical centerline with piston fully extended.**
- β_2 = **Angular measurement of driven lever from vertical centerline with damper fully closed.**

To perform the following procedure, a calculator with basic functions, plus the following scientific functions, is necessary:

-Sine Function (SIN)
-Inverse Sine Function (SIN^{-1}) or (INV SIN)
-Square Function (x^2)
-Square Root Function ($\sqrt{x}$)

Use the following procedure to determine θ_2, the angular rotation of the driven lever.

(a) Add value of β_1 to value of θ_1.

(b) Enter answer from step (a) and press sine key (SIN).

(c) Divide answer from step (b) by 2.0.

(d) Multiply answer from step (c) by length of driven lever ($\mathbf{R_2}$).

(e) Write down answer from step (d) and label it (d). Clear calculator.

(f) Enter value for length of drive lever ($\mathbf{R}_1$).

(g) Divide value from step (f) by value marked (d).

(h) Press square key (x^2).

(i) Write down answer from step (h) and label it (h) for use later.

(j) Clear calculator.

(k) Enter value for β_1 and press sine key (SIN).

(l) Divide answer from step (k) by 2.

(m) Press square key (x^2).

(n) Write down answer from step (m) and label it (m) for later use.

(o) Enter value for β_2 and press sine key (SIN).

(p) Divide answer from (o) by 2.

(q) Press square key (x^2).

(r) Write down answer from (q) and label it (q) for later use.

(s) Clear calculator.

(t) Enter value marked (h).

(u) Subtract value marked (m) from value marked (h).

(v) Add value marked (q) to step (u).

(w) Press square root function key ($\sqrt{x}$).

(x) Press inverse sine (INV SIN or SIN^{-1}).

(y) Write down answer from step (x) and label it (x).

(z) Clear calculator.

(aa) Enter value for β_2.

(ab) Divide value from step (aa) by 2.

(ac) Write down answer from step (ab) and label it (ab). Clear calculator.

(ad) Enter value from step (x).

(ae) Subtract value from step (ab).

(af) Multiply answer from step (ae) by 2.

(ag) The value in step (af) is equal to total angular rotation of driven lever "θ_2".

4. Figure out length of connecting linkage based on length of drive lever, driven lever, and the initial offset of both. Use Figure A-4 and the following relationship:

$$\ell=[L-(R_1 Cos\beta_1+R_2 Cos\beta_2)^2+(R_1 Sin\beta_1-R_2 Sin\beta_2)]^{0.5}$$

NOTE

The following known values are used to calculate the length of the linkage in inches; "ℓ".

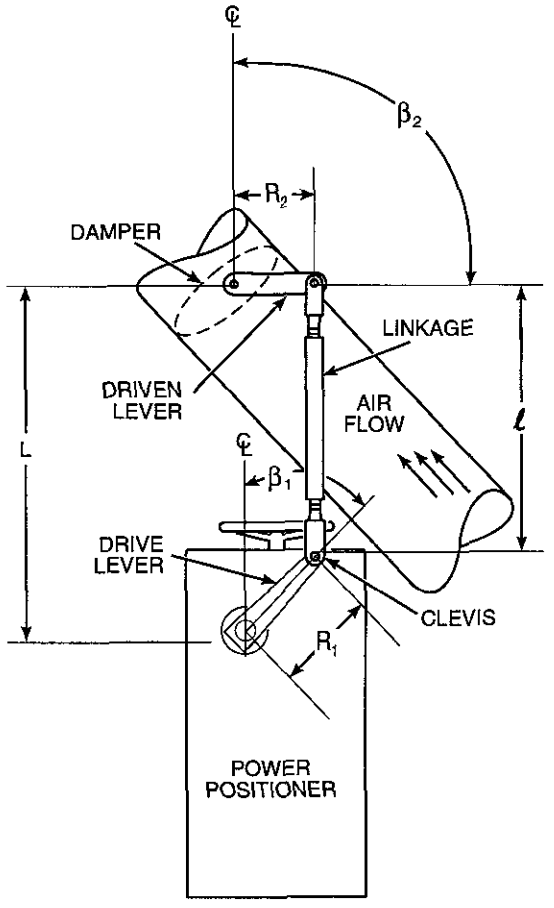
L = Length between drive and driven shaft center lines, measured in inches.

R_1 = Length of the drive lever (from shaft center to clevis pin center) measured in inches.

R_2 = Length of the driven lever (from shaft center to clevis pin center) measured in inches.

β_1 = Angular measurement of drive lever from vertical center line with piston fully extended.

β_2 = Angular measurement of driven lever from vertical center line with damper fully closed.



RECORD SETUP DIMENSIONS AND ANGLES USED:

β_1 _____ °

β_2 _____ °

ℓ _____ INCHES

R_1 _____ INCHES

R_2 _____ INCHES

P00011

Figure A-4. Connecting Linkage Length

To perform the following procedure, a calculator with basic functions, plus the following scientific functions, is necessary:

-Sine Function (SIN)
-Cosine Function (COS)
-Square Function (x^2)
-Square Root Function ($\sqrt{x}$)

Use the following procedure to determine ℓ, the length of connecting linkage in inches:

(a) Clear calculator.

(b) Enter value for β_1 and press cosine key (COS).

(c) Multiply answer from step (b) by length of drive lever ($\mathbf{R_1}$).

(d) Write down answer from step (c) and label (c).

(e) Clear calculator.

(f) Enter value for β_2 and press cosine key (COS).

(g) Multiply answer from step (f) by length of driven lever ($\mathbf{R_2}$).

(h) Write answer from step (g) down and label (g). Clear calculator.

(i) Add answer from step (h) to value marked (c).

(j) Press square key (x^2).

(k) Write down answer from step (j) and label (j).

(l) Clear calculator.

(m) Enter distance between drive and driven shaft (**L**).

(n) Subtract value marked (j) from step (m).

(o) Write down answer from step (n) and label (n).

(p) Clear calculator.

(q) Enter value for β_1 and press sine key (SIN).

(r) Multiply answer from step (q) by length of drive lever ($\mathbf{R_1}$).

(s) Write down answer from step (r) and label (r).

(t) Clear calculator.

(u) Enter value for β_2 and press sine key (SIN).

(v) Multiply answer from step (u) by length of driven lever ($\mathbf{R_2}$).

(w) Write down answer from step (v) and label (v). Clear calculator.

(x) Subtract value marked (v) from value marked (r).

(y) Add answer from step (x) to value marked (n).

(z) Press square root function key ($\sqrt{x}$).

(aa) The value in step (z) is equal to length of connecting linkage "ℓ ".

Design linkage system by using values for lengths of drive and driven levers, angular position of both levers from vertical (offsets), and distance between drive and driven levers centers to calculate length of linkage.

5. Close damper to minimum flow position. Make sure driven lever is at angle (β_2) and drive lever is at angle (β_1).

6. Cut linkage pipe to length (ℓ) allowing for both clevises. Attach clevises and install linkage between operating levers.

7. Check for freedom of movement by operating power positioner's handwheel. Make minor adjustments to linkage length by turning pipe to clevis fitting in or out as necessary.

b. Characterized Power Positioner.

1. Measure full travel of device being controlled from full open to full closed. Record maximum and minimum positions.

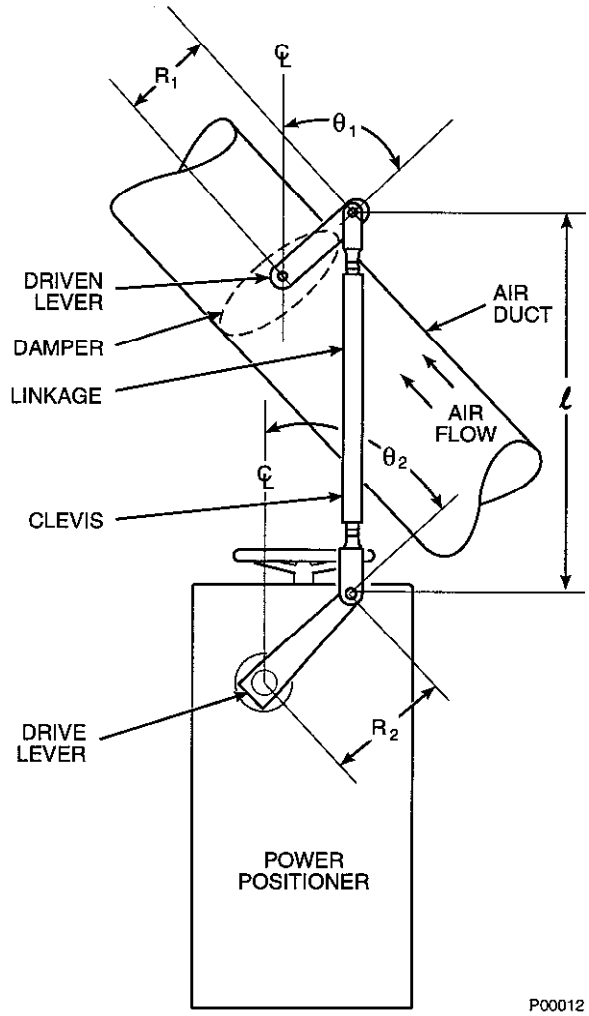


Figure A-5. Characterized Linear Linkage Design

2. Install Linear Linkage.

(a) Measure length of driven lever (R_1) on device to be controlled (Figure A-5).

(b) Attach clevis to drive lever so that distance R_2 is equal to R_1.

(c) Close damper of device being controlled to minimum flow position.

(d) Measure angle (θ_1) of device's driven lever from vertical center line.

(e) Install power positioner's drive lever so its angle from vertical center line (θ_2) is equal to device's driven lever angle (θ_1).

(f) Measure distance (ℓ) between drive and driven levers connection holes. Allowing for clevis length, cut pipe to fit this measurement. Attach clevises.

(g) Install linkage pipe between drive and driven levers. Check for freedom of movement by operating power positioner's handwheel. Make minor adjustments to linkage length by turning linkage clevis fitting in or out as necessary.

3. Check power positioner calibration and make sure linear cam is installed. Refer to paragraphs 4-2 and 4-3. Make any adjustments to power positioner prior to cutting cam.

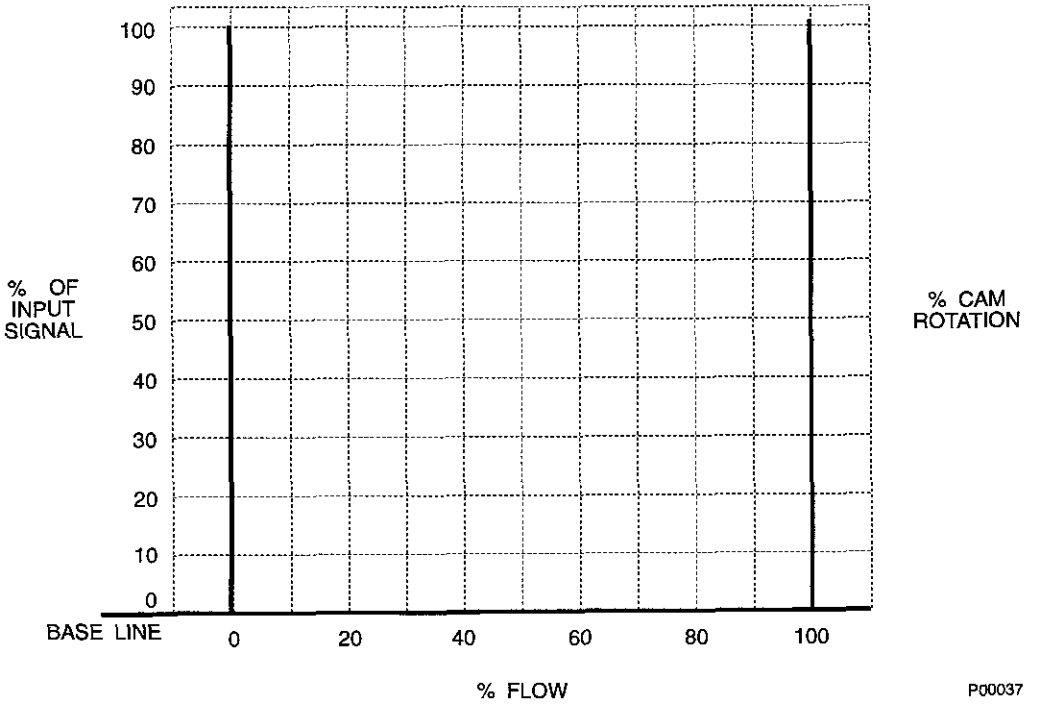
4. Copy "System Flow Chart" (Table A-1. Measure and record actual flow of system starting at 0% input signal to power positioner and increasing up to 100% in increments of 20%. Divide actual flow by flow at 100% input signal to determine Percent Flow. Enter percent flow in Percent Flow column in Table A-1.

Table A-1. System Flow Chart.

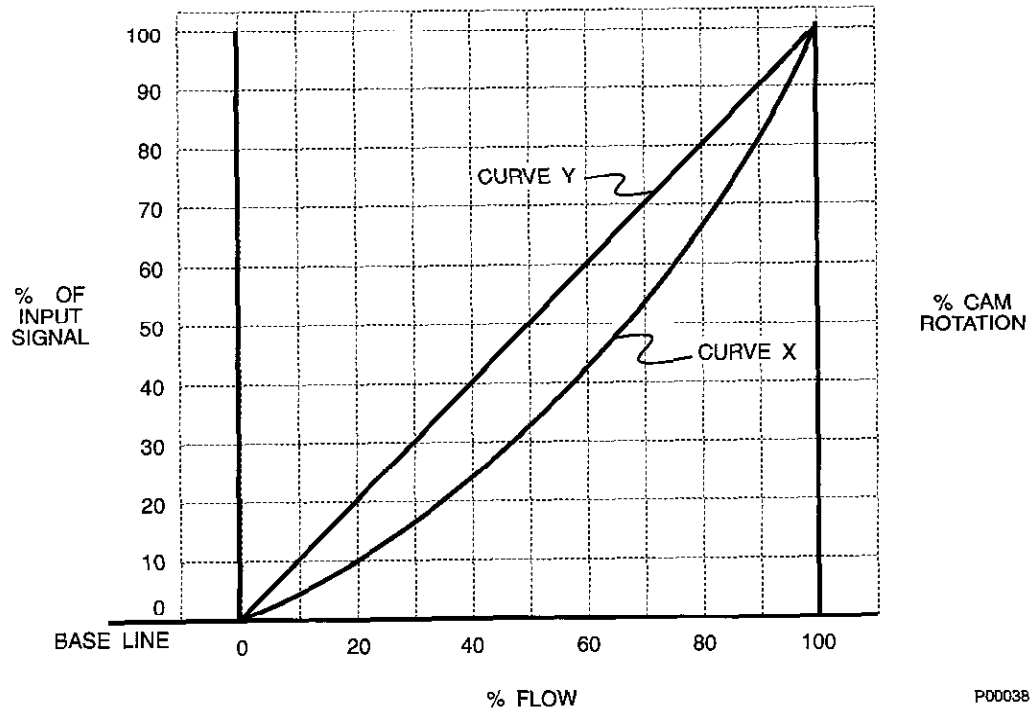
INPUT SIGNAL (%)	ACTUAL FLOW (scfm)	PERCENT FLOW (%)
0%		
20%		
40%		
60%		
80%		
100%		

5. Near bottom edge on a sheet of graph paper, draw a baseline (Graph 1) 10 blocks long. Label "% Flow".

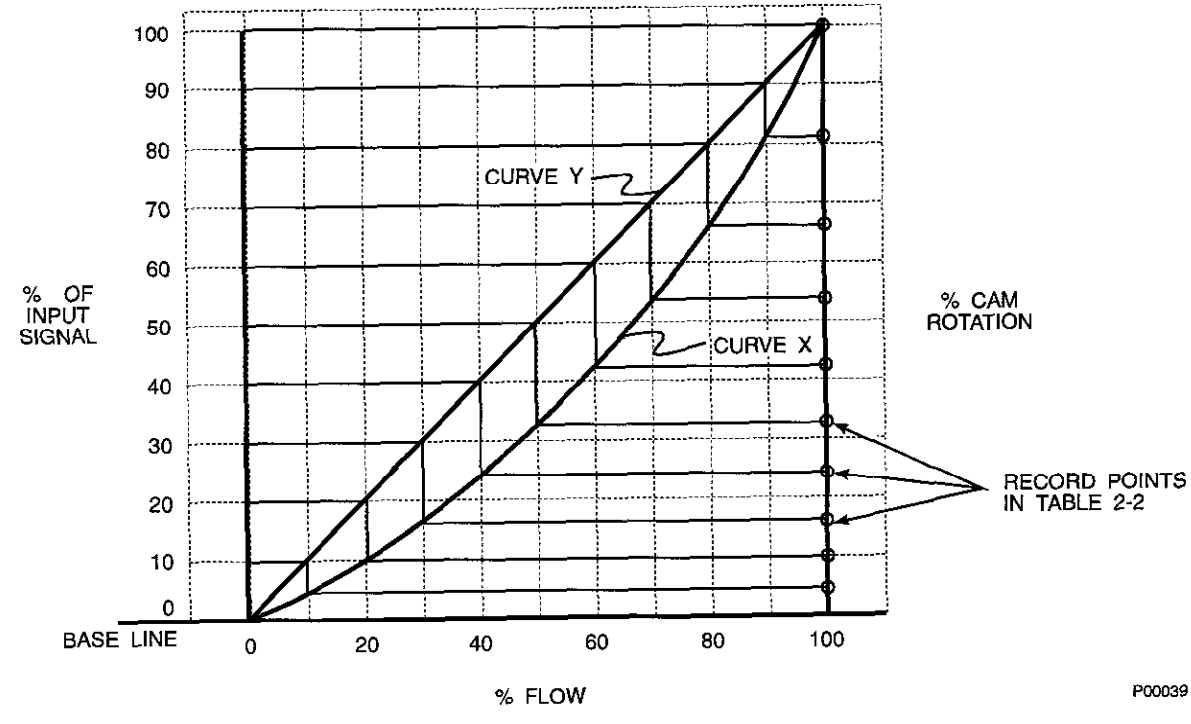
6. Starting at left edge of baseline, draw a vertical line 10 blocks long. Label this line "% Input Signal".



Graph 1



Graph 2



Graph 3

7. Starting at right edge of baseline, draw a vertical line 10 blocks long. Label this line "% Cam Rotation".

8. Scale "% Input Signal" line by marking baseline 0%. Mark 10% point one block upward. Continue labeling in 10% increments up to 100%.

9. Scale baseline by marking left end 0%. Mark 20% point two blocks to right horizontally. Continue labeling in 20% increments up to 100%.

10. Plot points on graph (Graph 2) with data from system flow chart (Table A-1). For example: Using Table A-1 in Graph 2, at a 20% input signal, percent of flow is 35%; follow 20% input signal line until it intersects 35% flow line; place a mark at this point. Repeat this procedure for 40%, 60%, 80%, and 100% input signals, placing marks at each intersection with corresponding flow line. Connect these points with a smooth curve starting at a point with zero % flow and zero % input signal. Label curve X.

11. Draw a straight line from zero point on curve X to 100% point on curve X. Label this line curve Y.

12. From 10% increment on "% Input Signal" scale, draw a horizontal line to curve Y (Graph 3).

13. From point in step 12, draw a vertical line downward to meet curve X.

14. From point in step 13, draw a horizontal line to "% Cam Rotation" scale.

15. Repeat process from step 12 through step 14 for 20% to 90% input signal.

16. Value of "% Cam Rotation" is read where line in step 14 intersects "% Cam Rotation" scale. Estimate value by using percentage scale on left edge of graph. Copy Table A-2 and record values in % Cam Rotation in blank column and again in Table 4-1 Characterized column for future reference.

17. Make a copy of Figure A-6, Cam Shaping.

18. Plot points from Table A-2 on copy of cam. Refer to example in Figure A-7.

19. Set compass for 0.4375 inch radius and draw 0.875 inch circles using points plotted in step 18 as center.

20. Draw a smooth curve connecting edges of circles that are on same side as cam's mounting holes. This is shape of new cam contour. Make several copies for future reference.

21. Cut out paper cam leaving new cam contour, mounting hole, and slotted hole.

Table A-2. Cam Rotation Points.

Example:		**Record Values from step (p):**	
% INPUT SIGNAL	**% CAM ROTATION**	**% INPUT SIGNAL**	**% CAM ROTATION**
0		0	
10		10	
20		20	
30		30	
40		40	
50		50	
60		60	
70		70	
80		80	
90		90	
100		100	

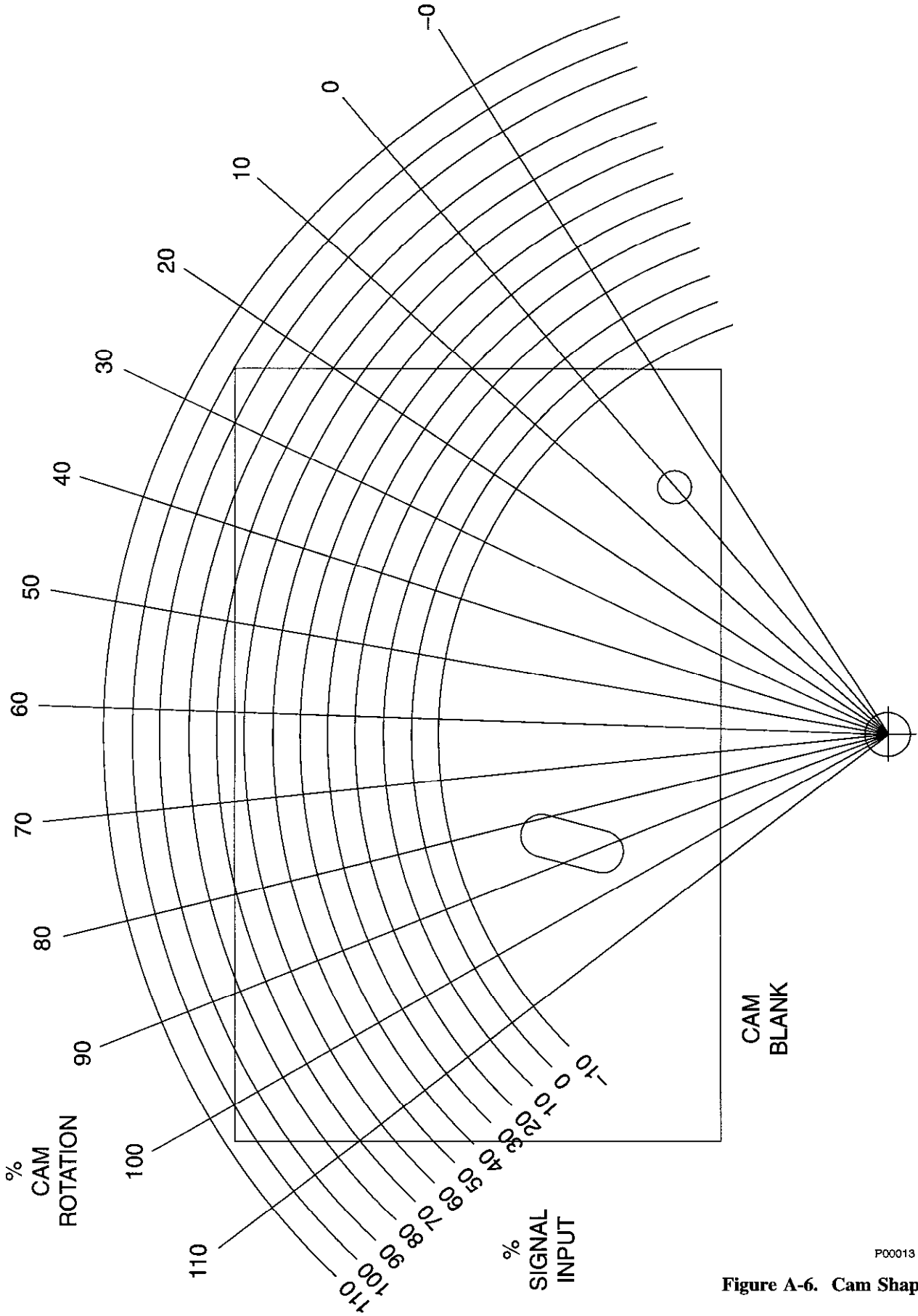


Figure A-6. Cam Shaping

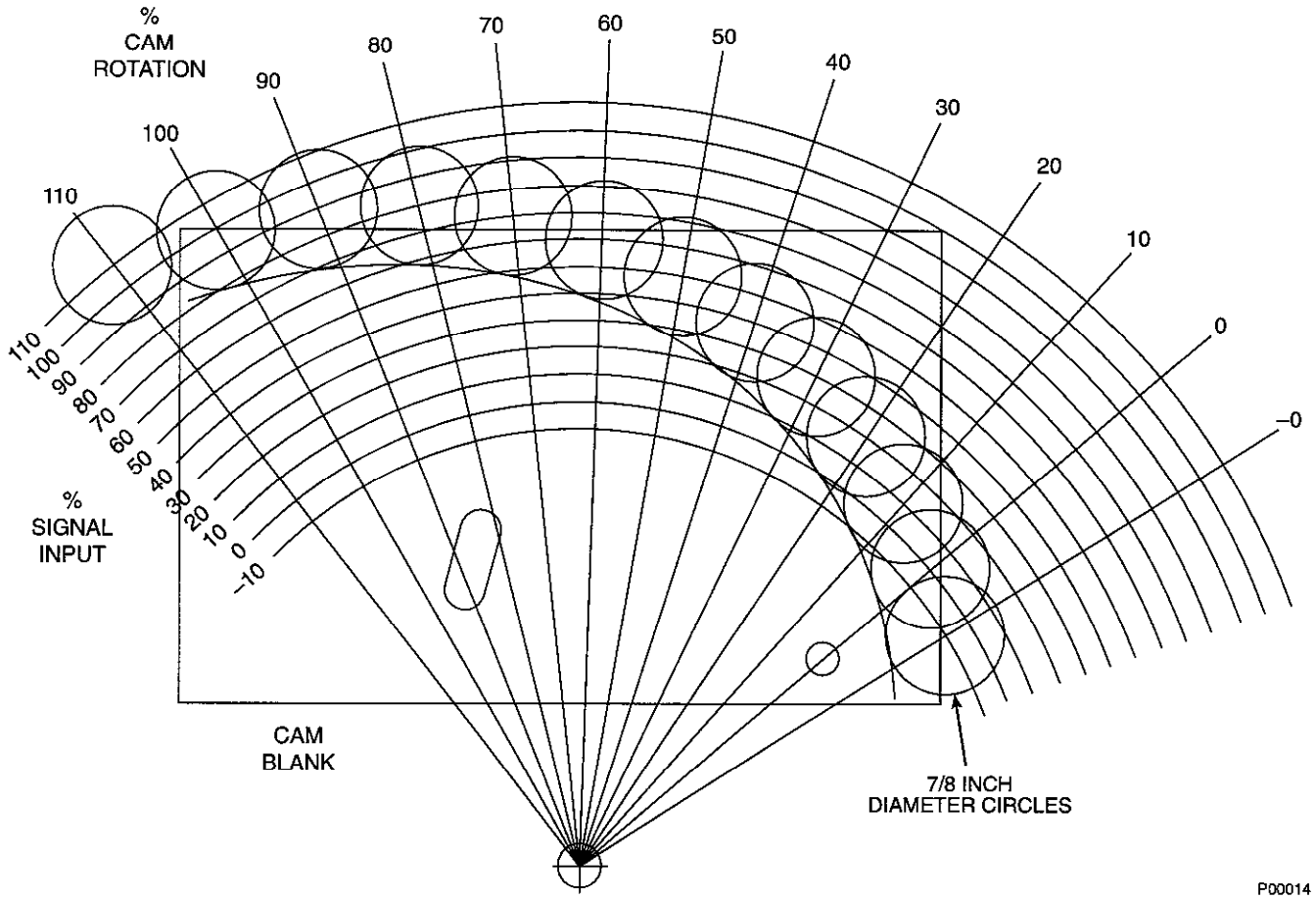


Figure A-7. Characterized Cam Example

22. Line up mounting and slotted holes of paper cam to mounting and slotted holes of metal cam. Cement paper cam to metal cam. Remove material from cam as needed to give metal cam shape of paper cam. Using a file or similar tool, smooth curve until no ridges or imperfections are felt on edge of curve.

23. Install cam on power positioner and check for a linear relationship between actual flow of system and input signal to power positioner. A 10% input signal will produce a 10% flow, a 50% input signal will produce a 50% flow. Make minor adjustments by draw filing cam.

24. Record power positioner characterized action in Table 4-2, schedule "D". Use the following procedure:

    (a) Set signal air to 0%.

    (b) Measure distance from top of packing washer to bottom of clevis head.

    (c) Increase signal air to 10%.

    (d) Measure distance from top of gland cap to bottom of clevis head. Subtract value in step 2. Record this value as piston movement in inches for 10% signal air in Table 4-2.

    (e) Repeat steps (c) and (d) for 20% to 90% in 10% increments.

    (f) Divide actual distance traveled at each signal by total distance traveled to determine percent of full stroke. Enter percent traveled at each signal in percent of full stroke column.

APPENDIX B. ELECTRIC POSITION TRANSMITTER FOR 8 INCH x 14 INCH POWER POSITIONER

SECTION I. DESCRIPTION

The Rosemount Electric Position Transmitter Field Retrofit Kit is designed for installation on the Rosemount 8 x 14 Torque Type Power Positioner. It transmits the position of the piston rod through a mechanical linkage to a potentiometer. The electric position transmitter converts the position of the potentiometer to a low level DC current which can be read on a DC milliammeter. The amplifier can be set to indicate "zero" with the piston extended or retracted.

SECTION II. CALIBRATION

B-1. AMPLIFIER CALIBRATION.

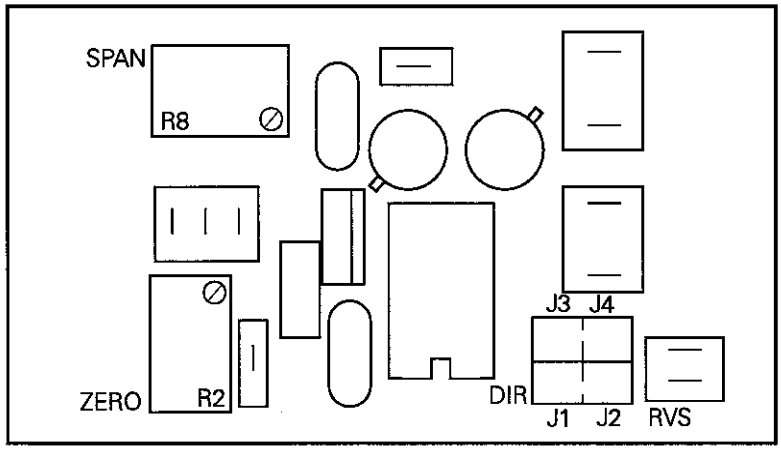
a. If the zero point of the positioner is with the piston fully retracted, jumpers P1 and P2 should be in the J1 and J3 positions. If the zero point is with the piston fully extended, then move the jumpers to J2 and J4 position (Figure B-1). The EPT cover must be removed to access the jumpers.

NOTE

Electric Position Transmitter units are preset at the factory for reverse operation (jumpers in the J2/J4 position).

b. Refer to Figure B-2 for a typical EPT wiring diagram.

c. Remove two plug buttons (1, Figure B-2) from the top of the transmitter case.



CONFIGURATION CHART		
JUMPER	DIRECT	REVERSE
P1	J1	J2
P2	J3	J4

Figure B-1. Jumper and Adjustment Location

NOTE

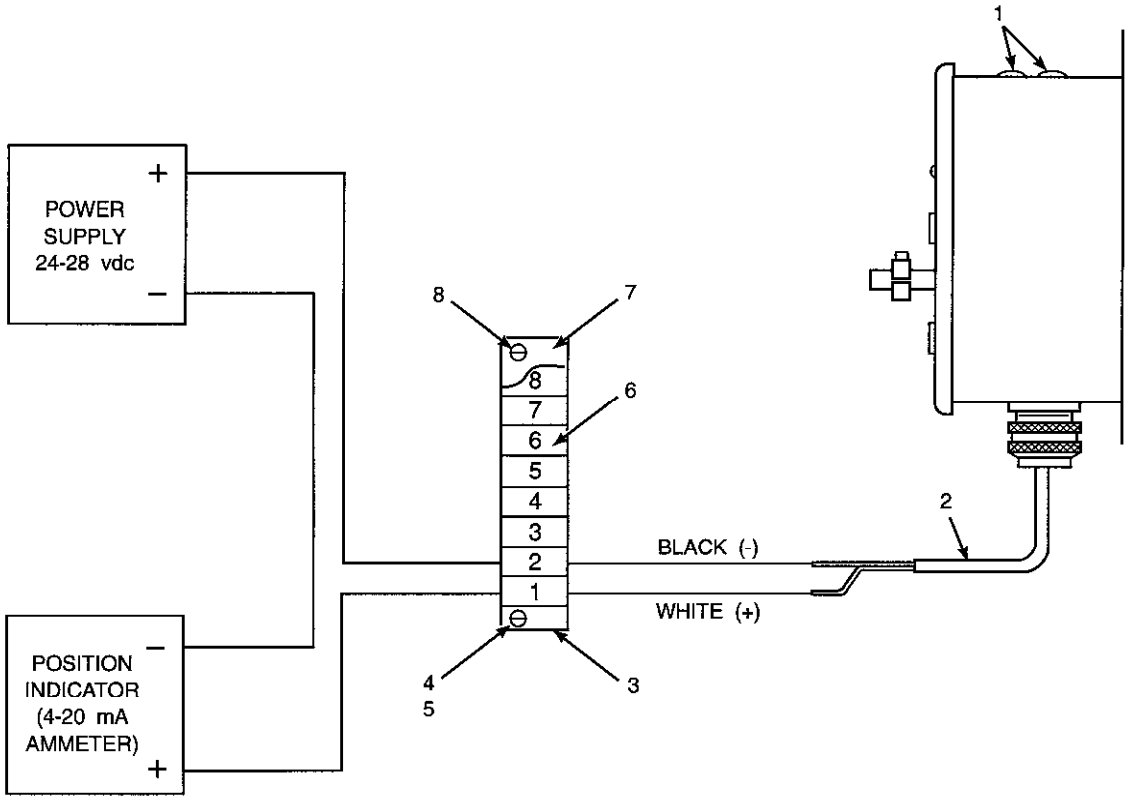
An ammeter may be connected in series for amplifier calibration to verify position indicating meter is giving accurate readings.

d. With the amplifier power supply on, move power positioner shaft to zero position. Tune zero adjustment (as labeled on amplifier cover) until ammeter indicates 4 mA.

e. Move the power positioner to the opposite end of its stroke and tune the span adjustment (as labeled on amplifier cover) for a reading of 20 mA.

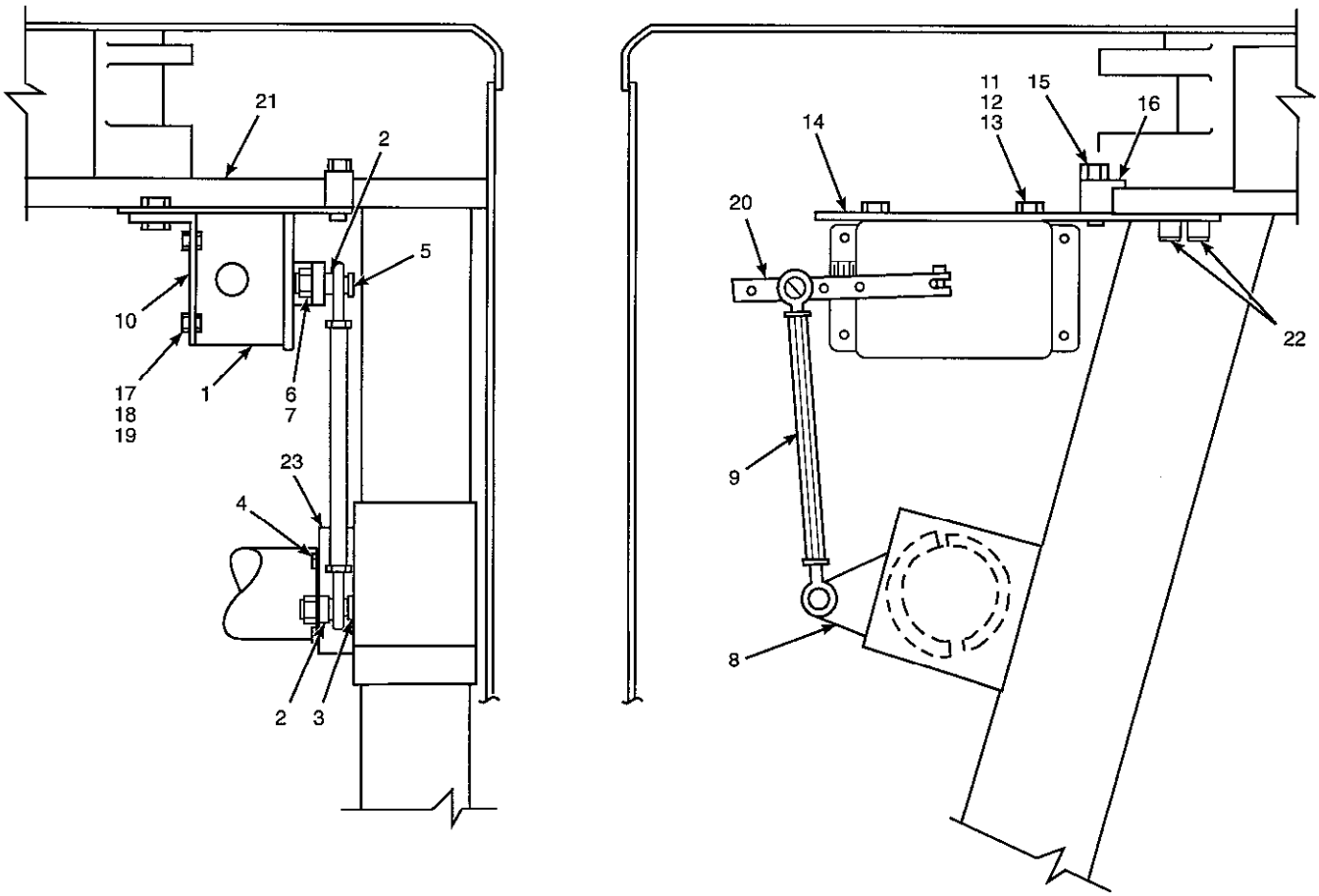
f. Replace two plug buttons (1, Figure B-2) in EPT case.

g. Install power positioner cover and secure with screws removed at disassembly.



ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	Button Plugs	5	Lock Washer
2	Amplifier Cable	6	Terminal Marker
3	Terminal Block	7	Terminal Cover
4	Pan Head Screw	8	Pan Head Screw

Figure B-2. EPT Wiring Installation



ITEM	DESCRIPTION	ITEM	DESCRIPTION
1	EPT	13	Nut
2	Spacer	14	Position Transmitter Bracket
3	Screw	15	Screw
4	Screw	16	Clamp
5	Screw	17	Screw
6	Washer	18	Lockwasher
7	Nut	19	Nut
8	Lever Blade	20	Lever Assembly
9	Hex Link	21	Positioner Floor Stand
10	Mounting Bracket	22	Existing Cap Screws
11	Screw	23	Existing Collar Clamp
12	Lockwasher		

Figure B-3. EPT Assembly

Table B-1. EPT Retrofit Kit Part No. 7362C69G01.

FIGURE and INDEX No.	PART or DRAWING No.	DESCRIPTION	QTY
B-3, 1	4511C68G01	Electric Position Transmitter	1
B-3, 2	2832A86H01	Spacer	2
B-3, 3	120103-1932075	Screw	1
B-3, 4	120103-1632025	Screw	2
B-3, 5	120103-1932100	Screw	1
B-3, 6	220197-002	Washer	1
B-3, 7	120033-007	Nut	2
B-3, 8	7305A21H01	Lever Blade	1
B-3, 9	172833-001	Hex Link	1
B-3, 10	7362C62H01	Mating Bracket	1
B-3, 11	120088-3816063	Screw	2
B-3, 12	120114-006	Lockwasher	2
B-3, 13	120082-008	Nut	2
B-3, 14	7362C63401	Position Transmitter Bracket	1
B-3, 15	120088-3118100	Screw	1
B-3, 16	6292A94H01	Clamp	1
B-3, 17	700010AJ8H	Screw	4
B-3, 18	70520AL10K	Lockwasher	4
B-3, 19	120032-17	Nut	4
B-3, 20	9884A39H01	Lever Assembly	1
	183504-002	Cable Clamp (Not Illustrated)	4
B-1, 1	1B1403-008	Terminal Block	1
B-1, 2	70001DAJ2P	Pan Head Screw	2
B-1, 3	70520AL10F	Lockwasher	2
B-1, 4	143650-005	Terminal Marker	1
B-1, 5	114656-005	Terminal Cover	1
B-1, 6	70001DAJ2T	Pan Head Screw	2

Table B-2. Recommended Spare Parts.

PART or DRAWING No.	DESCRIPTION
4844B27H01	Potentiometer, 10 K
4516D67G01	Amplifier PC Assembly

INDEX

This index is an alphabetical listing of parts, terms, and procedures having to do with the Hagan Model PP814T Torque Type Power Positioner. Every item listed in this index refers to a location in the manual by one or more page numbers.