Instruction Manual
IB-106-322N Original Issue
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Hagan 2-1/2 x 5 and 4 x 5

Econo Torque Type Floor Mounted Power Positioner

ROSEMOUNT® Analytical

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ESSENTIAL INSTRUCTIONS
READ THIS PAGE BEFORE PROCEEDING!

Rosemount Analytical designs, manufactures and tests its products to meet many national and international standards. Because these instruments are sophisticated technical products, you **MUST properly install, use, and maintain them** to ensure they continue to operate within their normal specifications. The following instructions **MUST be adhered to** and integrated into your safety program when installing, using, and maintaining Rosemount Analytical products. Failure to follow the proper instructions may cause any one of the following situations to occur: Loss of life; personal injury; property damage; damage to this instrument; and warranty invalidation.

- **Read all instructions** prior to installing, operating, and servicing the product.
- If you do not understand any of the instructions, **contact your Rosemount Analytical representative** for clarification.
- **Follow all warnings, cautions, and instructions** marked on and supplied with the product.
- **Inform and educate your personnel in the proper installation, operation, and maintenance of the product**.
- **Install your equipment as specified in the Installation Instructions of the appropriate Instruction Manual and per applicable local and national codes**. Connect all products to the proper electrical and pressure sources.
- To ensure proper performance, **use qualified personnel** to install, operate, update, program, and maintain the product.
- When replacement parts are required, ensure that qualified people use replacement parts specified by Rosemount. Unauthorized parts and procedures can affect the product's performance, place the safe operation of your process at risk, **and VOID YOUR WARRANTY**. Look-alike substitutions may result in fire, electrical hazards, or improper operation.
- **Ensure that all equipment doors are closed and protective covers are in place, except when maintenance is being performed by qualified persons, to prevent electrical shock and personal injury**.

The information contained in this document is subject to change without notice.

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PREFACE

The purpose of this manual is to provide information concerning the components, functions, installation and maintenance of the Hagan 2-1/2 x 5 and 4 x 5 Econo Torque Type Floor Mounted Power Positioner.

Some sections may describe equipment not used in your configuration. The user should become thoroughly familiar with the operation of this module before operating it. Read this instruction manual completely.

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.

⏚ : EARTH (GROUND) TERMINAL

⏚ : PROTECTIVE CONDUCTOR TERMINAL

⚠ : RISK OF ELECTRICAL SHOCK

⚠ : WARNING: REFER TO INSTRUCTION BULLETIN

NOTE TO USERS

The number in the lower right corner of each illustration in this publication is a manual illustration number. It is not a part number, and is not related to the illustration in any technical manner.

IMPORTANT

SAFETY INSTRUCTIONS FOR THE WIRING AND INSTALLATION OF THIS APPARATUS

The following safety instructions apply specifically to all EU member states. They should be strictly adhered to in order to assure compliance with the Low Voltage Directive. Non-EU states should also comply with the following unless superseded by local or National Standards.

1. Adequate earth connections should be made to all earthing points, internal and external, where provided.

2. After installation or troubleshooting, all safety covers and safety grounds must be replaced. The integrity of all earth terminals must be maintained at all times.

3. Mains supply cords should comply with the requirements of IEC227 or IEC245.

4. All wiring shall be suitable for use in an ambient temperature of greater than 75°C.

5. All cable glands used should be of such internal dimensions as to provide adequate cable anchorage.

6. To ensure safe operation of this equipment, connection to the mains supply should only be made through a circuit breaker which will disconnect all circuits carrying conductors during a fault situation. The circuit breaker may also include a mechanically operated isolating switch. If not, then another means of disconnecting the equipment from the supply must be provided and clearly marked as such. Circuit breakers or switches must comply with a recognized standard such as IEC947. All wiring must conform with any local standards.

7. Where equipment or covers are marked with the symbol to the right, hazardous voltages are likely to be present beneath. These covers should only be removed when power is removed from the equipment — and then only by trained service personnel.

8. Where equipment or covers are marked with the symbol to the right, there is a danger from hot surfaces beneath. These covers should only be removed by trained service personnel when power is removed from the equipment. Certain surfaces may remain hot to the touch.

9. Where equipment or covers are marked with the symbol to the right, refer to the Operator Manual for instructions.

10. All graphical symbols used in this product are from one or more of the following standards: EN61010-1, IEC417, and ISO3864.

SECTION 1
DESCRIPTION AND SPECIFICATIONS

1-1 GENERAL

The Rosemount Model PP075T Econo Torque Power Positioner (Figure 1-1) is a pneumatic, double-acting, piston-type power positioner. The unit converts a pneumatic input signal to a corresponding mechanical movement for positioning devices such as guide vanes, control valves, and dampers.

As shown by the model number explanation in paragraph 1-3, the positioner can be supplied with either a 2-1/2 x 5 in. or 4 x 5 in. cylinder, as required. Both cylinders are available with either direct linear feedback or characterized cam feedback depending upon system application. A non-characterized unit can easily be converted in the field to a characterized version with the addition of a few bolt-on parts. Consult the factory for details.

Other options include an auto/manual transfer valve, brake, limit switches, and heater/ thermostat.

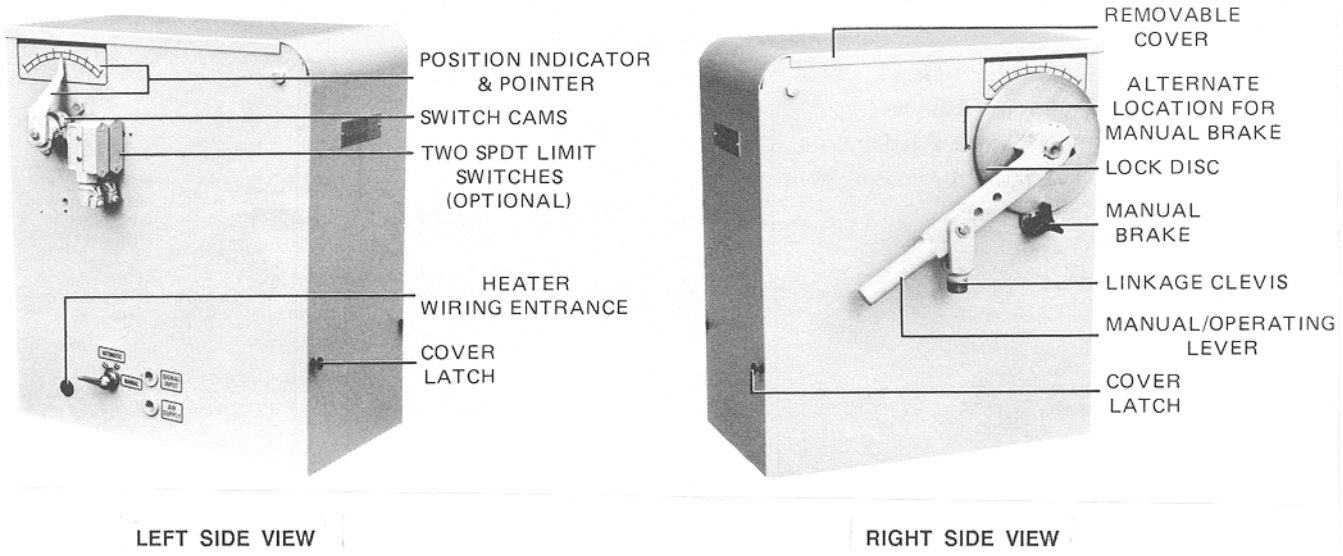


Figure 1-1. Model PP075T Power Positioner

1-2 SPECIFICATIONS

Refer to Descriptive Bulletin 100-322.

Repeatability	3% of Full Stroke
Sensitivity	6% of Full Stroke
Temperature Limit	40° to 170° F (4° to 77° C)
Full Stroke	
Time (unloaded)	2 seconds or less
Air Supply	
Maximum	120 psi (827.4 kPa)
Minimum	45 psi (310.3 kPa)
Recommended	100 psi (689.5 kPa)
Air Consumption	0.4 SCFM (11.3 L/min.) Free Air
Torque Load Data based on recommended air supply	
Small Torque	120 ft-lbs (162.7 N·m)
Control Torque	75 ft-lbs (101.7 N·m)
Maximum Friction	
Load	30 ft-lbs (40.7 N·m)
Maximum Allowable	
Weight Load	45 ft-lbs (60.0 N·m)
Input Signal	3-15, 3-27, or 0-30 psi (20.7-103.4, 20.7-186.2, or 0-116.9 kPa)
Output Shaft Angle	80°
Unit Weight	60 lbs (27.2 g)

1-3 MODEL NUMBER ENCODING (6296A02, REV. 2)

The complete model number for the Model PP075T Power Positioner is derived as follows:

MODEL PP075T

Pneumatic Power Positioner

Control Torque Rating – ft-lbs

Econo Torque Floor Mounted

Positioner Type
- 1 Noncharacterized
- 2 Characterized

Positioner Size (diameter and stroke in inches)
- 1 2-1/2 x 5 Cylinder
- 2 4 x 5 Cylinder

Signal Range
- 1 3-15 psig (20.7-103.4 kPa)
- 2 3-27 psig (20.7-186.2 kPa)
- 3 0-30 psig (0-116.9 kPa)
- 4 4-20 mA (I/P Transducer mounted and piped)

Manual and Break Operation
- 0 None
- 1 Manual Operator Only
- 2 Manual Operator and Brake
- 3 Manual Operator, Manual Lock, and Soft Air Lock
- 4 Manual Operator, Manual Lock, and Fail Safe (fails to 100%)

Limit Switches
- 0 None
- 2 Two SPDT switches
- 3 Electric Positioner Transmitter (EPT)
- 4 Two SPDT Switches and EPT

Heater/Thermostat
- 0 None
- 1 117 Vac, 150 watt Heater with Thermostat

SECTION 2
INSTALLATION

2-1 MECHANICAL (Refer to Figure 2-1)

a. Location Selection

The power positioner should be located in a dry area free of excessive shock and vibration with a continuous ambient temperature meeting specifications listed in paragraph 1-2.

Sufficient clearance must be allowed for the operating lever. Allow a 24 in. (610 mm) minimum working space for front cover removal and maintenance.

b. Mount Power Positioner

The power positioner is designed to be mounted in an upright position. The base of the unit can be bolted to a horizontal surface using three 0.5 in. (12.7 mm) diameter mounting bolts (not supplied).

c. Position Operating Lever, Output Indicator, and Manual Brake (Optional)

The operating lever, output indicator, and manual brake (optional) can be installed on either side of the power positioner as desired. This allows the unit to be used for either right-hand or left-hand external linkage operation.

As viewed from the right side of the power positioner, the operating lever will move clockwise with an increasing input signal (not reversible). To change the motion of the operating lever with respect to the input signal, the operating lever must be positioned on the left side of the power positioner or rotated 180 degrees.

The operating lever has an 80 degree operating angle range and can be installed at any position around the shaft.

To prevent interference between the brake clamp and the operating lever, provision has been made to allow the brake clamp to be located on either the shaft vertical or horizontal centerline on either side of the stand (Figure 2-1).

d. Position Limit Switches (Optional)

Both SPDT switches can be mounted on either side of the housing; however, they must be located on the side opposite the output/manual lever.

The switches can be set to trip at any position.

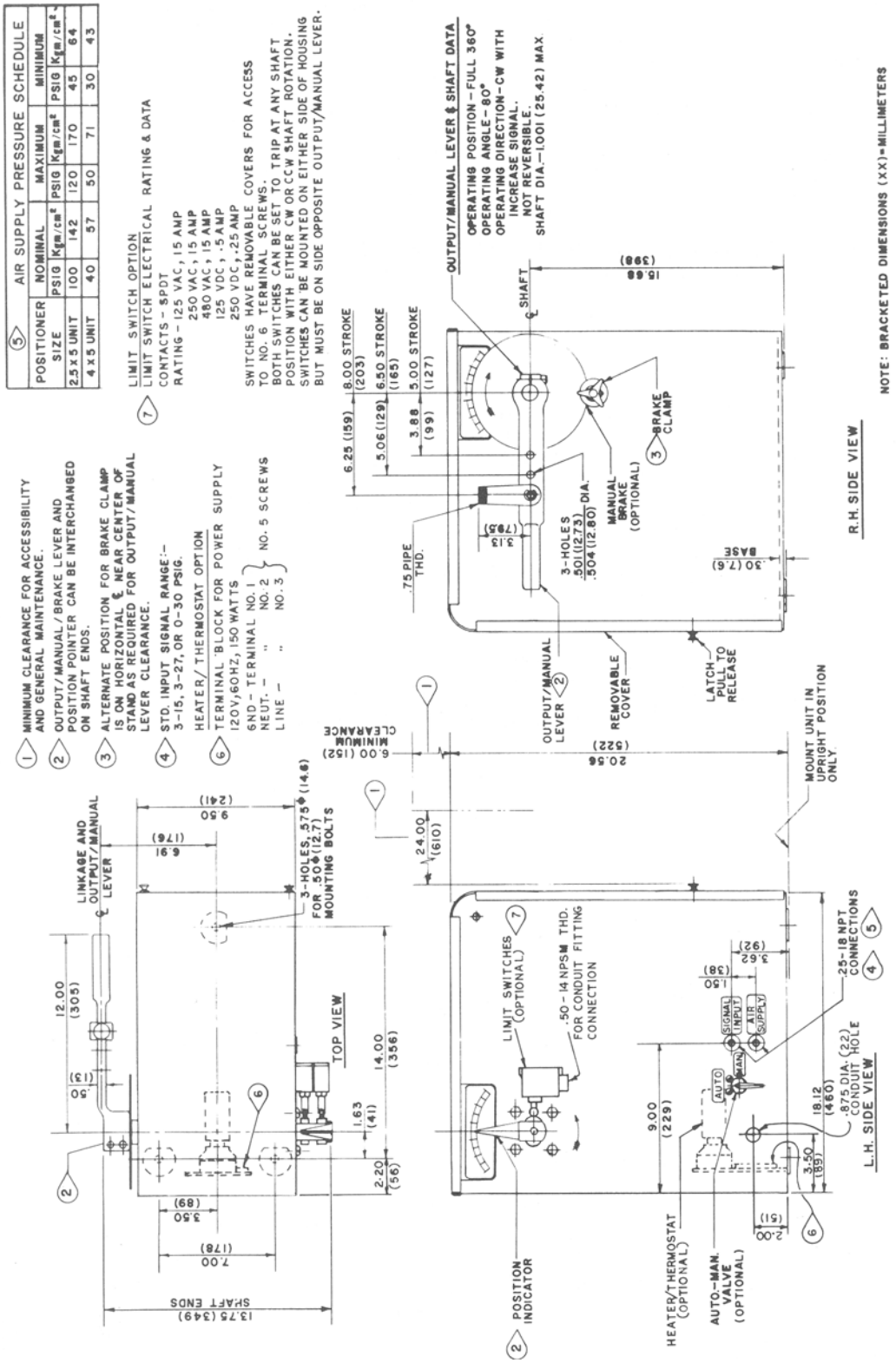


Figure 2-1. Model PP075T Power Positioner, Mounting Dimensions (263C469, Rev. 2)

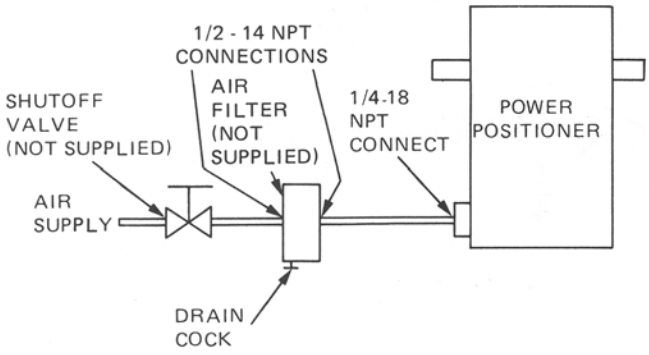


Figure 2-2. Typical Air Supply Installation

e. Connect Air Supply Piping

The air supply piping should be installed with a manual shutoff valve and air filter as shown in Figure 2-2. The shutoff valve is necessary to isolate the power positioner during servicing. Copper tubing with 1/4 inch O.D. and 0.035 in. (0.89 mm) wall thickness is recommended for piping to the air supply connection. A sealant may be used, if necessary, to prevent leakage at the connections. Use sparingly.

Air filter P/N 771B920 must be used in order to provide reliable, continuous service. When connected properly, the air filter will remove finely dispersed water or oil droplets from the air supply, thereby preventing sticking action in the pilot valve. Port 2 (inlet) is connected to the air supply; Port 1 (outlet) is connected to the power positioner.

Prior to connecting the air supply line to the power positioner, the supply line should be purged as follows:

1. Purge air supply line before connecting air filter.
2. Connect air filter and open drain cock.
3. Slowly open the air shutoff valve and allow moisture and foreign particles to be blown out through the drain cock.
4. Close the drain cock and allow compressed air to blow through the open end of the air supply piping until all dirt and foreign particles are blown out.
5. Shut off the compressed air supply.
6. Connect the air supply line to the 0.25-18 NPT female connection on the power positioner, Figure 1-1.

   Air supply pressures are as follows:

	2-1/2 x 5 Unit	4 x 5 Unit
Recommended	100 psig (689.5 kPa)	40 psig (275.8 kPa)
Maximum	120 psig (827.4 kPa)	50 psig (344.8 kPa)
Minimum	45 psig (310.3 kPa)	30 psig (206.9 kPa)

f. Connect Input Signal Piping

Prior to connecting the input signal piping to the power positioner, blow out piping by operating the relay station at the control panel and manually set up a signal pressure between 50 and 100 percent. Allow the air to blow through the open end of the tubing. Reduce the signal pressure to zero and connect the signal piping to the 0.25-18 NPT female connection (Figure 2-1) on the power positioner.

2-2 ELECTRICAL

a. Heater/Thermostat Wiring (Optional)

Heater power consumption is 150 watts using a 120 Vac, 60 Hz power source.

Feed the heater power supply wiring through the 0.5 in. (12.7 mm) conduit hole located on the lower left-hand side of the housing (Figure 1-1) and connect to the internal terminal board using the No. 5 connection screws (Figure 2-3).

b. Limit Switch Wiring (Optional)

Each switch has a 0.5-14 NPSM threaded opening suitable for a 0.5 in. (12.7 mm) flexible conduit fitting. A removable cover on the switch permits access to No. 6 screw terminals.

Electrical ratings for the limit switch SPDT contacts are as follows:

15.00A at 125 Vac, 250 Vac, or 480 Vac
0.50A at 125 Vdc
0.25A at 250 Vdc

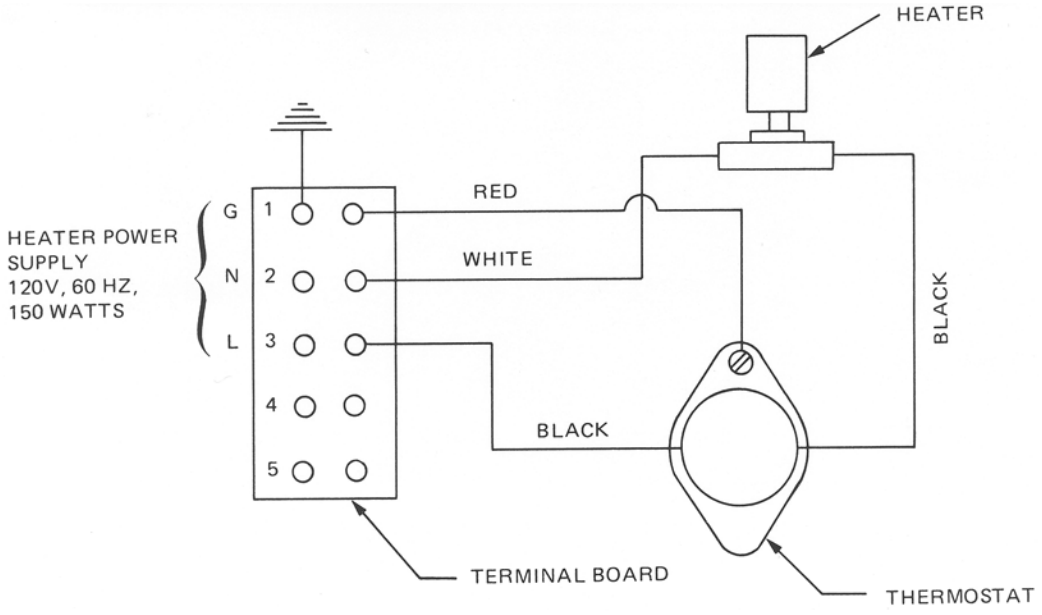


Figure 2-3. Heater/Thermostat Wiring Diagram

SECTION 3
CALIBRATION

3-1 CALIBRATION PROCEDURES

The power positioner must be calibrated so that the piston is at its lower limit when the control signal is at minimum pressure and moves to its upper limit when the signal is increased to maximum pressure.

a. Characterized Units (Figure 3-1 and Figure 3-2).

1. Using the manual/operating lever, position the piston against its lower stop.

2. Disconnect the external mechanical linkage at the clevis (Figure 1-1).

3. Slide the feedback cam (Figure 3-1) mounted on a split hub clamp along the output shaft until hub clamp bears against the right side of the shaft ring (Figure 3-2).

4. Rotate the cam until the roller on feedback lever (51, Figure 7-1) drops into the cam pocket and just starts to rise out of the pocket. At this point, there will be a slight upward movement at the swivel end of the feedback lever.

NOTE

The feedback spring should be under some slight tension to ensure the cam roller contacts the cam face.

5. At this position, tighten the hub on the output shaft.

6. Apply minimum control signal to the pilot valve. The piston should move to the lowest position, against bottom cylinder head. Check this zero adjust in the following manner:

   (a) Maintain minimum control signal on the pilot valve.

   (b) Loosen the set screw on the positioner arm.

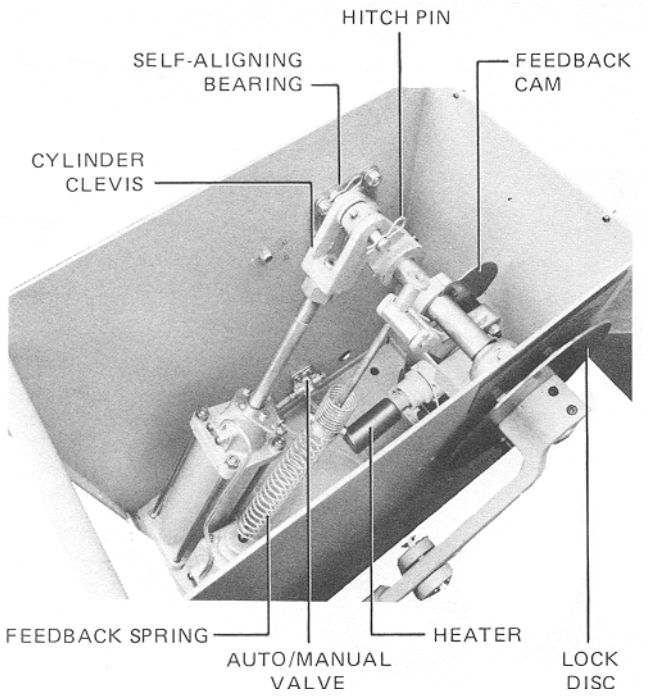


Figure 3-1. Characterized Unit, Top View

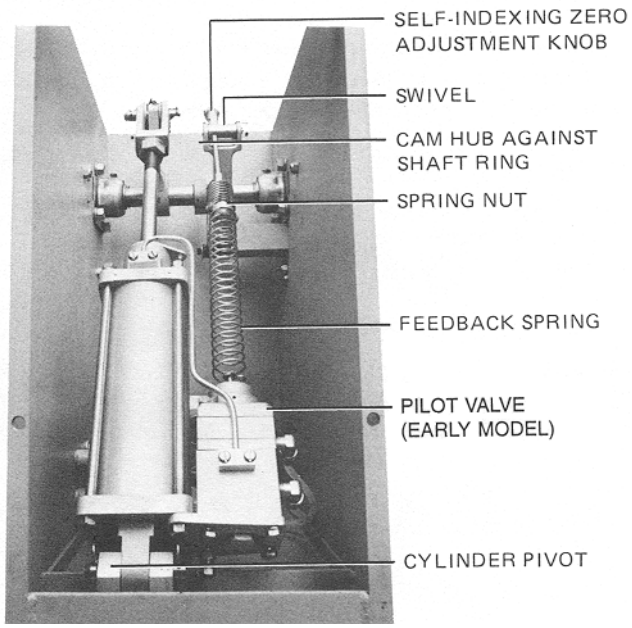


Figure 3-2. Characterized Unit, Front View

(c) Move the positioner arm up until the piston moves to the bottom of the cylinder.

(d) Move the positioner arm down until the piston begins to move upward.

(e) Move the positioner arm down until the piston just returns to lowest position.

(f) Lock this setting by tightening the set screw until the positioner arm binds to the piston rod.

7. With the piston at the bottom of the cylinder, place a mark on either the clevis or the 0.5 in. (12.7 mm) diameter chrome-plated piston rod. The mark is for use in measuring the piston stroke. If the stroke is not correct, increase or decrease the number of active coils in the calibration spring. Active coils are those that are free of the positioner arm and that flex when under load.

   Determine stroke by increasing control signal pressure slowly and observing travel of the mark (discussed in preceding paragraph).

   (a) If the piston moves to upper limit before the control signal reaches maximum pressure, the number of active coils must be decreased as described in step 8.

   (b) If piston travel is less than desired when maximum signal is applied, the number of active coils must be increased as described in step 9. Maximum travel is approximately 5 in. (127 mm).

   (c) If piston stroke is satisfactory, perform steps 10, 11, and 12.

8. To decrease the number of active coils, use the following procedure:

   (a) Reduce control signal to zero.

   (b) Count the active coils of calibration spring. Active coils are those that are free of the positioner arm and that flex when under load.

   (c) Determine the exact control signal pressure at which the piston reaches upper limit.

   (d) Determine the number of active coils required by using the following equation:

   $$\frac{Pa}{Pm} \times Ca = \text{Number of active coils required}$$

   Where:

   Pa = Signal pressure at which piston reaches upper limit
   Pm = Maximum control signal pressure to be used
   Ca = Actual number of active coils

   (e) Reduce active coils to the number required by turning the calibration spring further onto the positioner arm.

   (f) Repeat step 7 to check the stroke again.

9. To increase the number of active coils, use the following procedure:

   (a) Reduce control signal to zero.

   (b) Count active coils of calibration spring. Active coils are those that are free of the positioner arm and that flex when under load.

   (c) Determine exact piston stroke by measuring amount of travel of the mark (on piston rod or clevis) when control signal is increased from zero to maximum pressure.

   (d) Determine the number of active coils required by using the following equation:

   $$\frac{Sr}{Sa} \times Ca = \text{Number of active coils required}$$

   Where:

   Sa = Actual stroke
   Pm = Required stroke
   Ca = Actual number of active coils

(e) Increase the number of active coils by turning spring off of the positioner arm.

(f) Repeat step 7 to see if desired stroke is obtained.

10. Repeat step 6 to check minimum setting again.

11. Check mechanical linkage between the positioner and the damper or valve that the positioner positions. All links must be properly aligned.

12. Reconnect mechanical linkage to clevis.

b. Noncharacterized Units (Figure 3-3).

1. Using the manual/operating lever, position the piston against its lower stop.

2. Disconnect the external mechanical linkage at the clevis, Figure 1-1.

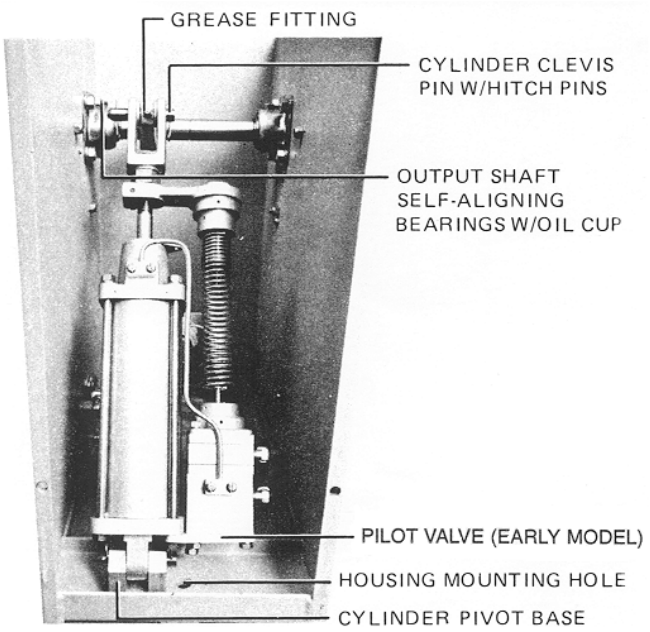


Figure 3-3. Noncharacterized Unit, Front View

3. Apply minimum control signal to the pilot valve. The piston should move to the lowest position, against bottom cylinder head. Check this zero adjust in the following manner:

(a) Maintain minimum control signal on the pilot valve.

(b) Loosen the set screw on the positioner arm.

(c) Move the positioner arm up until the piston moves to the bottom of the cylinder.

(d) Move the positioner arm down until the piston begins to move upward.

(e) Move the positioner arm down until the piston just returns to lowest position.

(f) Lock this setting by tightening the set screw until the positioner arm binds to the piston rod.

4. With the piston at the bottom of the cylinder, place a mark on either the clevis or the 0.5 in. (12.7 mm) diameter chrome-plated piston rod. The mark is for use in measuring the piston stroke. If the stroke is not correct, increase or decrease the number of active coils in the calibration spring. Active coils are those that are free of the positioner arm and that flex when under load.

Determine stroke by increasing control signal pressure slowly and observing travel of the mark (discussed in preceding paragraph).

(a) If the piston moves to upper limit before the control signal reaches maximum pressure, the number of active coils must be decreased as described in step 5.

(b) If piston travel is less than desired when maximum signal is applied, the number of active coils must be increased as described in step 6. Maximum travel is approximately 5 in. (127 mm).

(c) If piston stroke is satisfactory, perform steps 7, 8, and 9.

5. To decrease the number of active coils, use the following procedure:

   (a) Reduce control signal to zero.

   (b) Count the active coils of calibration spring. Active coils are those that are free of the positioner arm and that flex when under load.

   (c) Determine the exact control signal pressure at which the piston reaches upper limit.

   (d) Determine the number of active coils required by using the following equation:

   $$\frac{Pa}{Pm} \times Ca = \text{Number of active coils required}$$

   Where:

   Pa = Signal pressure at which piston reaches upper limit
   Pm = Maximum control signal pressure to be used
   Ca = Actual number of active coils

   (e) Reduce active coils to the number required by turning the calibration spring further onto the positioner arm.

   (f) Repeat step 4 to check the stroke again.

6. To increase the number of active coils, use the following procedure:

   (a) Reduce control signal to zero.

   (b) Count active coils of calibration spring. Active coils are those that are free of the positioner arm and that flex when under load.

   (c) Determine exact piston stroke by measuring amount of travel of the mark (on piston rod or clevis) when control signal is increased from zero to maximum pressure.

   (d) Determine the number of active coils required by using the following equation:

   $$\frac{Sr}{Sa} \times Ca = \text{Number of active coils required}$$

   Where:

   Sa = Actual stroke
   Pm = Required stroke
   Ca = Actual number of active coils

   (e) Increase the number of active coils by turning spring off of the positioner arm.

   (f) Repeat step 4 to see if desired stroke is obtained.

7. Repeat step 3 to check minimum setting again.

8. Check mechanical linkage between the positioner and the damper or valve that the positioner positions. All links must be properly aligned.

9. Reconnect mechanical linkage to clevis.

SECTION 4
THEORY OF OPERATION

4-1 GENERAL

The piston assembly and power take-off clevis of the power positioner (Figure 4-1) move away from the mounting pivot with an increase in control signal pressure. Movement of the piston, which is equipped with graphite-impregnated teflon piston cups, begins when the increasing control signal at the pilot valve assembly causes the stainless steel stem to move downward from the neutral setting. The pilot valve assembly then directs power air through the bottom tubing assembly to the bottom of the aluminum cylinder and exhausts air at the other end of the cylinder to atmosphere. The resulting pressure difference across the piston moves it upward.

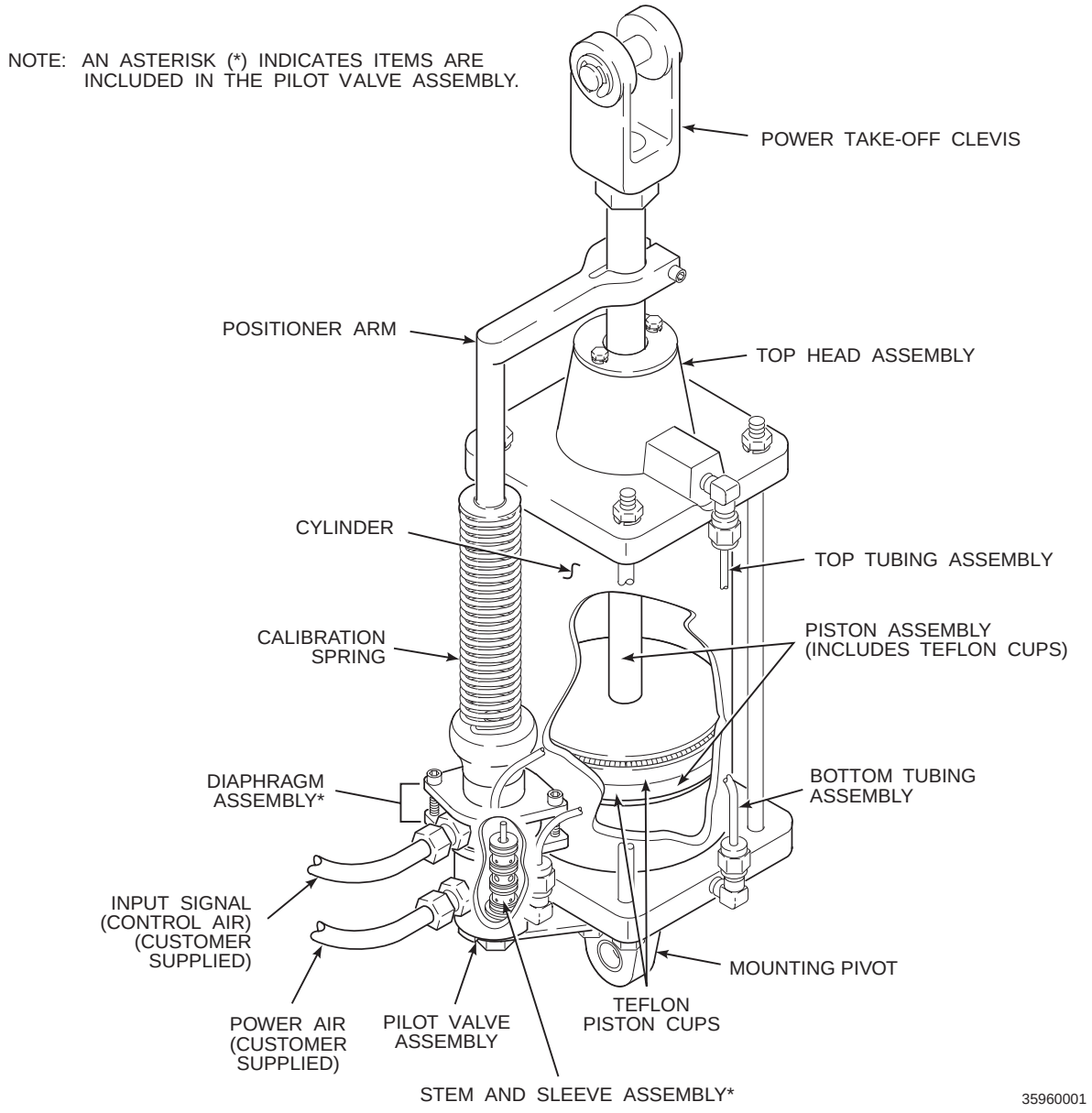


Figure 4-1. Cylinder Unit - Main Components

Characterized power positioners employ a feedback cam in series with the calibration spring, adjusting linkage, and the output shaft. The shape of the cam affects the force exerted by the feedback spring, thereby providing the desired relationship between the piston position and the input air pressure signal.

Two cams are available for the positioner. The normally supplied standard linear cam has a linear function on one half and a square function on the other half. The other cam (optional) has a square root function on one half with the other half blank for cutting a special function in the field.

The AUTO/MANUAL valve (optional) allows the operating lever to be used for manual positioning. In MANUAL, the air supply to the pilot valve will be blocked off and the manual brake clamp can be applied to hold the unit in the desired position.

As the piston moves upward, it raises the upper end of the calibration spring. Tension in the spring is the feedback force in the pilot valve assembly. Piston movement continues until the spring force equals the force from the control signal, which restores the pilot valve stem to the neutral position. This blocks the flow of power air to cylinder and prevents further piston movement until signal pressure changes again.

For each control signal pressure, the piston is at a particular distance from the bottom of the cylinder. At the minimum signal, it is at the lowest point in the cylinder. At the maximum signal, it is at the upper limit, a distance of 5 in. (127 mm) from the lowest point. At any other signal, the distance from the bottom of the cylinder is proportional to the signal pressure. Full stroke time is two seconds or less. Toggling of the piston rod at or near full stroke is prevented by the large area guide bearings, which are set relatively far apart in the top head assembly. The guide bearings are made of sintered teflon.

4-2 PILOT VALVE

The pilot valve is a force/balance device. The pilot valve makes use of an external calibration spring (connected to the positioner arm), an internal dual-diaphragm assembly, and a sleeve and stem assembly.

Pilot valve operation is determined by the interaction of two primary forces:

a. A downward force developed by the control signal as it acts upon the diaphragm assembly.

b. An upward force created by the tension of the calibration spring.

In operation, the pilot valve diaphragm assembly moves up or down and repositions the stem when the force of the calibration spring and the force due to the signal pressure are not in balance. Starting with the stem in the neutral position, an increase of the control signal pressure causes a downward movement of the pilot valve diaphragm assembly. This forces the stem downward, uncovering ports in a stainless sleeve which permit power air to flow into the lower end of the cylinder and the air in the upper end to exhaust to atmosphere. The piston moves upward and pulls on the calibration spring. Tension in this spring increases until it balances the force due to the control signal acting in the diaphragm assembly. The stem then returns to the neutral position and blocks the ports in the sleeve, which prevents further movement of the piston.

With a decrease in control signal pressure, the opposite actions occur. In this case, the force due to the control signal becomes less than the force of the calibration spring. The spring then pulls the spring post and stem seat upward. The stem is pushed upward by the spring in the pilot valve assembly and uncovers ports that transmit power air from the pilot valve to the top of the cylinder and exhaust the bottom of the cylinder. The piston then moves downward, which reduces the tension in the calibration spring until it balances the force due to the lower control signal. The pilot valve assembly stem will then be in the neutral position again and prevent further movement of the piston.

SECTION 5
MAINTENANCE

5-1 GENERAL MAINTENANCE PROCEDURES

Proper functioning of the Rosemount Model PP075T Econo Torque Power Positioner depends on proper maintenance procedures. All procedures in this section must be followed carefully.

a. Cylinder and Stand Assembly Access

To gain access to the cylinder assembly and other items inside the stand assembly for maintenance, perform the following steps:

1. Pull one top hitch pin (Figure 3-1) and the cylinder clevis pin (Figure 3-3).

NOTE

For the characterized unit, it will be necessary to unhook the feedback screw swivel from the feedback lever.

2. Swing the cylinder outward through the front opening of the stand assembly.

   If required, the cylinder assembly can be completely removed from the stand assembly.

   (a) Disconnect all air tubes from cylinder.

   (b) Pull one hitch pin and cylinder pin at both ends of the cylinder.

NOTE

The characterized unit will also require that the feedback lever be unhooked.

Routine maintenance includes periodic lubrication, draining, and cleaning the air filter, the pilot valve stem, and sleeve. Other maintenance will be required only when the positioner fails to operate satisfactorily. Refer to the troubleshooting procedure in paragraph e.

b. Lubrication

1. Using a grease gun, periodically lubricate the fitting (Figure 3-3) on the top end of the cylinder with moly disulfide grease.

2. Periodically fill the oil cups on the two self-aligning output shaft bearings with SAE No. 10 oil.

3. At regular intervals, apply a few drops of SAE No. 30 oil to both the power take-off clevis pin and the mounting pivot pin.

4. Occasionally oil the mechanical linkage between the power positioner and the controlled element.

NOTE

The cam follower roller and the feedback lever needle bearings are prelubed and sealed at the factory and thus require no additional maintenance.

c. Air Supply Filter (P/N 771B920)

The air supply filter should be drained as necessary and never be allowed to become over one-half full of condensation.

Disposable filter elements within the filter should be inspected occasionally and replaced if necessary. New filter elements are available from the factory in quantities of ten per box, P/N 6292A98H01.

d. Cleaning Pilot Valve Sleeve and Stem

When clean and dry compressed air is used and the positioner is operated in a normal manner, the sleeve and stem should be removed from the pilot valve assembly, cleaned, and inspected once every six months. More frequent cleaning and inspection may be required if the condition of the air is poor or if operating conditions are severe.

A sticking stem will cause sluggish piston response during control signal changes. A worn stem will cause power air to continuously blow through the exhaust ports in the pilot valve body.

Use the following procedure for cleaning and inspecting the pilot valve:

1. Shut off the compressed air supply to the pilot valve assembly.
2. Reduce the control signal to zero.
3. Remove the pilot valve stem and sleeve as follows:

NOTE

The pilot valve stem and sleeve can be removed without disconnecting the cylinder from the cylinder lever, or the cylinder can be disconnected at the cylinder lever and laid back inside stand housing. The characterized unit will require the lower end of the range spring to be slid off the pilot valve spring post.

(a) Unscrew sleeve retainer (18, Figure 5-1).

(b) Remove bottom loading spring (17) and bottom stem seat (16).

CAUTION

Be careful not to lose stem, bottom stem seat, and bottom loading spring.

(c) Allow the stem to fall from pilot valve assembly.

CAUTION

Be careful that the stem does not fall on a hard surface. If the stem will not fall, use the special cap screw fixture to remove the sleeve and stem assembly.

(d) Wash the stem and sleeve with solvent. Dry the sleeve with compressed air and wipe off the stem with a clean cloth.

CAUTION

Do not use any abrasives or sharp tools to clean stem and sleeve.

(e) Check the stem for straightness by rolling it on a flat surface. If not perfectly straight, it must be replaced.

NOTE

Both the stem and the sleeve must be replaced together as a complete assembly.

(f) Check that o-rings on the stem and sleeve assembly are in good condition. Install new o-rings if necessary.

(g) Insert the stem into the bore of the sleeve.

NOTE

Since the stem is symmetrical, it may be installed with either end toward the bottom of the sleeve.

(h) Install the sleeve in the pilot valve assembly using the special cap screw fixture.

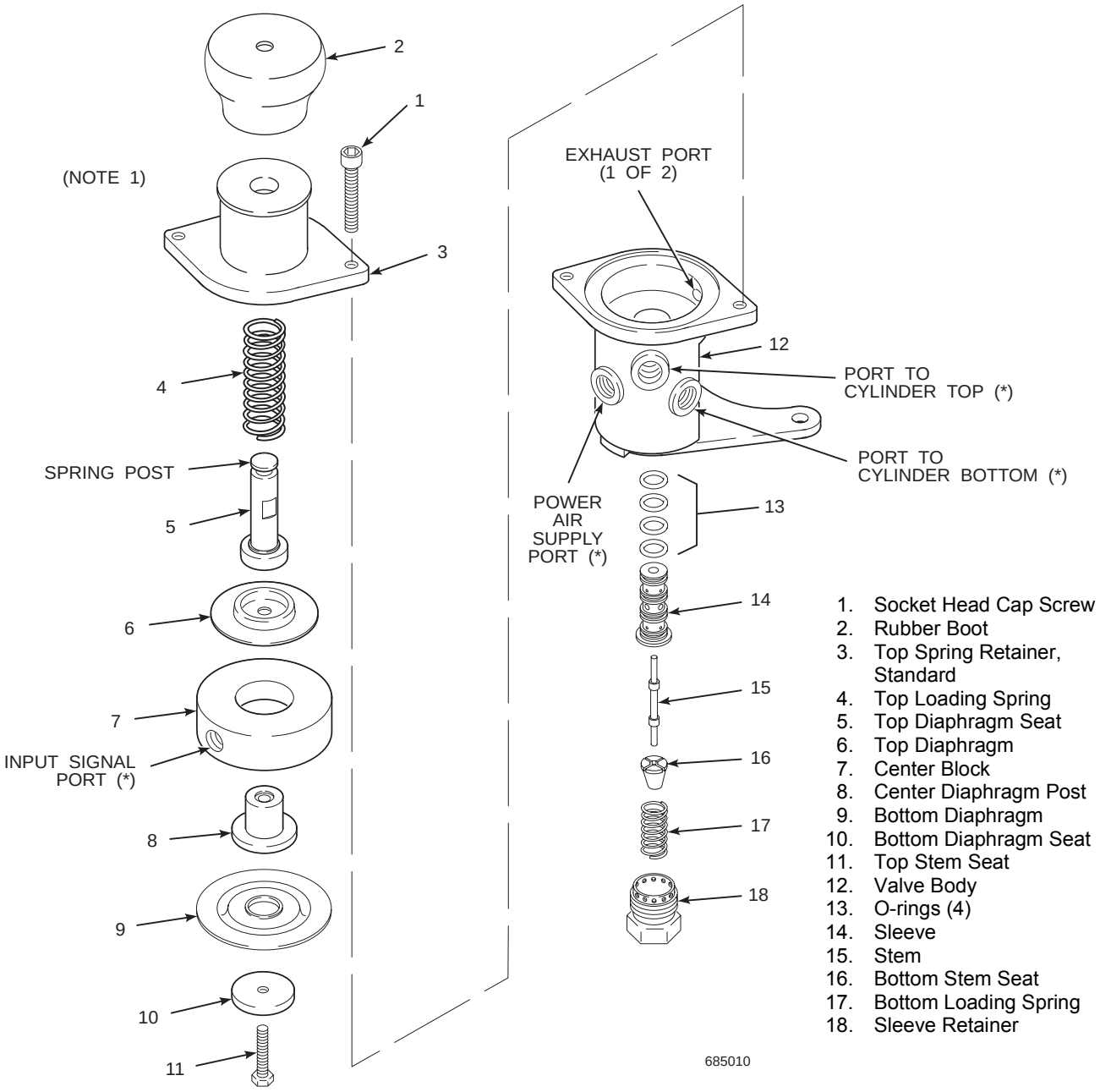
(i) Replace the pilot valve bottom stem seat (16, Figure 5-1), bottom loading spring (17), and sleeve retainer (18).

(j) Tighten the sleeve retainer until it contacts the bottom of the sleeve.

(k) Turn on the air supply pressure and reapply the control signal. The power positioner is now ready for operation.

e. Troubleshooting

The four most common causes of unsatisfactory operation of the Model PP075T power positioner are listed below. Check if any of these conditions exist and correct them before removing the positioner from service.



1. Socket Head Cap Screw
2. Rubber Boot
3. Top Spring Retainer, Standard
4. Top Loading Spring
5. Top Diaphragm Seat
6. Top Diaphragm
7. Center Block
8. Center Diaphragm Post
9. Bottom Diaphragm
10. Bottom Diaphragm Seat
11. Top Stem Seat
12. Valve Body
13. O-rings (4)
14. Sleeve
15. Stem
16. Bottom Stem Seat
17. Bottom Loading Spring
18. Sleeve Retainer

NOTE 1: 2-1/2 X 5 POWER POSITIONERS USING AN EPT REQUIRE A MODIFIED TOP SPRING RETAINER AND A TOP DIAPHRAGM COVER IN PLACE OF ITEM (3). IN THE STANDARD PILOT VALVE ASSEMBLY A TOP DIAPHRAGM COVER IS NOT USED.

NOTE 2: AN ASTERISK (*) INDICATES A 1/8 NPT TAPPED PORT.

Figure 5-1. Pilot Valve Assembly - Exploded View

1. Complete loss of air supply or air supply pressure is below normal. Check for the following conditions:
   (a) Air supply shut off at a valve or a break (or blockage) in piping.
   (b) Pressure reducing valves incorrectly adjusted. Adjust valves.
   (c) Restricted air filter elements. Blow down all filters.
2. Plugged air signal line. Check that all lines are clean and free of foreign material.
3. Leaks in air signal lines. Apply soap suds on each connection and check for leaks.
4. Excessive friction at mounting pivot, take-off clevis, and associated mechanical linkage. Check that these points are well oiled and not binding.

   If none of these causes of trouble are found, refer to the troubleshooting chart (Table 5-1).

f. Replacement of Pilot Valve Diaphragms

1. General. Diaphragms (6 and 9, Figure 5-1) in the pilot valve assembly must be replaced if they are soft and spongy, hard and brittle, or broken. A broken diaphragm shows up as erratic operation of the power positioner with piston not moving to upper limit when the maximum signal is applied to pilot valve. If the break is large, considerable signal air will be noticed leaking continuously from pilot valve assembly.
2. Procedure. Use the following procedure when inspecting and replacing diaphragms.
   (a) Shut off air supply.
   (b) Reduce control (input) signal to positioner to zero and disconnect input signal line at pilot valve assembly.
   (c) Disconnect calibration spring from top diaphragm seat (5) spring post.
   (d) Remove socket head cap screws (1). Remove items (2) through (11) as an assembled unit.
   (e) Remove top spring retainer (3) with attached rubber boot (2).
   (f) Remove top loading spring (4).

NOTE

Top stem seat (11) unthreads from top diaphragm seat (5), which allows both diaphragms (6 and 9) to be removed.

   (g) Hold top diaphragm seat (5) stationary by placing a box wrench on the flats of seat. Unthread top stem seat (11) from top diaphragm seat (5).

CAUTION

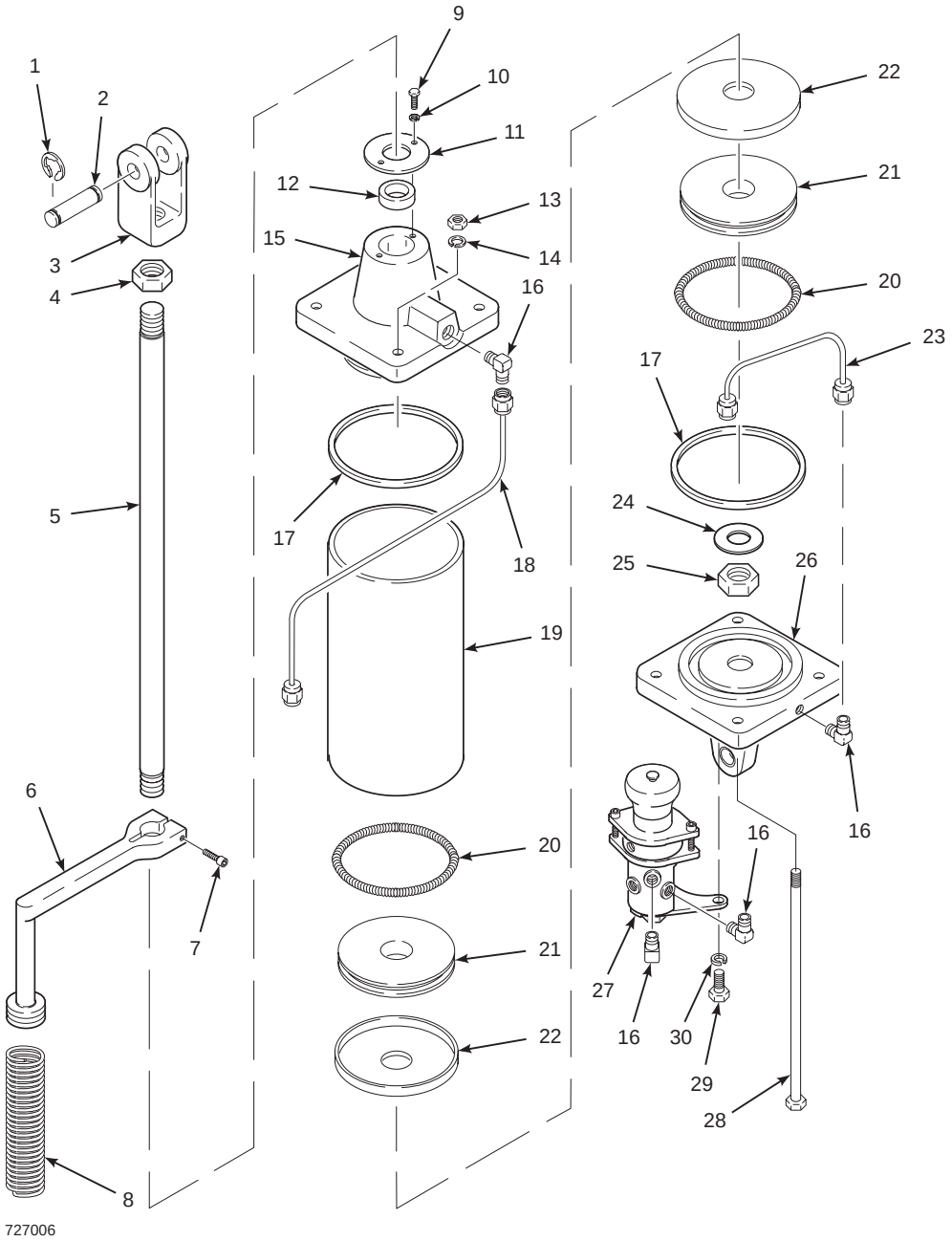
Excessive clamping pressure produced by exceeding torque valve will damage diaphragms. Do not exceed specified torque valves.

   (h) Replace diaphragms if broken, hard and brittle, or soft and spongy. Reassemble diaphragm assembly with Loctite™ sealant on threads of top stem seat (11). Torque assembly to 1 to 1.5 ft-lbs (1 to 2 N·m).
   (i) Reassemble items (1) through (11) to valve body (12). Only tighten screws (1) by hand at this time.
   (j) Apply and maintain 10 psi (69 kPa) air pressure between diaphragms through signal input port.
   (k) Turn screws (1) alternately and in steps to a torque of 2 ft-lbs (3 N·m).
   (l) Remove input signal air pressure.
   (m) Turn screws (1) alternately and in steps to a torque of 4 ft-lbs (5 N·m).
   (n) Connect the calibration spring to spring post.
   (o) Remove the 10 psi (69 kPa) line and reconnect the control signal line to pilot valve assembly. Turn on air supply pressure. The power positioner is now ready for operation.

Table 5-1. Troubleshooting Chart

NOTE
Unless otherwise indicated, item numbers are in reference to Figure 5-2.

Symptom	Cause	Solution
1. Erratic operation along with one of the following:		
a. Piston moves in a jerky manner.	a. Sticky material on inside of cylinder wall.	a. Clean cylinder walls.
b. Piston fails to move to desired position quickly when signal changes.	b. Pilot valve stem (15, Figure 5-1) sticking due to gummy deposits.	b. Clean stem and sleeve.
c. Power air continuously blows through exhaust ports of pilot valve assembly.	c. Pilot valve stem (15, Figure 5-1) excessively worn.	c. Replace stem and sleeve.
2. Piston does not travel full stroke when maximum signal is applied and one of the following symptoms is present:		
a. No other symptoms.	a. Too few active coils in calibration spring (8).	a. Increase number of active coils in spring.
b. Signal air continuously leaking from exhaust ports of pilot valve assembly (27).	b. Broken diaphragm in pilot valve assembly.	b. Replace broken diaphragm.
c. Power air blows continuously through exhaust ports of pilot valve assembly (27).	c. Piston cups (22) worn.	c. Replace both piston cups.
3. Piston does not return to bottom of cylinder when signal is zero and one of the following symptoms is present:		
a. No other symptoms.	a. Zero adjustment incorrect.	a. Recalibrate unit.
b. Power air leaking past piston rod (5) at seal retainer (11).	b. Piston rod seal (12) worn.	b. Replace piston rod seal.
c. Power air continuously blows out of exhaust ports of pilot valve assembly (27).	c. Piston cups (22) worn.	c. Replace both piston cups.



1.	Retaining Ring	9.	Cap Screw	17.	Cylinder Head Gasket	25.	Elastic Stop Nut
2.	Clevis Pin	10.	Lockwasher	18.	Top Tubing	26.	Bottom Cylinder Head
3.	Clevis	11.	Seal Retainer	19.	Cylinder	27.	Pilot Valve Assembly
4.	Locknut	12.	Seal	20.	Garter Spring	28.	Tie-Rod
5.	Piston Rod	13.	Hex Nut	21.	Piston Cup Follower	29.	Hex Head Cap Screw (4 x 5 Only)
6.	Positioner Arm	14.	Lockwasher	22.	Piston Cup		
7.	Clamping Screw	15.	Top Head Assembly	23.	Bottom Tubing	30.	Lockwasher (4 x 5 Only)
8.	Calibration Spring	16.	Elbow Fitting	24.	Washer		

Figure 5-2. Cylinder Assembly - Exploded View

g. Repairs to Cylinder Assembly

1. Replacement of Piston Rod Seal. Excessive air leakage from the top head assembly (15, Figure 5-2) past the piston rod (5) indicates that the silicone seal (12) is worn and must be replaced. To replace piston rod seal proceed as follows:

NOTE

Loosening of clamp screw and removal of feedback arm applies to non-characterized unit only.

(a) Move piston to bottom of cylinder by reducing control signal to zero. Then shut off air supply.

(b) Disconnect linkage at clevis (3).

(c) Mark the location of positioner arm (6) on piston rod (5). Disconnect lower end of calibration spring (8) from pilot valve spring post.

(d) Loosen clamping screw (7) in arm (6).

(e) Hold clevis and loosen locknut (4) with a wrench. Unscrew clevis and locknut, and remove the arm from the piston rod.

(f) Unscrew cap screws (9), and remove lockwasher (10) and seal retainer (11) to expose seal (12).

(g) In order to ease removal of seal, place one layer of plastic electrical-type tape over piston rod threads. Start tape at outer end of piston rod and overlap it with raised edges facing the same direction the seal is to be removed. The tape should also be lubricated with a coating of McLube™ MOS2-200 grease.

(h) Slip seal off piston rod.

(i) Before installing new seal, remove tape installed in step g. Retape threads in opposite direction. Tape should be overlapped with raised, sharp edges facing downward so they will not scratch seal as it is pulled down piston rod. Tape should also be lubricated with a light coating of McLube™ MOS2-200 grease.

(j) Install a new seal after lubricating it with McLube™ MOS2-200 grease.

(k) Reassemble power positioner using preceding steps in reverse order. Clevis and arm must be properly aligned and located. Use the mark made in step (c) when reassembling arm (6, Figure 5-2) on standard units.

(l) After reassembling unit, perform steps in paragraph 3-1, Calibration Procedures. The positioner will then be ready for operation.

2. Replacement of Piston Cups. If the piston moves in a jerky manner, it is usually an indication of an accumulation of sticky material on the inside walls of the cylinder (19). For the positioner to operate properly, the cylinder walls must be clean.

   If graphite-impregnated teflon piston cups (22) wear to the extent that air leaks past the piston, they should be replaced. This is indicated by power air blowing continuously through the exhaust openings of the pilot valve.

   Before cleaning the cylinder walls or replacing the piston cups, make sure there is no problem in the control system. Both standard and on/off units can operate like there is a piston cup problem when their control systems are dirty. Before replacing piston cups, follow cleaning procedures in paragraph

5-1d. If this does not solve the problem, proceed as follows:

(a) Shut off all air supply.

(b) Disconnect power and control air supply lines to pilot valve assembly (27). Disconnect mechanical linkage at clevis (3).

(c) Remove pivot pin through bottom cylinder head (26) and place positioner on a work bench.

(d) Disconnect calibration spring (8, Figure 5-2) from pilot valve.

(e) Disconnect tubing (18) from pilot valve.

(f) Remove hex nuts (13), lockwashers (14), and four steel tie-rods (28).

(g) Remove pilot valve assembly (27) and bottom cylinder head (26) as an assembly.

(h) Invert the remaining positioner assembly and support it vertically by clamping clevis (3) in a vise.

(i) Remove cylinder (19) from piston assembly by slowly turning the cylinder clockwise while pulling it upward away from top head assembly (15).

(j) Clean out bore of cylinder with a cloth soaked in a solvent. Do not scrape with sharp tools or use abrasive materials such as emery cloth.

(k) Inspect piston cups (22). If worn, creased, or scratched, they must both be replaced.

(l) If piston cups require replacement, remove elastic stop nut (25) and washer (24) from rod (5). Two piston cup followers (21) and piston cups may then be slipped off the end of the piston rod.

CAUTION

Be careful that piston cups are not creased or scratched during assembly. Use piston insertion sleeve, P/N 4847B54H01. Damaged piston cups will impair positioner performance.

(m) Reassemble piston assembly and insert it into cylinder in the following manner:

1 Assemble parts of piston on end of piston rod except outer garter spring (20) and outer piston cup.

2 Turn elastic stop nut (25) until only finger tight.

3 Check that gasket (17) is in place at top head assembly and then slip cylinder down over the piston assembly until washer (24) is about 1/4 in. (6 mm) from end of cylinder.

4 Remove elastic stop nut (25), washer (24), and outer piston cup follower (21). Install outer piston cup (22), outer piston cup follower (21) and garter spring (20); reassemble entire piston. Tighten elastic stop nut (25).

5 Hold top head assembly and pull cylinder back over piston assembly until piston is approximately half way into cylinder.

(n) Remove positioner from vise. Pull top head assembly along piston rod until it hits the end of the cylinder.

(o) Reassemble positioner by installing pilot valve and bottom cylinder head at lower end of cylinder and installing tie-rods, lockwashers, and nuts.

(p) Connect tubing (18) to pilot valve assembly.

(q) Connect calibration spring to pilot valve assembly.

(r) Mount positioner and connect linkage to clevis. Connect power air supply and control air signal lines to control system. Open control signal air.

(s) Turn on power air supply pressure. The positioner is now ready for operation.

h. Cam Manufacture for Special Function Applications

Field shaping of a cam from a cam blank may be required in some applications where the process-to-input signal relationship does not conform to the standard available cam shapes. The following procedure is recommended for developing a non-standard cam.

1. Preliminary Steps.

   (a) Determine the minimum and maximum positions of the final control element (e.g., valve or damper) being operated by the power positioner.

   (b) Adjust the mechanical linkage so the power positioner travels through its full stroke while the element being positioned travels from its required minimum to maximum position.

   (c) Set the power positioner stroke, as directed in paragraph 3-1, Calibration Procedures, so the positioner reaches the bottom of its stroke when the input signal is zero. When the input signal is maximum, adjust the positioner so the piston just reaches the top of its stroke.

2. Procedure.

   (a) Determine the percent of process (e.g., flow) at each 20 percent increment of input signal [e.g., 0 to 30 psig (0 to 116.9 kPa) input signal, a 6 psig (41.4 kPa) increment].

   (b) Plot the curve X (Figure 5-3) from the data obtained from the previous step.

   (c) In this example, the desired characteristic (curve Y, Figure 5-3) has been chosen to be a straight line. Curve Y is plotted between minimum and maximum values on curve X. A characteristic other than a straight line may be plotted in the same fashion on Curve Y, if desired.

   (d) At each 20 percent of input signal (Figure 5-3), project a horizontal line to straight line curve Y. Project vertically downward from the intersection of the horizontal line and curve Y to curve X. From the intersection of the vertical projection and curve X, project a horizontal line to the right. Read and tabulate the actual percent of cam rotation, indicated on the right margin, versus the percent of input signal as shown in the example table (Table 5-2).

   (e) Using the blank scale layout (Figure 5-4) and the information from Table 5-2, plot the cam roller centers on the scale (Figure 5-5).

   (f) Using a compass set to 0.5 in. (12.7 mm) diameter, draw the cam roller circles with the plotted points as centers.

   (g) Carefully draw a smooth curve through the tangent points on the inner side of the circles.

   (h) Cut out the paper cam leaving the cam contour and the two mounting holes.

3. Carefully line up the two mounting holes and cement the cutout to the blank cam section of the square root cam for final shaping using coarse and fine files.

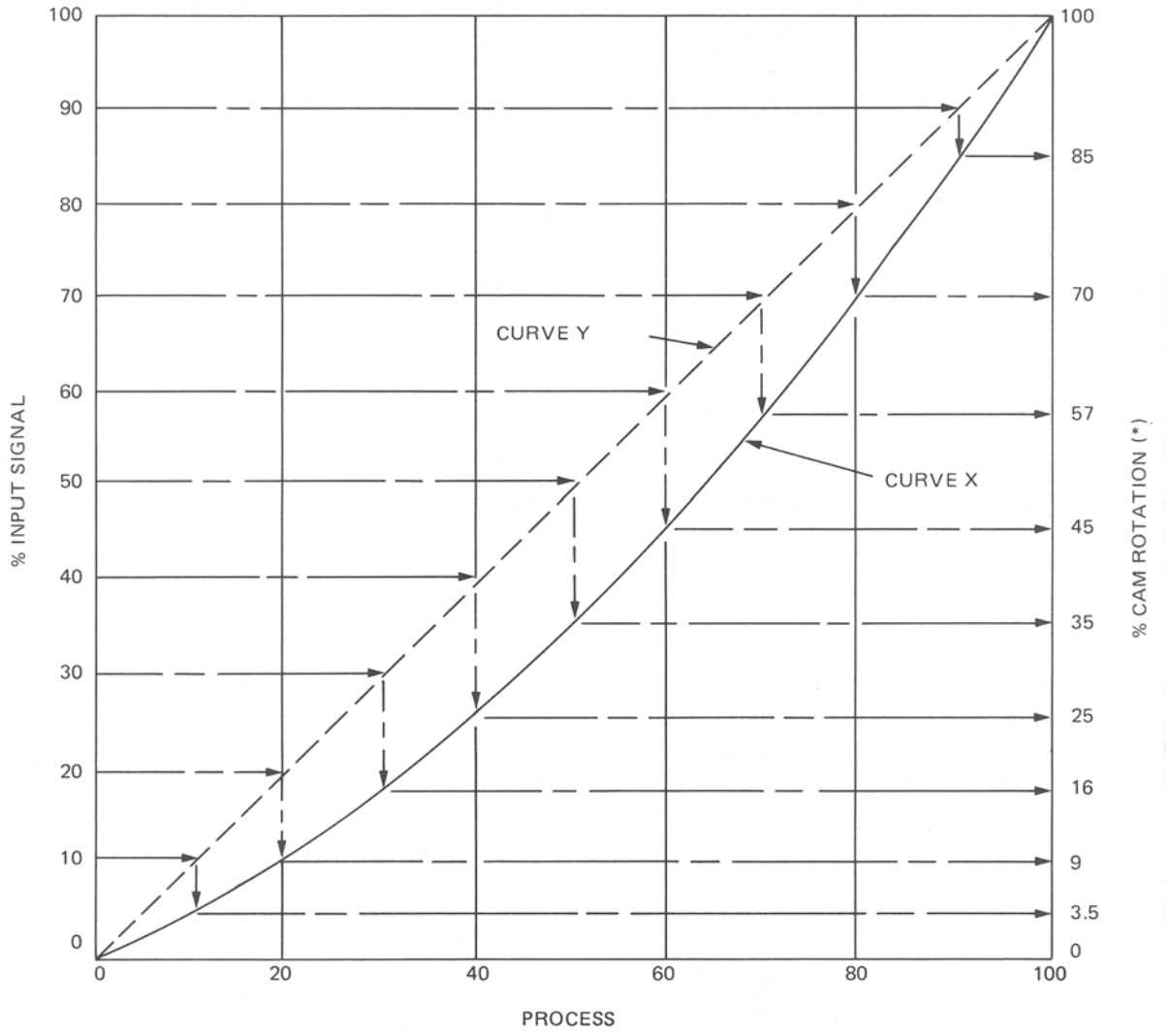
Table 5-2. Tabulation of Percent Input Signal vs. Percent Cam Rotation

Example

Input Signal %	Cam Rotation %
0	0
20	9
40	25
60	45
80	70
100	100

Developed Table

Input Signal %	Cam Rotation %
0	
20	
40	
60	
80	
100	



Curve X represents the process versus the input signal relationship determined from field data.

Curve Y represents the desired process versus the input signal relationship. This relationship is maintained by the operation of the Power Positioner after the cam is properly shaped.

(*) These values represent the radial location of the center points of the cam roller and are used to plot the cam curve shown in Figure 5-3.

Figure 5-3. Example of Desired and Actual Process and Input Signal Relationship

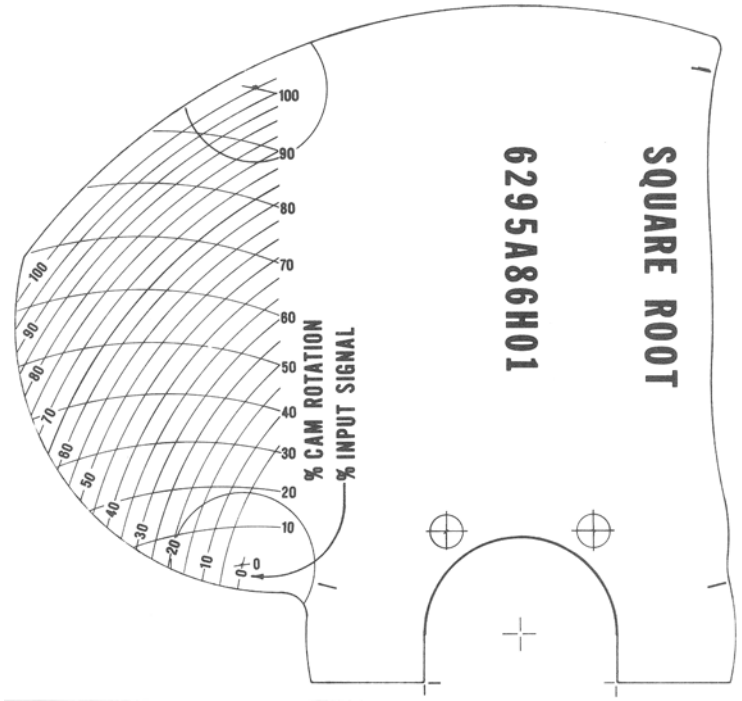


Figure 5-4. Blank Scale Layouts for Developing Cam Contour

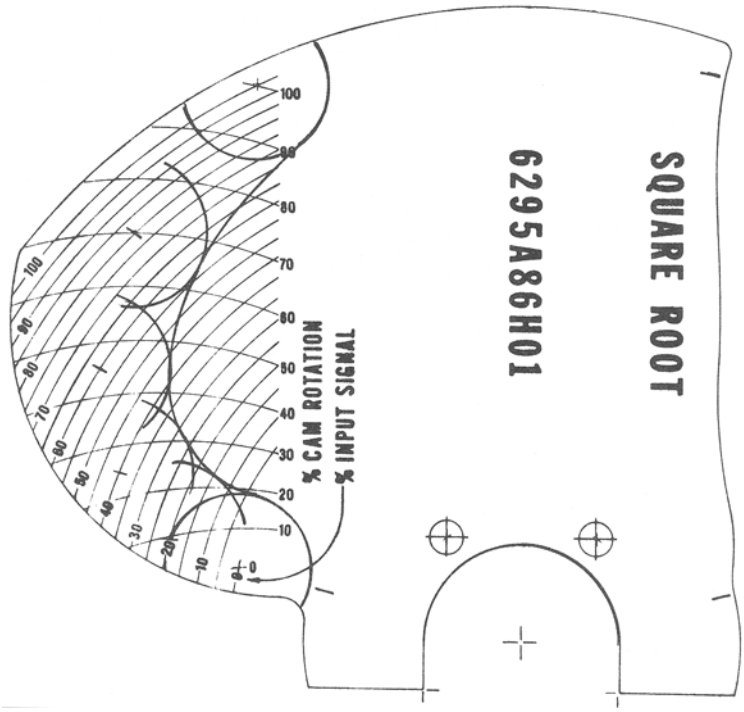


Figure 5-5. Example of Field Shaped Cam Plot

SECTION 6
RETURN OF MATERIAL

6-1 If factory repair of defective equipment is required, proceed as follows:

a. Secure a return authorization number 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 returned without proper authorization and identification.

b. Carefully pack defective unit in a sturdy box with sufficient shock absorbing material to ensure 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 was operating (housing, weather, vibration, dust, etc.).
3. Site from which equipment was removed.
4. Whether warranty or nonwarranty service is requested.
5. Complete shipping instructions for return of equipment.
6. Reference the return authorization number.

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

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

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.

SECTION 7
ASSEMBLY DRAWINGS AND PARTS LISTINGS

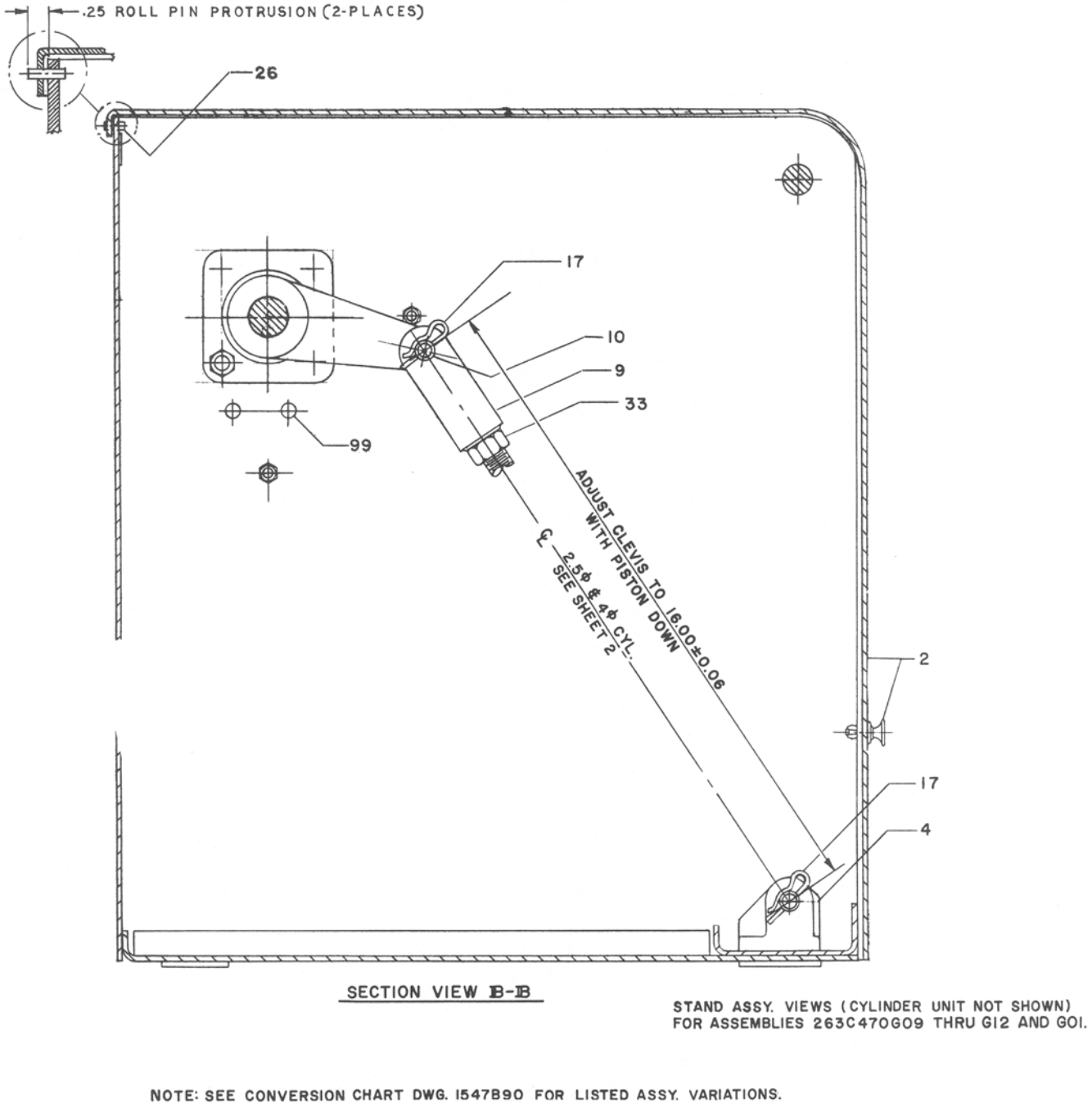


Figure 7-1. Model PP075T Power Positioner (Sheet 1 of 16)

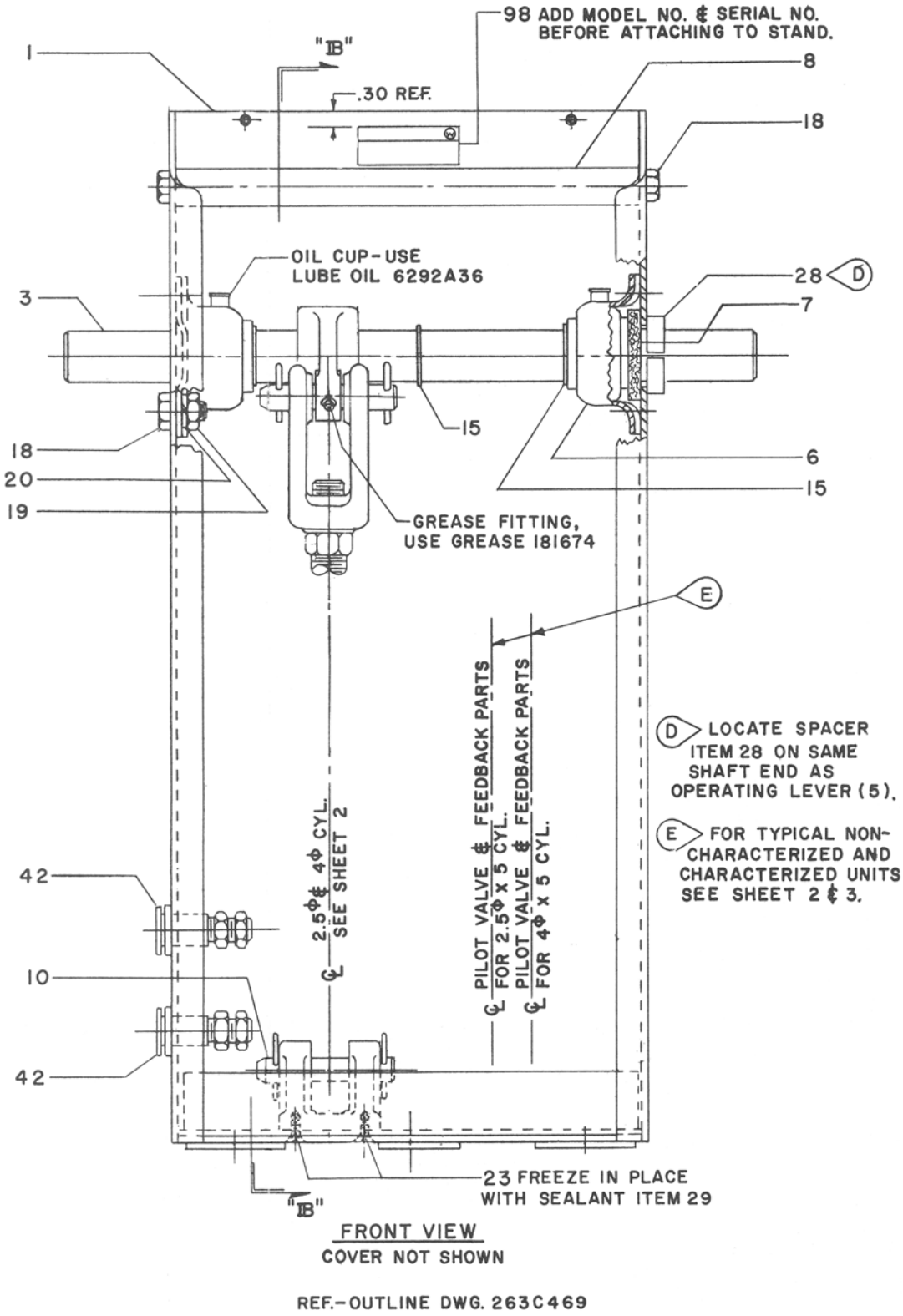
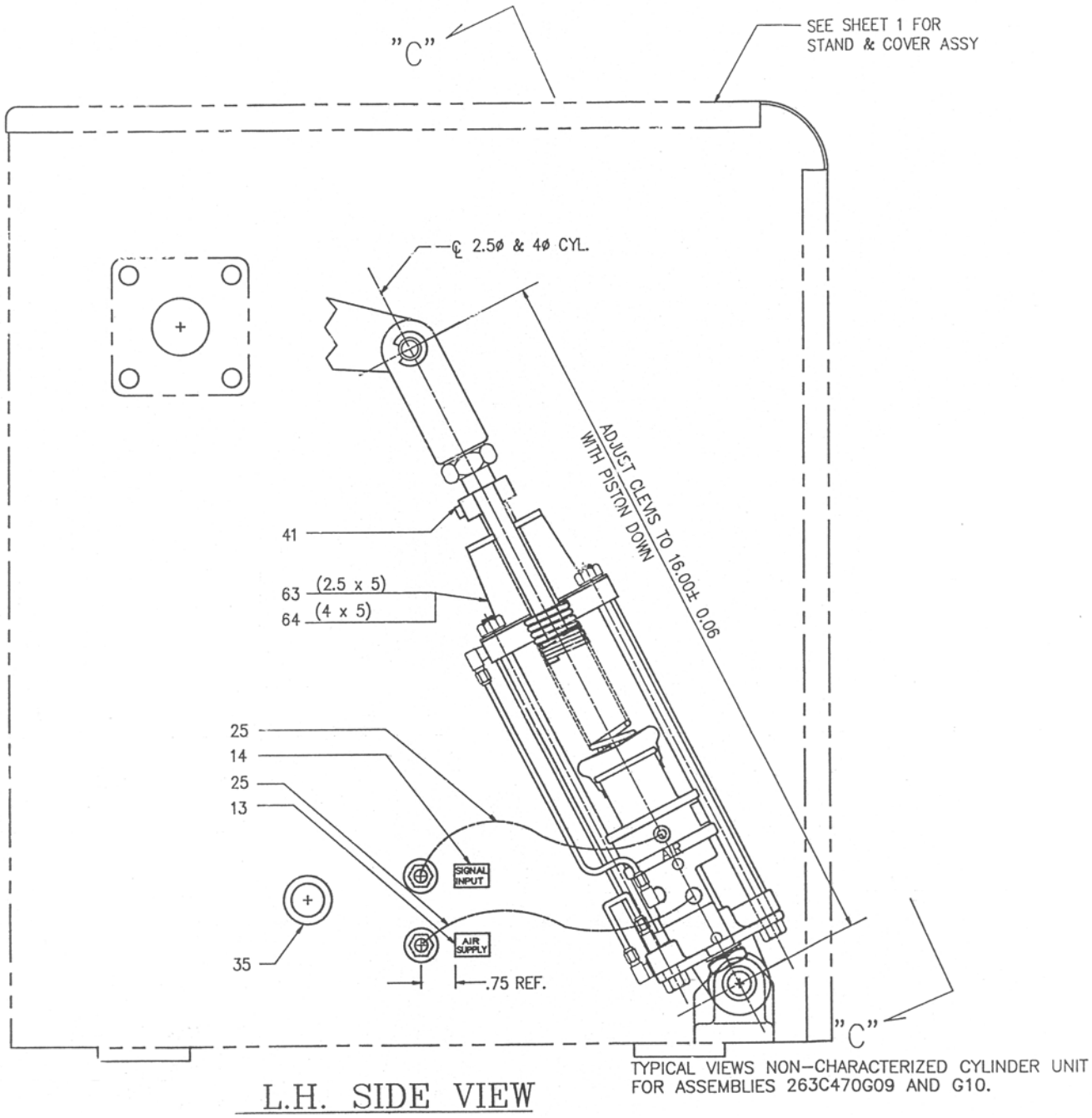


Figure 7-1. Model PP075T Power Positioner (Sheet 2 of 16)



NOTE: SEE CONVERSION CHART DWG. 1547B90 FOR LISTED ASSY. VARIATIONS.

Figure 7-1. Model PP075T Power Positioner (Sheet 3 of 16)

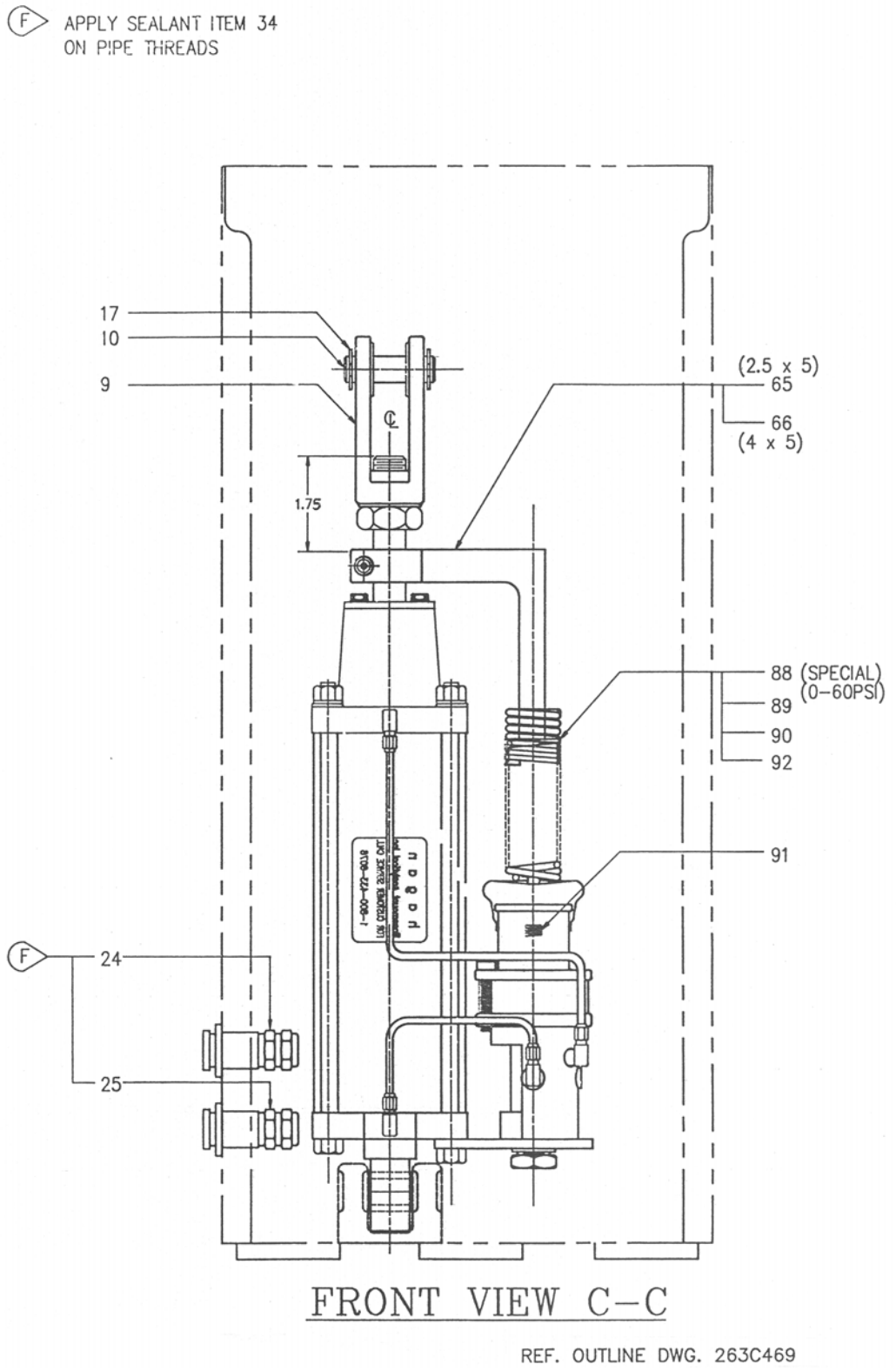


Figure 7-1. Model PP075T Power Positioner (Sheet 4 of 16)

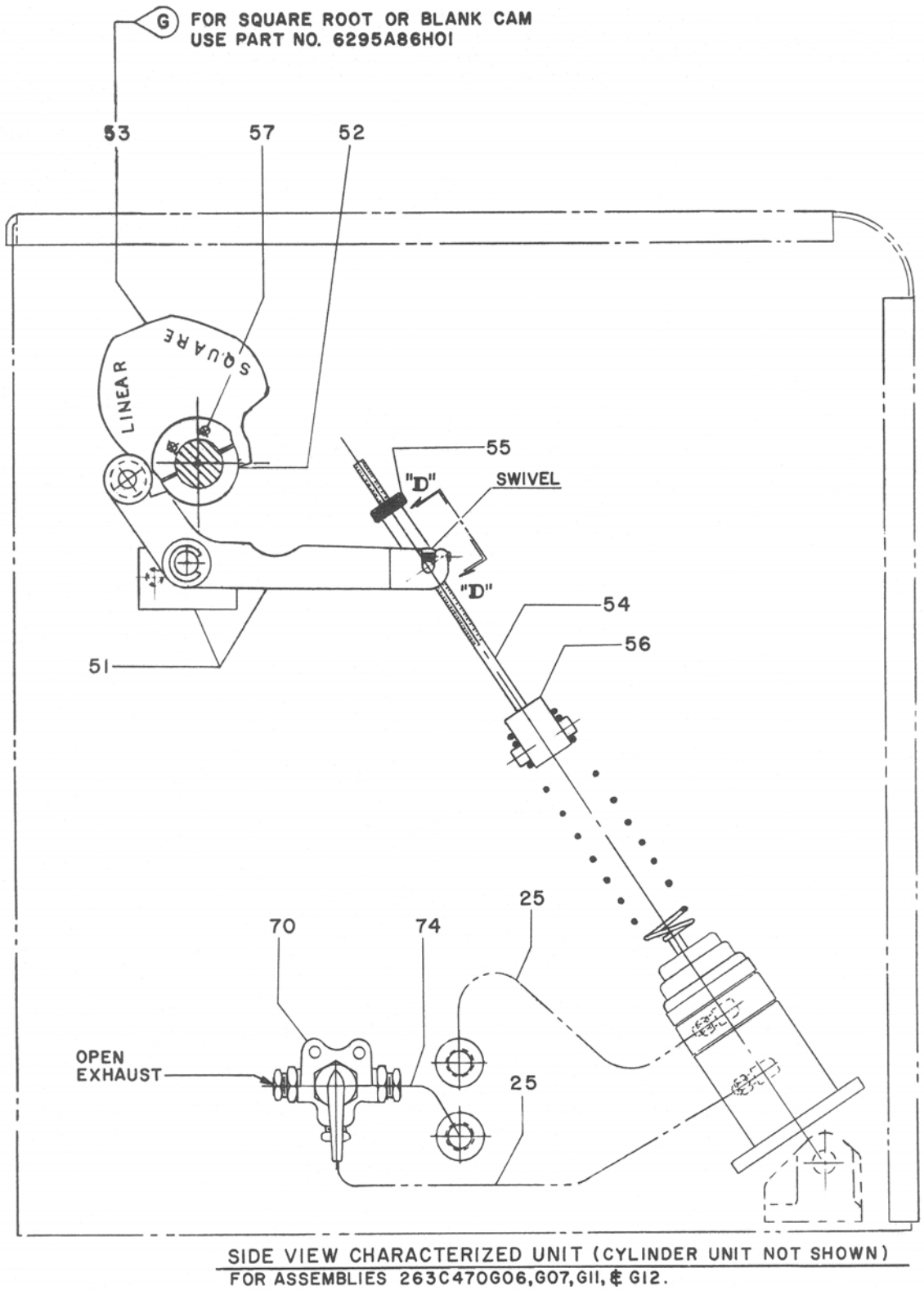
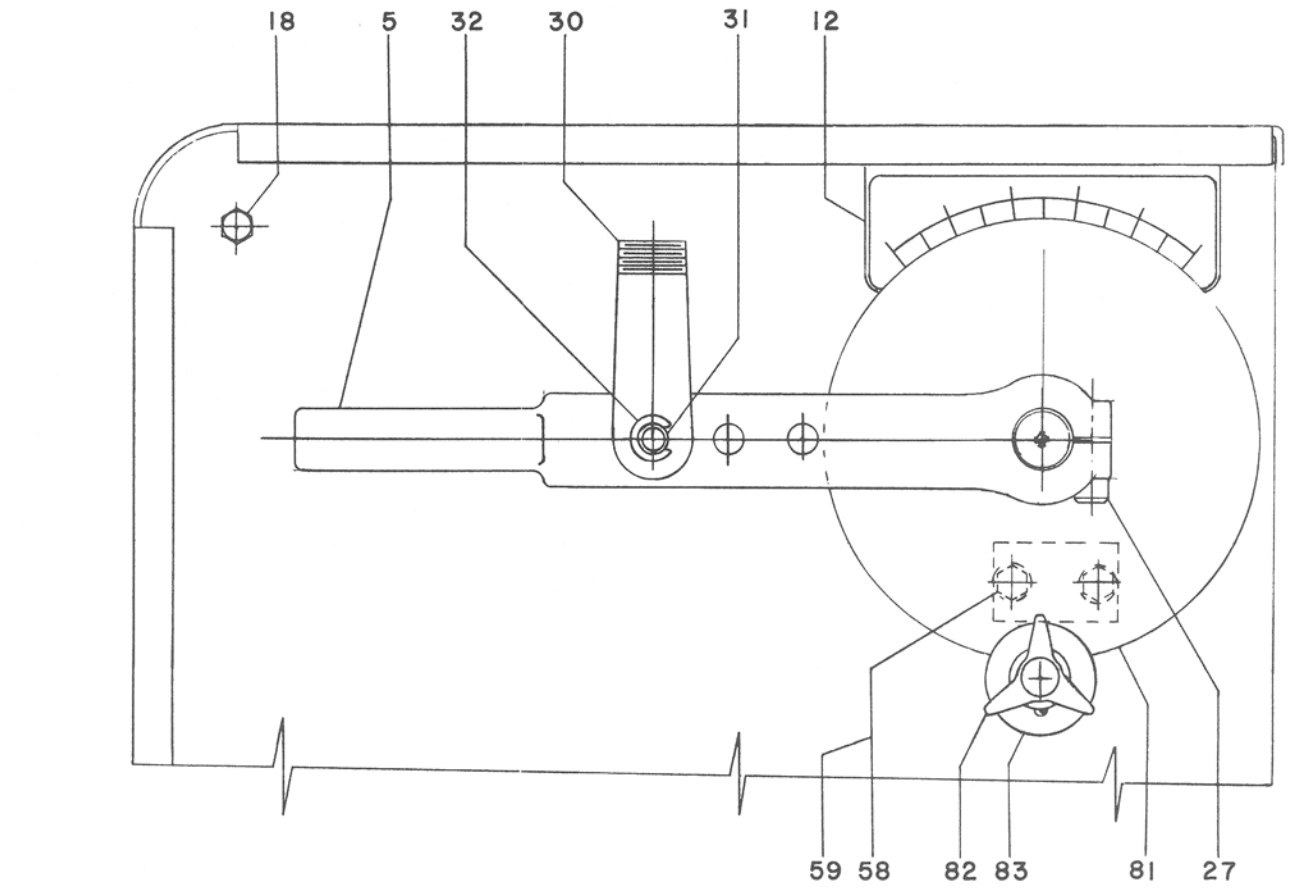
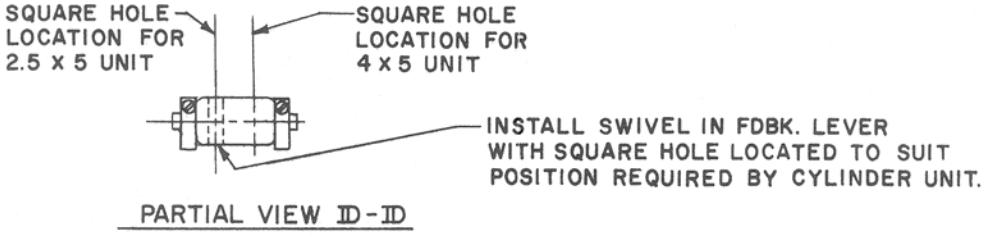


Figure 7-1. Model PP075T Power Positioner (Sheet 5 of 16)



R.H. SIDE PARTIAL VIEW
OPTIONAL BRAKE & CLAMP SHOWN
FOR ASSEMBLY 263C470G07



PARTIAL VIEW ID-ID

NOTES

1. SEE CONVERSION CHART DWG. 1547B90 FOR LISTED ASSEMBLY VARIATIONS.
2. EARLY STYLE PILOT VALVE DEPICTED.

REF.-OUTLINE DWG. 263C469

Figure 7-1. Model PP075T Power Positioner (Sheet 6 of 16)

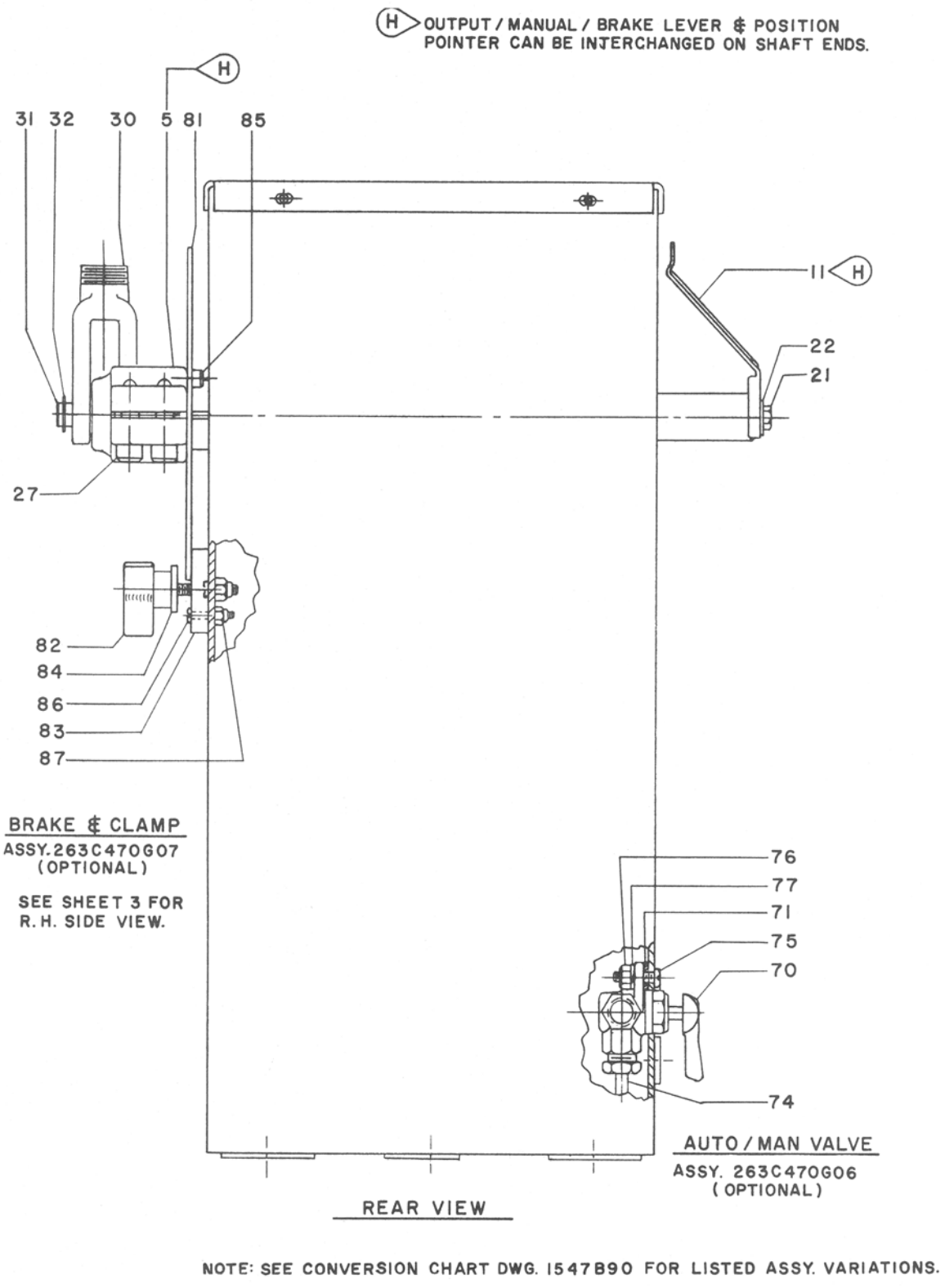


Figure 7-1. Model PP075T Power Positioner (Sheet 7 of 16)

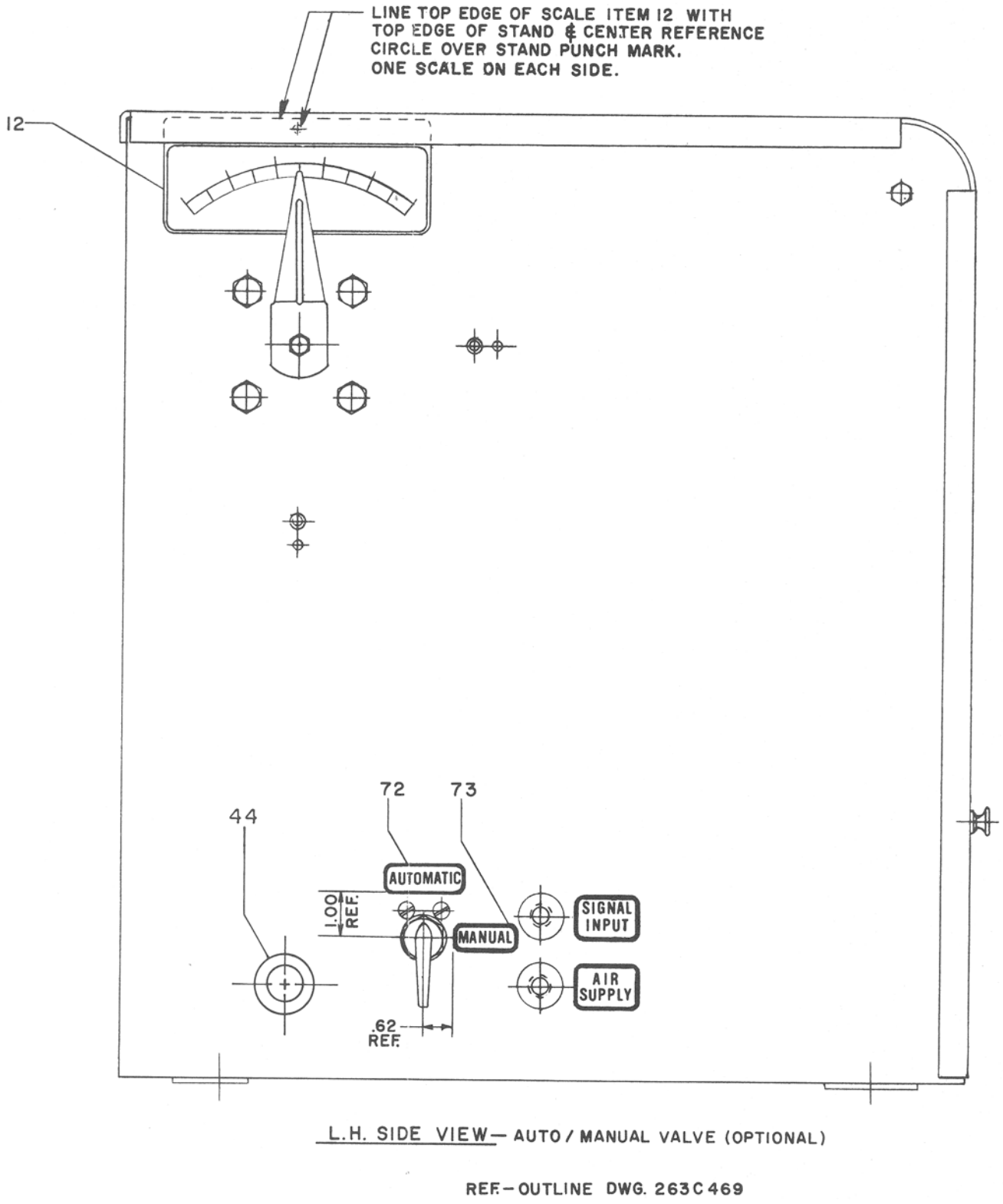


Figure 7-1. Model PP075T Power Positioner (Sheet 8 of 16)

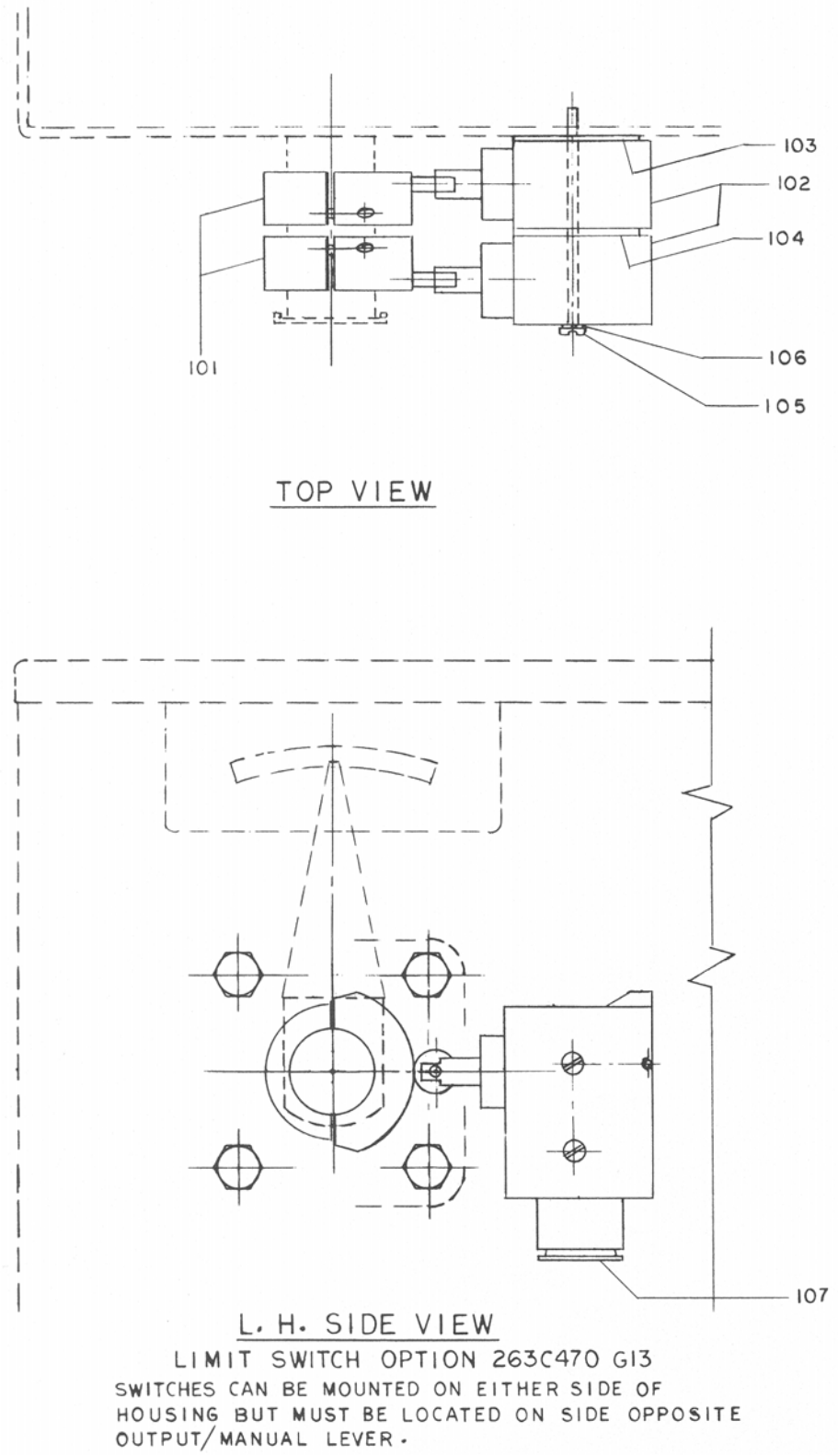


Figure 7-1. Model PP075T Power Positioner (Sheet 9 of 16)

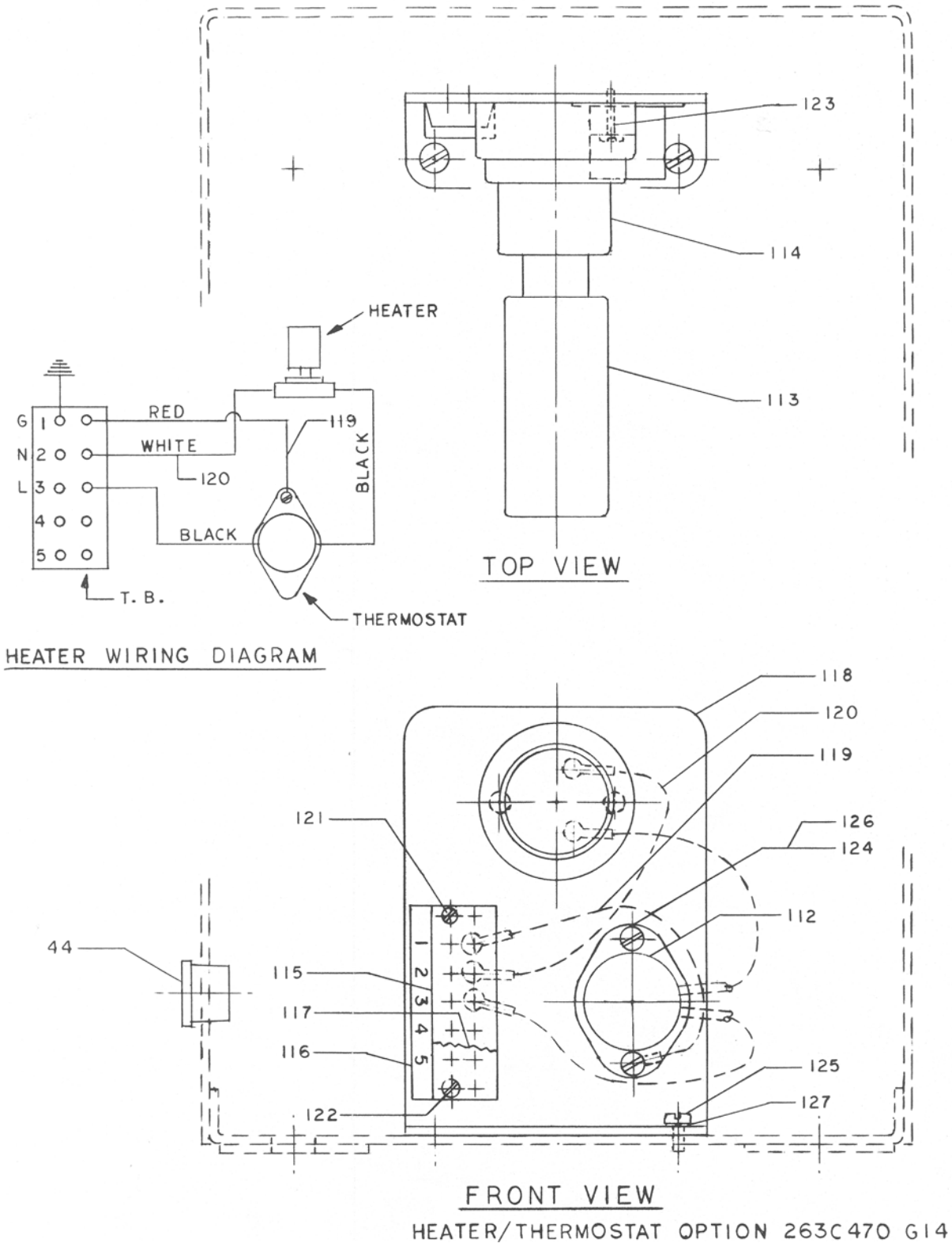


Figure 7-1. Model PP075T Power Positioner (Sheet 10 of 16)

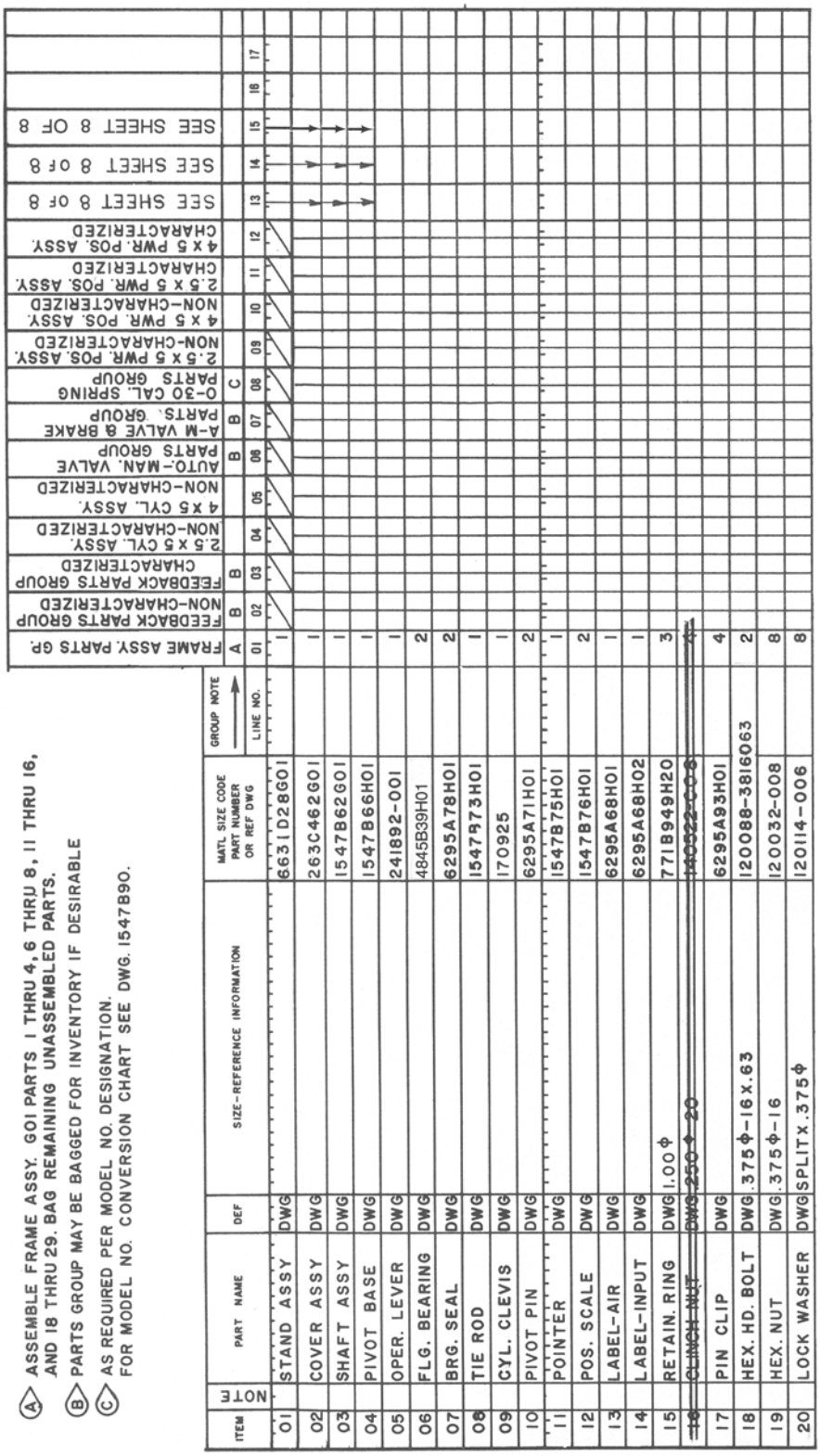
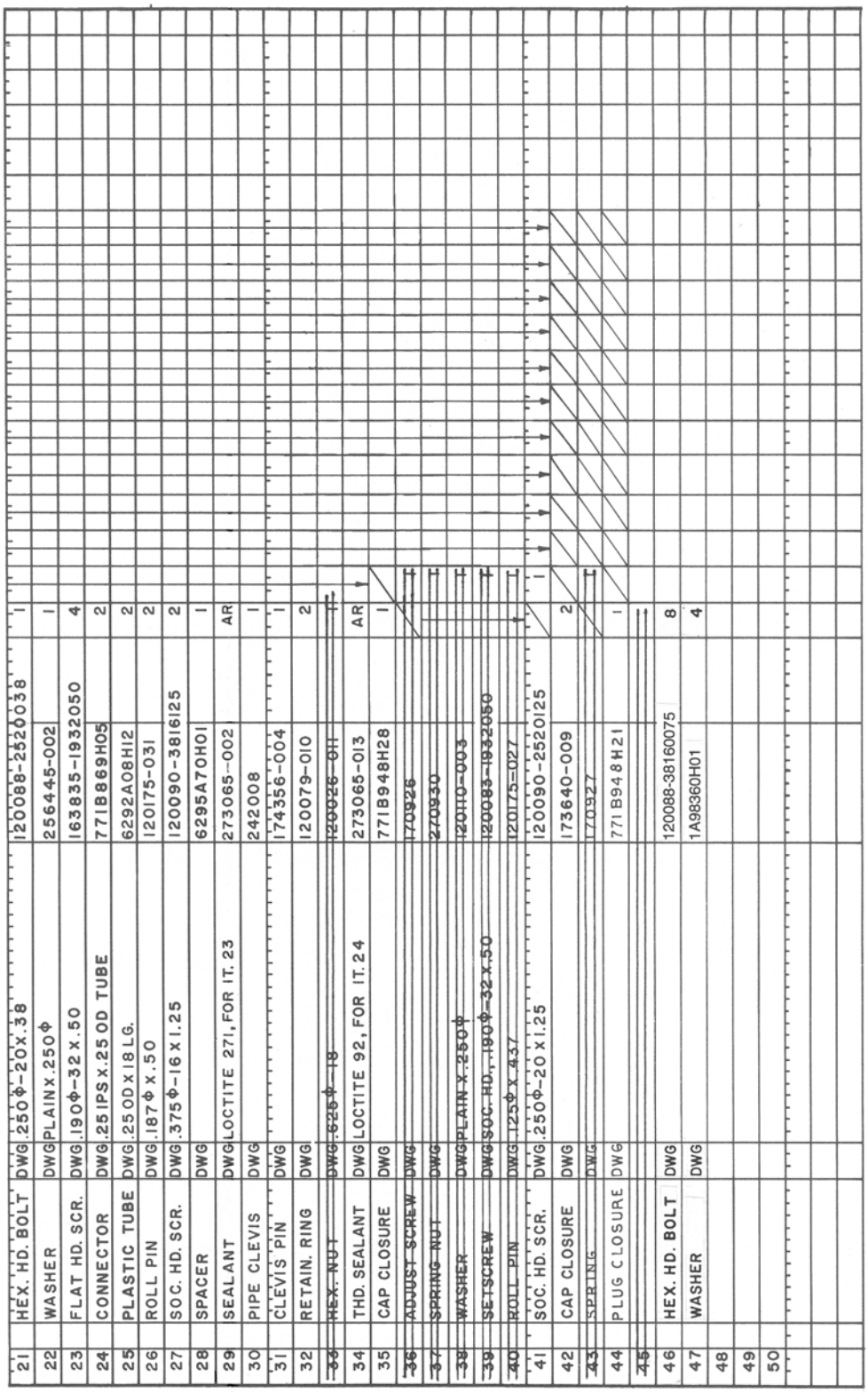
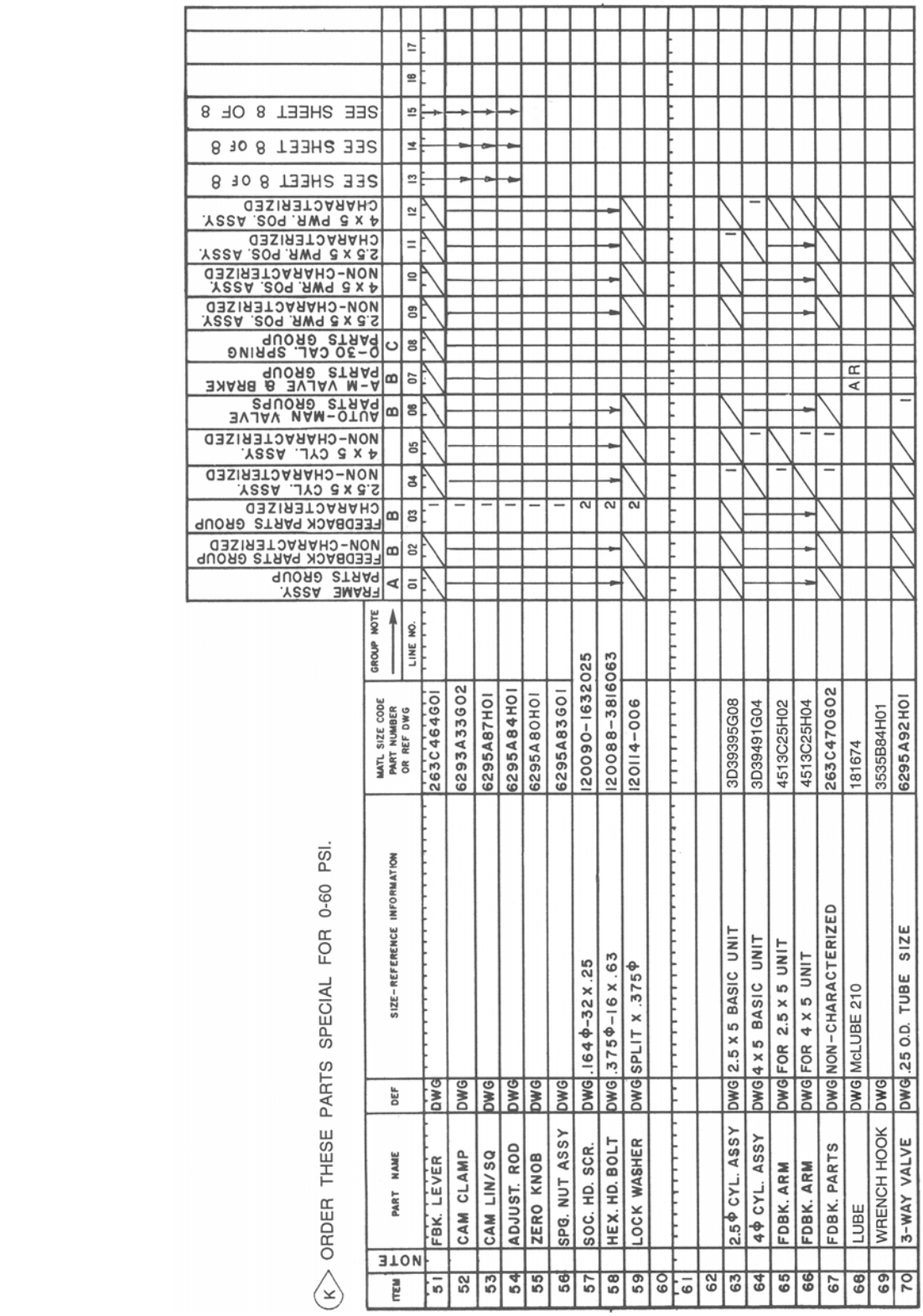


Figure 7-1. Model PP075T Power Positioner (Sheet 11 of 16)



21	HEX. HD. BOLT	DWG	.250Φ-20X.38	120088-2520038	1
22	WASHER	DWG	PLAIN X.250Φ	256445-002	1
23	FLAT HD. SCR.	DWG	.190Φ-32 X.50	163835-1932050	4
24	CONNECTOR	DWG	.25 IPS X.25 OD TUBE	771B869H05	2
25	PLASTIC TUBE	DWG	.25 OD X 18 LG.	6292A08H12	2
26	ROLL PIN	DWG	.187Φ X .50	120175-031	2
27	SOC. HD. SCR.	DWG	.375Φ-16 X 1.25	120090-3816125	2
28	SPACER	DWG		6295A70H01	1
29	SEALANT	DWG	LOCTITE 271, FOR IT. 23	273065-002	AR
30	PIPE CLEVIS	DWG		242008	1
31	CLEVIS PIN	DWG		174356-004	1
32	RETAIN. RING	DWG		120079-010	2
~~33~~	~~HEX. NUT~~	~~DWG~~	~~.626Φ-18~~	~~120026-011~~	~~1~~
34	THD. SEALANT	DWG	LOCTITE 92, FOR IT. 24	273065-013	AR
35	CAP CLOSURE	DWG		771B948H28	1
~~36~~	~~ADJUST SCREW~~	~~DWG~~		~~170926~~	~~1~~
~~37~~	~~SPRING NUT~~	~~DWG~~		~~270930~~	~~1~~
~~38~~	~~WASHER~~	~~DWG~~	~~PLAIN X.250Φ~~	~~120110-003~~	~~1~~
~~39~~	~~SETSCREW~~	~~DWG~~	~~SOC. HD., .190Φ-32 X.50~~	~~120083-1932050~~	~~1~~
~~40~~	~~ROLL PIN~~	~~DWG~~	~~.125Φ X .437~~	~~120175-027~~	~~1~~
41	SOC. HD. SCR.	DWG	.250Φ-20 X 1.25	120090-2520125	1
42	CAP CLOSURE	DWG		173640-009	2
~~43~~	~~SPRING~~	~~DWG~~		~~170927~~	~~1~~
44	PLUG CLOSURE	DWG		771B948H21	1
~~45~~					
46	HEX. HD. BOLT	DWG		120088-38160075	8
47	WASHER	DWG		1A98360H01	4
48					
49					
50					

Figure 7-1. Model PP075T Power Positioner (Sheet 12 of 16)



ITEM	NOTE	PART NAME	DEF	SIZE-REFERENCE INFORMATION	MATL SIZE CODE PART NUMBER OR REF DWG	GROUP NOTE LINE NO.
51		FBK. LEVER	DWG		263C464G01	
52		CAM CLAMP	DWG		6293A33G02	
53		CAM LIN/SQ	DWG		6295A87H01	
54		ADJUST. ROD	DWG		6295A84H01	
55		ZERO KNOB	DWG		6295A80H01	
56		SPG. NUT ASSY	DWG		6295A83G01	
57		SOC. HD. SCR.	DWG	.164Φ-32 x .25	120090-1632025	
58		HEX. HD. BOLT	DWG	.375Φ-16 x .63	120088-3816063	
59		LOCK WASHER	DWG	SPLIT x .375Φ	120114-006	
60						
61						
62						
63		2.5Φ CYL. ASSY	DWG	2.5 x 5 BASIC UNIT	3D39395G08	
64		4Φ CYL. ASSY	DWG	4 x 5 BASIC UNIT	3D39491G04	
65		FDBK. ARM	DWG	FOR 2.5 x 5 UNIT	4513C25H02	
66		FDBK. ARM	DWG	FOR 4 x 5 UNIT	4513C25H04	
67		FDBK. PARTS	DWG	NON-CHARACTERIZED	263C470G02	
68		LUBE	DWG	McLUBE 210	181674	
69		WRENCH HOOK	DWG		3535B84H01	
70		3-WAY VALVE	DWG	.25 O.D. TUBE SIZE	6295A92H01	

(K) ORDER THESE PARTS SPECIAL FOR 0-60 PSI.

	A	B	B	B		B	B	C												
	FRAME ASSY. PARTS GROUP	FEEDBACK PARTS GROUP NON-CHARACTERIZED	FEEDBACK PARTS GROUP CHARACTERIZED	2.5 x 5 CYL. ASSY. NON-CHARACTERIZED	4 x 5 CYL. ASSY. NON-CHARACTERIZED	AUTO-MAN VALVE PARTS GROUPS	A-M VALVE & BRAKE PARTS GROUP	O-30 CAL. SPRING PARTS GROUP	2.5 x 5 PWR. POS. ASSY. NON-CHARACTERIZED	4 x 5 PWR. POS. ASSY. NON-CHARACTERIZED	2.5 x 5 PWR. POS. ASSY. CHARACTERIZED	4 x 5 PWR. POS. ASSY. CHARACTERIZED	SEE SHEET 8 OF 8	SEE SHEET 8 OF 8	SEE SHEET 8 OF 8				
LINE NO.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18		
51			1																	
52			1																	
53			1																	
54			1																	
55			1																	
56			1																	
57			2																	
58			2	1	1	1			1	1	1									
59			2	1	1															
60																				
61																				
62																				
63			1	1							1									
64					1							1								
65				1																
66			1	1	1	1			1	1	1									
67			1	1	1															
68							A R													
69																				
70			1	1	1	1			1	1	1									

Figure 7-1. Model PP075T Power Positioner (Sheet 13 of 16)

71		VALVE SHIM	DWG		6295A79H01						1						
72		AUTO. LABEL	DWG		6295A97H01						1						
73		MAN. LABEL	DWG		6295A96H01						1						
74		PLASTIC TUBE	DWG	.25 O.D. X 9.5 LG.	6292A08H03						1						
75		PAN HD. SCR.	DWG	.190Φ-32 X .63	120103-1932063						2						
76		HEX. NUT	DWG	.190Φ-32	120026-010						2						
77		LOCK WASHER	DWG	SPLIT X .190Φ	120114-003						2						
78		FLAT WASHER	DWG	.500 Ø 10	120110-005												
79		PAN HD. SCR.	DWG	.164-32 X 1.25	120103-1632125												
80		VALVE PARTS	DWG		263C470G06							1					
81		LOCK DISC	DWG		1547B71H01							1					
82		BOLT	DWG	.500-20 X 1.75 CRS ZINC PL	120088-5020175							1					
83		LOCK ANVIL	DWG		3535B82H01							1					
84		LOCK CLAMP	DWG		3535B82H01							1					
85		SOC. HD. SCR.	DWG	.250Φ-20 X .375	120090-2520038							2					
86		PAN HD. SCR.	DWG	.164Φ-32 X .75	120103-1632075							2					
87		STOP NUT	DWG	.164Φ-32	120033-006							3					
88	K	0-60 SPRING	DWG	SPECIAL FOR 0-60 PSI	171268												
89	C	3-15 SPRING	DWG		171267												
90		0-30 SPRING	DWG		170952								1				
91		BIAS SPRING	DWG		170964								1				
92	C	3-27 SPRING	DWG		171266												
93		FRAME ASSY	DWG		263C470G01									1	1	1	1
94		FDBK. PARTS	DWG	CHARACTERIZED	263C470G03											1	1
95		WRENCH	DWG	.75 HEX BOX	3535B83H01												
96		2.5Φ CYL. ASSY	DWG	NON-CHARACTERIZED UNIT	263C470G04									1			
97		4Φ CYL. ASSY.	DWG	NON-CHARACTERIZED UNIT	263C470G05										1		
98		SERIAL TAG	DWG		172685									1	1	1	1
99		CAP CLOSURE	DWG		771B948H07									2	2		
100	K	SPG. NUT ASSY	DWG	SPECIAL FOR 0-60 PSI	6295A83G02												

Figure 7-1. Model PP075T Power Positioner (Sheet 14 of 16)

7

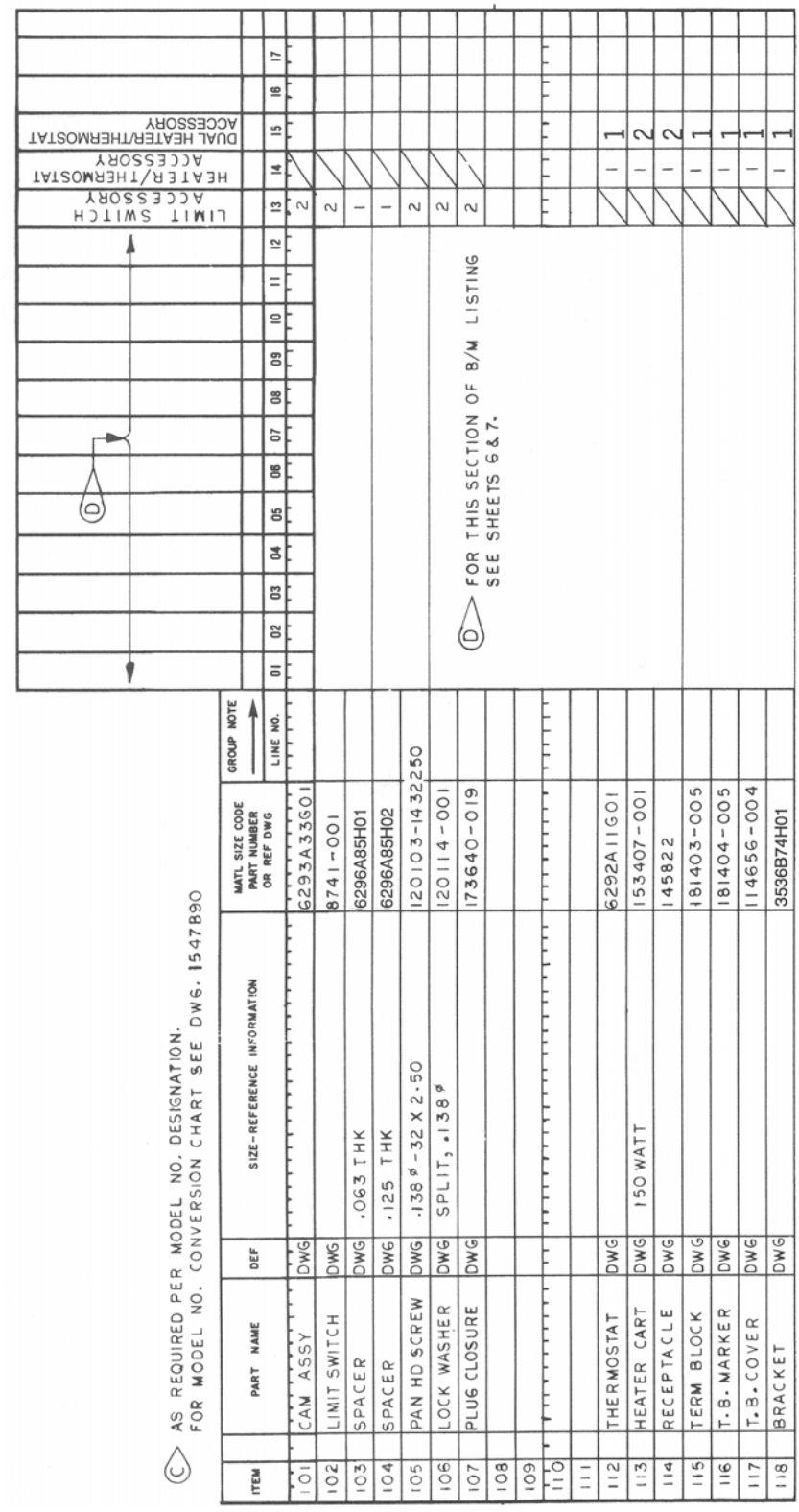
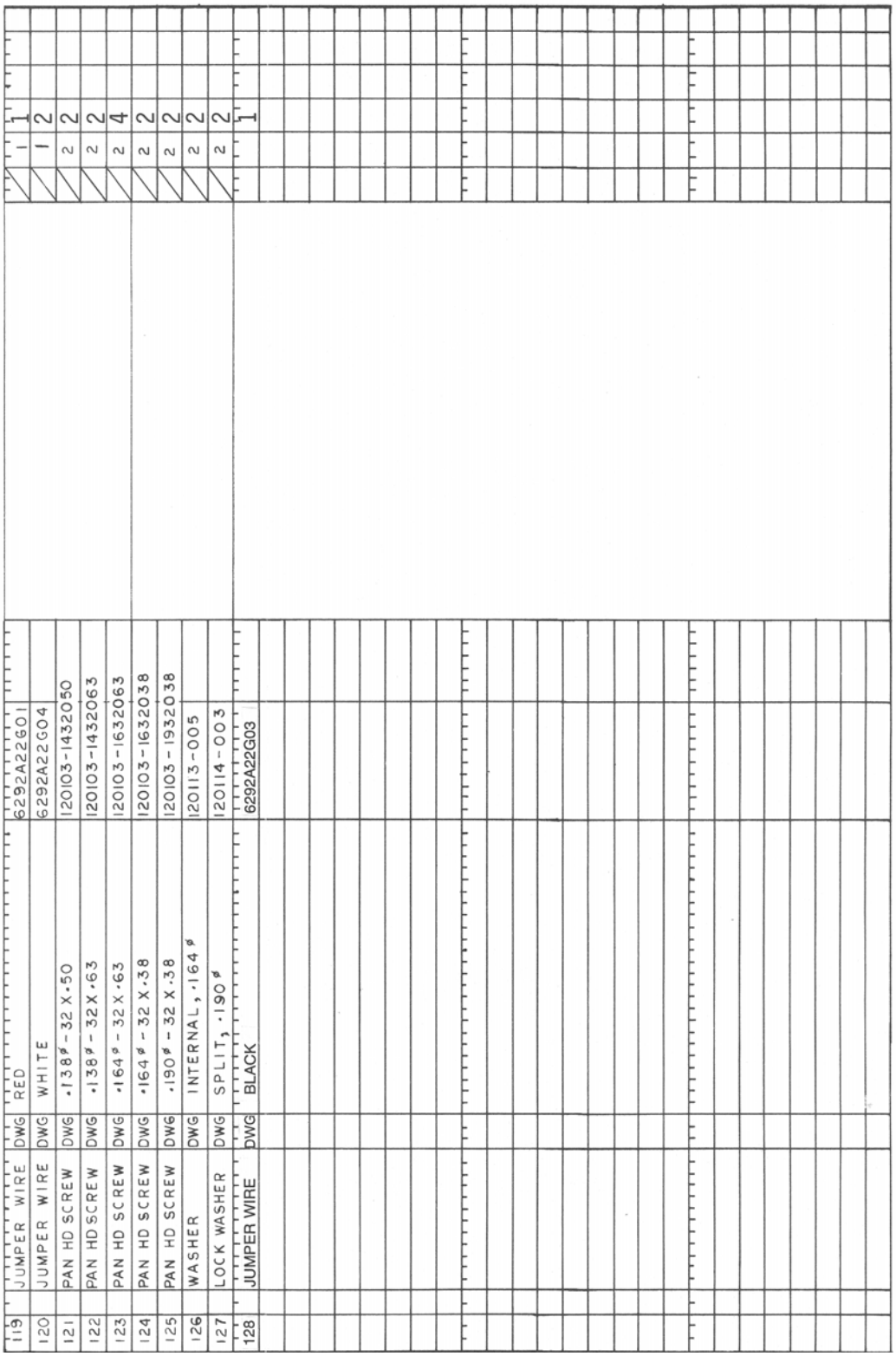
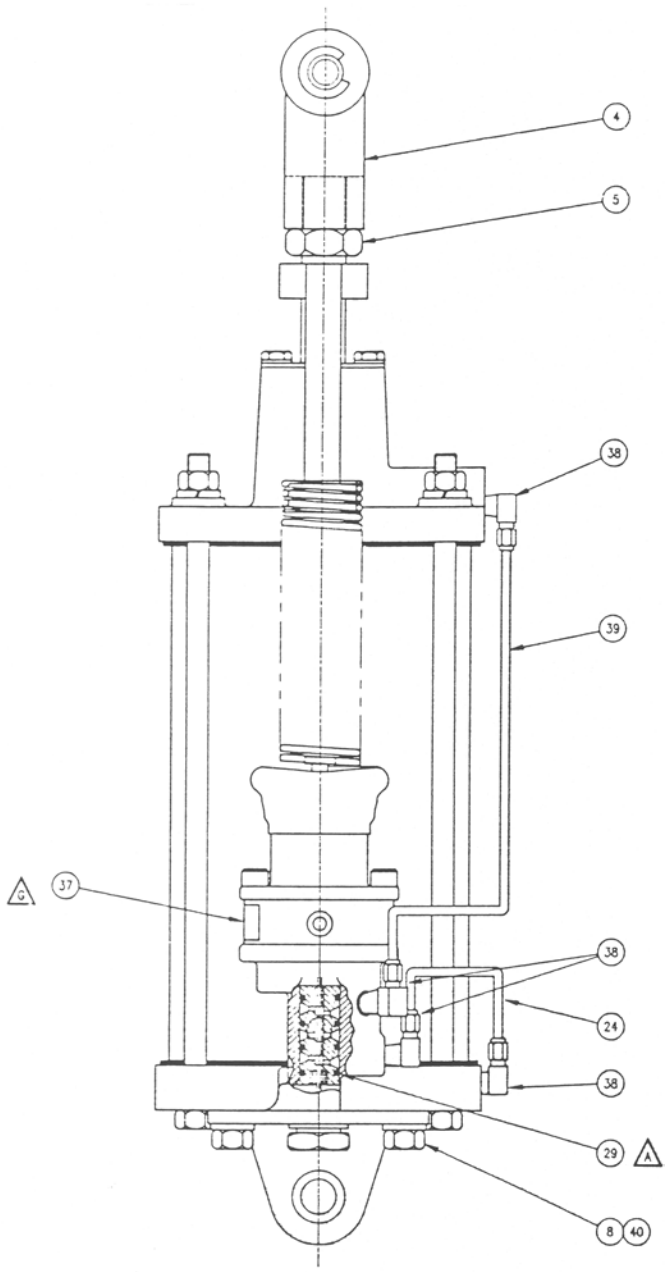


Figure 7-1. Model PP075T Power Positioner (Sheet 15 of 16)



119	JUMPER WIRE	DWG	RED	6292A22601					1	1	
120	JUMPER WIRE	DWG	WHITE	6292A22G04					1	2	
121	PAN HD SCREW	DWG	.138"-32 X.50	120103-1432050					2	2	
122	PAN HD SCREW	DWG	.138"-32 X.63	120103-1432063					2	2	
123	PAN HD SCREW	DWG	.164"-32 X.63	120103-1632063					2	4	
124	PAN HD SCREW	DWG	.164"-32 X.38	120103-1632038					2	2	
125	PAN HD SCREW	DWG	.190"-32 X.38	120103-1932038					2	2	
126	WASHER	DWG	INTERNAL, .164"	120113-005					2	2	
127	LOCK WASHER	DWG	SPLIT, .190"	120114-003					2	2	
128	JUMPER WIRE	DWG	BLACK	6292A22G03						1	

Figure 7-1. Model PP075T Power Positioner (Sheet 16 of 16)



ITEM	PART NAME	DEFINER / SIZE – REFERENCE INFORMATION	MFR CODE PART NUMBER OR REF DWG	GROUP G01	G02	G03	G04	G05
1	E-RING	DWG)	120079-010	2	2	2		
2	PISTON	DWG) DISC	177737	1	1	1	1	
3	CLEVIS PIN	DWG)	170924	1	1	1		
4	CLEVIS	DWG)	170925-002	1	1	1		
5	NUT	DWG)	120026-011	1	1	1		
6	ARM	DWG)	4513C25H04	1	1	1		
7	SCREW HEX HD	DWG) .31-24 x 9.12	174080-003	4	4	4	4	
8	WASHER, LOCK	DWG)	120114-029	6	6	6	6	
9	ASSEMBLY	DWG) BOTTOM CYLINDER HEAD	4545B30G01	1	1	1	1	
10	PISTON CUP	DWG)	171292	2	2	2	2	
11	SPRING	DWG) GARTER	171425	2	2	2	2	
12	FOLLOWER	DWG) PISTON CUP	171293	2	2	2	2	
13	ROD	DWG) PISTON	4847B25H01	1	1	1	1	
14	CYLINDER	DWG)	3D39492H01	1	1	1	1	
15	GASKET	DWG)	4847B17H02	2	2	2	2	
16	ASSEMBLY	DWG) TOP CYLINDER HEAD	3D39504G01	1	1	1	1	
17	SEAL	DWG)	152507-001	1	1	1	1	
18	RETAINER	DWG) SEAL	170949	1	1	1	1	
19	SCREW, HEX HD	DWG) #10-32 x .38	163792-1932038	2	2	2	2	
20	SPRING	DWG) CALIBRATION, 0-30#	170952	1	–	–	–	
21	WASHER, LOCK	DWG) #10	120114-017	2	2	2	2	
22	SPRING	DWG) CALIBRATION, 3-15#	171267	–	1	–	–	
23	SPRING	DWG) CALIBRATION, 3-27#	171266	–	–	1	–	
24	TUBING	DWG) .125 STAINLESS STEEL	3D39399H04	1	1	1	1	
25	ASSEMBLY	DWG) VALVE, 0-30# & 0-60#	3D39398G01	1	–	–	–	
26	WASHER	DWG) PLAIN	120110-005	1	1	1	1	
27	NUT	DWG) ELASTIC STOP	120171-002	1	1	1	1	
28	SCREW, SOC HD	DWG) .25-20 x 1.25	120080-2520125	1	1	1	–	
29	ASSEMBLY	DWG) STEM & SLEEVE	177804	1	1	1	1	
30	ASSEMBLY	DWG) VALVE, 3-15# & 3-27#	3D39398G02	–	1	1	1	
31	NUT	DWG) .31-24 HEX	120026-019	4	4	4	4	
32	CAPLUG	DWG) 12 NPT	173640-007	2	2	2	–	
33	ELBOW	DWG) .25 OD x .12 IPS	7718867H04	–	–	–	2	
34	SEALANT	DWG) PIPE THREAD	273065-013	–	–	–	A/R	
35	LABEL	DWG) SERVICE	1A97978H01	1	1	1	1	
36	LABEL	DWG) .375 x 2.00	1A98310H01	1	1	1	1	
37	LABEL	DWG) .25 x .75	1A98310H03	1	1	1	–	
38	ELBOW	DWG) .12 OD TUBE x .12 IPS	7718867H03	4	4	4	4	
39	TUBING	DWG) .125 STAINLESS STEEL	3D39399H03	1	1	1	1	
40	SCREW	DWG) HEX HEAD	163792-3118062	2	2	2	–	

"A" – SEE DWG 173001 FOR VALVE PERFORMANCE CHECK SHEET
"B" – LUBRICAT SEAL 17 WITH McLUBE MOS -200 GREASE BEFORE ASSEMBLY
"C" – POSITIONING ACCURACY OF 3-15 PSI MODEL : ±1-1/2% OR BETTER
"D" – TIGHTEN LOCKNUT 27 TO 15-20 FT.LBS. TORQUE
"E" – MAX AMBIENT TEMPERATURE: 170°F
MAX AIR SUPPLY PRESSURE : 125 PSIG
"F" – FACE RADIUS LIP OF ITEM 12 TOWARD INSIDE CORNER OF CUP, ITEM 10
"G" – MAKE LABEL WITH APPLICABLE SIGNAL RANGE IN THE AREA USE RANGE VALUE (TYP. "0-30") TO MATCH SPRINGS ITEMS 20, 22, 23 THIS DOES NOT APPLY TO ASSEMBLY G04
"H" – CENTERLINES MUST BE PARALLEL WITHIN ±2°

Figure 7-2. 4 X 5 Power Positioner (Sheet 1 of 2)

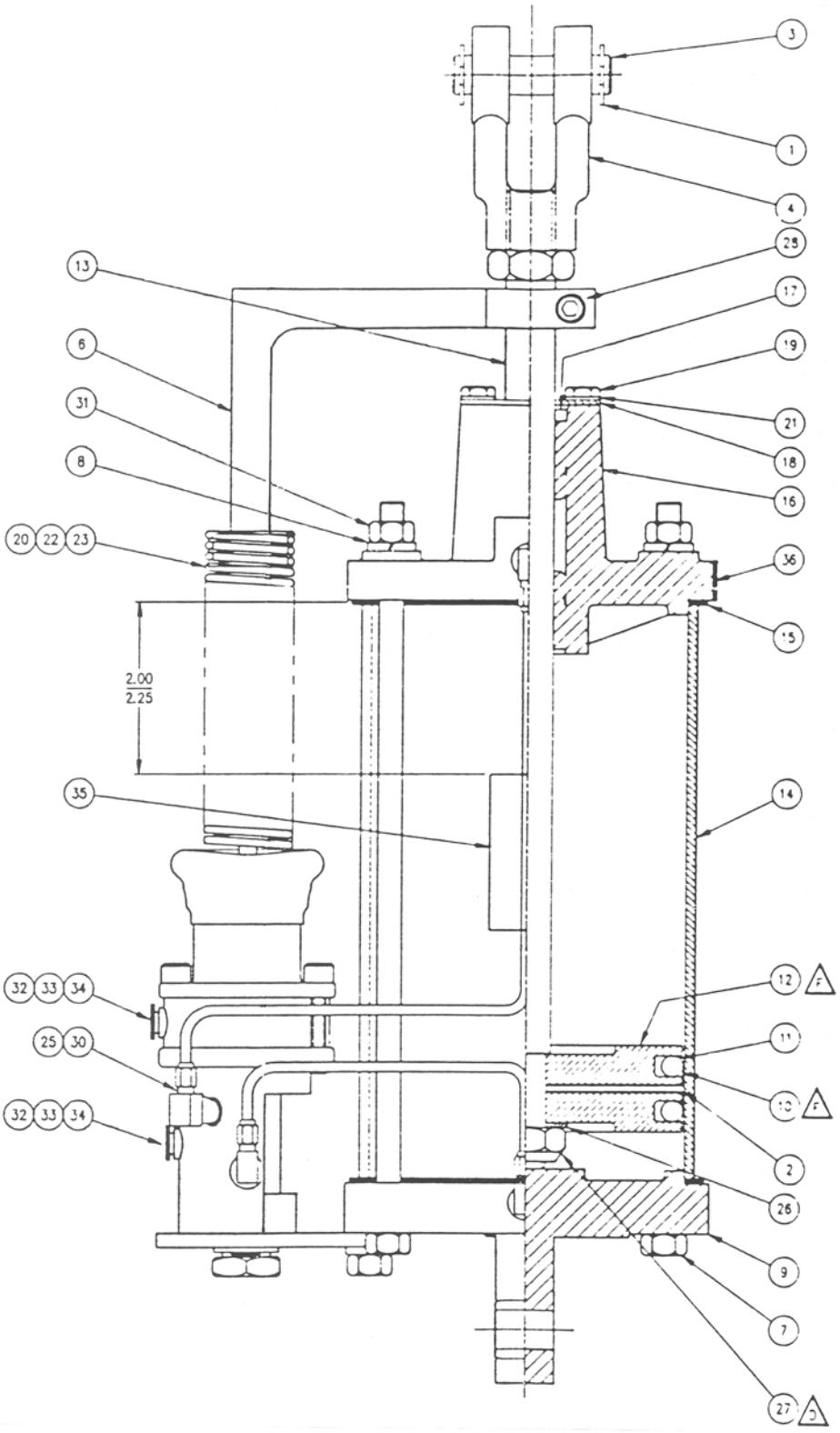
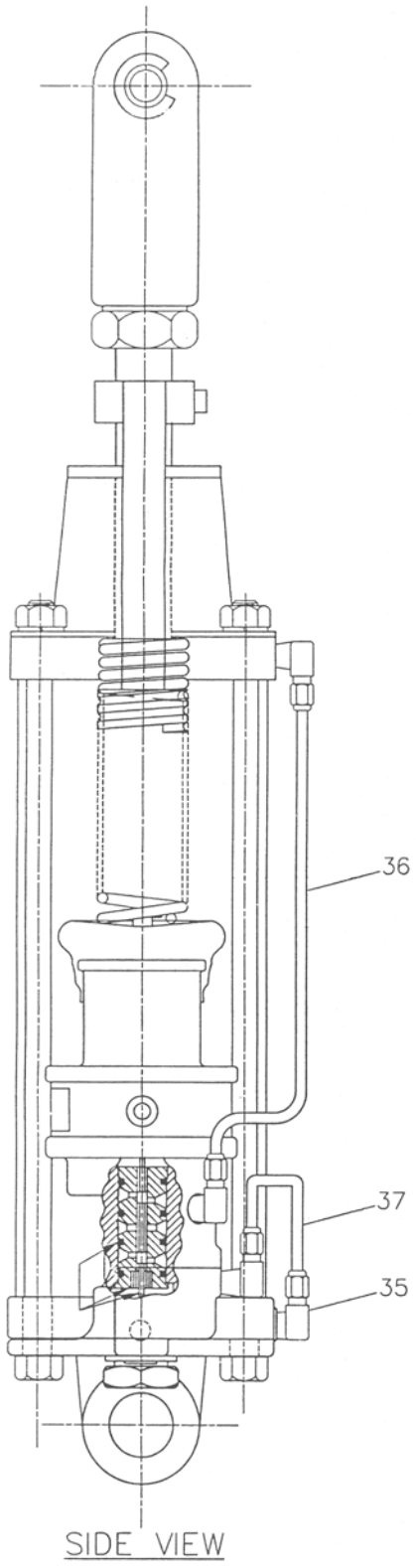


Figure 7-2. 4 X 5 Power Positioner (Sheet 2 of 2)



PARTS LIST			PARTS LIST UNITS: INCHES		GROUP NOTE→								
NOTE / ITEM		PART NAME	DEFINER	SIZE – REFERENCE INFORMATION	MATL CODE / PART NUMBER OR REF DWG	GROUP G01	G02	G03	G04	G05	G06	G07	G08
01		ASSEMBLY	DWG	)TOP HEAD	4847B35G01	1							1
02		CYLINDER	DWG		4847B29H01	1							1
03		SEAL RETAINER	DWG	)	170949	1							1
04		SEAL	DWG	)	152507-001	1							1
05		GASKET	DWG	)CYLINDER HEAD	4847B17H01	2							2
06		CAP SCREW	DWG	).312-24 x 9.38 LG	17-080-003	4							4
07		NUT	DWG	).312-24 HEX	120026-019	4							4
08		WASHER	DWG	).312 LOCK	12014-029	4							4
09		PISTON ROD	DWG	)	4847B25H01	1							1
10		PISTON CUP	DWG	)	170857	2							2
11		FOLLOWER	DWG	)PISTON CUP	170942	2							2
12		GARTER SPRING	DWG	)	170941	2							2
13		STOP NUT	DWG	)ELASTIC	120171-002	1							1
14		WASHER	DWG	).500 PLAIN	120110-005	1							1
15		NUT	DWG	).625-18 HEX	120036-014	1							1
16		CAP SCREW	DWG	)	163792-1932038	2							2
17		WASHER	DWG	)#10 LOCK	12011+-017	2							2
18		ARM	DWG	)	4513C25H02	1							
19		SPRING	DWG	)	170927	1							
~~20~~		~~ADJ SCREW~~	~~DWG~~	~~)SPRING~~	~~170926~~	~~1~~							
~~21~~		~~STD WASHER~~	~~DWG~~	~~).25 SAE~~	~~256445-002~~	~~1~~							
~~22~~		~~SCREW~~	~~DWG~~	~~)#10-32 x 1.25 LG~~	~~163792-1932125~~	~~1~~							
~~23~~		~~ROLL PIN~~	~~DWG~~	~~).125 x .438~~	~~120175-027~~	~~1~~							
~~24~~		~~BASE PLATE~~	~~DWG~~	~~)VALVE~~	~~170938~~	~~1~~							
~~25~~		~~CAP SCREW~~	~~DWG~~	~~).250-20 x .62 LG HEX HD~~	~~163792-2520063~~	~~4~~							
26		CAP SCREW	DWG	).250-20 x 1.25 LG SOC HD	120090-2520125	1							
~~27~~		~~WASHER~~	~~DWG~~	~~).250 LOCK~~	~~120114-018~~	~~4~~							~~4~~
28		VALVE ASSY	REF	)	3D39398								
29		ASSEMBLY	DWG	)STEM & SLEEVE	173283	1							1
30		SPRING	REF	)0-30 LB	170952								
31		SPRING	REF	)3-15 LB	171267								
32		SPRING	REF	)3-27 LB	171266								
~~33~~		~~SPRING NUT~~	~~DWG~~	~~)0-30, 3-15 & 3-27 LB~~	~~270930~~	~~1~~							
34		CAPLUG	DWG	).125 NPT	173640-007	2							
35		ELBOW	DWG	.125 PIPEx.125 TUBE	771B867H01	4							4
36		TUBING	LGH	18") 1/8" 304 S.S.	3D39399H05	1							1
37		TUBING	LGH	9") 1/8" 304 S.S.	3D39399H02	1							1
38		LABEL	DWG	)HAGAN	1A97978H01	1							1
39		LIMIT SWITCH	DWG	)	8741-001		2						
40		SW STRIKER	DWG	)WELDMENT	3535B04G01		1						
41		BRACKET	DWG	)SW BRKT	3535B01H01		2						
42		SPACER	DWG	).68 OD x .35 ID x .25	3534B99H01		1						
43		SCREW	DWG	).138-32 x 1.25 LG PAN HD	70001DAJ4B		4						
44		WASHER	DWG	)#6 FLAT	70500BD30C		4						
45		WASHER	DWG	)#6 SPLIT LOCK	70510CR10G		4						
46		NUT PLATE	DWG	).138-32 THD	3535B09H01		2						
47	J	GAUGE	DWG	)PRESSURE, 0-30 PSI	275431-007			1					
48	J	PRESS REG	DWG	)	4505C21G01			1					
49	J	TRANSDUCER	DWG	) I/P	9885A31H01			1					
50		PUSH ROD ASSY	DWG	)	4844B01G01				1				
51		SPACER	DWG	)PUSH ROD	4843B98H01				1				
52		STOP NUT	DWG	)ELASTIC #10-32	120033-007				1				
53		SCREW	DWG	)FIL HD #10-32 x 2 LG	120092-1932200				1				
54		SCREW	DWG	)PAN HD #10-32 x .75 LG	120103-1932075				1				
55		WASHER	DWG	)FLAT #10	256445-003				2				
56		SCREW	DWG	)PAN HD #6-32 x .38 LG	120103-1432038				4				
57		ASSY	DWG	)CABLE, POT & BOX	4844B08G02				1				
58	I	ROD END	DWG		232207-001					2			
59		CYL HEAD	DWG	)BOTTOM	4846B57G02					1			
60	I	THRD ROD	AML	).625-18 x 36.00 LG	1A98415H01					1			
61		BOT CYL HEAD	DWG	)	4847B34G01						1		1
62		CLEVIS	DWG	)	170925-002						1		
63		CLEVIS PIN	DWG	)	170924							1	
64		"E" RING RING	DWG	)	120079-010						2		
65		ASSEMBLY	DWG	) BASIC	3D39395G01	X							
66		ASSEMBLY	DWG	) LIMIT SWITCH	3D39395G02		X						
67		TRANSDUCER	DWG	) I/P PARTS	3D39395G03			X					
68		EPT	DWG	) PARTS	3D39395G04				X				
69		TC200	DWG	) VERITRIM PARTS	3D39395G05					X			
70		TC200	DWG	) W/O VERITRIM	3D39395G06						X		
71		LABEL	REF		1A98542H03								
72		LABEL	REF		1A98542H04								
73		FIXTURE	DWG		198263							1	
74		SLEEVE	DWG	) LOADING	4847B54H01							1	
75		VALVE ASSY	DWG		3D39398G02								1
76		ELBOW	DWG		771B867H04								2
77		ASSEMBLY	DWG	) ECONOTORQUE	3D39395G08								X

Figure 7-3. 2-1/2 x 5 Power Positioner (Sheet 1 of 2)

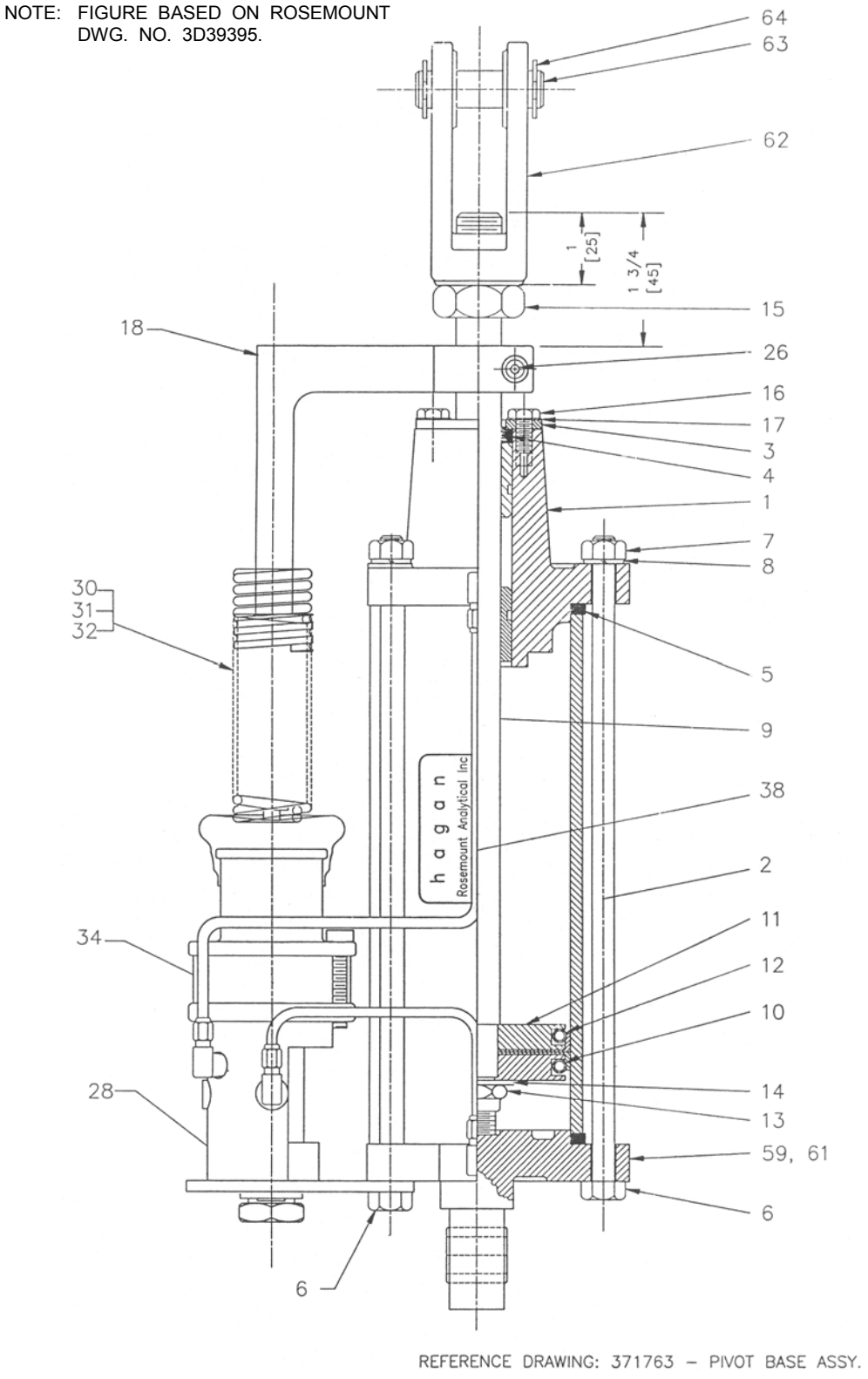


Figure 7-3. 2-1/2 X 5 Power Positioner (Sheet 2 of 2)

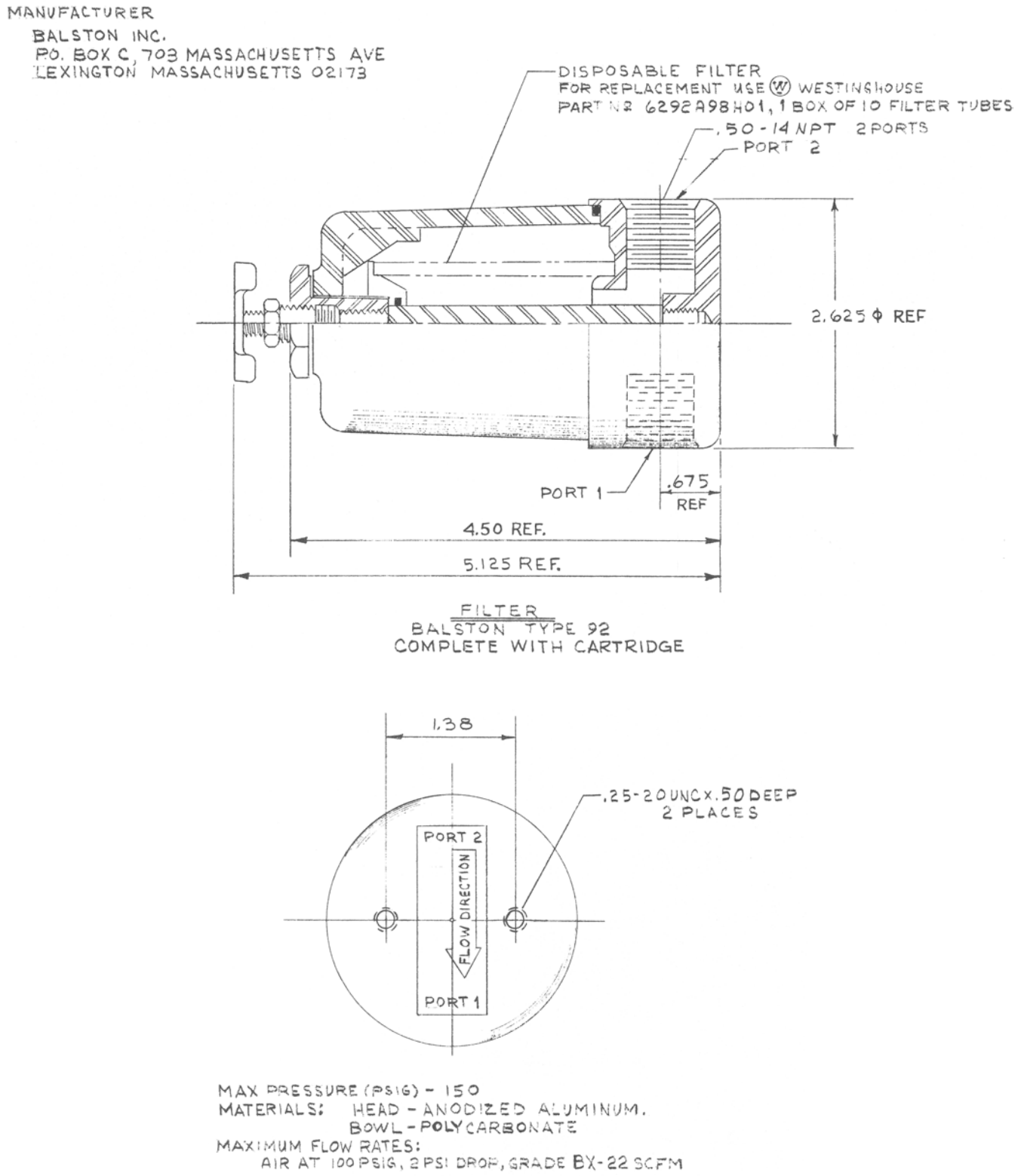
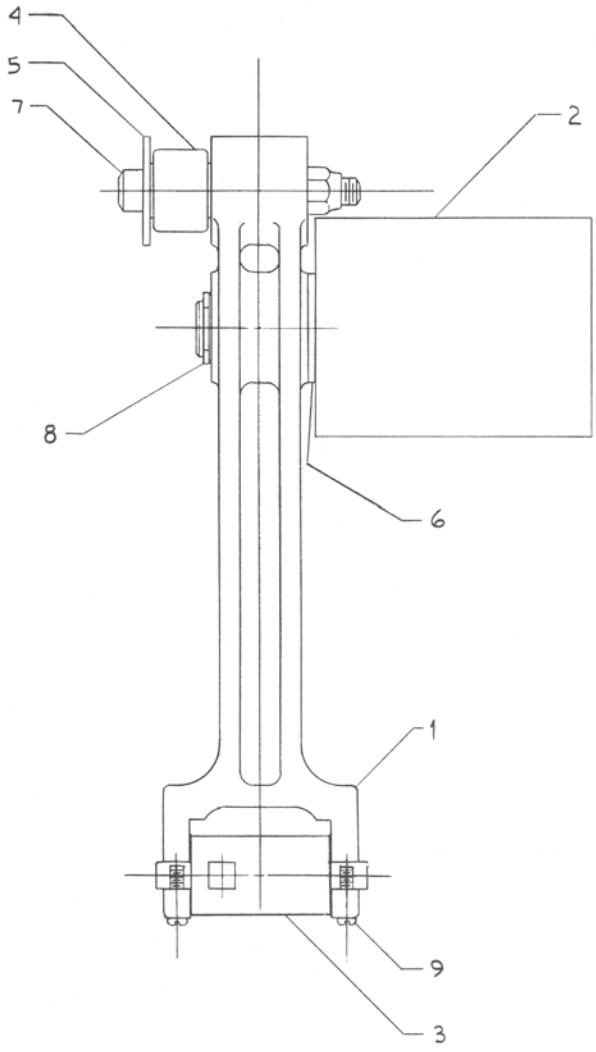


Figure 7-4. Air Supply Filter



ITEM		PART NAME	DEF	SIZE-REFERENCE INFORMATION	MATL SIZE CODE PART NUMBER OR REF DWG	GROUP NOTE → LINE NO.	01	02	03	04	05
01		LEVER ASSY	DWG		1547B77G01		1				
02		FBK PVT ASSY	DWG		6295A67G01		1				
03		SWIVEL	DWG		1547B72H01		1				
04		CAM FOLLOWER	DWG		6295A91H01		1				
05		GUIDE WSHR	DWG		6295A76H01		1				
06		SPACER WSHR	DWG		6295A75H01		1				
07		SCREW	DWG	),250-20x2.00 SOC. HD.	120090-2520200		1				
08		EXT RTNG RG	DWG		771B949H12		1				
09		SCREW	DWG	).112-40x.50 PAN HD.	120103-1140050		2				

Figure 7-5. Feedback Lever on Roller Assembly

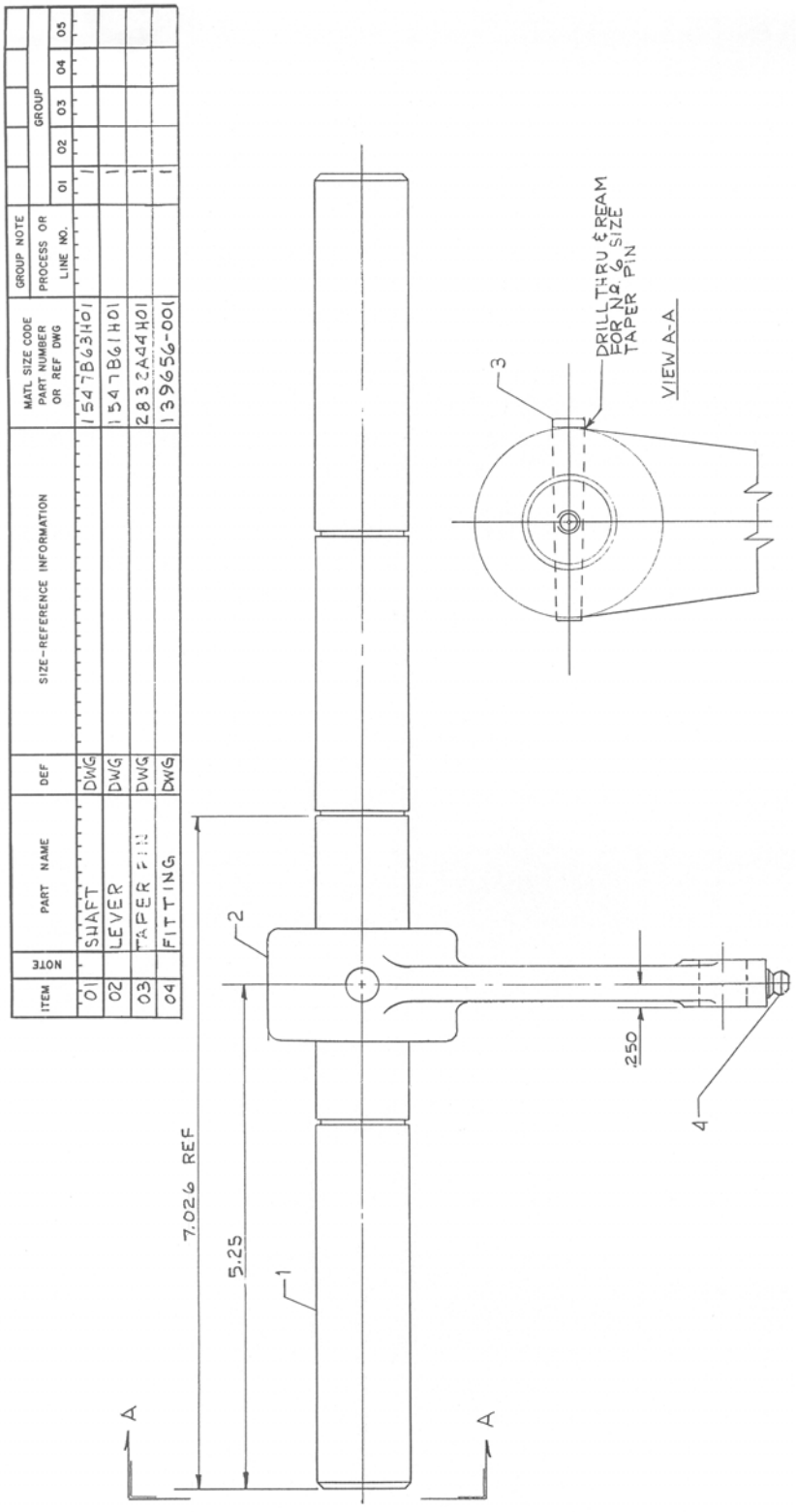


Figure 7-6. Main Shaft Assembly

WARRANTY

Goods and part(s) (excluding consumables) manufactured by Seller are warranted to be free from defects in workmanship and material under normal use and service for a period of twelve (12) months from the date of shipment by Seller. Consumables, glass electrodes, membranes, liquid junctions, electrolyte, o-rings, etc., are warranted to be free from defects in workmanship and material under normal use and service for a period of ninety (90) days from date of shipment by Seller. Goods, part(s) and consumables proven by Seller to be defective in workmanship and/or material shall be replaced or repaired, free of charge, F.O.B. Seller's factory provided that the goods, part(s) or consumables are returned to Seller's designated factory, transportation charges prepaid, within the twelve (12) month period of warranty in the case of goods and part(s), and in the case of consumables, within the ninety (90) day period of warranty. This warranty shall be in effect for replacement or repaired goods, part(s) and the remaining portion of the ninety (90) day warranty in the case of consumables. A defect in goods, part(s) and consumables of the commercial unit shall not operate to condemn such commercial unit when such goods, part(s) and consumables are capable of being renewed, repaired or replaced.

The Seller shall not be liable to the Buyer, or to any other person, for the loss or damage directly or indirectly, arising from the use of the equipment or goods, from breach of any warranty, or from any other cause. All other warranties, expressed or implied are hereby excluded.

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Limitations of Remedy. SELLER SHALL NOT BE LIABLE FOR DAMAGES CAUSED BY DELAY IN PERFORMANCE. THE SOLE AND EXCLUSIVE REMEDY FOR BREACH OF WARRANTY SHALL BE LIMITED TO REPAIR OR REPLACEMENT UNDER THE STANDARD WARRANTY CLAUSE. IN NO CASE, REGARDLESS OF THE FORM OF THE CAUSE OF ACTION, SHALL SELLER'S LIABILITY EXCEED THE PRICE TO BUYER OF THE SPECIFIC GOODS MANUFACTURED BY SELLER GIVING RISE TO THE CAUSE OF ACTION. BUYER AGREES THAT IN NO EVENT SHALL SELLER'S LIABILITY EXTEND TO INCLUDE INCIDENTAL OR CONSEQUENTIAL DAMAGES. CONSEQUENTIAL DAMAGES SHALL INCLUDE, BUT ARE NOT LIMITED TO, LOSS OF ANTICIPATED PROFITS, LOSS OF USE, LOSS OF REVENUE, COST OF CAPITAL AND DAMAGE OR LOSS OF OTHER PROPERTY OR EQUIPMENT. IN NO EVENT SHALL SELLER BE OBLIGATED TO INDEMNIFY BUYER IN ANY MANNER NOR SHALL SELLER BE LIABLE FOR PROPERTY DAMAGE AND/OR THIRD PARTY CLAIMS COVERED BY UMBRELLA INSURANCE AND/OR INDEMNITY COVERAGE PROVIDED TO BUYER, ITS ASSIGNS, AND EACH SUCCESSOR INTEREST TO THE GOODS PROVIDED HEREUNDER.

Force Majeure. Seller shall not be liable for failure to perform due to labor strikes or acts beyond Seller's direct control.

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