Pure-Flo®
Advantage® Piston Actuator (APA)
Maintenance Manual

This manual provides installation and maintenance instructions for ADVANTAGE® PISTON ACTUATOR (APA) operated diaphragm valves. If additional information is required, please contact:

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33 Centerville Road, P.O. Box 6164
Lancaster, PA 17603-2064 USA
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WARNING

Valves and related products are designed and manufactured using good workmanship and materials, and they meet all applicable industry standards. These valves are manufactured with various materials, and they should be used only in services recommended by a company engineer.

Misapplication of the product may result in injuries or property damage. A selection of valve and valve components of the proper material and consistent with the particular performance requirement is important for proper application.

Examples of misapplication or misuse of any products include use in an application in which the pressure/temperature rating is exceeded or failure to maintain valve or related product as recommended and use of products to handle caustic and/or hazardous substances when not designed for that purpose.

If valve exhibits any indication of leakage, do not operate. Isolate valve and either repair or replace.

Edition 5/08

0.0 GENERAL

This manual provides installation and maintenance instructions for manually operated Pure-Flo diaphragm valves. The latest version of this manual can be found on the website listed on the cover. If additional information is required, or if your valves have pneumatic, electric, or any type of power actuation, contact:

ITT Pure-Flo
33 Centerville Rd.
Lancaster, PA 17603
(717) 509-2200
Attention: Sales Department

0.1 **Safety**

The safety precautions in these operating instructions are specially marked with the standard symbol for danger when non-observance could result in personal injury, loss of life or property damage.

Non-observance of these safety precautions can endanger the valve and its functions.

0.1.1 **Qualifications and training of personnel**

The personnel responsible for operation, maintenance, inspection and assembly must be appropriately qualified.

The operating company must precisely define the responsibilities, competence and supervision of the personnel. If the personnel lack the necessary knowledge, they are to be trained and instructed. If required this can be carried out by the manufacturer/supplier of the valve by order of the operating company. Furthermore, the operating company is to ensure that the contents of the operating instructions have been fully understood by the personnel.

0.1.2 **Dangers through non-observance of the safety precautions**

The non-observance of the safety precautions can result in the endangering of lives as well as the environment and the valve. The non-observance of the safety precautions can lead to the loss of all claims for damages.

Non-observance can result in the following:

- failure of important functions of the valve/plant
- endangering of lives by electrical, mechanical and chemical influences
- endangering the environment through leakage of dangerous materials
- personal injury or property damage

0.1.3 **Safety awareness at work**

Attention must be paid to the safety precautions in these operating instructions, the current national regulations concerning the prevention of accidents as well as any labor, company and safety-regulations of the operating company.

0.1.4 **Safety precautions for the operating company/individual operator**

- If hot or cold components of the valves are a source of danger, these components must be secured against contact by operating company.
- Contact guard for moving parts may not be removed when valve is in operation.
- Do not hang items off the valves. Any accessories must be firmly or permanently attached.
- Do not use the product as a step or hand hold.
- Do not paint over identification tag, warnings, notices or other identification marks associated with the product.
- PTFE diaphragms emit toxic fumes due to thermal decomposition at temperatures of 380ºC or greater.

0.1.5 **Safety precautions for maintenance, inspection and assembly**

Work on externally actuated valves should only be carried out when the valve is removed from service. Valves that have been exposed to harmful media such as caustic chemicals must be decontaminated.

On completion of work, all safety and protective equipment must immediately be fitted again or reactivated.

Before the re-operation, attention should be paid to the points in section 1.0.

0.1.6 **Unauthorized reconstruction and manufacture of spare parts**

Reconstruction or modification of the valve is only admissible after consultation with the manufacturer.

Genuine spare parts and accessories authorized by the manufacturer serve to maintain safety. The use of diaphragms other than genuine ITT diaphragms violates Diaphragm valve industry standard MS SP88. Valve pressure, temperature and overall performance can not be guaranteed. Use of non-genuine ITT diaphragms or parts can annul all liability for the consequences.

Manufacturer's parts are not to be used in conjunction with products not supplied by the manufacturer. The use of manufacturer's parts with products not supplied by the manufacturer can annul all liability for the consequences.

0.1.7 **Inadmissible modes of operation**

The operational reliability of the valve supplied is only guaranteed when used as designated, as laid down in section 1.0. The operating limits given on the identification tag and in the data sheet may not be exceeded under any circumstances.

0.2 **Transport and storage**

The universally recognized technical standards and the regulations regarding

prevention of accidents must be observed at all times when handling.

0.2.1 **Transport**
The goods have to be carefully handled in order to prevent damage.

The end flange caps supplied are to be fitted to the valve as applicable.

0.2.2 **Unpacking**
Unpack the shipment, check to make sure that all contents are present and undamaged.

0.2.3 **Storage**
If the valve is not to be installed immediately following delivery, it must be properly stored.

Storage should be in a dry room at a temperature as constant as possible.

Storage over a longer period may necessitate individual moisture proof packing. This is dependent on the local conditions.

0.2.4 **Return shipment**
If the return shipment is required, contact manufacturer at the address listed on page 1 for specific instructions.

The operator of valves used for aggressive or toxic media such as caustic chemicals must ensure that these are well flushed and cleaned before being handed to the maintenance personnel. This is particularly important when returning to the product manufacturer. MSDS are required for authorization to return valves to the manufacturer.

1.0 INSTALLATION

CAUTION!

WELD END VALVES

Weld end valves for schedule 10 and heavier pipe require actuator removal prior to welding in line. The actuator may remain on valves with schedule 5 and lighter ends, providing that automatic welding equipment is employed. The valve must be in the open position and properly purged with an inert gas. Manual welding requires topworks removal for all tubing gages and pipe schedules.

1.1 Pure-Flo® diaphragm valves may be installed in any orientation. For horizontal piping systems to be drained through the valve, consult the Engineering Catalog for the appropriate drain angle. Note: Pure-Flo® valves have either raised hash marks (castings) or small machined dots (wrought & forgings) on the valve body to indicate the correct drain angle. Locate these marks at the 12 o'clock position to achieve the optimum drain angle. Note: According to good practice, horizontal pipework should be sloped toward the drain point to ensure optimum draining.

CAUTION!

1.2 Prior to pressurization (with the valve slightly open) tighten the bonnet fasteners in accordance with Table 1.

It is recommended that bonnet fasteners be retightened at ambient conditions after the system has cycled through operating pressure and temperature. If leakage occurs at the body/diaphragm seating area, immediately depressurize system and tighten bonnet bolts as noted above. If leakage continues, diaphragm replacement is required. Follow applicable steps in section 3.7.

1.3 Maximum valve operating pressure is 150 psig (10.3 bar). This pressure is applicable up to 100°F (38°C). **VALVES AT MAXIMUM PRESSURE CANNOT BE USED AT MAXIMUM TEMPERATURES.**

CAUTION!

The actuator size/configuration may limit the actual operating pressure, consult Engineering Catalog for actuator sizing. Consult factory or Engineering Catalog for vacuum operation.

1.4 Air line connections should be made with care as damage may occur to the plastic actuator cylinder. Connection size is 1/8" NPT.

1.5 The plastic actuator cylinder (0.50"-2.00", DN 15 - 50) can have the air inlet positioned in any quadrant For 0.50" through 2.00" (DN 15 - 50), the actuator must be removed from the valve body and the steps outlined in section 3.10 are to be followed.

2.0 OPERATION & ADJUSTMENT

CAUTION!

APA IS NOT AUTOCLAVABLE

2.1 The Advantage® Piston Actuator is a non-sealed design and does not provide secondary containment of process fluids in the event of a diaphragm failure. Each bonnet is equipped with a weep hole to allow fluid seepage indicating a diaphragm failure. Replace diaphragm immediately. Failure to follow these instructions could result in serious personal injury or death, and property damage.

2.2 The Advantage® Piston Actuator is only available as a reverse acting (fail closed) pneumatic piston actuator. The actuator model number is located on the identification tag. The model number is a six digit number defining the actuator as follows:

APXXXY
AP = Advantage® Piston Actuator
XXX = Nominal Size.
Y = 6 60 PSI Spring Package
Y = 9 90 PSI Spring Package

2.3 Maximum permitted air supply pressure is 90 psig (6.2 bar, 620 kPa).

ACTUATOR PRESSURE RATING

The Advantage® Piston Actuator has a pressure rating of 90 psig (6.2 bar, 620 kPa). However, the actuator will withstand pressures in excess of the rated pressure without risk of bursting.

Maintaining operating pressure at or below 90 psig (6.2 bar, 620 kPa) will ensure optimum life of the operating components. However, operation at pressures up to 95 psig (6.5 bar, 650 kPa), for limited periods of time, will not noticeably affect the life of these components.

2.4 For operation and adjustment of actuator accessories, see Section 4.0.

2.5 Actuator travel is shown in Table 2.

3.0 MAINTENANCE

ALL MAINTENANCE PROCEDURES MUST BE PERFORMED BY QUALIFIED PERSONNEL. MAINTENANCE DONE BY PERSONNEL NOT QUALIFIED TO PERFORM IT COULD RESULT IN PERSONAL INJURY, DEATH OR PROPERTY DAMAGE.

Remove all line pressure.

3.1 **Periodic inspection**

Periodically inspect condition of external valve parts. Replace all parts showing excessive wear or corrosion.

When the process fluid is hazardous or corrosive, extra precautions should be taken. The user should employ appropriate safety devices and should be prepared to control a leak of the process fluid. Fluid seeping from the weep hole indicates a diaphragm failure. Replace diaphragm immediately. For diaphragm replacement, see Section 3.7. Failure to follow these instructions could result in serious personal injury or death, and property damage.

3.2 **Bonnet leaking**

Air pressure from the bonnet weep hole may indicate o-ring failure. Follow applicable replacement instructions in Section 3.9.

3.3 **Cover leaking**

Air pressure from the cover vent hole may indicate o-ring or u-cup seal failure. Follow applicable replacement instructions in Section 3.9.

3.4 **Diaphragm-flange leakage**

If valve diaphragm flange area leaks, depressurize system and open valve slightly, using a local bleed type regulator. Tighten bonnet bolts as described in Section 1.2. If leakage continues, valve diaphragm replacement is required.

3.5 **Lubrication**

Standard lubricant is Chevron FM ALC EP (FDA compliant) for all Pure-Flo® valves. Actuators should be lubricated in the spindle o-ring areas, cover o-ring area, cylinder o-ring areas, bushing o-ring areas, spring contact surfaces and piston to cylinder contact area whenever the actuator is disassembled. Remove residual grease prior to re-lubrication.

CAUTION!

Special lubricants may be required for oxygen or other unique services. Contact ITT Industries for evaluation of non-standard lubricants.

3.6 **Advantage® Piston Actuator to valve body mounting instructions**

Regulate air pressure in the actuator to move the diaphragm upward until the backing cushion or elastomer diaphragm rests against the bonnet. Do not apply excessive air pressure that results in inversion of the diaphragm. No lubricants are permissible on the diaphragm seal face or body interior/seal area. Place actuator assembly on body and tighten bonnet fasteners in accordance with Table 1.

3.7 **Valve diaphragm replacement**

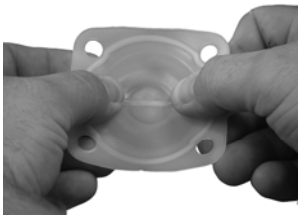
3.7.1 Load the actuator with sufficient air to slightly open valve. This will ease the spring tension holding the valve diaphragm to the body weir.

3.7.2 Remove the bonnet bolts. Lift actuator assembly from valve body. Release air and disconnect air line. Note air inlet position.

3.7.3 Unscrew diaphragm from compressor by turning counterclockwise. Inspect valve compressor pin for excessive wear. Replace pin and/or compressor if excessive wear or axial pin movement. See Figure 1. Refer to section 3.9.

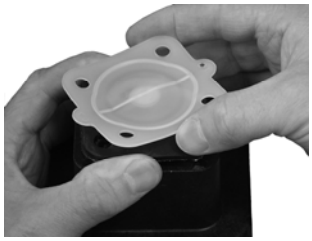
3.7.4 For PTFE assemblies only:
3.7.4.1 Install the new elastomer backing cushion over the tube nut.

3.7.4.2 Invert the PTFE diaphragm by pressing the center of the diaphragm face with your thumbs while holding the edge of the diaphragm with your fingers.

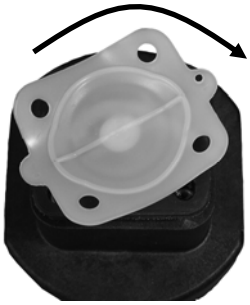


3.7.4.3 Engage the threads of the diaphragm into the tube nut by rotating clockwise.

3.7.4.4 Continue rotating the PTFE diaphragm clockwise into the compressor while securing the backing cushion from rotating.



3.7.5 Rotate the diaphragm until hard stop or heavy resistance is achieved and additional force does not significantly rotate the diaphragm into the compressor.



3.7.6 For PTFE assemblies only reinvert diaphragm.

3.7.7 Back off (no more than 1/2 turn) until the bolt holes in diaphragm and the bonnet flange align.

CAUTION! Do not overtighten diaphragm.

3.7.8 Connect air line to actuator and load chamber with sufficient air to move the diaphragm upward until the backing cushion or elastomer diaphragm rests against the bonnet. Do not apply excessive air pressure that results in inversion of the diaphragm.

3.7.9 Replace actuator assembly on body, and tighten bonnet bolts in accordance with Table 1. Ensure air inlet position is correct.

Note: To change from an elastomer diaphragm to PTFE, the compressor must be changed, and a tube nut must be installed. To change from a PTFE diaphragm to elastomer, the compressor must be changed and no tube nut is required.

3.8 **Spring replacement**

If present, the switch package must be removed.

3.8.1 Remove actuator from the valve body. Load the actuator with sufficient air to slightly open valve to simplify disassembly, then release air.

3.8.2 Secure actuator firmly in a vise or other suitable type of holding fixture. Soft jaws should be used.

3.8.3 Remove cover by turning counterclockwise to unthread it from the cylinder and lift out spring(s).

3.8.4 Replace spring(s) using the following procedure: Per section 3.5, lubricate indicating spindle/o-ring area, spring contact surfaces and piston/cylinder area. Drop in new spring(s). Turn the cover clockwise to compress the spring(s) until the cover bottoms out on the cylinder.

CAUTION! Do not overtighten cover.

3.8.5 Replace actuator assembly on body, and tighten bonnet bolts in accordance with Table 1.

3.8.6 Apply sufficient air pressure to actuator to fully open the valve. Confirm that valve strokes freely.

3.9 **Spindle o-ring and u-cup seal replacement**

3.9.1 Remove actuator from valve body and dismantle actuator following the instructions noted in section 3.8.1 through 3.8.3.

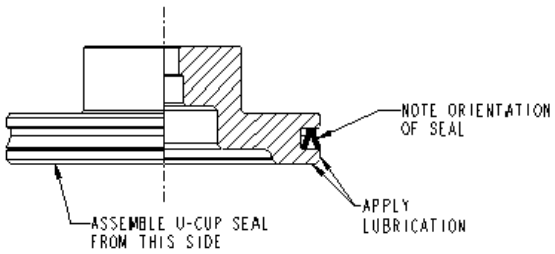
3.9.2 Remove indicating spindle by turning counterclockwise to unthread it. Note: Verify that the valve's spindle and compressor cannot rotate by keeping the compressor engaged in bonnet fingers.

3.9.3 Remove the bearing washer and piston.

3.9.4 Remove the u-cup seal from piston.

3.9.5 Replace u-cup seal using the following procedure: In order to facilitate installation, Apply Chevron Poly FM2 (FDA compliant) to the piston's face, retaining shoulder and groove. Insert the u-cup seal in one side of the piston groove. Then slowly push it over the piston head. After the u-cup seal has completely snapped into the groove, check to be sure that it has been properly positioned. See the figure

below for orientation of u-cup seal in piston groove. There should be axial play between the static lip and retaining shoulder.



3.9.6 Replace indicating spindle/cover o-ring. Lubricate o-rings prior to installation per Section 3.5.

3.9.7 Withdraw valve diaphragm, compressor and spindle assembly from the bonnet.

3.9.8 Replace valve spindle/piston o-ring and valve spindle/bushing o-ring. Lubricate o-rings prior to installation per Section 3.5.

3.9.9 Reassemble by reversing the instructions in section 3.9.7 through 3.9.1. Confirm the compressor long fingers are not dragging on bonnet and the stem moves freely. Note: When assembling indicating spindle to valve spindle use Loctite 7649 Primer N followed by Blue Loctite #242.

CAUTION! Do not overtighten indicating spindle. Maximum allowable torque on this joint for all assembly sizes is 32 in-lbs (3.6 N-m).

Then follow the steps outlined in section 3.8.4 through 3.8.6.

3.10 **Positioning air inlet and cylinder o-ring replacement (0.50” through 2.00”, DN 15 - 50)**

3.10.1 Remove actuator from valve body and dismantle actuator following the instructions noted in sections 3.9.1 through 3.9.4.

3.10.2 Remove bushing by turning it counterclockwise to unthread it.

3.10.3 Lift cylinder from bonnet.

3.10.4 Replace bushing o-rings. On 1.50” (DN 40) and 2.00” (DN 50), replace cylinder/flanged nut o-ring. Lubricate o-rings prior to installation per Section 3.5.

3.10.5 Orient air inlet on cylinder to the desired position and locate it on bonnet. Make sure that the cylinder is flush with the bonnet.

3.10.6 Turn the bushing on bonnet clockwise until snug. Note: The .5" size requires a washer under the bushing head.

CAUTION! Do not overtighten bushing. Maximum allowable torque on this joint is 200 in-lbs for 0.5", 0.75" and 1.0" and 240 in-lbs for 1.5" and 2.0".

3.10.7 Reassemble the remainder of the assembly by following the instructions in section 3.9.9.

4.0 ACCESSORIES

4.1 Operation of Adjustable Opening Stop (AOS)

4.1.1 Remove switch package if present.

4.1.2 Using air pressure and bleed type regulator, open valve to desired position.

4.1.3 Rotate AOS spindle counterclockwise until resistance is felt.

4.1.4 Opening stop is now set.

4.2 Travel (closing) stop and manual over-ride are not available.

5.0 SWITCH PACK 2.0

CAUTION! The switch package is not autoclavable; maximum temperature is 150°F, 65.5°C. Switches and Positioners cannot be used together.

Retrofit - The switch package as received from the factory is pre-set, only minimal adjustment is required to adapt to the actuator.

5.1 **Field mounting (Bio-Tek® through 2.00”, DN 8 - 50)**

5.1.1 Remove the four (4) stainless steel screws on the actuator top cover. Place the valve in the open position.

5.1.2 Remove the plastic plug from the indicating spindle.

5.1.3 Thread the switch indicating spindle into the valve indicating spindle. Use Blue Loctite #242.

5.1.4 Mount the adapter, insure that both o-rings are on the adapter and lubricated with Dow 111. The correct torque is 5.0 in-lbs (.56 N-m).

5.1.5 Slide the switch sub assembly down over the adapter, position the conduit entrances in the location most desirable, (45° increments), press down and tighten the set screw located on the side of the lower housing to lock the unit in place. The set screw torque should not exceed 5.0 in-lbs (.56 N-m).

5.1.6 Holding the lower housing stationary, unscrew the top switch package cover and wire to the terminal strip (Reference factory wiring decal). Verify the switches operate correctly by cycling the valve, see 5.2 for switch adjusting procedure. Screw the switch

package cover on; insure the o-ring remains in the groove.

5.2 **Setting switches (Switches are identified with decal)**

5.2.1 Remove top switch package cover.

5.2.2 Place valve in full open position.

5.2.3 Connect test device to terminal strip on connections identified for SW (open) switch. The switch type, inductive proximity versus dry contact mechanical, determines the type of test device required. Contact switches use a traditional voltmeter with resistance capability to verify continuity; inductive proximity switches cannot use this method. Proximity switches require an inductive proximity tester, such as Pepperl+Fuch's model #1-1305, which supplies the proper load and supply voltage to the switch. Inductive proximity switches must be energized with the correct load and supply voltage to sense the target.

CAUTION!

Do not short the inductive proximity switch by directly connecting a power supply, irreparable and immediate damage can occur to the switch.

5.2.4 Loosen the two (2) screws on the open switch slightly.

5.2.5 Use the adjusting screw accessible from the top to move the switch up or down the bracket to the optimum position. (Two turns past the trigger location is recommended.)

5.2.6 Tighten the two (2) screws on the switch.

5.2.7 Place the valve in the full closed position.

5.2.8 Repeat the above steps for the SW (closed) switch.

5.2.9 Replace the top switch package cover.

6.0 SWITCH PACK 2.5

CAUTION!

The switch package is not autoclavable; maximum temperature is 150°F, 65.5°C. Switches and Positioners cannot be used together.

Retrofit - The switch package as received from the factory is pre-set, only minimal adjustment is required to adapt to the actuator.

CAUTION!

The Switch Pack 2.5 only functions with Bio-Tek through 1" size.

6.1 **Field mounting (Bio-Tek® through 1.00", DN 8 - 25)**

6.1.1 Remove the four (4) stainless steel screws on the actuator top cover. Place the valve in the open position.

6.1.2 Remove the plastic plug from the indicating spindle.

6.1.3 Mount the adapter, insure that both o-rings are on the adapter and lubricated with Dow 111. The correct torque is 5.0 in-lbs (.56 N-m).

6.1.4 Place the washer on the adapter. Thread the switch indicating spindle (item 12) into the actuator spindle. Use Blue Loctite #242.

6.1.5 Slide the switch sub assembly down over the adapter, position the conduit entrances in the location most desirable, (45° increments), press down and tighten the set screw located on the side of the lower housing to lock the unit in place. The set screw torque should not exceed 5.0 in-lbs (.56 N-m).

6.1.6 Attach target assembly (item 9) to switch indicating spindle (item 12) using shoulder screw with Belleville washers in place. Use Blue Loctite #242. Run field wires and conduit to terminal strip. (Reference factory wiring tag.) Verify the switches operate correctly by cycling the valve, see 6.2 for switch adjusting procedure. Screw the switch package cover on; insure the o-ring remains in the groove.

6.2 **Setting switches (Switches are identified with decal)**

6.2.1 Remove top switch package cover.

6.2.2 Place valve in full open position.

6.2.3 Connect test device to terminal strip on connections identified for open switch. The switch type, inductive proximity versus dry contact mechanical, determines the type of test device required. Contact switches use a traditional volt meter with resistance capability to verify continuity; inductive proximity switches cannot use this method. Proximity switches require an inductive proximity tester, such as Pepperl+Fuch's model #1-1350, which supplies the proper load and supply voltage to the switch. Inductive proximity switches must be energized with the correct load and supply voltage to sense the target.

CAUTION!

Do not short the inductive proximity switch by directly connecting a power supply, irreparable and immediate damage can occur to the switch.

6.2.4 Use the switch actuator (item 7) accessible from the top to set the optimum position. (Two turns past the trigger location is recommended.)

6.2.5 Place the valve in the full closed position.

6.2.6 Repeat the above steps for the SW (Closed) switch

6.2.7 Replace the top switch package cover.

7.0 SWITCH PACK 3.0 & VSP

CAUTION!

The switch package is not autoclavable; maximum temperature is 140°F, 60.0°C. Switches and Positioners cannot be used together.

Retrofit - The switch package as received from the factory on valve assemblies is pre-set, only minimal adjustment is required to adapt to the actuator.

7.1 **Field mounting (Bio-Tek® through 2.00", DN 8 - 50)**

7.1.1 Remove the four (4) stainless steel screws on the actuator top cover. Place the valve in the open position.

7.1.2 Remove the plastic plug from the indicating spindle.

7.1.3 Insure all o-rings are on the adapter and lubricated with Dow 111. Slip the switch indicating spindle, #10-24 UNC threads first, through the adapter until the threads are exposed. Apply Blue Loctite #242 to the threads, thread the switch spindle into the actuator spindle until it shoulders.

7.1.4 Attach the adapter to the upper cover. The correct torque is 5.0 in-lbs (.56 N-m).

7.1.5 Thread the appropriate switch actuator(s) on the spindle.

7.1.6 Position the closed switch actuator approximately 0.14" (4 turns) from end of threads and position the open switch actuator approximately 0.25" (7 turns) below the top of the spindle, do not tighten the set screw.

7.1.7 Remove the switch package top cover; slide the sub assembly down over the adapter using care not to damage the switch internals (specifically the mechanical switch levers). Position the conduit entrance in the location most desirable, press down and tighten the set screw located on the side of the lower housing to lock the unit in place. Note that the plastic adapter has two molded counterbores. Locating the set screw in one of these holes provides maximum resistance to conduit rotation. The set screw torque should not exceed 5.0 in-lbs. (.56 N-m).

7.1.8 Run field wires and conduit to the terminal strip. Verify the switches operate correctly by cycling the valve. See 7.2 for switch adjusting procedure. Screw the switch package top cover on.

7.2 **Setting switches**

7.2.1 Verify the switch package locking set screw is tight.

7.2.2 Remove top switch package cover.

7.2.3 Place valve in full open position.

7.2.4 Connect test device to terminal strip for open switch. The switch type, inductive proximity versus dry contact mechanical, determines the type of test device required. Contact switches use a traditional volt meter with resistance capability to verify continuity; inductive proximity switches cannot use this method. Proximity switches require an inductive proximity tester, such as Pepperl+Fuch's model #1-1350, which supplies the proper load and supply voltage to the switch. Inductive proximity switches must be energized with the correct load and supply voltage to sense the target.

CAUTION!

Do not short the inductive proximity switch by directly connecting a power supply, irreparable and immediate damage can occur to the switch.

7.2.5 Verify the circuit board is firmly seated (SP3.0 style).

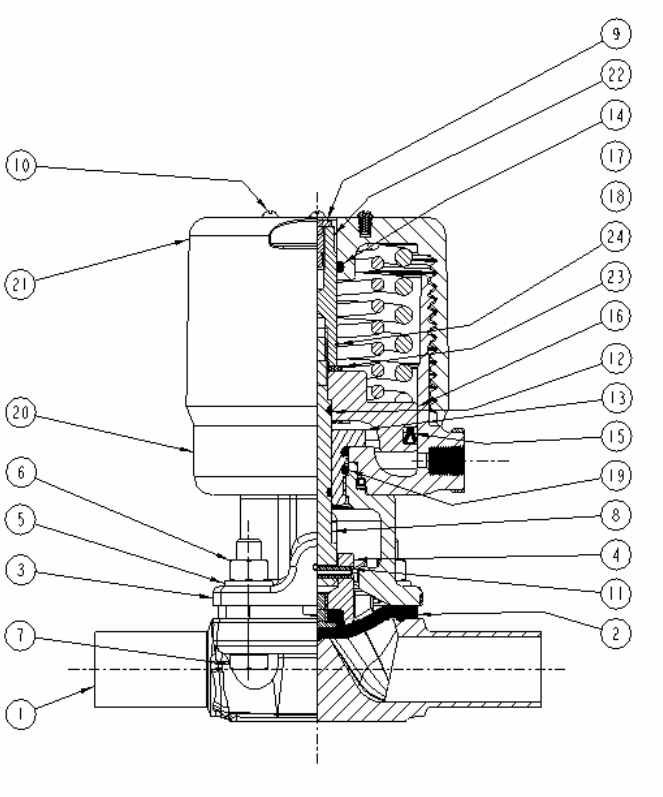
7.2.6 For mechanical switches only, press on the top of the circuit board to move it toward the switch actuator (SP3.0 style). Thread the switch actuator two (2) turns past the initial switch indication.

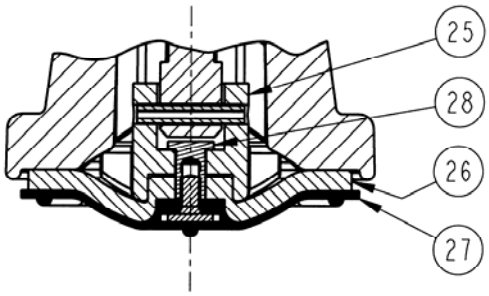
7.2.7 Lock in place with the set screw on switch actuator.

7.2.8 Place the valve in the full closed position and connect the appropriate test device to the terminal strip for valve CLOSED switch. Repeat section 7.2.5-7.2.7 for the valve CLOSED switch. Note on SP 3.0 units, the closed switch actuator must never hit the adapter in the closed position with body attached.

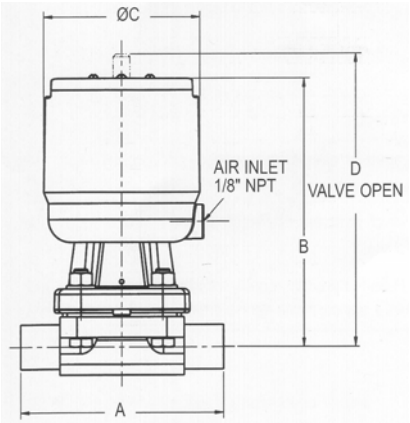
ADVANTAGE® PISTON ACTUATOR
FIGURE 1

LIST OF PARTS			
ITEM	DESCRIPTION	MATERIAL	QTY
1	STANDARD ITT BODY	STN. STL.	1
2	STANDARD ITT ELASTOMER DIAPHRAGMS	EPDM, BUNA-N	1
3	BONNET	STN. STL.	1
4	COMPRESSOR	ZINC	1
5	WASHER, PLAIN	STN. STL.	4
6	NUT, HEX	STN. STL.	4
7	SCREW, HEX HD CAP	STN. STL.	4
8	SPINDLE, VALVE	STN. STL.	1
9	PLUG	PLASTIC	1
10	SCREW, MACHINE RD HEAD	STN. STL.	4
11	PIN, COMPRESSOR	STN. STL.	1
12	O-RING	BUNA-N	2
13	BUSHING	BRASS	1
14	O-RING	BUNA-N	1
15	SEAL, PISTON	BUNA-N	1
16	PISTON	ZINC	1
17	SPRING, OUTER	STEEL	1
18	SPRING, INNER	STEEL	1
19	O-RING	BUNA-N	2
20	CYLINDER	GLASS REINFORCED POLYESTER (PBT)	1
21	COVER, CYLINDER	GLASS REINFORCED POLYESTER (PBT)	1
22	SPINDLE, INDICATING	STN. STL.	1
23	WASHER	STN. STL.	1
24	RING, RETAINING	STN. STL.	1
25	COMPRESSOR	ZINC	1
26	BACKING CUSHION	EPDM	1
27	STANDARD ITT PLASTIC DIAPHRAGMS	PTFE, GRADE TM OR R2	1
28	TUBE NUT	BRASS	1





PLASTIC DIAPHRAGM DETAIL

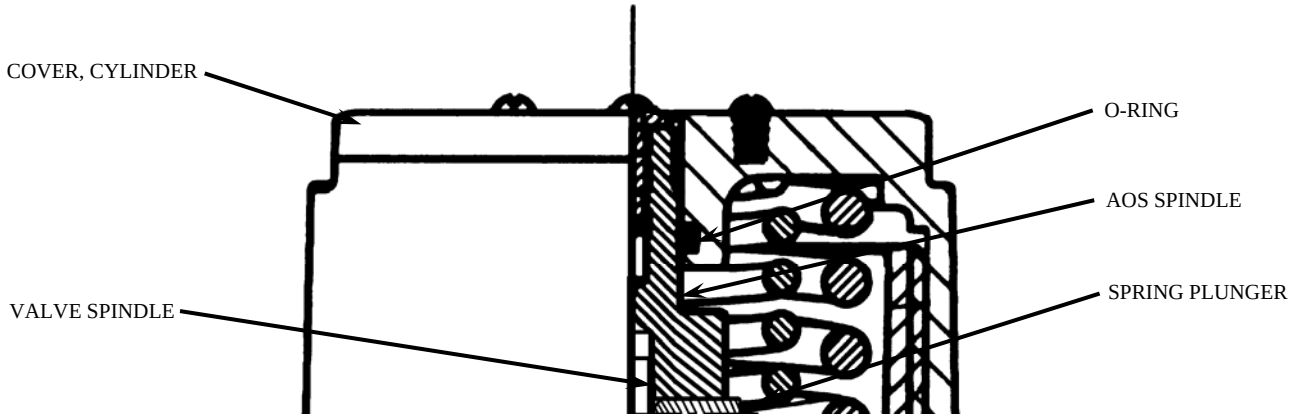


DIMENSIONAL DATA

Valve Size		"A"		"B"		"C"		"D"	
Inch	DN	Inch	cm	Inch	cm	Inch	cm	Inch	cm
0.50	15	3.50	8.98	4.52	11.48	2.75	6.99	4.77	12.12
0.75	20	4.00	10.16	5.33	13.54	3.38	8.59	5.71	14.50
1.00	25	4.50	11.43	5.89	14.96	3.38	8.59	6.39	16.23
1.50	40	5.50	13.97	9.54	24.23	5.00	12.70	10.35	26.29
2.00	50	6.25	15.87	10.07	25.58	5.00	12.70	11.19	28.42

* Buttweld is 3.50" / 8.89 cm, Tri-Clamp is 2.53" / 6.43 cm

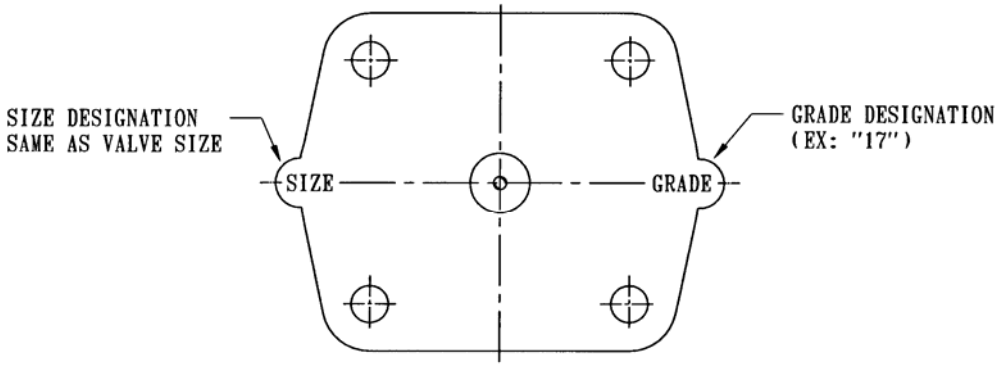
ADVANTAGE® PISTON ACTUATOR
FIGURE 2
ADJUSTABLE OPENING STOP (AOS)

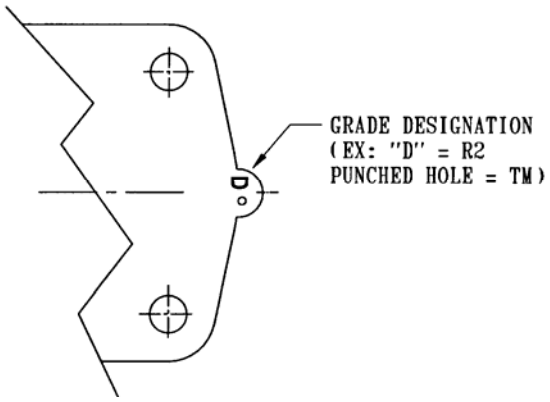


(Actuator shown in valve's closed position.)

FIGURE 3
VALVE DIAPHRAGM IDENTIFICATION

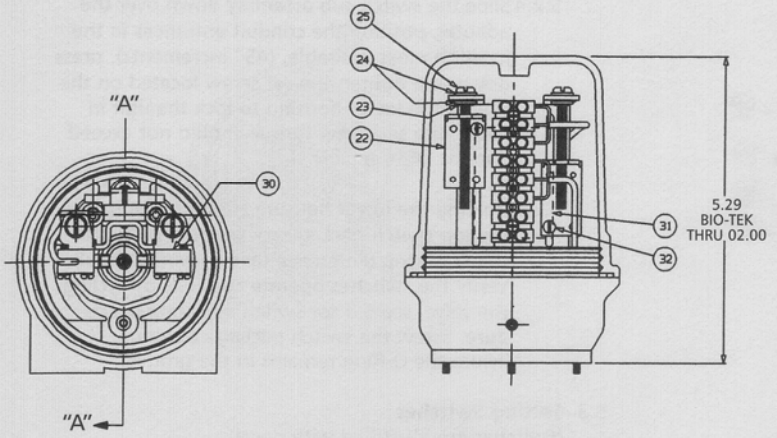
ELASTOMER – THESE DIAPHRAGMS ARE ONE-PIECE, MADE OF RUBBER, WITH MOLDED IN STUD. (SEE TABS)

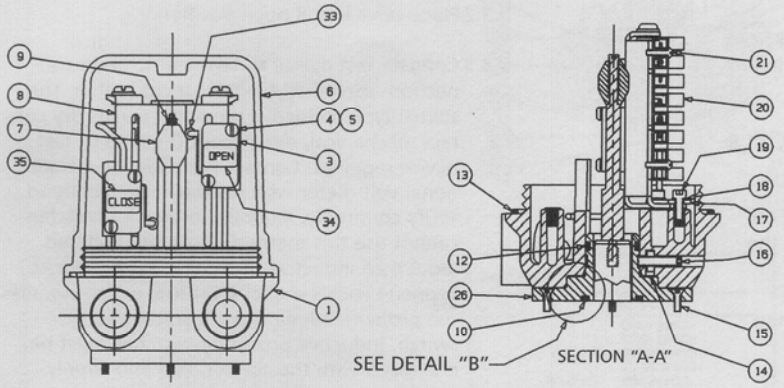




R2, TM (PTFE) – THESE DIAPHRAGMS ARE TWO-PIECE, WHITE PLASTIC WITH A BLACK EPDM BACKING CUSHION.

SWITCH PACK 2, SP2.0
FIGURE 4

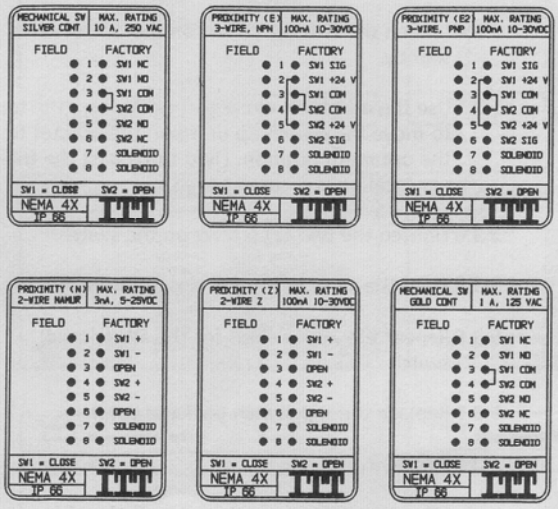




NOTE:
1. RECOMMENDED SPARE PARTS ARE MARKED WITH AN ASTERISK (*) ON THE LIST OF PARTS.
2. ▲- USED ON BIO-TEK - 01.000
   + - USED ON BIO-TEK - 02.000
   ⧫ - USED ON 1.500 & 02.000

Δ 3. SWITCHES
PROX P&F #NJ3-V3-Z
PROX P&F #NJ3-V3-N
PROX P&F #NJ3-V3-E
PROX P&F #NJ3-V3-E2
MECH #X97173-V3L (SIL CONT)
MECH #X97174-V3L (GOLD CONT)

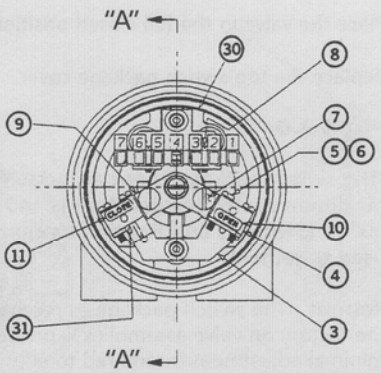
● 4. USED ONLY WITH PROXIMITY SWITCHES.
↑ 5. USED ONLY WITH MECHANICAL SWITCHES

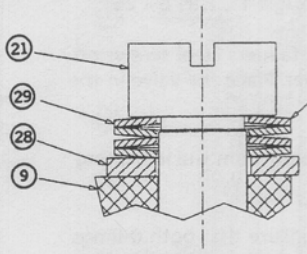


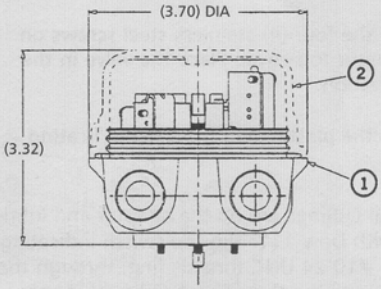
WIRING LABELS (ITEM 31)

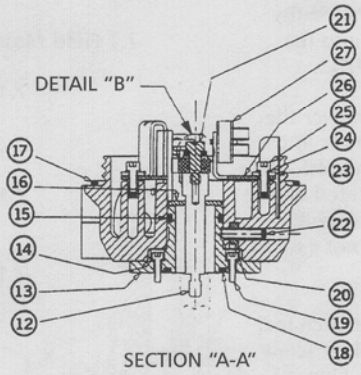
	ITEM	DESCRIPTION	MATERIAL	QTY.
	1	HOUSING-LOWER	PAS	1
	2			
Δ	3	SWITCH	-	2
	4	SCREW-PAN HD MACH #4-40UNC X .62 LG	STN STL,18-8	4
	5	WASHER-SPRING LOCK #4 REGULAR	STN STL,18-8	4
	6	HOUSING-UPPER	PAS	1
	7	ACTUATOR-SWITCH	ALUM,B-211-6061-T6	1
	8	BRACKET-SWITCH MTG	STN STL,A-240,SERIES 300	1
+	9	ROD-SWITCH ACTUATOR	STN STL,A-582,TY 303	1
*	10	O-RING #117	BUNA-N,FDA COMPLIANT	1
▲	11	ADAPTER-SWITCH	PAS	1
*	12	O-RING #116	BUNA-N,FDA COMPLIANT	1
*	13	O-RING #152	BUNA-N,FDA COMPLIANT	1
	14	NUT-SQUARE #8-32UNC	STN STL,18-8	1
⧫	15	SCREW-FL HEX SOC HD #4-40UNC X .38	STN STL,18-8	4
	16	SCREW-HEX SOC SET #8-32UNCX.75KN CP	STN STL,18-8	1
	17	WASHER-PLAIN #6 TYPE A	STN STL,18-8	3
	18	WASHER-SPRING LOCK #6 REGULAR	STN STL,18-8	3
	19	SCREW-HEX SOC HD CAP #6-32UNC X .38	STN STL,18-8	3
	20	TERMINAL STRIP	-	1
	21	SCREW-PAN HD MACH #3-48UNC X .38 LG	STN STL,18-8	2
	22	BRACKET-ADJUSTING	STN STL,A-240,SERIES 300	2
	23	RING-RETAINING TRUARC #5133-14	STL	2
	24	WASHER-PLAIN #8 TYPE B NARROW	STN STL,18-8	4
	25	SCREW-MODIFIED	STN STL,18-8	2
⧫	26	ADAPTER-SWITCH	PAS	1
▲	27	WASHER-SPRING LOCK #4 REGULAR	STN STL,18-8	4
▲	28	SCREW-HEX SOC HD CAP #4-40UNCX0.375	STN STL,18-8	4
	29			
↑	30	INSULSTOR-SWITCH	NOMEX ARAMID	2
	31	LABEL-SWITCH PACK	MYLAR	1
	32	SCREW-RND HD MACH #4-40UNCX.125 LG	STN STL,18-8	2
●	33	SWITCH-ACTUATOR #JV-5	STN STL	2
	34	LABEL-SWITCH (OPEN)	MYLAR	1
	35	LABEL-SWITCH (CLOSE)	MYLAR	1

SWITCH PACK 2.5, SP2.5
FIGURE 4A









NOTE:
1. RECOMMENDED SPARE PARTS ARE MARKED WITH AN ASTERISK (*) ON THE LIST OF PARTS.

● 2. SWITCHES
PROX P&F #NJ3-V3-Z
PROX P&F #NJ3-V3-N
PROX P&F #NJ3-V3-E
PROX P&F #NJ3-V3-E2
MECHANICAL X96324-UM (SIL CONT)
MECHANICAL X96325-UM (GOLD CONT)

▲ 3. USED ONLY WITH MECHANICAL SWITCHES.

ITT Engineered Valves

TERM STRIP NO.	DESCRIPTION	
1	NO OR NC	OPEN SWITCH
2	NO OR NC	CLOSE SWITCH
3	COMMON	OPEN & CLOSE SWITCH
4	NOT USED	------
5	SOLENOID.	POWER (RED)
6	SOLENOID.	POWER (RED)
7	SOLENOID.	GROUND (GREEN) OPT.

MECHANICAL SWITCH SILVER CONTACTS	MAX. RATING 5A 250VAC	NEMA 4X

ITT Engineered Valves

TERM STRIP NO.	DESCRIPTION	
1	+	OPEN SWITCH
2	–	OPEN SWITCH
3	+	CLOSE SWITCH
4		CLOSE SWITCH
5	SOLENOID.	POWER (RED)
6	SOLENOID.	POWER (RED)
7	SOLENOID.	GROUND (GREEN) OPT.

PROXIMITY (N) 2-WIRE NAMUR	MAX. RATING 3mA 250VDC	NEMA 4X

ITT Engineered Valves

TERM STRIP NO.	DESCRIPTION	
1	NO	OPEN SWITCH
2	NC	OPEN SWITCH
3	COMMON	OPEN & CLOSE SWITCH
4	NO	CLOSE SWITCH
5	NC	CLOSE SWITCH
6	NOT USED	------
7	NOT USED	------

MECHANICAL SWITCH SILVER CONTACTS	MAX. RATING 5A 250VAC	NEMA 4X

ITT Engineered Valves

TERM STRIP NO.	DESCRIPTION	
1	+	OPEN SWITCH
2	–	OPEN SWITCH
3	+	CLOSE SWITCH
4		CLOSE SWITCH
5	SOLENOID.	POWER (RED)
6	SOLENOID.	POWER (RED)
7	SOLENOID.	GROUND (GREEN) OPT.

PROXIMITY (Z) 2-WIRE Z	MAX. RATING 100mA 10-30VDC	NEMA 4X

ITT Engineered Valves

TERM STRIP NO.	DESCRIPTION	
1	NO OR NC	OPEN SWITCH
2	NO OR NC	CLOSE SWITCH
3	COMMON	OPEN & CLOSE SWITCH
4	NOT USED	------
5	SOLENOID.	POWER (RED)
6	SOLENOID.	POWER (RED)
7	SOLENOID.	GROUND (GREEN) OPT.

MECHANICAL SWITCH GOLD CONTACTS	MAX. RATING 0.1A 250VAC	NEMA 4X

ITT Engineered Valves

TERM STRIP NO.	DESCRIPTION	
1	SIGNAL	OPEN SWITCH
2	+ 24V	OPEN & CLOSE SWITCH
3	COMMON	OPEN & CLOSE SWITCH
4	SIGNAL	CLOSE SWITCH
5	SOLENOID.	POWER (RED)
6	SOLENOID.	POWER (RED)
7	SOLENOID.	GROUND (GREEN) OPT.

PROXIMITY (E) 3-WIRE, NPN	MAX. RATING 100mA 10-30VDC	NEMA 4X

ITT Engineered Valves

TERM STRIP NO.	DESCRIPTION	
1	NO	OPEN SWITCH
2	NC	OPEN SWITCH
3	COMMON	OPEN & CLOSE SWITCH
4	NO	CLOSE SWITCH
5	NC	CLOSE SWITCH
6	NOT USED	------
7	NOT USED	------

MECHANICAL SWITCH GOLD CONTACTS	MAX. RATING 0.1A 250 VAC	NEMA 4X

ITT Engineered Valves

TERM STRIP NO.	DESCRIPTION	
1	SIGNAL	OPEN SWITCH
2	+24V	OPEN & CLOSE SWITCH
3	COMMON	OPEN & CLOSE SWITCH
4	SIGNAL	CLOSE SWITCH
5	SOLENOID.	POWER (RED)
6	SOLENOID.	POWER (RED)
7	SOLENOID.	GROUND (GREEN) OPT.

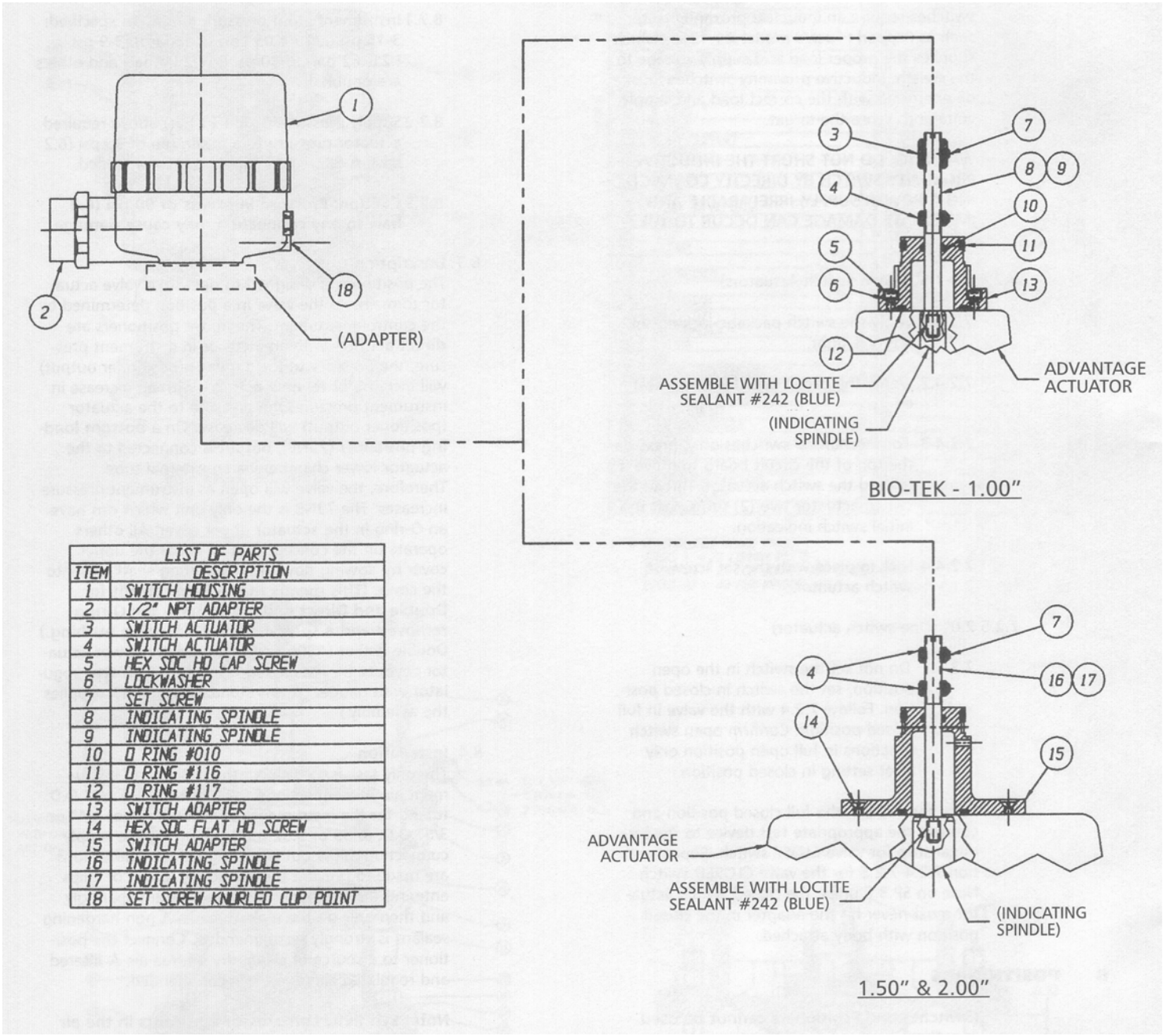
PROXIMITY (E2) 3-WIRE, PNP	MAX. RATING 100mA 10-30VDC	NEMA 4X

WIRING DIAGRAM CARDS (ITEM 30)

LIST OF PARTS

	ITEM	DESCRIPTION	MATERIAL	QTY.
	1	HOUSING-LOWER	PAS	1
	2	HOUSING-UPPER	PAS	1
	3	BRACKET-SWITCH MTG	STN STL	1
●	4	SWITCH	—	1
	5	SCREW-PAN HD MACH	STN STL	4
	6	WASHER-SPRING LOCK	STN STL	4
	7	ACTUATOR-SWITCH	STN STL	2
	8	SCREW-PAN HD MACH #3-48UNC X .38 LG	STN STL	2
	9	PLATE-SWITCH ACTUATOR	UHMW	1
	10	LABEL-SWITCH (OPEN)	MYLAR	1
	11	LABEL-SWITCH (CLOSE)	MYLAR	1
	12	SPINDLE EXTENSION	STN STL	1
	13	ADAPTER-SWITCH	PAS	1
	14	WASHER-SPRINGLOCK #4 REGULAR	STN STL	4
*	15	O-RING #116 BUNA-N, FDA	BUNA-N	1
*	16	WASHER-PLAIN 0.3125 TYPE B REGULAR	STN STL	1
*	17	O-RING #152 BUNA-N, FDA	BUNA-N	1
*	18	O-RING #117 BUNA-N, FDA	BUNA-N	1
	19	SCREW-HEX SOC HD CAP #4-40UNCX0.375	STN STL	4
	20	NUT-SQUARE #8-32UNC	STN STL	1
	21	SCR-SHLDR .187 DIA X .375 LG; 8-32	STN STL	1
	22	SCREW-HEX SOC SET #8-32UNCX.75KN CP	STN STL	1
	23	WASHER-PLAIN #6 TYPE A	STN STL	2
	24	WASHER-SPRING LOCK #6 REGULAR	STN STL	2
	25	SCREW-HEX SOC HD CAP #6-32UNC X .38	STN STL	2
	26	BRACKET-TERMINAL STRIP MTG	STN STL	1
	27	TERMINAL STRIP	—	1
	28	WASHER-SUPERIOR #10-406040	STN STL	1
	29	WASHER-BELLEVILLE #A1-371915	STN STL	4
	30	CARD-WIRING DIAGRAM	PLASTIC	1
▲	31	INSULATOR-SWITCH	NOMEX ARAMID	2

SWITCH PACK 3, SP3.0
FIGURE 4B



LIST OF PARTS	
ITEM	DESCRIPTION
1	SWITCH HOUSING
2	1/2" NPT ADAPTER
3	SWITCH ACTUATOR
4	SWITCH ACTUATOR
5	HEX SOC HD CAP SCREW
6	LOCKWASHER
7	SET SCREW
8	INDICATING SPINDLE
9	INDICATING SPINDLE
10	O RING #010
11	O RING #116
12	O RING #117
13	SWITCH ADAPTER
14	HEX SOC FLAT HD SCREW
15	SWITCH ADAPTER
16	INDICATING SPINDLE
17	INDICATING SPINDLE
18	SET SCREW KNURLED CUP POINT

TABLE – 1
FASTENER TORQUES – BODY TO BONNET

Valve Size		PTFE Diaphragm	Elastomer Diaphragm
Inch	DN	in-lbs (N-m)	in-lbs (N-m)
0.50"	15	25-60 (2.8-6.8)	20 - 40 (2.3 - 4.5)
0.75"	20	50-65 (5.7-7.4)	20 - 50 (2.3 - 5.7)
1.00"	25	65 - 90 (7.4 - 10.1)	45 - 70 (5.1 - 7.9)
1.25" & 1.50"	32 & 40	200 - 225 (23 - 25)	75 - 130 (8.5 - 14.7)
2.00"	50	225 - 275 (25 - 31)	100 - 180 (11 - 20)

Notes:
1. Make multiple criss-cross passes to build up torque to final table values. Make additional criss-cross passes using table values to evenly tighten each bolt to within 5% of stated torque.
2. Values given are for lubricated fasteners.
3. Minimum values given will provide longer diaphragm cycle life for valves in non-autoclave and low thermal cycle conditions.
4. Maximum values given will be required for autoclave conditions and for high thermal cycle conditions.
5. Torques should be applied at near ambient conditions (< 100° F).

TABLE – 2
NOMINAL ACTUATOR TRAVEL

Valve Size	Inch	0.50”	0.75″	1.00″	1.50”	2.00″
	DN	15	20	25	40	50
Valve Stroke	Inch	0.25	0.38	0.50	0.81	1.12
	mm	6.3	9.6	12.7	20.6	28.4

ADVANTAGE PISTON ACTUATOR WEIGHTS

Weights are less body and diaphragm					
Valve Size		60 PSI Spring Package		90 PSI Spring Package	
Inch	DN	lbs	kg	lbs	kg
0.50"	15	1.70	0.77	1.80	0.82
0.75"	20	3.00	1.36	3.21	1.46
1.00″	25	3.39	1.54	3.60	1.63
1.50″	40	10.28	4.66	11.72	5.32
2.00″	50	11.81	5.36	13.25	6.01

TABLE – 3
APPROXIMATE MAXIMUM CHAMBER VOLUME

Valve Size		Piston Chamber	
Inch	DN	in^3	cm^3
0.50"	15	3.22	52.8
0.75"	20	3.72	61.0
1.00"	25	4.06	66.5
1.50"	40	14.6	239
2.00"	50	18.3	300

NOTES

ITT Pure-Flo

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