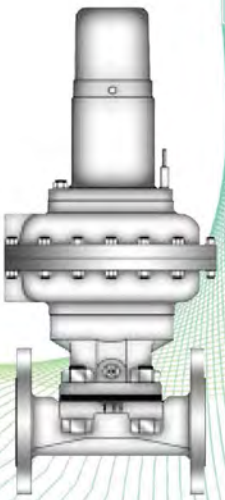
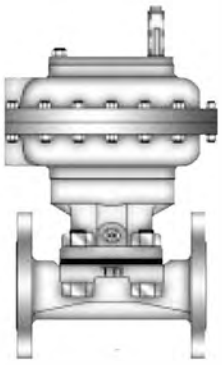
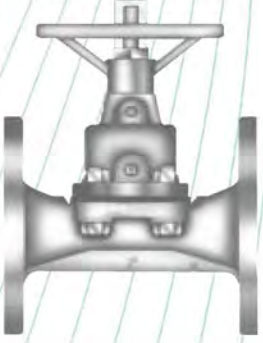
Installation, Operation, and Maintenance Manual



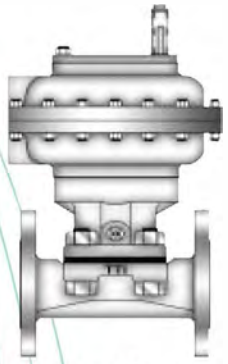
Spring to Close
Air to Open



Spring to Open
Air to Close



Handwheel Operated



Air to Open
Air to Close

TRU-TECH VALVE

INSTALLATION & MANUAL VALVES

SC - SPRING TO CLOSE - AIR TO OPEN

SC - SPRING TO CLOSE (MULTI-PAK) AIR TO OPEN

SO - SPRING TO OPEN AIR TO CLOSE

AA - AIR TO OPEN AIR TO CLOSE

TTV 130E
08/2015

INSTALLATION & MANUAL VALVES

Compact Diaphragm Valves have a *face to face* that is interchangeable with most solid wedge, double disc, and resilient wedge gate valves as well as most short pattern plug and ball valves using ANSI B16.10 as a standard. These valves are the best for O.E.M.'s and other usage on new projects. Straight thru valves are referred to as Tru-Flow and Enhanced Weir valves as Tru-Trol.

Standard Diaphragm Valves have a *face to face* that is interchangeable with most other brands of diaphragm valves using MSS SP-88 as a standard. These valves are used on replacement projects where existing piping integrity must be maintained. Straight thru valves are referred to as Maxi-Flow and Enhanced Weir valves as Maxi-Trol.

GENERAL INSTALLATION INSTRUCTIONS FOR ALL TTV DIAPHRAGM VALVE TYPES

CAUTION: When replacing an existing valve, always exhaust the pressure and drain the process media from the line before starting. Tru-Tech Diaphragm Valves may be installed in any position. There is no upstream or downstream side and valves may be installed in either horizontal or vertical runs. Proper gaskets and/or spacers (see Figure 1) must be used when installing valves with a plastic lined body. Failure to supply correct gaskets may damage the flange face and/or severely shorten the valves life.

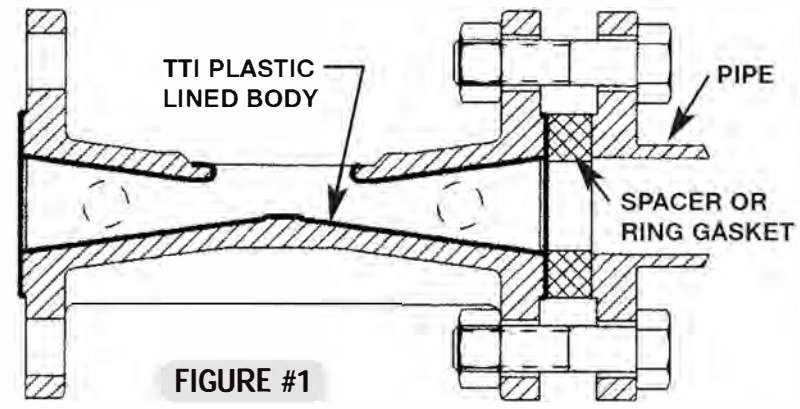


FIGURE #1

Also, care should be taken to avoid damage to plastic lined bodies prior to installation. As a recommendation, we suggest leaving the flange protectors on until you are ready to install the valve. Always remember to tighten the flange bolts evenly (see Figure 2). Also, remember to use the correct torque as noted in Figure 3.

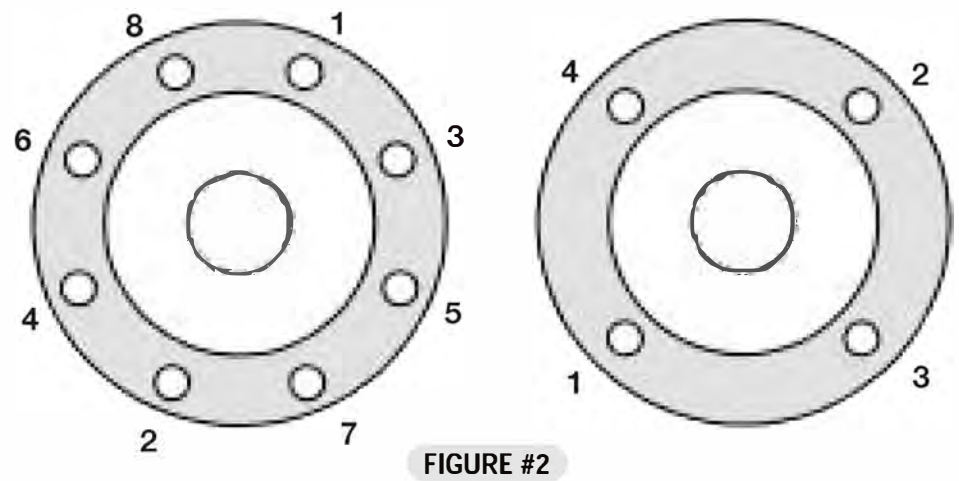


FIGURE #2

PROPER BOLTING SEQUENCE FOR LINED VALVES. (VALVE FLANGE END)

END FLANGE BOLT TORQUE FOR PLASTIC LINED VALVES

PIPE SIZE	# OF BOLTS	RECOMMENDED BOLT TORQUE (FT-LBS) STANDARD BOLT
1	4	40
1-1/2	4	45
2	4	50
2-1/2	4	55
3	4	65
4	8	70
6	8	75
8	8	125

FIGURE #3

INSTALLATION AND MANUAL VALVES

After the valve is installed in the line, and upon reaching normal operating pressure and temperature re-check the bonnet bolts and re-tighten evenly. See Figure 4 for correct torque setting and Figure 5 for correct tightening sequence. Do not over tighten. Recheck again after 24 hours and re-torque if necessary.

CAUTION: Diaphragm Valves displace fluid when closing. Therefore that are not suitable for use in "locked line' conditions.

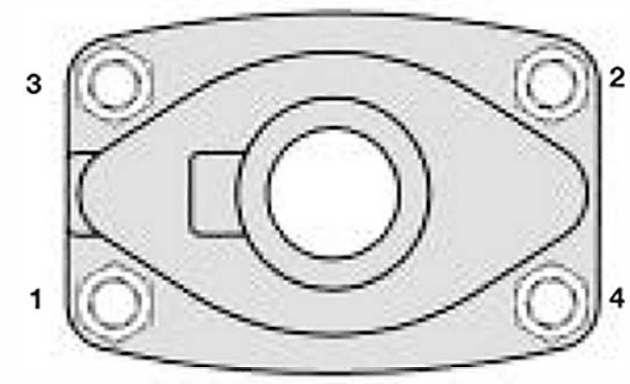
CAUTION: Over closure of the diaphragm valve by hand wheel, air pressure, or spring force can damage the internal workings or the valves and is the number one cause of premature valve failure. Use only enough closing force to effect tight shut off. Adjustable travel stops are furnished to help minimize the problem as standard on manual valves and as an extra cost option on pneumatically actuated valves.

MANUALLY OPERATED DIAPHRAGM VALVE WITH LIMIT SWITCHES AND/OR PROXIMITY SWITCHES AND OPTIONAL YOKE MOUNT.

BONNET FASTENER TORQUES IN FOOT-POUNDS (PLATED/LUBRICATED)			
VALVE TYPE			UNLINED OR PLASTIC OR RUBBER LINED
DIAPHRAGM TYPE			ELASTOMER OR PTFE
BONNET SIZE	TRU-TROL OR MAXI-TROL VALVE SIZE	TRU-FLOW OR MAXI-FLOW VALVE SIZE	
A	1", 1-1/4"	1/2", 3/4"	9
B	1-1/2", 2"	1", 1-1/4"	16
C	2-1/2", 3"	1-1/2", 2"	40
D	4"	2-1/2", 3"	80
E	5", 6"	4"	40
F	8"	5", 6"	80

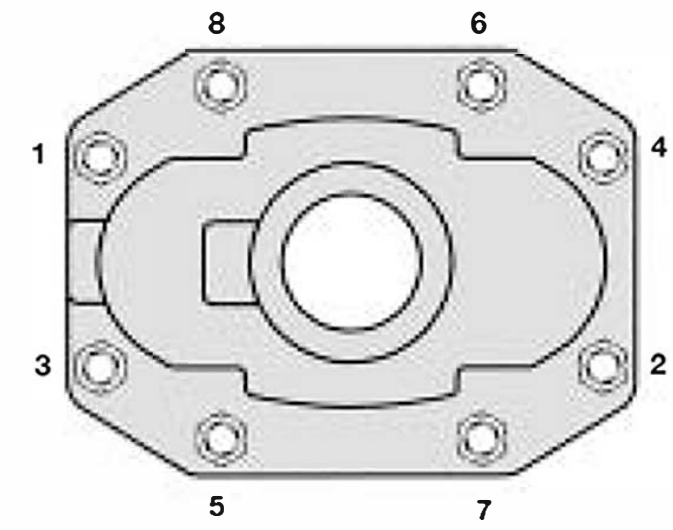
FIGURE #4

PROPER BOLT TIGHTENING SEQUENCE



4-BOLT PATTERN

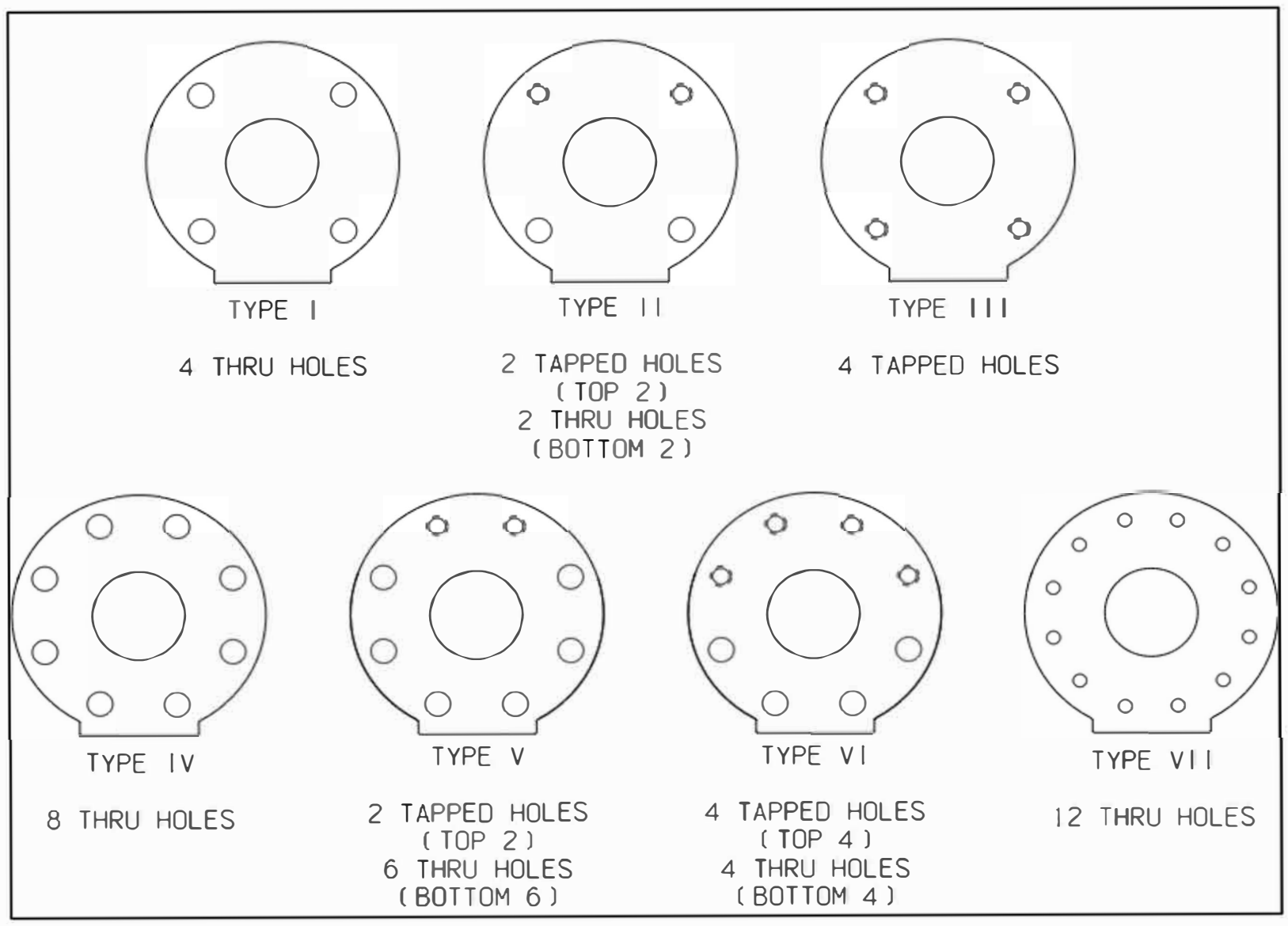
NOTE: ALL BONNET BOLTS MUST BE CHECKED AND RE-TIGHTENED (WITH DIAPHRAGM IN THE OPEN POSITION) IF NECESSARY 24 HRS AFTER SYSTEM STAR-UP AT OPERATING TEMPERATURE.



8-BOLT/STLD PATTERN

FIGURE #5

FLANGE BOLT HOLE TYPES AND SIZES



TRU-FLOW

Size	Type	Bolt & Thread Size	# Bolts	# Nuts
1/2"	III	1/2" – 13 UNC	4	0
3/4"	I	1/2" – 13 UNC	4	4
1	I	1/2" – 13 UNC	4	4
1-1/4"	I	1/2" – 13 UNC	4	4
1-1/2"	II	1/2" – 13 UNC	4	2
2"	I	5/8" – 11 UNC	4	4
2.5"	II	5/8" – 11 UNC	4	2
3"	II	5/8 – 11 UNC	4	2
4"	V	5/8" – 11 UNC	8	6
6"	VI	3/4" – 10 UNC	8	4

TRU-TROL

Size	Type	Bolt & Thread Size	# Bolts	# Nuts
1/2"	III	1/2" – 13 UNC	4	0
3/4"	I	1/2" – 13 UNC	4	4
1	I	1/2" – 13 UNC	4	4
1-1/4"	I	1/2" – 13 UNC	4	4
1-1/2"	I	1/2" – 13 UNC	4	4
2"	I	5/8" – 11 UNC	4	4
2.5"	I	5/8" – 11 UNC	4	4
3"	I	5/8 – 11 UNC	4	4
4"	IV	5/8" – 11 UNC	8	8
6"	IV	3/4" – 10 UNC	8	8
8"	VI	3/4" – 10 UNC	8	4

FLANGE BOLT HOLE TYPES AND SIZES

MAXI-FLOW

Size	Type	Bolt & Thread Size	# Bolts	# Nuts
1/2"	III	1/2" – 13 UNC	4	0
3/4"	I	1/2" – 13 UNC	4	4
1	I	1/2" – 13 UNC	4	4
1-1/4"	I	1/2" – 13 UNC	4	4
1-1/2"	I	1/2" – 13 UNC	4	4
2"	I	5/8" – 11 UNC	4	4
2.5"	I	5/8" – 11 UNC	4	4
3"	I	5/8 – 11 UNC	4	4
4"	IV	5/8" – 11 UNC	8	8
6"	IV	3/4" – 10 UNC	8	8

MAXI-TROL

Size	Type	Bolt & Thread Size	# Bolts	# Nuts
1/2"	III	1/2" – 13 UNC	4	0
3/4"	I	1/2" – 13 UNC	4	4
1	I	1/2" – 13 UNC	4	4
1-1/4"	I	1/2" – 13 UNC	4	4
1-1/2"	I	1/2" – 13 UNC	4	4
2"	I	5/8" – 11 UNC	4	4
2.5"	I	5/8" – 11 UNC	4	4
3"	II	5/8" – 11 UNC	4	4
4"	IV	5/8" – 11 UNC	8	8
6"	IV	3/4" – 10 UNC	8	8
8"	IV	3/4" – 10 UNC	8	8
10"	VII	7/8" – 9 UNC	12	12

There are seven different flange hole types that are used by Tru-Tech Valves (as seen in the figure above) according to the corresponding ASME/ANSI Flange Class Standards. Due to limited space in between the bonnet and flange certain sizes of ANSI Length Tru-Tech Valves, threaded flange holes are provided in place of where a nut would have been. The correct bolt hole size and thread type for each valve size can be found in the chart above.

Installation for Threaded Flange Holes:
When installing a flanged valve that has threaded holes, several precautions should be made. Always ensure that bolts with the proper thread size and length are being used prior to attempting installation. Bolts that are too long could interfere with the bonnet and bolts that will not extend slightly past the inner valve flange face could result in a lack of enough force to properly hold the flange onto the piping. Take care to ensure that proper alignment is made with respect to the pipe flange through holes and the valve's threaded flange holes so that cross threading does not occur. When bolting on a valve with threaded flange holes be sure to hold the valve's flange firmly against the pipe flange to ensure that undue stress is not being placed on the threads and that proper compression of the gasket is made to seal the connection. Follow directions for proper bolting sequence and torques as outlined in the Installation, Operation, and Maintenance Manual.

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INSTALLATION AND MANUAL VALVES

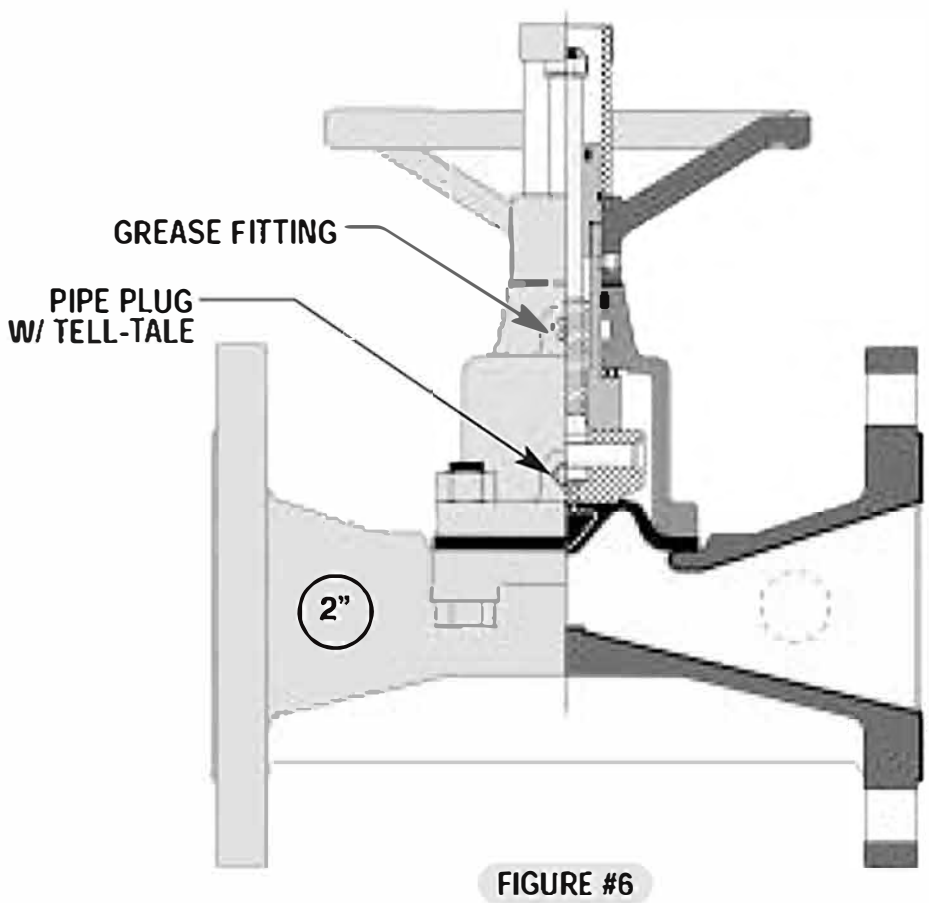


FIGURE #6

TRU-TECH DIAPHRAGM VALVE SHOWN WITH STANDARD (WEATHERPROOF) BONNET. HANDWHEEL OPERATED WITH TRAVEL STOP AND CLEAR ENCLOSURE

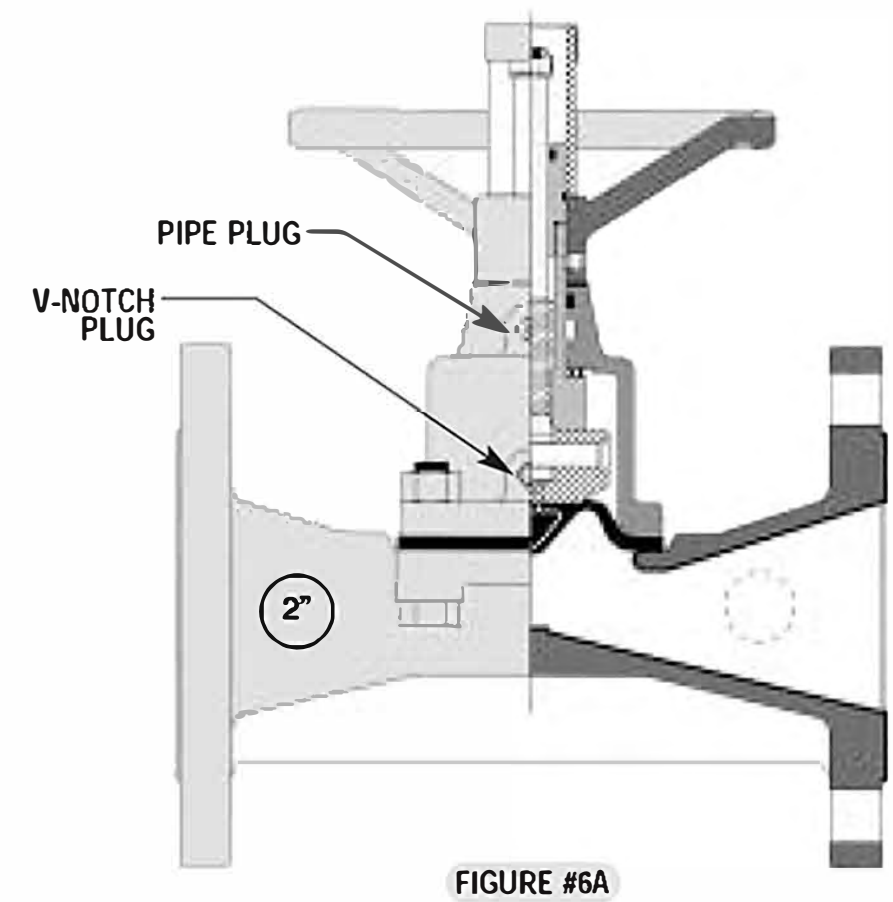


FIGURE #6A

TRU-TECH DIAPHRAGM VALVE SHOWN WITH OPTIONAL SEALED BONNET, HANDWHEEL OPERATED WITH TRAVEL STOP AND CLEAR ENCLOSURE

OPERATION (Hand wheel Operated Valves)

Valves furnished with a standard bonnet, Figure 6, will be furnished with a visual position indicator, travel stop, and clear protective enclosure. The valve is closed by turning the hand wheel clockwise and opened by turning the hand wheel counter-clockwise. (See Figure 8 for valve stroke and number of turns chart)

When the TTV Diaphragm is open, its diaphragm lifts high out of the flow path for improved diaphragm life and higher CV (see Figure 7). When the valve is closed, the diaphragm seals drop tight, even with slurries and gritty materials.

The TTV diaphragm valve is well suited for chemical applications because the diaphragm seals the media from all the working parts of the valve. An extra bonus of this design is that the valve has "zero fugitive emissions".

Valves with a deals bonnet, Figure 6A; operate in the same manner as valves with a standard bonnet. Sealed bonnet valves are an extra cost option furnished with factory pressure tested O-ring seals which prevents external leakage in case of a ruptured diaphragm. seepage indicates the diaphragm has ruptured.

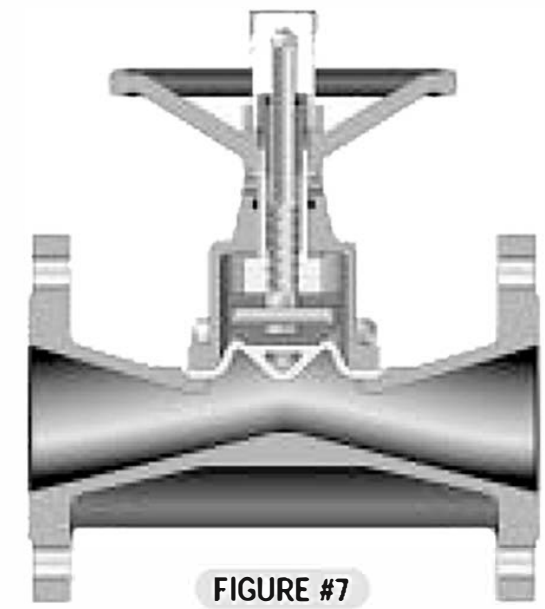


FIGURE #7

These valves are also furnished with a v-notch plug, which permits safe inspection for a ruptured diaphragm. Sealed bonnet diaphragm valves are recommended to be used in the handling of hazardous or corrosive process fluids. The user should be prepared to handle a spill when inspecting the valve. To inspect the valve for diaphragm rupture, loosen the v-notch plug (turn counter-clockwise).

OPERATION (Hand wheel Operated Valves)

All manual valves are furnished with a travel stop as a standard. These are furnished to extend diaphragm life by indicating the amount of closure required to effect tight shut off and hopefully by preventing an overzealous operator from over closing the valve. Travel stops are pre-set at the factory at final testing, and usually do not need field adjustment. If for some reason adjustment is required, use the following procedure. See Figure 9. With the valve and the pipeline at normal operating pressure and temperature, back off the lock nut counter-clockwise and open the valve. Slowly close the valve by turning the hand wheel clockwise. Once the diaphragm is sealed against the desired line pressure and tight shut off if effected, snug hand wheel 1/8 of a turn more. Turn travel stop lock nut and washer until it bottoms out against the bushing (making metal to metal contact) secure with the lock nut.

ADJUSTMENT OF VALVES WITH "TRAVEL STOP" USING A TEST FIXTURE

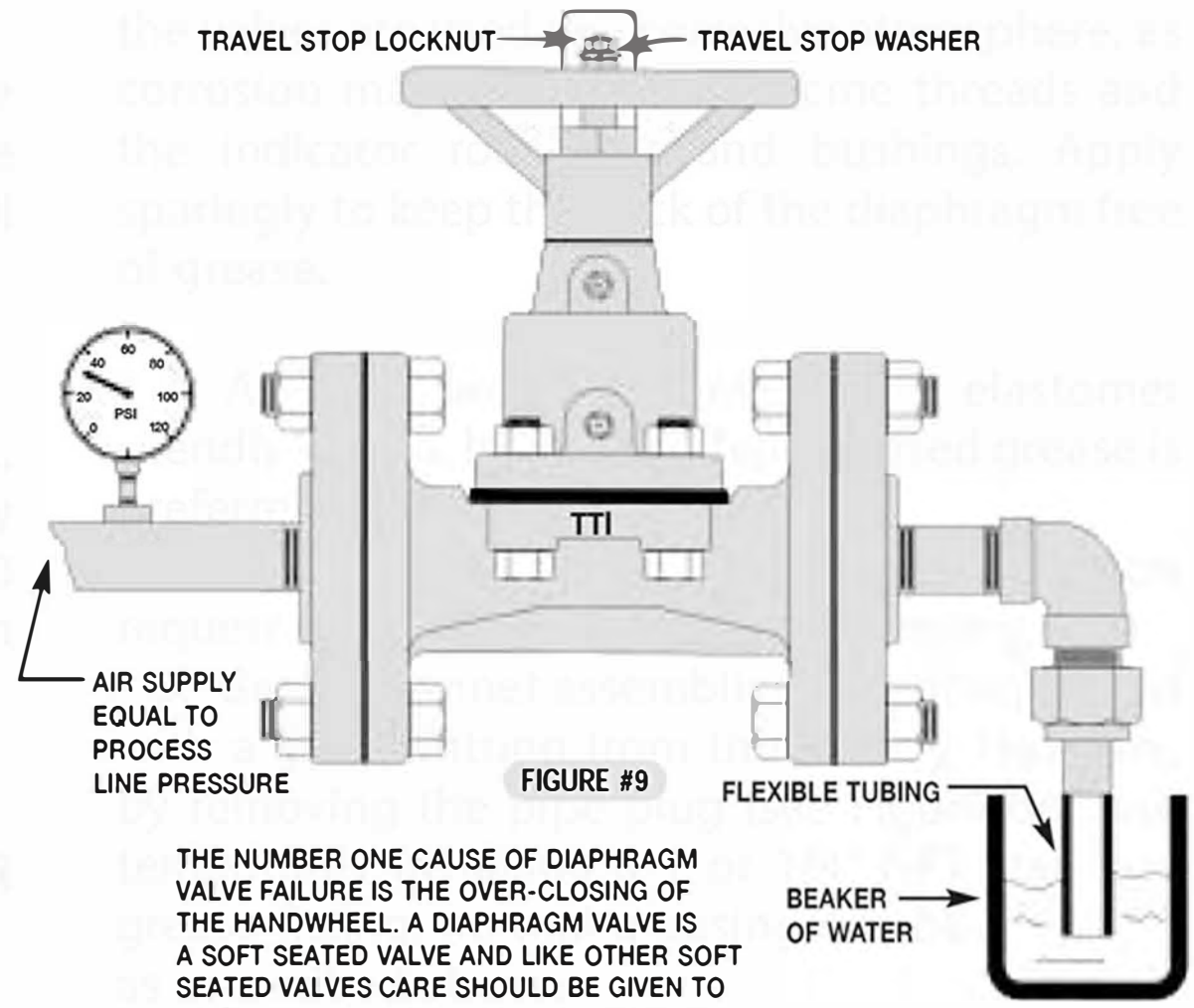


FIGURE #9

THE NUMBER ONE CAUSE OF DIAPHRAGM VALVE FAILURE IS THE OVER-CLOSING OF THE HANDWHEEL. A DIAPHRAGM VALVE IS A SOFT SEATED VALVE AND LIKE OTHER SOFT SEATED VALVES CARE SHOULD BE GIVEN TO PREVENT DAMAGE DURING CLOSING, USING ONLY ENOUGH FORCE THAT IS NECESSARY TO ACHIEVE SHUT-OFF.

BONNET SIZE	TRU-TROL AND MAXI-TROL VALVE SIZE	TRU-FLOW AND MAXI-FLOW VALVE SIZE	ELASTOMER DIAPHRAGMS		TEFLON-FACED DIAPHRAGMS	
			STEM TRAVEL (IN.)*	HANDWHEEL TURNS	STEM TRAVEL (IN.)	HANDWHEEL TURNS
A	1 & 1-1/4	1/2 & 3/4	7/16	3-1/2	11/32	2-5/8
B	1-1/2 & 2	1 & 1-1/4	5/8	3-3/4	15/32	2-7/8
C	2-1/2 & 3	1-1/2 & 2	1	6	3/4	4-1/2
D	4	2-1/2 & 3	1-9/16	6-1/4	1-3/16	4-3/4
E	5 & 6	4	2-11/32	9-3/8	1-15/32	7-1/8
F	8	5 & 6	3-3/8	13-1/2	2-5/8	10-1/2

* FOR STEM TRAVEL OF PNEUMATIC VALVES SUBTRACT 22% FROM NUMBER

FIGURE #8

Valves for Vacuum Service

Tru-Tech Diaphragm valves have been used successfully for years in a variety of vacuum services. Doing a specialized job with a standard production valve can result in substantial cost savings. Most industrial vacuum processing falls within the range from atmospheric pressure to 0.1 micron. This is a range with which Tru-Tech's Diaphragm Valves have demonstrated their ability to serve satisfactorily. Due to Tru-Tech's double studded diaphragm design, diaphragm pull out is virtually eliminated. On larger sizes of valves evacuation of bonnets may be necessary to get the valve fully open. An easy method is to connect the tapped vent hole in the bonnet to the system drawing a vacuum from the main line. This method will assure that the pressure will always be the same on each side of the diaphragm. (Be sure to specify when vacuum is involved.)

OPERATION
(Hand wheel Operated Valves)

Socket or Butt Welded Bodies

CAUTION: Valve body diaphragm must be disassembled and the diaphragm removed before welding. The extreme heat caused by welding will cause premature failure or the diaphragm.

Throttling Applications

Some throttling applications should be avoided, i.e., heavy abrasive slurries or excessively high velocity across the weir (over 15-20 FPS for clear fluids or 8-10 FPS for light slurries) can lead to excessive wear, which will shorten diaphragm and/or lining life.

AIDS TO SUCCESSFUL SERVICE LIFE OF YOUR DIAPHRAGM VALVE

Valve Closure

A diaphragm valve is a soft-seated valve. Never use wrenches or "cheater bars" to close valve, as premature diaphragm failure may result. Use only enough force to effect bubble tight closure +1/8 turn. If excessive force is required it could mean other problems have occurred, like an obstruction in the line.

Service

If the type of service (pressure, media, concentration, temperature) was known, the valve materials were selected for that service. Never install the valve into an unknown application because the body and diaphragm materials may not be compatible. (Always consult factory before making change.)

Operating Pressure vs. Temperature

When valves are to be operated at temperatures in excess of 120 degrees F, pressure ratings decrease. See Figure 10.

MAINTENANCE

Standard bonnet assemblies are equipped with a grease fitting and should be lubricated on a regular schedule of about 3 times a year. Adequate greasing is especially important where the valves are used in a corrosive atmosphere, as corrosion may freeze up the acme threads and the indicator rod shaft and bushings. Apply sparingly to keep the back of the diaphragm free of grease.

1. Any standard lubricant, that is elastomer friendly will do, however, a Teflon based grease is preferred.
2. Special lubricants are available upon request (for silicone free, food processing, etc.)
3. Sealed bonnet assemblies are not equipped with a grease fitting from the factory. However, by removing the pipe plug (see Figure 6A) and temporarily installing a 1 or 1/4" NPT standard grease fitting, normal greasing can be achieved as prescribed above.

CAUTION: Remember to remove the grease fitting and re-install the pipe plug after the valve has been lubricated.

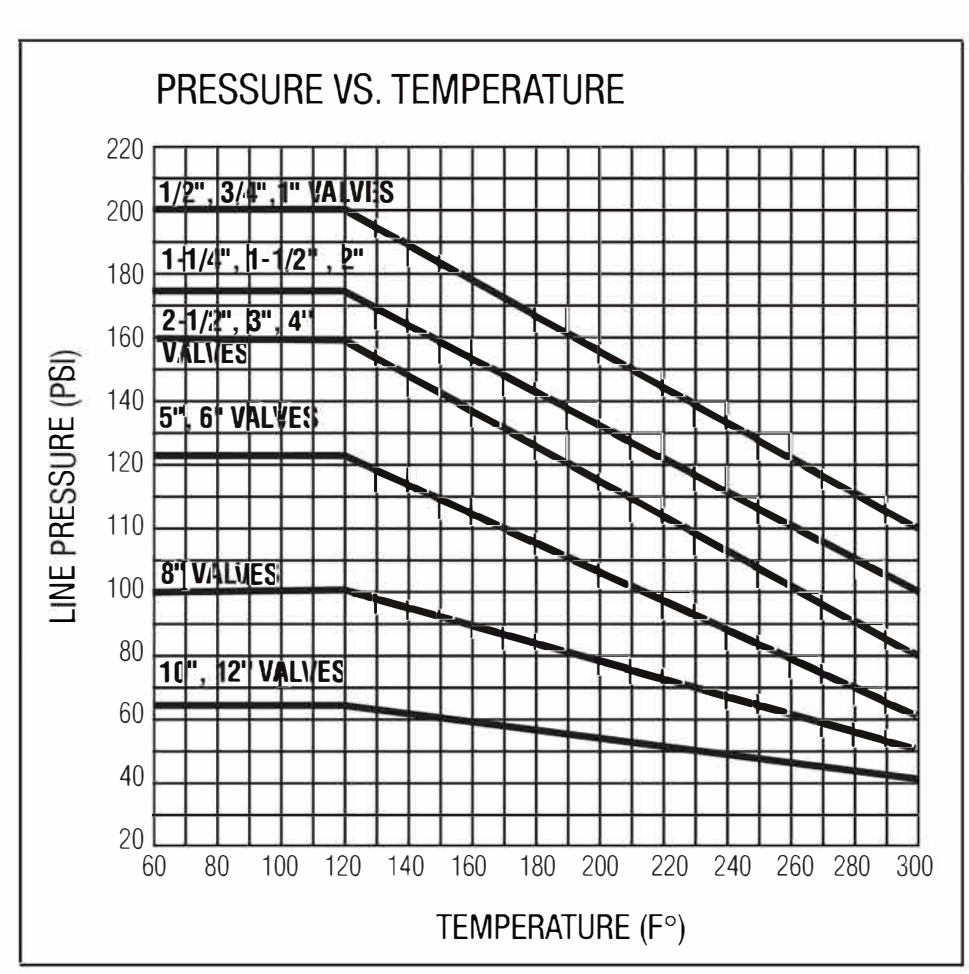
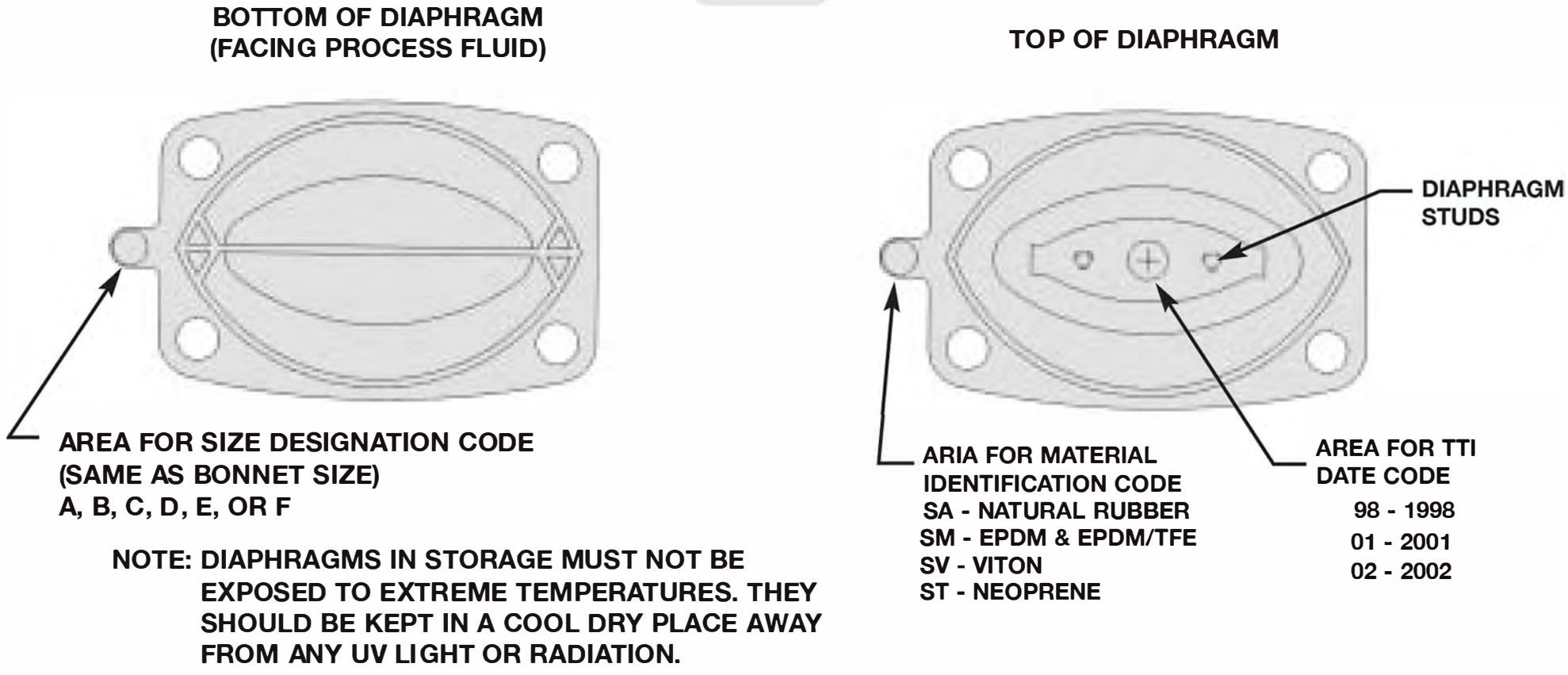


FIGURE #10

VALVE DIAPHRAGM IDENTIFICATION

FIGURE #11



MAINTENANCE

Periodically inspect the condition of all external valve parts, including checking the proper torque on the bonnet bolts or nuts. If weapage between the body and diaphragm is noted (re-torque as per Figure 4 and 5). Replace all parts showing excessive wear or corrosion. On sealed bonnet valves, back off the v-notch plug 1/2 to 3/4 turn to check for diaphragm leakage.

CAUTION: When the process fluid is hazardous or corrosive, extra precaution should be taken. The user should employ appropriate safety procedures and be prepared to control a leak of the process fluid. A fluid leak from the tell-tale plug indicates a diaphragm failure. Replace the diaphragm immediately. (Always depressurize and isolate valve first before beginning.)

If a leak is detected between the body and the diaphragm, de-pressurize the system and open the valve approximately one turn. Tighten the bonnet bolts/nuts per instructions in Figure 4 and 5.

Diaphragm Replacement - *Refer to Figure 4*

- Remove pressure and isolate media from the line into which the valve is installed.
- Remove bonnet bolts/nuts – P/N 22, 23
- Remove bonnet assembly from valve (now is a good time to inspect the seating area in the body and to inspect any lining that might be damaged or wearing).

Remove diaphragm by:

- Turn hand wheel clockwise, until shaft/indicator rod/compression assembly disengages from the bushing.
- Remove the two diaphragm cap screws, P/N 20.
- Remove existing diaphragm and replace with a new one. Reinstall cap screws, tighten each side evenly. Do not over tighten.
- Reassemble in reverse order.

Replacement diaphragm should be identical to the original (see diaphragm identification chart Figure 11).

MAINTENANCE

Sealed Bonnet, O- Ring Replacement

A. Remove pressure and isolate media from the line into which the valve is installed.

B. Remove bonnet bolts/nuts, P/N 22, 23, remove bonnet assembly.

C. Turn hand wheel clockwise until shaft/indicator rod/compression assembly disengages from the bushing.

D. Remove clear indicator rod cover by removing plastic snap ring.

E. Remove the two hand wheel setscrews, P/N 73 – Figure 14, and slide off hand wheel.

F. Remove and replace inside O-ring seal, P/N7. Slide out bushing, P/N 15, from bonnet, P/N 2, and remove and replace bonnet seal O-ring, P/N 12. 9see O-ring replacement size chart Figure 12).

G. Reassemble in reverse order.

O-Ring Installation Guide:

Many O-ring failures can be directly attributed to improper installation during assembly. In spite of its simple appearance, the O-ring is a precision devise requiring care during installation. Some of the more frequent causes of O-ring failure due to careless handling are listed.(See Figure 12 and 13 for replacement O-ring sizing.)

Failure Analysis: Damage to an O-ring during installation can occur when:

1. There are sharp corners on mating metal components such as the O-ring gland or threads over which the O-ring must pass during assembly.

2. Oversize O-ring on piston seal application.

3. Undersize O-ring on road application.

4. O-ring twisted/pinched during installation.

5. O-ring properly lubricated before installation.

6. O-ring dirty upon installation.

7. O-ring gland and/or other surfaces which the O-ring must pass during assembly contaminated with metal particles.

8. General carelessness

Prevention and Correction:
The best way to prevent damage to O-ring during installation is to practice "common sense". There are some specific solutions that are listed below.

1. Break all sharp edges on metal components.

2. Check all components for cleanliness before installation.

3. Tape all threads over which the O-ring will pass.

4. Use an O-ring lubricant if its use will not contaminate the system.

5. Double Check O-ring to insure correct size and material.

INSTALLATION AND MANUAL VALVES

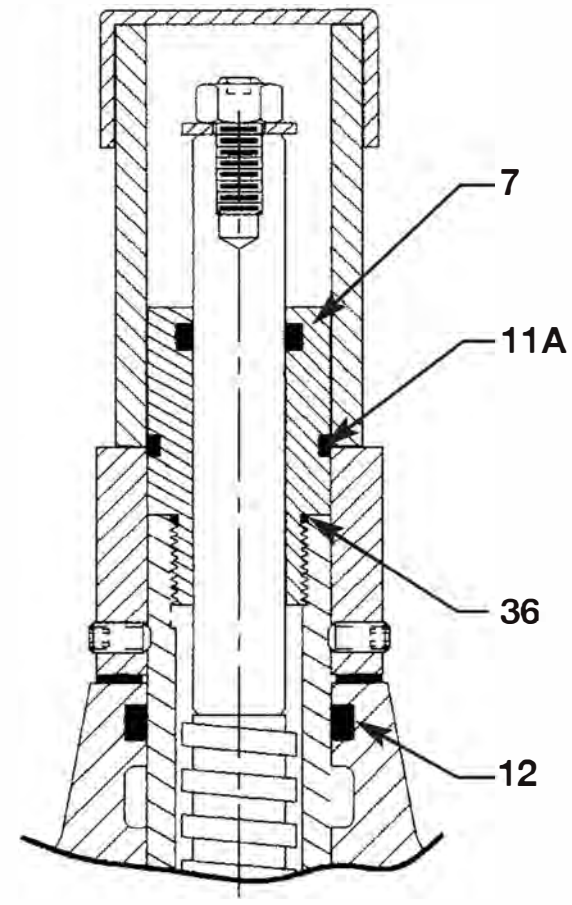
Special Note: All valves designed and manufactured by Tru-Tech Valve are guaranteed for satisfactory and durable service. All designs are the property of the company. The material specifications shown herein conform to the most recently published standards. We reserve the right to substitute materials, which in our opinion are of equal or superior quality in the construction of any valve.

Tru-Tech Diaphragm Valves are designed and manufactured using good workmanship and materials. Tru-Tech strives to avoid injuries and damage, which could result from misapplication of the product. Proper valve selection is imperative. The following are examples of (but not limited to) misapplication or misuse.

- Excessive pressure or temperature.
- Service incompatible with diaphragm or body lining.
- Undersized or oversized valve actuators.
- Making non-factory modifications of the valve of any kind.
- Failure to maintain valves as recommended.
- Using too much operating force to open and/or close valve.

O- RINGS FOR BONNET & STANDARD ENCLOSURE CAP

FIGURE #13

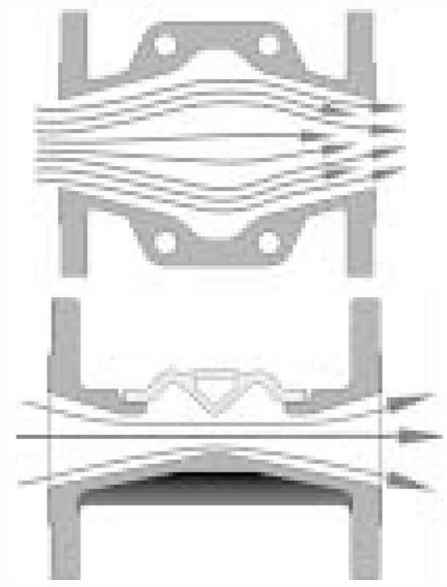


REPLACEMENT O-RING SIZE CHART						
BONNET SIZE	TRU-TROL & MAXI-TROL SIZE	TRU-FLOW & MAXI-FLOW SIZE	PART NUMBER			
			P/N 7	P/N 12	P/N 36	P/N 11A
A	1, 1-1/4	1/2, 3/4	111	117	014	017
B	1-1/2, 2	1, 1-1/4	112	212	015	018
C	2-1/2, 3	1-1/2, 2	112	214	016	020
D	4	2-1/2, 3	112	324	020	123
E	6	4	208	325	022	125
F	8	6	210	329	028	133

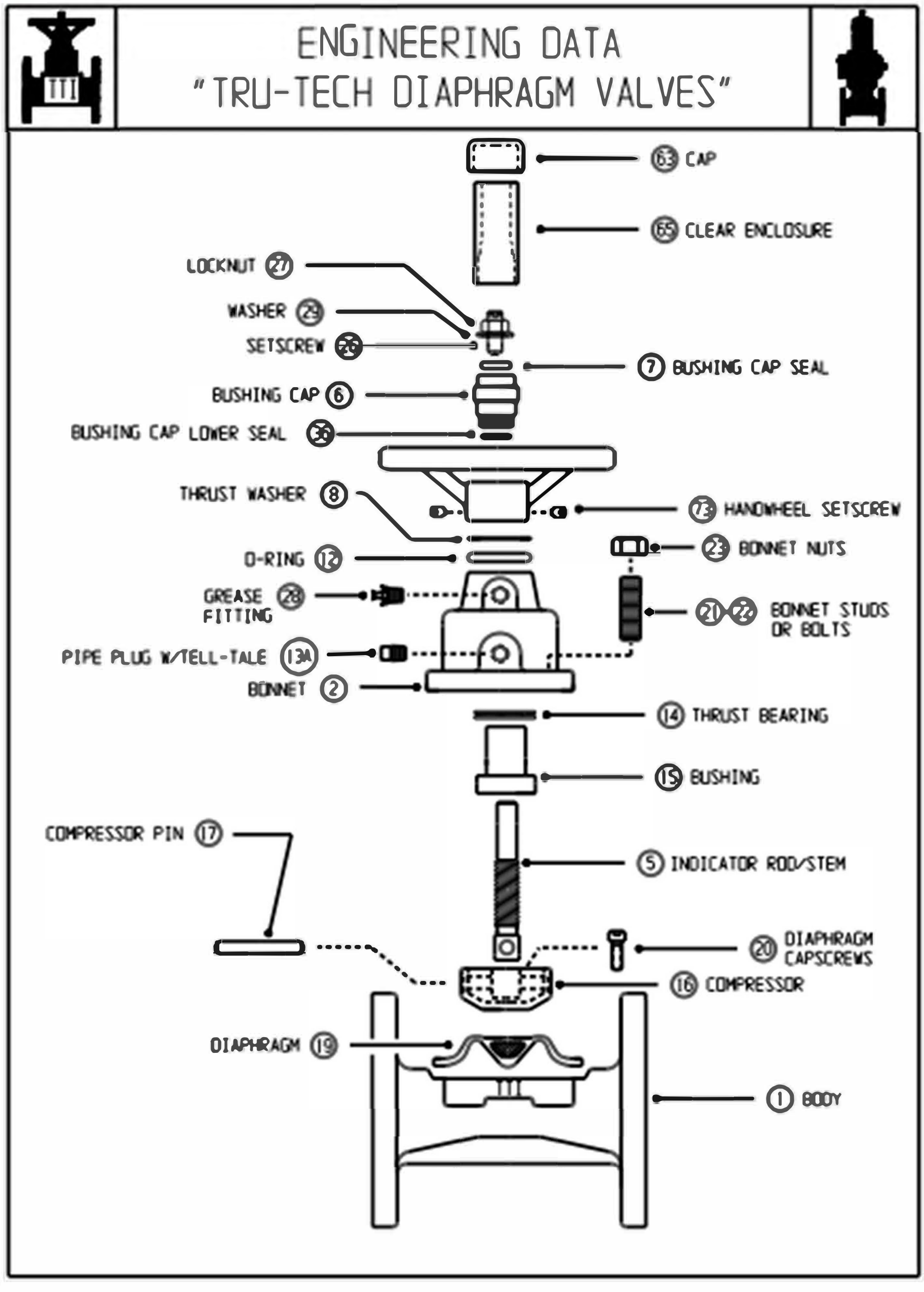
FIGURE #12

Why Do TTV Diaphragm Valves Last Longer?

The TTV valve reduces diaphragm flex by contracting the vertical height of the flow area and by expanding the width. The resultant body shape provides laminar flow characteristics of a venture and less turbulence to the flow media. In addition, the reduced flex results in longer diaphragm life.



INSTALLATION AND MANUAL VALVES



Parts List

NO.	DESCRIPTION	STANDARD MATERIAL
01	BODY	**
02	BONNET	CAST IRON, A126 CLASS B
03	HANDWHEEL	CAST IRON, A126 CLASS B
05	INDICATOR ROD/STEM	STEEL 12L14, BLACK OXIDE FINISH
08	THRUST WASHER	NYLON
12	BONNET SEAL *	BUNA-N
13A	PIPE PLUG W/TELL-TALE	POLYETHYLENE
14	THRUST BEARING	POLISHED STEEL
15	BUSHING	DUCTILE IRON, ASTM A536
16	COMPRESSOR	CAST IRON, A126 CLASS B
17	COMPRESSOR PIN *	CARBON STEEL, AISI 1070
19	DIAPHRAGM *	MATERIAL AS SPECIFIED
20	DIAPHRAGM CAPSCREWS	18-8 STAINLESS STEEL
21/22	BONNET STUDS OR BOLTS	STEEL GRADE 2, GRADE5 ZINC PLATED
23	BONNET NUTS	STEEL GRADE 2, GRADE5 ZINC PLATED
28	GREASE FITTING	STEEL, ELECTRO ZINC PLATED
26	TRAVEL STOP SETSCREW	STAINLESS STEEL, BLACK OXIDE FINISH
27	LOCKNUT	STAINLESS STEEL, ZINC-PLATED
29	WASHER	STAINLESS STEEL, ZINC-PLATED
63	ENCLOSURE CAP	POLYETHYLENE
65	CLEAR ENCLOSURE	ACRYLIC
73	HANDWHEEL SETSCREW	ALLOY STEEL, BLACK FINISH

FIGURE #15

* RECOMMENDED SPARE PARTS

** AS SUPPLIED, (DUCTILE IRON A536 GR 65-45-12, CAST IRON A126 CLASS B, 316 STAINLESS STEEL CF8M, ALLOY 20 CF7M, CAST STEEL WCB).

SC - SPRING TO CLOSE - AIR TO OPEN

INSTALLATION, OPERATING, AND MAINTENANCE INSTRUCTIONS FOR PNEUMETIC OPERATED DIAPHRAGM VALVES

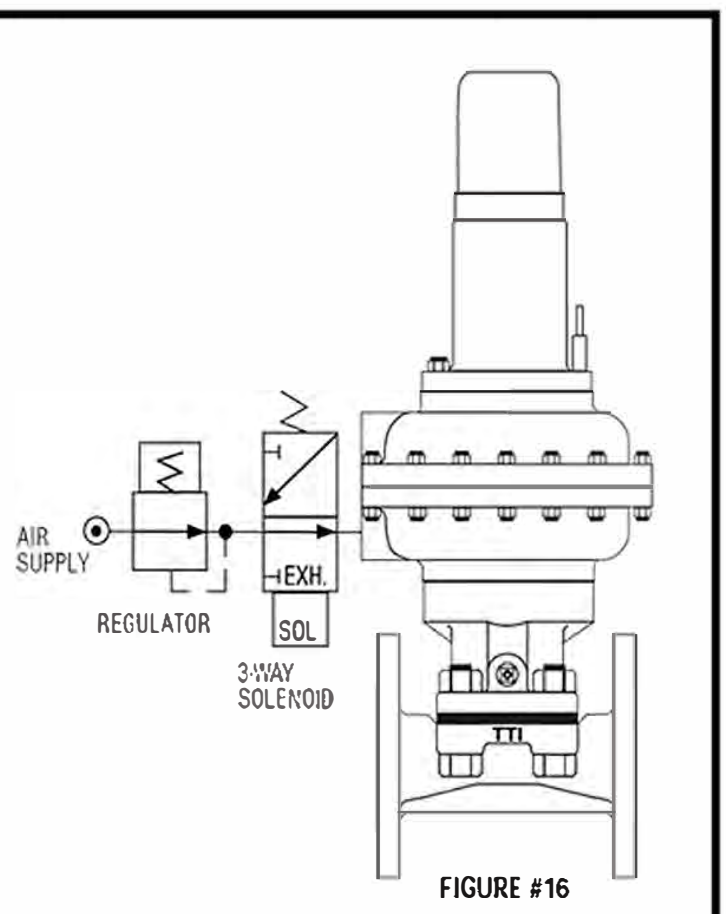


FIGURE #16

"SC" SPRING TO OPEN

(ON-OFF CONTROL)

TYPE "SC" PNEUMATIC ACTUATOR (SEE FIGURE 17)

Or Automatic Throttling (not shown).

This actuator/accessory package is designed to normally position the valve closed. The valve will open when compressed air is admitted into the lower actuator chamber and the actuator spring will close the valve when the air is exhausted.

General: The model "SC" valve is normally closed (by spring) and is powered open by a diaphragm type pneumatic actuator. The valve can, at extra cost, be equipped with a variety of options including:

- Manual Override (hand wheel or wrench) see Figure 17.
- Adjustable Opening Travel Stops (See Figure 17)
- Adjustable Close Travel Stops
- Three-way Solenoid w/ Regulator and Gauge (see Figure 16). To allow the valve to open in response to an electrical signal (normally 110V/60 cycle).
- Positioner (see Figure 18 & 19). To allow the valve to throttle in response to an air signal (normally 3-15 PSI).
- Transducer (see Figure 21). Feedback devices (to allow the valve to throttle in response to an electrical signal (normally 4-20 MA).

Installation: For general installation instructions see Page 1.

Connect the opening air supply line to the 1/4" NPT female pipe connection of the lower diaphragm case (P/N 110). (See Figure 22), these air lines should limit air pressure to 100 PSI maximum. Damage to the actuator can result at higher pressures, and a regulator is highly recommended. Utilizing a pressure regulator and limiting pressure will significantly increase actuator diaphragm life. When a Positioner and/or Transducer is supplied a filter/regulator is mandatory. Make sure that the opening air pressure is turned on and that the pressures are correct. The unit is ready for operational service.

Start Up: If the diaphragm valve does not fully open when operating air pressure is applied to the actuator, check to see that correct opening air pressure is being used, that there are no loose air connections, and that any solenoid valve or other device in the air line is functioning properly.

It is recommended at start-up to flush out the line to remove any sediment or foreign matter, which may be trapped in the valve body.

Note: Diaphragm valves displace fluid in closing. Therefore, they are not suitable for use in "locked line" conditions.

Maintenance: Provided that the unit has been properly specified as to body material, lining, body diaphragm, actuator size, etc., very little maintenance is required.

TTV DIAPHRAGM VALVE AND PNEUMATIC OPERATOR SIZING

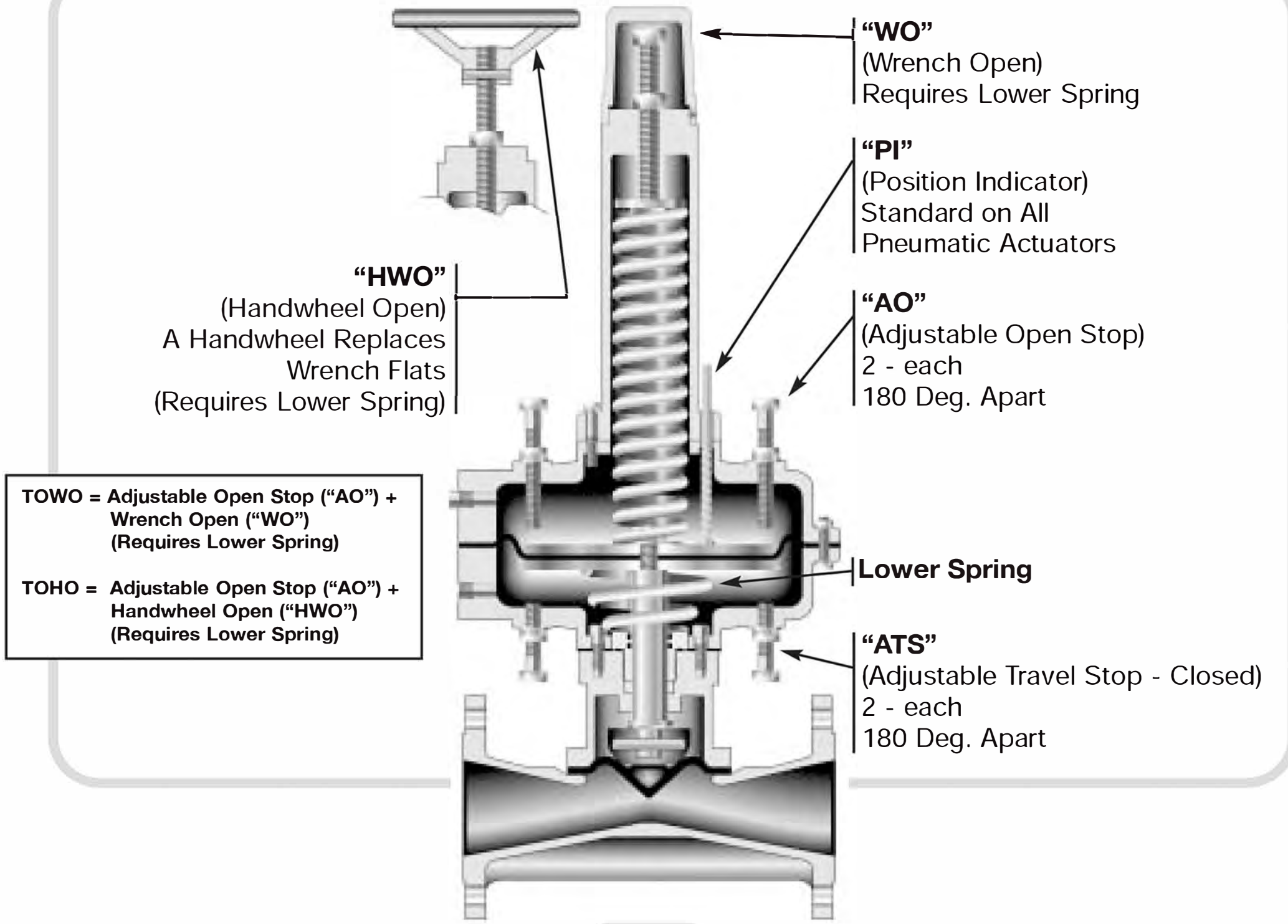


FIGURE #17

Replacing the Actuator Diaphragm & Actuator Bushing O-Rings:

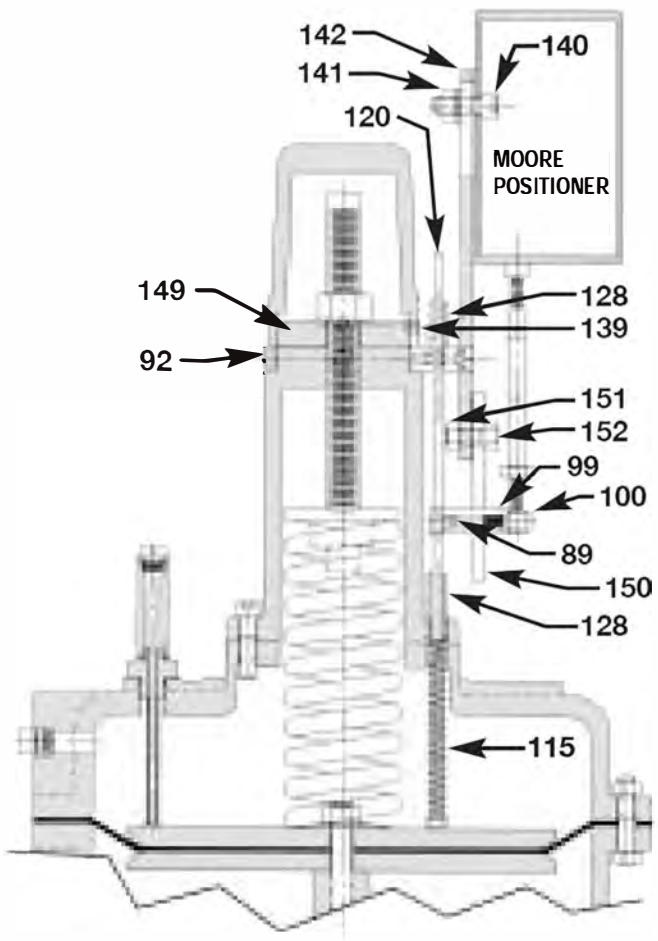
1. Exhaust or isolate the pressure from the valve and make sure that the operating pressure is vented from the actuator.

CAUTION: Spring Tension must be released before any disassembly. Remove weather cap (P/N 122) to expose the spring adjusting screw (P/N 101) and nut (P/N 102). Make a note of the distance the adjusting screw protrudes above the top of the upper spring case (P/N 104) so it can be returned to the same spring tension as before. Then back off nut and adjusting screw till it is just finger tight, releasing spring tension.

2. (Refer to Figure 22, Page 14). Loosen and remove the case nuts (P/N 111) from the case bolts (P/N 112) around the outer rim of the actuator and lift off the upper diaphragm case (P/N 104).

Note: Care should be taken so not to lose the indicator rod and spring (P/N 120) and (P/N 86) when removing upper case. Remove spring (P/N 103) and spring retainer (P/N 105) and guide ball.

SC - SPRING TO CLOSE AIR TO OPEN



NO.	DESCRIPTION
99	INDICATOR ROD CONNECTOR
89	INDICATOR ROD SETSCREW
100	SHOULDER SCREW
92	BRACKET SETSCREW
150	BRACKET GUIDE EXTENSION
151	BRACKET GUIDE NUT
152	BRACKET GUIDE BOLT
115	INDICATOR ROD SPRING
120	INDICATOR ROD
142	MOUNTING BRACKET
149	WEATHER CAP MOUNTING SPACER
141	POSITIONER LOCKNUT
140	POSITIONER CAPSCREW
128	BUSHING

FIGURE #18

Replacing the Actuator Diaphragm and Actuator Bushing O-Rings:

3. Loosen the diaphragm nut (P/N 106) at the center of the diaphragm and remove the nut, washer, upper diaphragm plate (P/N 107), noting that the curved ends are always facing the diaphragm and actuator diaphragm (P/N 108).

4. At this point, if desired (but not often necessary), the actuator bushing O-rings (P/N 32 inner seal, P/N 33 wiper ring and P/N 34 lower seal) can be replaced. Remove the lower diaphragm plate (P/N 109), lower case cap screws (P/N 114) and remove the lower diaphragm case (P/N 110). Unscrew counterclockwise actuator bushing (P/N 31) and slip it off actuator shaft (P/N 30) and carefully install the new O-rings seals. While the lower diaphragm case* (P/N 110) is removed the flat-top gasket (P/N 117) can be replaced if desired. Reverse directions to re-assemble unit. (At this time a Teflon or Silicone based lubricant can be applied to the actuator shaft and bushing for easier installation.)

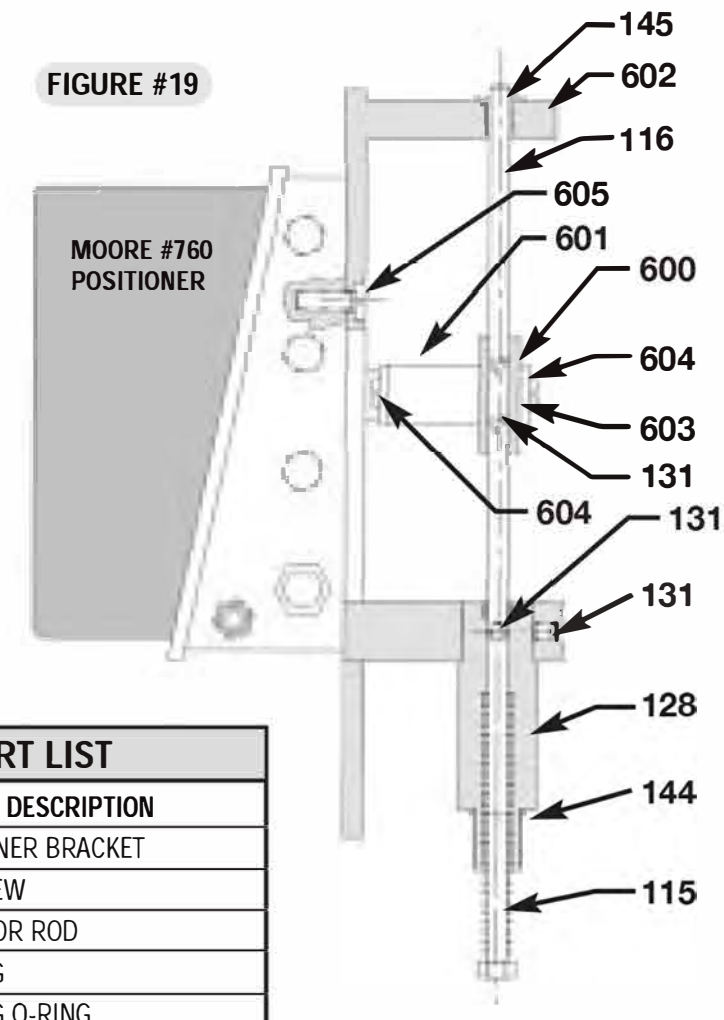
*Note: P/N 114 and P/N 110 only need to be removed if replacing flat-top gasket P/N 117.

5. Place the new diaphragm (P/N 108), upper diaphragm plate (P/N 107) and nut with washer (P/N 106) on the threaded end of the actuator shaft (P/N 30) and tighten the nut being careful to see that the thru holes of the diaphragm match those in the lower diaphragm case (P/N 103) and spring retainer (P/N 105) and guide ball.

6. Now insert the case bolts (P/N 112) upward through the lower diaphragm case and the actuator diaphragm and install the upper diaphragm case over spring, being care to see that the air connection is in the correct position.

7. After installing the case nuts (P/N 111) tighten them with a wrench evenly all around. Return adjusting screw (P/N 101) to dimension previously noted in step 1 and lock back into place with nut (P/N 102). Replace weather cap. Reconnect the air line and the unit is now ready for operational service.

FIGURE #19



PART LIST	
NO.	DESCRIPTION
602	POSITIONER BRACKET
131	SETSCREW
116	INDICATOR ROD
128	BUSHING
144	BUSHING O-RING
115	INDICATOR ROD SPRING
145	BEARING
600	INDICATOR ROD CONNECTOR
601	POSITIONER PIN
603	WASHER
604	POSITIONER PIN SCREWS
605	POSITIONER BRACKET SCREWS

Replacing the Valve Body Diaphragm:

Depending upon the type of service for which the valve is being used, it may be necessary to periodically replace the body diaphragm.

1. Remove or isolate pressure from the pipeline into which the diaphragm valve is installed.

2. (Refer to Figure 22, Page 14). Make sure that the operating air pressure is vented from the actuator. Remove weather cap (P/N 122) making note of the adjusting screw (P/N 101) how much it protrudes above the top of the spring case, then back off the adjusting screw (P/N 101) and lock nut (P/N 102) to remove spring tension.

3. Loosen and remove the bonnet nuts (P/N 23) and carefully lift off the flat-top bonnet and actuator assembly from the valve body. Activate air supply in upper diaphragm case (P/N 104) to lower body diaphragm assembly (until compressor pin (P/N 17) is below bottom flat-top bonnet (P/N 2A).

4. Using a hole punch (See Figure 20), drive compressor pin (P/N 17) out to remove compressor (P/N 16) and body diaphragm (P/N 19).

5. Remove diaphragm cap screws (P/N 20) to release body diaphragm (P/N 19) from the compressor (P/N 16) and replace with new diaphragm. (Diaphragm must be compatible with process fluid). Do not over tighten diaphragm cap screws (P/N 20) and tighten evenly when reassembling.

COMPRESSOR PIN/PUNCH CHART

TRU-TROL OR MAXI-TROL VALVE SIZE	TRU-FLOW OR MAXI-FLOW VALVE SIZE	BONNET SIZE	COMPRESSOR PIN DIAMETER	REQUIRED PUNCH DIAMETER
1", 1-1/4"	1/2", 3/4"	A	3/16"	3/16"
1-1/2", 2"	1", 1-1/4"	A	1/4"	1/4"
2-1/2", 3"	1-1/2", 2"	C	5/16"	5/16"
4"	2-1/2", 3"	D	5/16"	5/16"
5", 6"	4"	E	5/16"	5/16"
8", 10"	5", 6"	F	1/2"	1/2"

FIGURE #20

I/P - E/P TRANSDUCERS

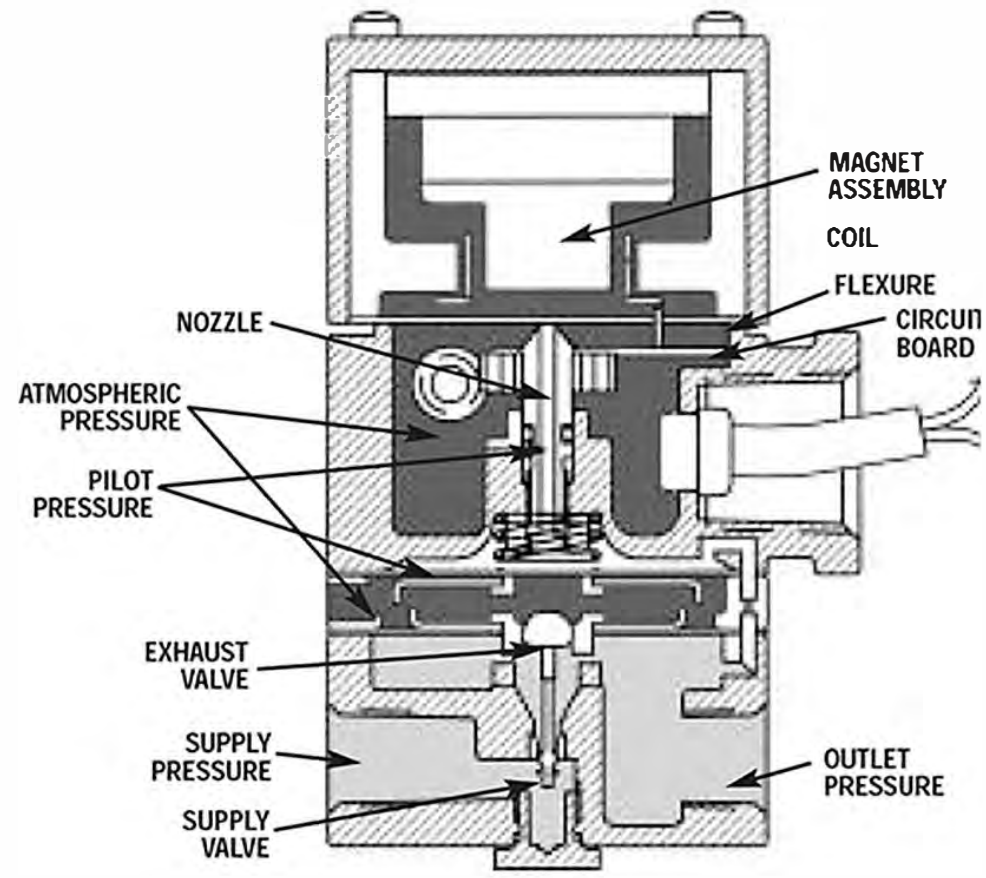


FIGURE #21

A transducer converts a current or voltage input signal (typically 4-20 MA) to a linearly proportional pneumatic output pressure (typically 3-15 PSI). This instrument is designed for flow control applications that require a high degree of reliability and repeatability at an economical cost.

Caution: **Some transducers must be piped in the horizontal position for correct operation. Re-piping might be necessary if mounting the diaphragm valve with transducer in the vertical position.**

6. Reinstall compressor pin (P/N 17) in compressor (P/N 16) and through actuator shaft hole (P/N 30), being sure compressor pin (P/N 17) is installed evenly on each side.

Note: Correct hole punch diameter should be used to avoid damaging compressor pin (P/N 17) during assembly and reassembly . (See Figure 20)

7. With the new diaphragm in place, mount the bonnet and actuator on the valve body and install the bonnet bolts and nuts (P/N 22, 23). At this time the nuts should be finger tight.

8. Tighten down the adjusting screw (P/N 101) and locknut (P/N 102) to the dimension previously noted from above. This will seat the valve diaphragm in the body. Tighten nuts evenly to torques give on Figure 4 and 5. The unit is now ready for operational service. After valve has been in service for 24 hours at operating pressure and temperature re-torque bonnet bolts.

SC - SPRING TO OPEN - AIR TO OPEN

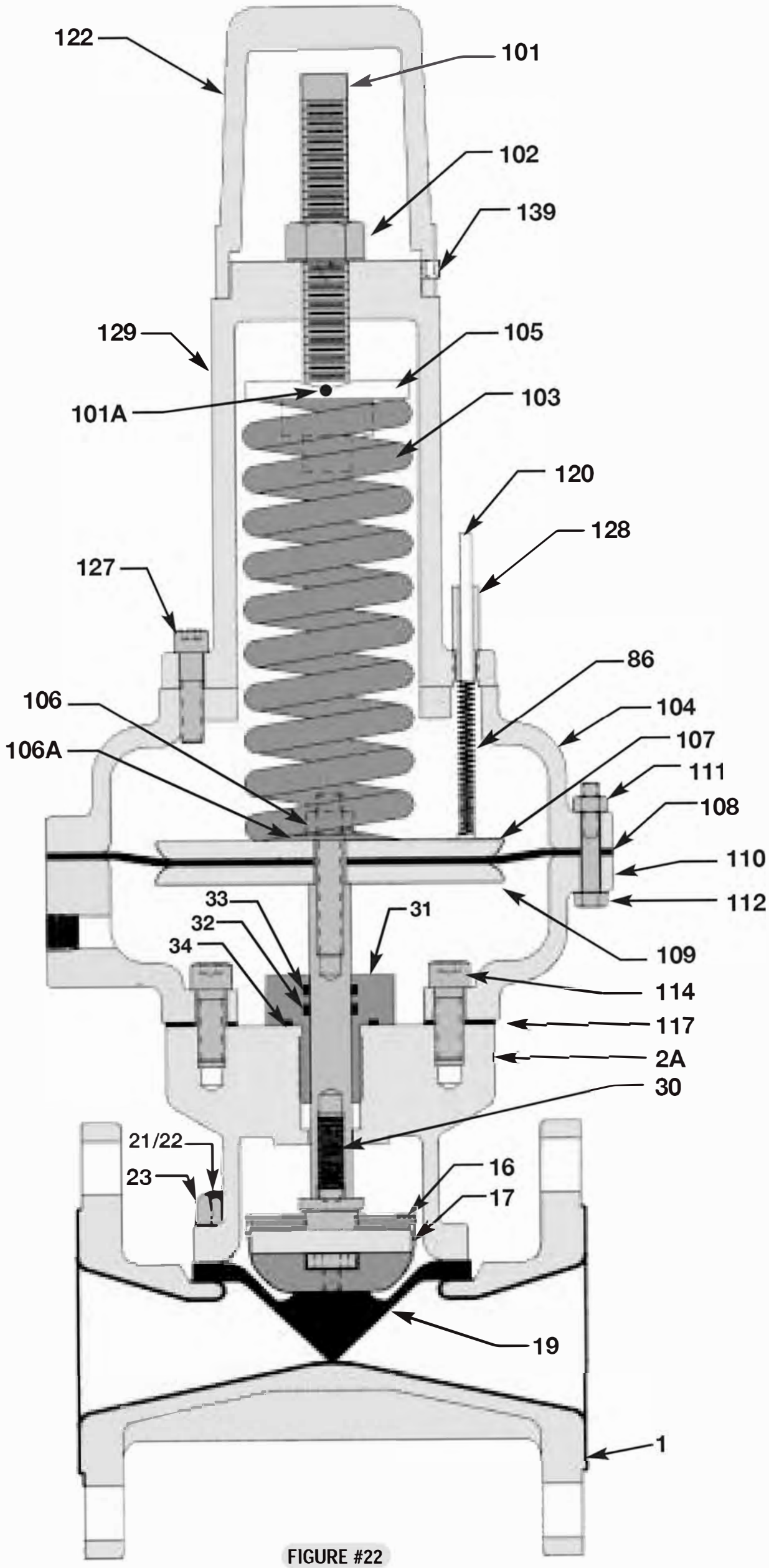


FIGURE #22

SC - SPRING TO CLOSE - AIR TO OPEN

Tru-Tech Diaphragm Valve, Pneumatic Operated
"SC" Spring to close, Air to open, fails closed
Material List

NO.	DESCRIPTION	STANDARD MATERIAL
1	BODY	**
2A	FLAT-TOP BONNET	CAST IRON A126 CLASS B
13A	TELL-TALE PIPE PLUG	POLYURETHANE
16	COMPRESSOR	CAST IRON A126 CLASS B
17	COMPRESSOR PIN *	STEEL, (COMM.)
19	DIAPHRAGM *	MATERIAL AS SPECIFIED
20	DIAPHRAGM CAPSCREWS	18-8 STAINLESS STEEL
21/22	BONNET STUDS OR BOLTS	STEEL GRADE 2, GRADE 5 ZINC PLATED
23	BONNET NUTS	STEEL GRADE 2, GRADE 5 ZINC PLATED
30	ACTUATOR SHAFT ASSEMBLY	303 STAINLESS STEEL
31	ACTUATOR BUSHING	NYCAST NYLOIL
32	ACTUATOR BUSHING INNER SEAL *	BUNA-N, 70 DURO
33	ACTUATOR BUSHING WIPER RING *	BUNA-N, 70 DURO
34	ACTUATOR BUSHING LOWER SEAL *	BUNA-N, 70 DURO
104	UPPER DIAPHRAGM CASE	CAST IRON A126 CLASS B
106	DIAPHRAGM NUT	STEEL ZINC PLATED, HIGH STRENGTH
107	UPPER DIAPHRAGM PLATE	DUCTILE IRON GR. 65-45-12
108	ACTUATOR DIAPHRAGM *	NITRILE RUBBER W/NYLON
109	LOWER DIAPHRAGM PLATE	DUCTILE IRON GR. 535 GR. 65-45-12
110	LOWER DIAPHRAGM CASE	CAST IRON A126 CLASS B
117	GASKET *	NITRILE RUBBER
111	CASE NUT	STEEL GR. 5 ZINC PLATED
112	CASE BOLT	STEEL GR. 5 ZINC PLATED
114	LOWER CASE CAPSCREWS	ALLOY STEEL, BLACK FINISH
120	INDICATOR ROD	PVC
106A	DIAPHRAGM WASHER	STEEL, ZINC PLATED
128	INDICATOR ROD BUSHING	BRONZE
129	SPRING CHAMBER	CAST IRON A126 CLASS B
122	WEATHER CAP	CAST IRON A126 CLASS B
139	WEATHER CAP SETSCREWS	STEEL, GR.2 BLACK FINISH
86	INDICATOR ROD SPRING*	SPRING STEEL
101	ADJUSTING SCREW	ALLOY STEEL
102	LOCKNUT	STEEL GR.2 ZINC PLATED
105	SPRING RETAINER	STEEL 1215
127	SPRING CHAMBER CAPSCREWS	ALLOY STEEL, BLACK FINISH
101A	GUIDE BALL	POLISHED STEEL

FIGURE #23

* RECOMMENDED SPARE PARTS

** AS SUPPLIED, (DUCTILE IRON A536 GR. 65-45-12, CAST IRON A126 CLASS B, 316 STAINLESS STEEL CF-8M. ALLOY 20 CF-7M. CAST STEEL WCB

SC - SPRING TO CLOSE (MULTI - PAK) - AIR TO OPEN

INSTALLATION, OPERATING, AND MAINTENANCE INSTRUCTIONS FOR PNEUMATIC OPERATED DIAPHRAGM VALVES

"SC" SPRING TO CLOSE
(ON - OFF Control)

Or Automatic Throttling (not shown)
Type "SC" Pneumatic Actuator
*Single of Multi-Spring Pak Configuration.

This actuator/accessory package is designed to normally position the valve closed. The valve will open when compressed air is admitted into the lower actuator chamber and the actuator spring will close the valve when the air is exhausted.

General: The model "SC" valve is normally closed (by spring) and is powered open by a diaphragm type pneumatic actuator. The valve can, at extra cost, be equipped with a variety of options including:

- Adjustable Opening Travel Stops. (See Figure 17)
- Adjustable Close Travel Stops. (See Figure 17)
- Three-Way Solenoid with Regulator and Gauge (See Figure 16). To allow the valve to open in response to an electrical signal (normally 110V/60 cycle).
- Single and Dual Limit Switches. (See Figure 25)
- Positioner (See Figure 18 and 19). To allow the valve to throttle in response to an air signal (normally 3-15 PSI).
- Transducer, Feedback Devices. To allow the valve to throttle in response to an electrical signal (normally 4-20 mA). (See Figure 21)

Installation: For general installation instructions see Page 1.

Connect the operating air supply to the lower diaphragm case (P/N 110) or if a positioner and/or transducer is supplied connect the air supply to that operating connection.

The use of a regulator is always recommended to prevent unneeded stress on the diaphragm. Actuator air supply should not exceed 100 PSI. The use of a filter/regulator is always recommended. When a positioner and/or transducer is supplied, a filter/ regulator is mandatory.

Assuming that the air pressure is turned on and at the correct pressure, and any other optional device (solenoid, transducer, limit switch, etc.) is turned on the unit is ready for automatic operation.

Start-Up: The TTV "SC" actuator comes already pre-tested and the spring tension pre-set per the required line pressure at the factory. Settings are made per the line specifications and air supply pressure given at the time the order was placed. If the valve does not close or open fully make sure there is no obstructions between the valve body and diaphragm. Check to make sure line pressure is correct and operating air pressure is correct. It is recommended at start-up to flush out the line to remove any sediment or foreign matter, which may be trapped in the valve body.

If the above conditions do not exist and the valve diaphragm still will not fully close more spring tension can be applied by turning adjusting screws (P/N 101, see Figure 26) clockwise for more shutoff force. (See steps 3 through 5, Page 17.) If the valve does not fully open (see valve stroke chart, Page 3) an increase in operating air pressure may be required (not to exceed 100 PSI).

Provided that the unit has been properly specified as to body material, lining, body diaphragm, actuator size, line and operating air pressures very little maintenance is required.

Maintenance: Assembly and Disassembly

SC - SPRING TO CLOSE (MULTI - PAK) - AIR TO OPEN

Replacing the Actuator Diaphragm and Adding or Replacing Spring Paks

1. Isolate or exhaust line pressure from the valve. Do not attempt to disassemble valve until line is depressurized.

2. (Refer to Figure 26, Page 20). Exhaust and disconnect all air and electrical connections to actuator.

3. Remove weather caps (P/N 122) by loosening set screws (P/N 139). Before proceeding measure how high adjusting screw (P/N 101) is above the weather cap mounting spacer (P/N 149) so spring tension can be set back to their original operating position.

4. Back off lock nut (P/N 102) a couple inches up adjusting screw (P/N 101).

5. Using a wrench turn adjusting screw (P/N 101) counterclockwise to decrease spring tension, these adjusting screws must be backed off evenly (on multiple spring units), or the valve may become jammed due to uneven spring tension being applied. It is recommended that when disassembling, alternate loosening of adjusting screw(s) (again on multiple spring actuators – 90, 140, and 280) by turning each counterclockwise two revolutions, then moving to the next one doing the same Figure 24.

Alternate loosening of adjusting screws until all tension is off springs. Note that this applies when applying (turning clockwise) spring tension also.

CAUTION: **Failure to release spring tension on all spring paks before disassembly could cause serious injury.

Replacing or Adding Springs in Springs Paks

After Step 5 has been completed fully, replacing, and/or adding springs is very easy.

6. Loosen and remove the spring support bolts (P/N 148).

7. Remove spring plate (P/N 146).

8. Slide off spring tubing (P/N 144) to expose springs (P/N 103), locate spring retainers (P/N 105) and guide balls and set aside. Depending on the line conditions each spring pak could contain as many as four springs (two inner and two outer). Change or replace springs as necessary.

NO.	DESCRIPTION
99	LIMIT SWITCH TRIPPER
89	INDICATOR ROD SETSCREW
92	BRACKET SETSCREW
149	WEATHERCAP SPACER
120A	INDICATOR ROD
115	TRIPPER SPRING
128	INDICATOR ROD BUSHING
142	MOUNTING BRACKET

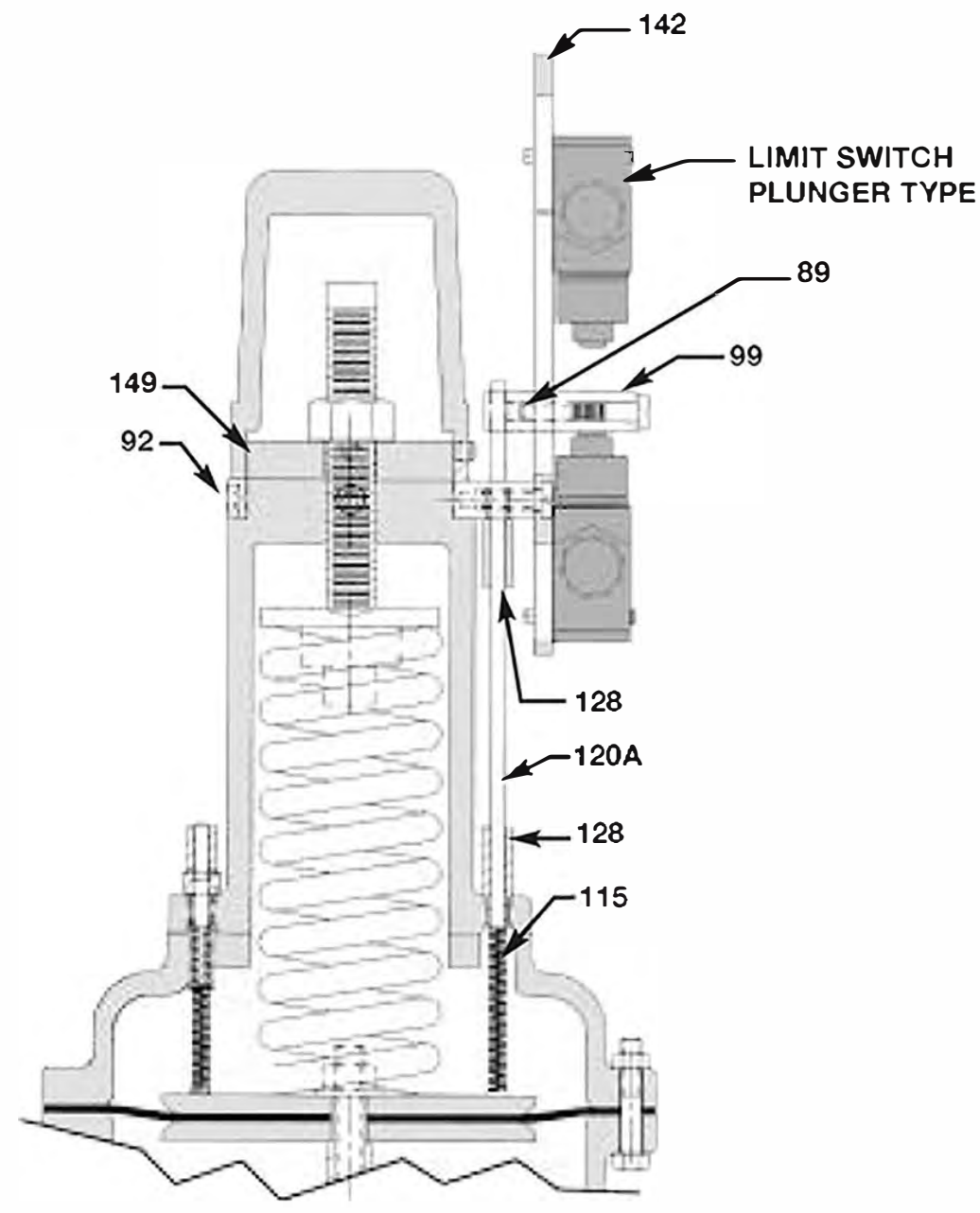


FIGURE #25

SC - SPRING TO CLOSE (MULTI - PAK) - AIR TO OPEN

Changing Actuator Diaphragm

(After Step 5 has been completed) it is recommended but not totally necessary to complete steps 6 through 8 also.

9. Using a wrench remove indicator rod bushing (P/N 85) to expose and remove spring (P/N 86) and plastic indicator rod (P/N 120) (if so equipped) if limit switches or a positioner or some other accessory is supplied, (see Page 25, Figure 32) loosen all set screws (P/N 131) to lift off mounting bracket (P/N 123) together with any mounted accessories and set aside. Remove bushing (P/N 123), indicator rod (P/N 116) and spring (P/N 86). This assembly is removed only to prevent damage to any accessories during disassembly or assembly, these can be put back after entire valve has been reassembled.

10. Loosen and remove case nuts (P/N 111) and bolts (P/N 112).

11. Remove upper actuator case (P/N 104). Spring supports (P/N 145) may stay attached.

12. Remove diaphragm nut (P/N 106) and washer (P/N 106A).

13. Remove upper diaphragm plate (107) to expose actuator diaphragm (P/N 108). Remove and replace with new one. If no more disassembly is required reverse above steps for assembly.

Replacing Bushing Seals, Gasket, and Diaphragm

14. After completing Step 13, the bushing seals (P/N 32, 33, 34) and gasket (P/N 117) can be replaced by removing actuator lower plate (P/N 109) and by removing the lower case cap screws (P/N 114). Lift off actuator lower case (P/N 110) to expose bushing (P/N 31), using a wrench back-out bushing and remove and replace the three O-ring seals (P/N 32, 33, 34). An O-ring lubricant should be used before replacing to ease assembly. Bushing can then be reinstalled back in the flat-top bonnet (P/N 2A). Flat-top bonnet gasket (P/N 117) can be replaced by removing lower case cap screws (P/N 114) and lift off flat-top bonnet (P/N 2A).

15. Pull down on diaphragm (P/N 19) to expose compressor pin (P/N 17).

16. Using a punch of the proper diameter (see Figure 20) remove compressor pin (P/N 17). The compressor (P/N 16) and diaphragm (P/N 19) will now be released from shaft (P/N 30)

17. Remove the two diaphragm cap screws (P/N 20) to replace diaphragm (P/N 19) and replace with new one (of the proper material). Do not over tighten diaphragm cap screws (P/N 20).

TO SELECT THE PROPER DIAPHRAGM VALVE FOR YOU APPLICATION:

- **SERVICE CONDITIONS?** What is the fluid being handled? It could be hydrochloric acid, tap water or something in between. Note also that is could be a combination of town or more things.

- **CONCENTRATION OF FLOWING FLUID?** The concentration affects the proper choice of body lining and diaphragm material.

- **SYSTEM OPERATING TEMPERATURE?** Many chemicals are more aggressive at elevated temperatures. Plus, body linings and diaphragm materials are pressure/temperature rated.

=

- **SYSTEM OPERATING PRESSURE?** Most diaphragm valves are pressure limited. Consult manufacturers recommendations for system compatibility.

Replacing Bushing Seals, Gasket, and Diaphragm

18. Complete reassembly can be done by reversing Steps 17 through 3 if necessary

19. When reassembling do not completely tighten bonnet nuts (P/N 23), just hand tighten at first. Only after the valve is completely assembled and the springs are adjusted back to their original position (valve closed) then bonnet bolts can be fully tightened per chart. (See Figure 4 and 5)

Removing Valve Body Diaphragm Only

(Without completely disassembling the valve actuator)

20. Follow Steps 1 through 5. These steps must be followed first or serious injury could result.

21. Loosen and remove bonnet bolts (P/N 23). Remove flat-top and actuator assembly and lay in its side.

22. Apply air pressure in upper case, just enough to expose compressor pin (P/N 17) for diaphragm removal.

23. Follow Steps 16 and 17 for removing and reinstalling valve body diaphragm (P/N 19).

24. Remount flat-top bonnet and actuator assembly on body. (An O-ring lubricant can be pout on the inside of the diaphragm holes for easier assembly on bonnet studs.

25. Hand tighten bonnet nuts (P/N 23). Follow Step 19 for proper tightening procedure.

Tips on Reassembly

- Spray springs (P/N 103) and inside of spring tubing with a light coat of oil.
- Always grease shaft (P/N 30) before reassembly for easier operation.
- Make sure the more rounded ends of the actuator plates (P/N 107, 109) are facing actuator diaphragm (P/N 108).
- When tightening case nuts (P/N 111) do so evenly crisscrossing around the actuator case.
- Make sure lower case cap screws (P/N 114) are properly tightened to prevent air leaks.
- Do not use sharp metal instruments when installing bushing O-rings (P/N 32, 33, 34).
- Lubricate inside of bushing (P/N 31) for easier operation.

SC - SPRING TO CLOSE (MULTI -PAK) - AIR TO OPEN

FIGURE #26A

FIGURE #26

SC - SPRING TO CLOSE (MULTI - PAK) - AIR TO OPEN

Tru-Tech Diaphragm Valve, Pneumatic Operated
"SC" Spring to close, Air to open, fails closed (For Multi-Barrel Configuration)
Material List

NO.	DESCRIPTION	STANDARD MATERIAL
1	BODY	**
2A	FLAT-TOP BONNET	CAST IRON A126 CLASS B
13A	TELL-TALE PIPE PLUG	POLYURETHANE
16	COMPRESSOR	CAST IRON A126 CLASS B
17	COMPRESSOR PIN •	STEEL, (COMM.)
19	DIAPHRAGM •	MATERIAL AS SPECIFIED
20	DIAPHRAGM CAPSCREWS	18-8 STAINLESS STEEL
21/22	BONNET STUDS OR BOLTS	STEEL GRADE 2, GRADE 5 ZINC PLATED
23	BONNET NUTS	STEEL GRADE 2 GRADE 5 ZINC PLATED
30	ACTUATOR SHAFT ASSEMBLY	303 STAINLESS STEEL
31	ACTUATOR BUSHING	NYCAST NYLOIL
32	ACTUATOR BUSHING INNER SEAL •	BUNA-N, 70 DURO
33	ACTUATOR BUSHING WIPER RING •	BUNA-N, 70 DURO
34	ACTUATOR BUSHING LOWER SEAL •	BUNA-N, 70 DURO
104	UPPER DIAPHRAGM CASE	CAST IRON A126 CLASS B
106	DIAPHRAGM NUT	STEEL ZINC PLATED, HIGH STRENGTH
107	UPPER DIAPHRAGM PLATE	DUCTILE IRON GR. 65-45-12
108	ACTUATOR DIAPHRAGM •	NITRILE RUBBER W/NYLON
109	LOWER DIAPHRAGM PLATE	DUCTILE IRON GR. 535 GR. 65-45-12
110	LOWER DIAPHRAGM CASE	CAST IRON A126 CLASS B
117	GASKET •	NITRILE RUBBER
111	CASE NUT	STEEL GR. 5 ZINC PLATED
112	CASE BOLT	STEEL GR. 5 ZINC PLATED
114	LOWER CASE CAPSCREWS	ALLOY STEEL, BLACK FINISH
120	INDICATOR ROD	PVC
106A	DIAPHRAGM WASHER	STEEL, ZINC PLATED
122	WEATHER CAP	CAST IRON A126 CLASS B
139	WEATHER CAP SETSCREWS	STEEL, GR.2 BLACK FINISH
86	INDICATOR ROD SPRING•	SPRING STEEL
101	ADJUSTING SCREW	ALLOY STEEL
102	LOCKNUT	STEEL GR.2 ZINC PLATED
105	SPRING RETAINER	STEEL 12L14
103	SPRING	SPRING STEEL
87	ENCLOSURE CAP	HIGH DENSITY POLYETHYLENE
84	CLEAR ENCLOSURE	POLYCARBONATE
85	INDICATOR ROD BUSHING	STEEL, ZINC PLATED
144	SPRING TUBING	STEAMLESS, COLD DRAWN STEEL
145	SPRING SUPPORTS	STEEL 12L14 FM
146	SPRING PLATE	STEEL (COMM)
147	SPRING SUPPORT STUDS	ALLOY STEEL, BLACK FINISH
148	SPRING SUPPORT BOLTS	ALLOY STEEL, BLACK FINISH
149	WEATHER CAP MTG. SPACER	STEEL (COMM)
160	SPRING GUIDE	UHMW
161	BEARING	STEEL (COMM)

FIGURE #27

• RECOMMENDED SPARE PARTS

•• AS SUPPLIED, (DUCTILE IRON A536 GR. 65-45-12, CAST IRON A126 CLASS B, 316 STAINLESS STEEL CF-8M. ALLOY 20 CF-7M. CAST STEEL WCB

SO - SPRING TO OPEN - AIR TO CLOSE

TYPE "SO" PNEUMATIC ACTUATOR

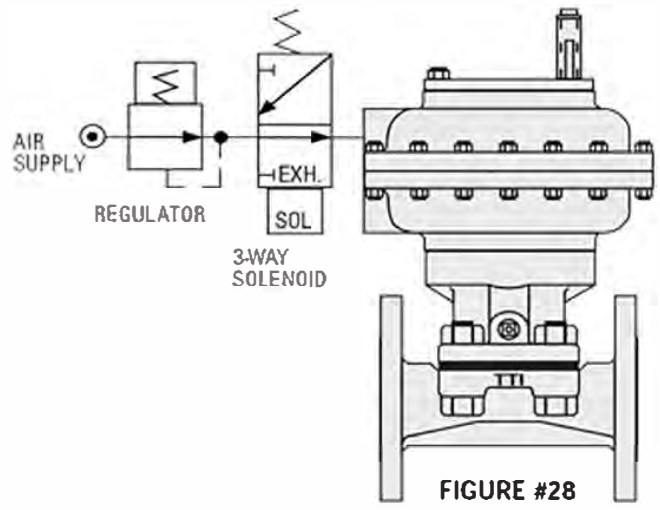


FIGURE #28

"SO" Spring to Open

(ON-OFF Control)

This actuator/accessory package is designed to normally position the valve open. The valve will close when compressed air is admitted into the upper actuator chamber and the actuator spring will open the valve when the air is exhausted.

The valve can be at an extra cost equipped with a variety of options including:

- Hand wheel Opening/Closing Device (See Figure 29)
- Adjustable Opening/Closing Travel Stops (See Figure 29)
- Three-Way Solenoid with Regulator and Gauge (See Figure 28)
- Dual Limit Switches (See Figure 32)
- Positioner (See Figure 19, 30, 31)
- Transducer, Feedback Devices (See Figure 21)

Installation: See Page 1

(Note: Some transducers may require piping modification because they must stay in the horizontal position to function.)

Connect the closing air supply line to the 1/4" NPT female pipe connection of the upper diaphragm case (P/N 104). This air line should limit air pressure to 100 PSI maximum. A regulator is highly recommended.

Remember use only enough air pressure to fully open the valve. This will significantly increase actuator diaphragm life. Make sure that the opening air pressure is turned on and that the pressure is correct. The unit is ready for operational service.

Start-Up and Trouble Shooting: If the diaphragm valve does no fully open when air pressure is applied to the actuator, check to see that the correct opening air pressure is being used. Also check to be sure that there are no loose air connections and that all solenoid valves and/or other devices in the air line are functioning properly.

It is advisable at start-up to open the control valve(s) and flush out the lines to remove any sediment or foreign matter, which may be trapped in the valve body. Sediment may prevent the valve from full closing and/or sealing drop tight. It could also permanently damage the seat area or the diaphragm.

CAUTION: Diaphragm valves displace fluid in closing, therefore, they are not suitable for use in "locked line" conditions.

Maintenance: Provided that the unit has been properly specified as to body material, lining, body diaphragm, actuator size, etc., very little maintenance is required.

SO - SPRING TO OPEN - AIR TO CLOSE

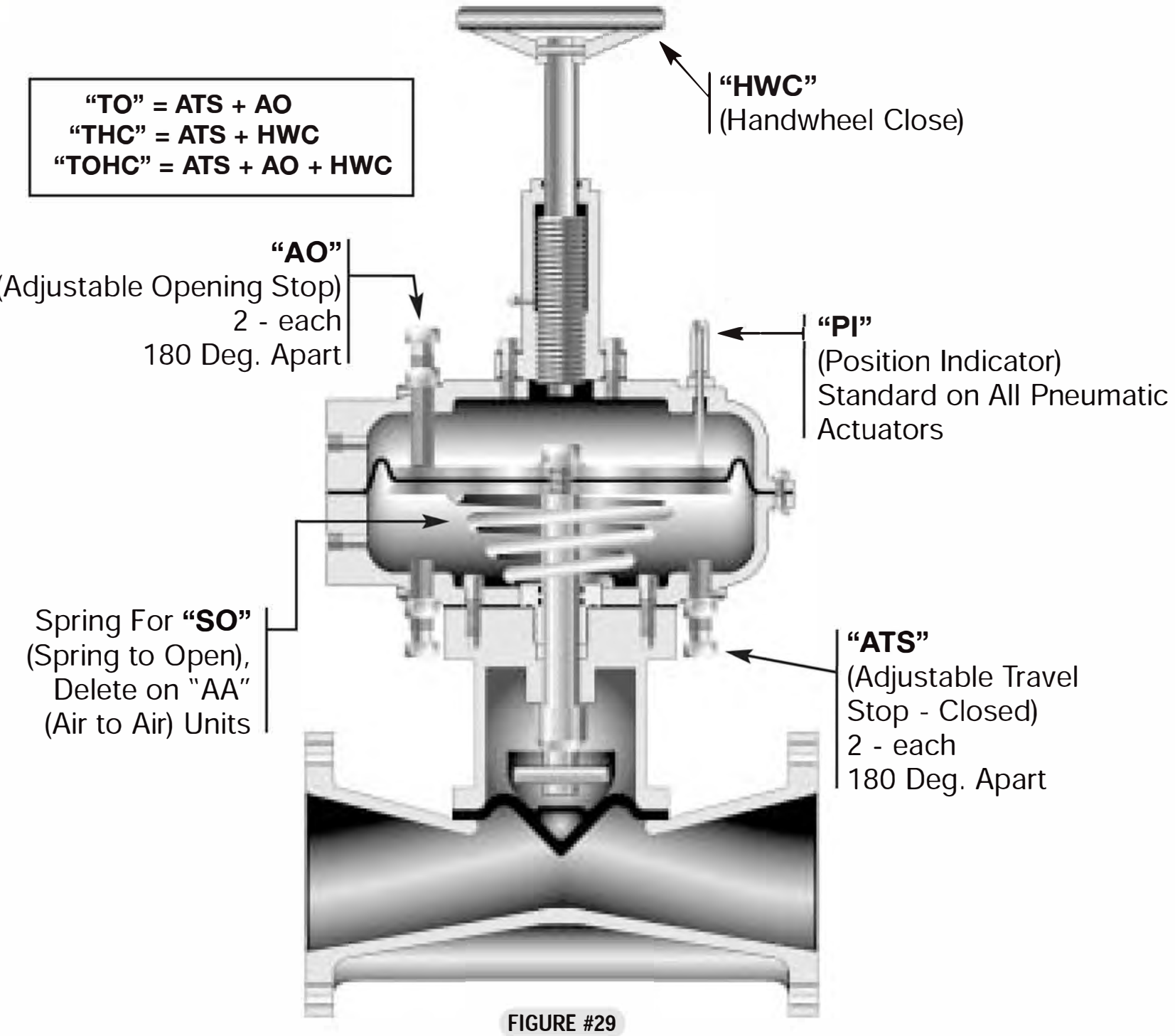


FIGURE #29

Replacing the Actuator Diaphragm and Actuator Bushing O-Rings:

1. Relieve or drain the line pressure in the pipeline and make sure the operating air pressure is exhausted from the actuator.

2. (Refer Figure 33, Page 26) Loosen and remove the case nuts (P/N 111) from the case bolts (P/N 112) around the outer rim of the actuator and lift off the upper diaphragm case (P/N 104).

3. Loosen the diaphragm nut (P/N 106) at the center of the diaphragm and remove the nut, washer, upper diaphragm plate (P/N 107), and actuator diaphragm. (Note that the curved ends of the actuator plates always face the actuator diaphragm.)

4. At this point the actuator bushing O-ring (P/N 32 inner seal, P/N 33 wiper ring, and P/N 34 lower seal) can be replaced. Remove the lower diaphragm plate (P/N 109), spring (P/N 123) lower case cap screws* (P/N 110), unscrew counterclockwise actuator bushing (P/N 31) and slip it off actuator shaft (P/N 30). Remove O-rings (P/N 32, 33, 34) and carefully install new ones. While lower diaphragm case (P/N 110) is removed, the gasket (P/N 117) can be replaced if desired. Then reassemble unit in reverse order. A Teflon or silicon based lubricant can be applied to the actuator shaft for easier installation of actuator bushing.

*Note: P/N 114 and P/N 110 need only be removed if replacing flat-top gasket, P/N 117.

SO -SPRING TO OPEN - AIR TO CLOSE

AUTOMATIC THROTTLING
"SO" SPRING OPEN, AIR CLOSED

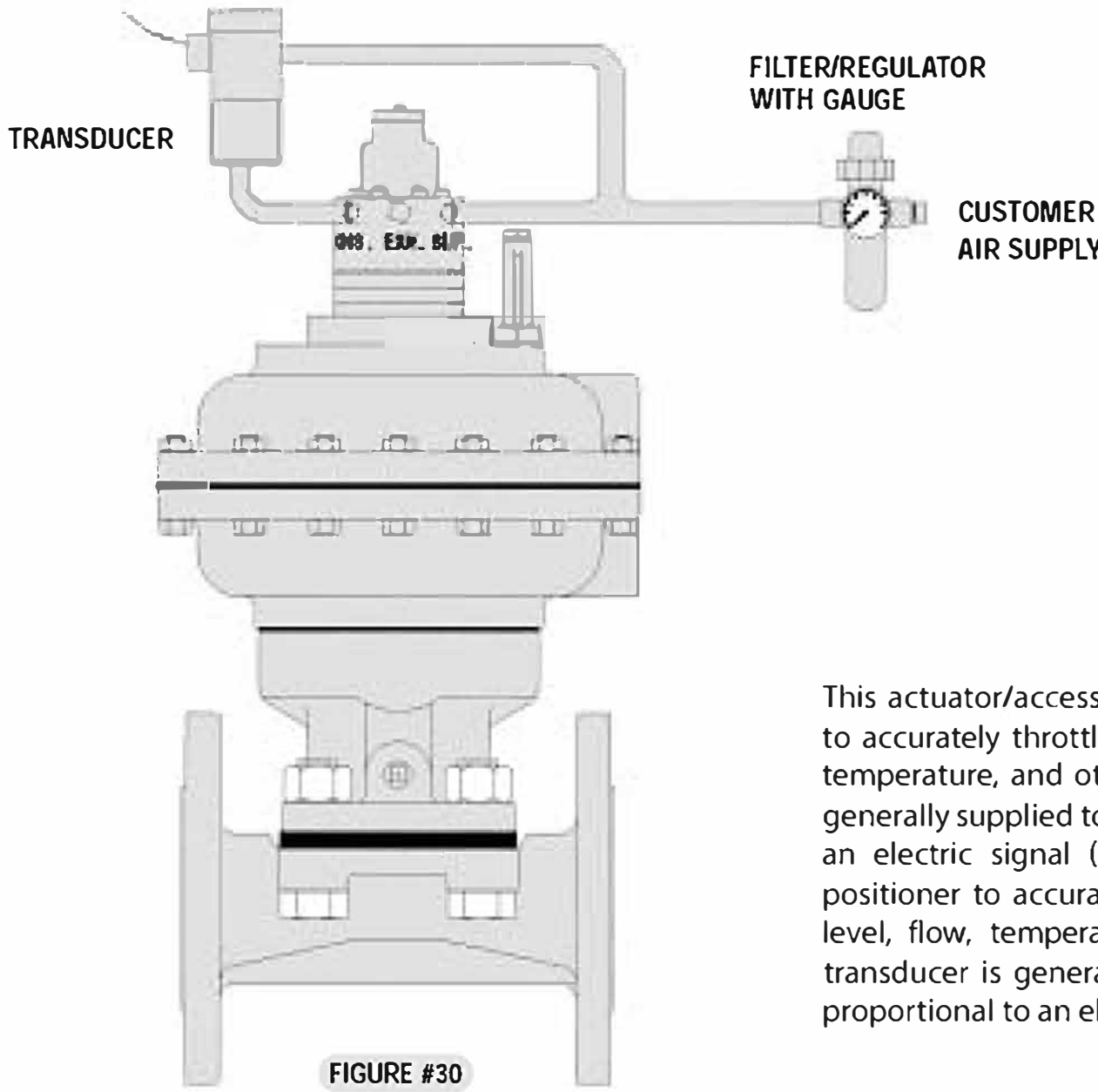


FIGURE #30

This actuator/accessory package is provided with a positioner to accurately throttle the valve for pressure, liquid level, flow, temperature, and other control requirements. A transducer is generally supplied to provide valve modulation proportional to an electric signal (most often 4-20 MA).s provided with a positioner to accurately throttle the valve for pressure, liquid level, flow, temperature, and other control requirements. A transducer is generally supplied to provide valve modulation proportional to an electric signal (most often 4-20 MA

TYPE "SO" PNEUMATIC ACTUATOR (continued)

Replacing the Actuator Diaphragm and Actuator Bushing O-Rings:

5. Place the new diaphragm (P/N 108), upper diaphragm plate (P/N 107) and nut with washer (P/N 106) on the threaded end of the actuator shaft (P/N 30) and tighten the nut with a wrench, being careful to see that the thru holes of the diaphragm match those in the lower diaphragm case (P/N 110).

6. Insert the case bolts (P/N 112) upward through the lower diaphragm case and the diaphragm and install the upper diaphragm case, being careful to see that the air connection is in the correct position.

7. After installing the case nuts (P/N 111) tighten them evenly all around with a wrench. Re-connect the air lines and the unit is ready for operational service.

Replacing the Valve Body Diaphragm:

Depending upon the type of service for which the valve is being used, it may be necessary to periodically replace the body diaphragm.

1. Remove or isolate pressure from the pipeline into which the diaphragm valve is installed.
2. Make sure that the operating air pressure is vented from the actuator.

SO - SPRING TO OPEN - AIR TO CLOSE

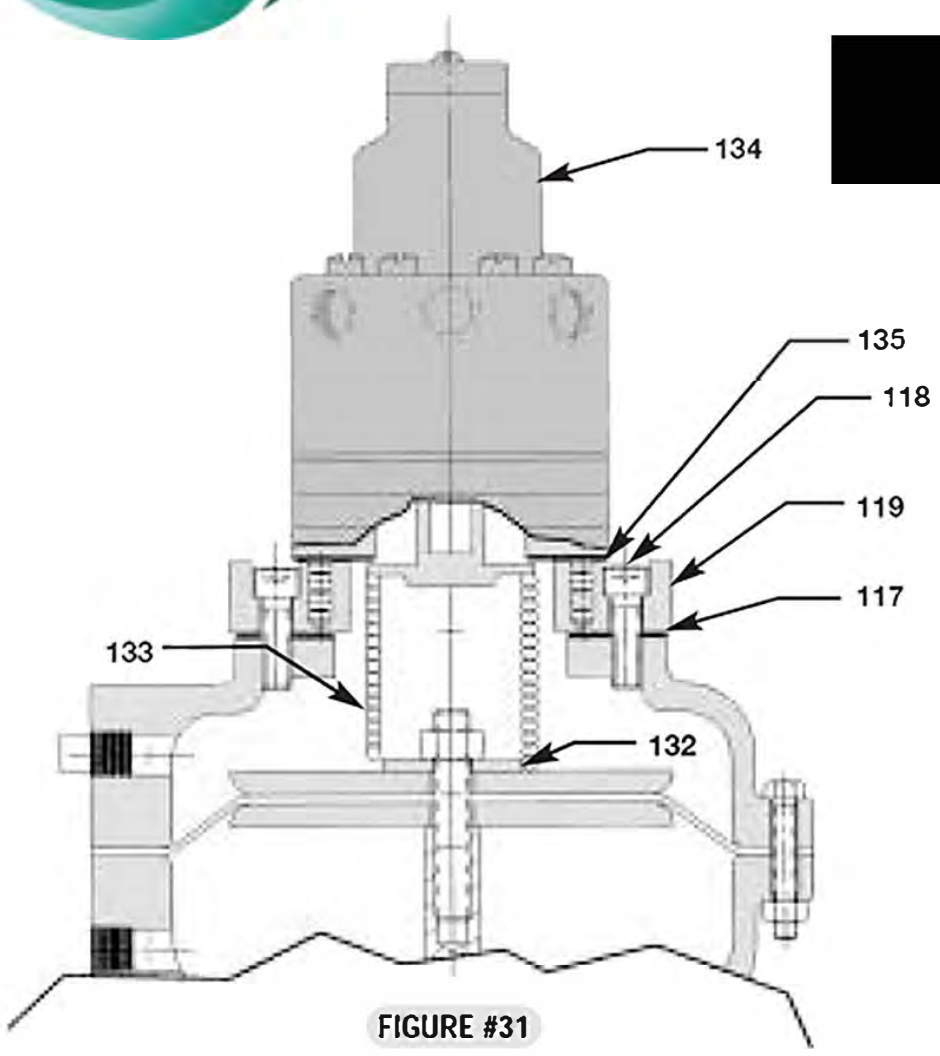


FIGURE #31

PART LIST	
NO.	DESCRIPTION
117	GASKET
119	ADAPTER PLATE
118	PLATE CAPSCREWS
133	RANGE SPRING
135	POSITIONER GASKET
134	TOP MOUNT POSITIONER
132	SPRING RETAINER

3. Loosen and remove the bonnet nuts (P/N 23) and lift off the bonnet and actuator assembly from the valve body. Activate air supply in the upper diaphragm case (P/N 104) to lower body diaphragm assembly. Until compressor pin (P/N 17) is below bottom of flat-top bonnet (P/N 2A).

4. Using a hole punch (Figure 20), drive compressor pin (P/N17) out to remove compressor (P/N 16) and body diaphragm (P/N 19).

5. Remove diaphragm cap screws (P/N 20) to release body diaphragm (P/N 19) from the compressor (P/N 16) and replace the new diaphragm. (Must be compatible with the process fluid). Do not over tighten diaphragm cap screws (P/N 20) and tighten evenly when reassembling.

6. Reinstall compressor pin (P/N 17) in compressor (P/N 16) and through actuator shaft hole (P/N 30), being sure compressor pin (P/N 17) is installed evenly on each side.

Note: Correct hole punch diameter (See Figure 20) should be used to avoid damaging compressor pin (P/N 17) during assembly and reassembly.

7. With the new diaphragm in place, mount the bonnet and actuator on the valve body and install the bonnet bolts and nuts (P/N 22, 23). At this time, the nuts should be finger tight.

8. Now apply closing air pressure to the actor to seat the valve diaphragm in the body. Tighten nuts evenly to torques given on the chart (Figure 4 and 5). The unit is now ready for operational service. After valve has been in service for 24 hours at operating pressure and temperature re-torque bonnet bolts.

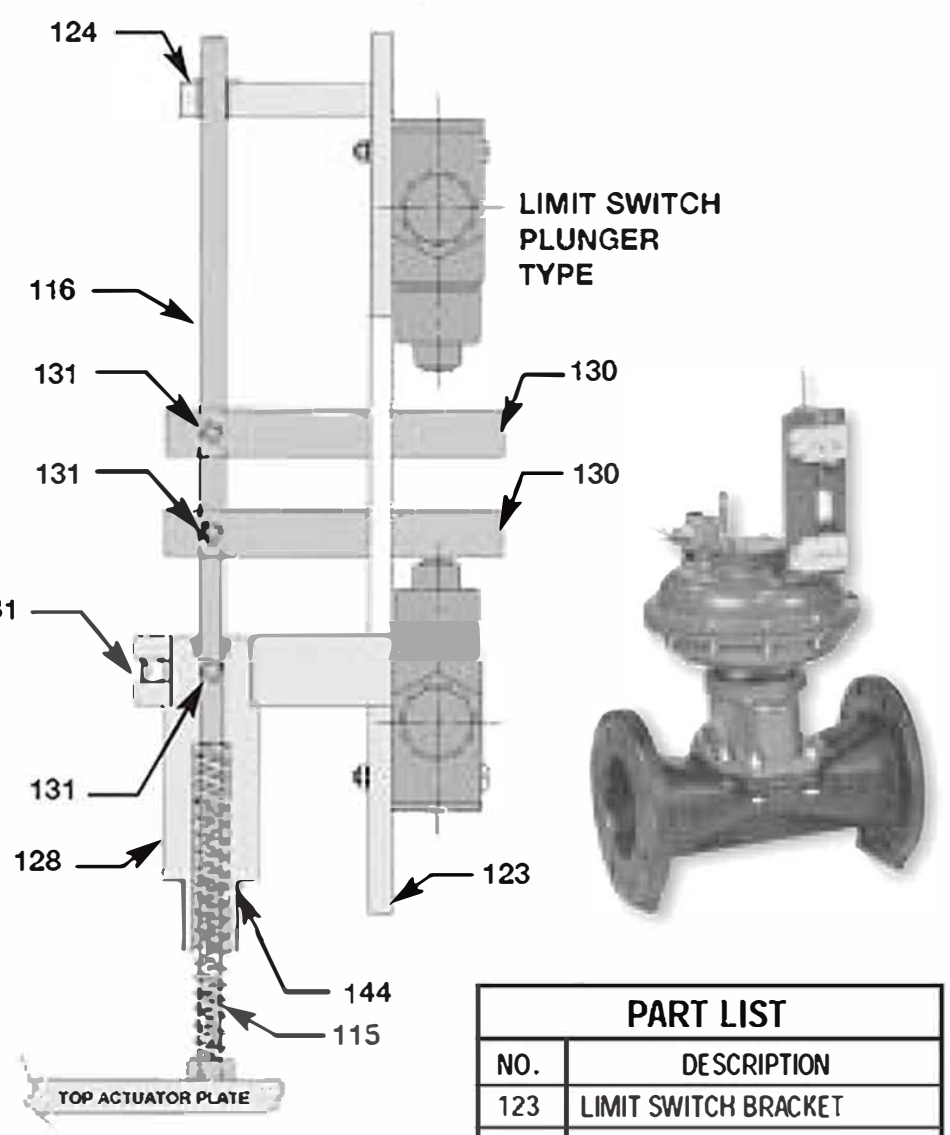


FIGURE #32

LIMIT SWITH ASSEMBLY
FOR DOUBLE ACTING
"AA" AND DIRECT ACTING
"SO" PNEUMATIC ACTUATORS

PART LIST	
NO.	DESCRIPTION
123	LIMIT SWITCH BRACKET
130	LIMIT SWITCH TRIPPER
131	SETSCREW
116	INDICATOR ROD
128	BUSHING
144	BUSHING O-RING
115	INDICATOR ROD SPRING
124	BUSHING

SO - SPRING TO OPEN - AIR TO CLOSE

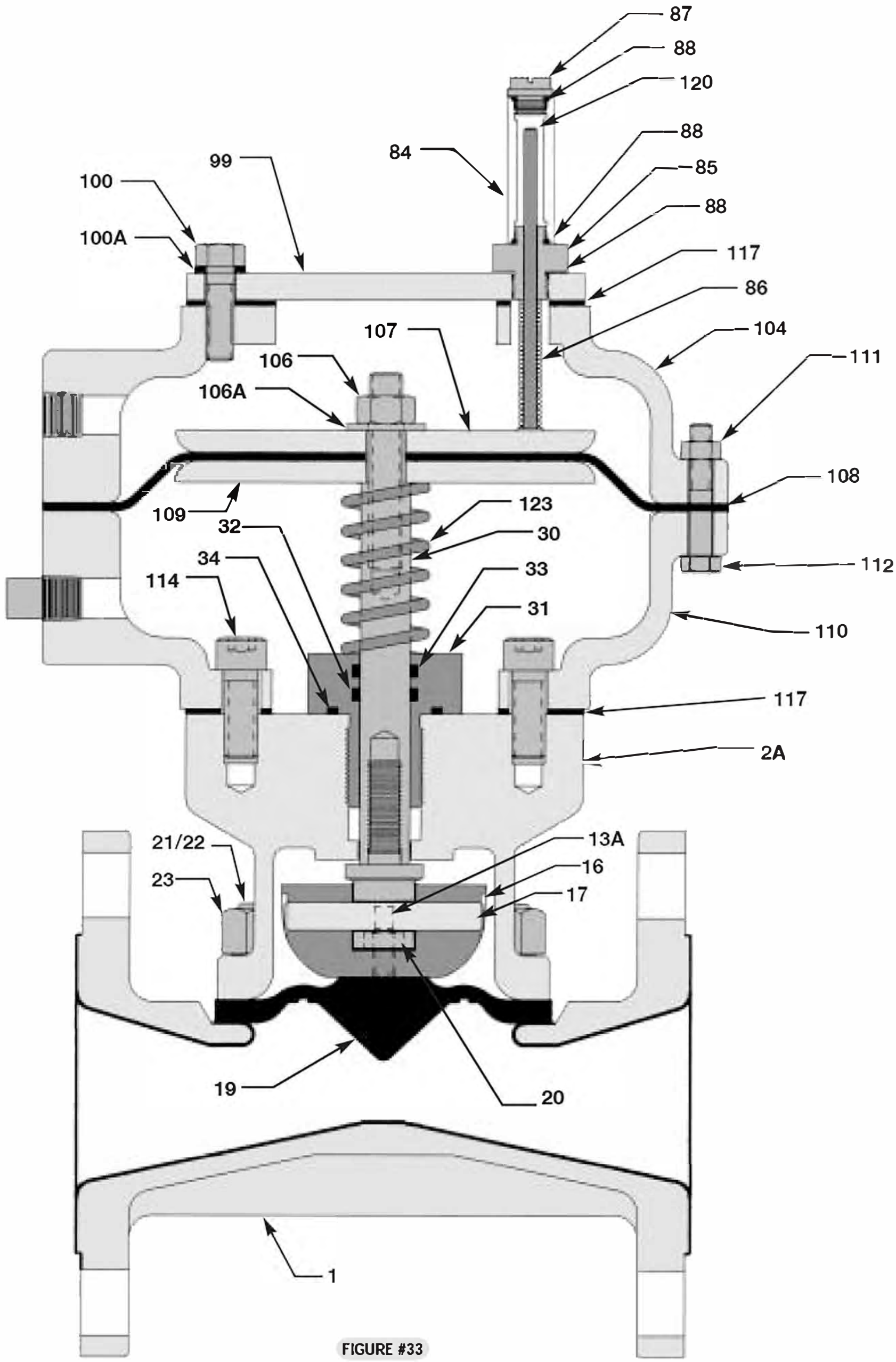


FIGURE #33

SO - SPRING TO OPEN - AIR TO CLOSE

Tru-Tech Diaphragm Valve, Pneumatic Operated
"AA" Double Acting, Air to Open, Air to Close, Fails Part Open
Material List

NO.	DESCRIPTION	STANDARD MATERIAL
1	BODY	**
2A	FLAT-TOP BONNET	CAST IRON A126 CLASS B
13A	TELL-TALE PIPE PLUG	POLYURETHANE
16	COMPRESSOR	CAST IRON A126 CLASS B
17	COMPRESSOR PIN *	STEEL, (COMM.)
19	DIAPHRAGM *	MATERIAL AS SPECIFIED
20	DIAPHRAGM CAPSCREWS	18-8 STAINLESS STEEL
21/22	BONNET STUDS OR BOLTS	STEEL GRADE 2, ZINC PLATED
100A	TOP PLATE BOLT SEAL	STEEL GRADE 2, ZINC PLATED, BUNA-N
23	BONNET NUTS	STEEL GRADE 2, ZINC PLATED
30	ACTUATOR SHAFT ASSEMBLY	303 STAINLESS STEEL
31	ACTUATOR BUSHING	NYCAST NYLOIL
32	ACTUATOR BUSHING INNER SEAL *	BUNA-N, 70 DURO
33	ACTUATOR BUSHING WIPER RING *	BUNA-N, 70 DURO
34	ACTUATOR BUSHING LOWER SEAL *	BUNA-N, 70 DURO
104	UPPER DIAPHRAGM CASE	CAST IRON A126 CLASS B
106	DIAPHRAGM NUT	STEEL ZINC PLATED, HIGH STRENGTH
107	UPPER DIAPHRAGM PLATE	DUCTILE IRON GR. 65-45-12
108	ACTUATOR DIAPHRAGM *	NITRILE RUBBER W/NYLON
109	LOWER DIAPHRAGM PLATE	DUCTILE IRON GR. 535 GR. 65-45-12
110	LOWER DIAPHRAGM CASE	CAST IRON A126 CLASS B
117	GASKET *	NITRILE RUBBER
111	CASE NUT	STEEL GR. 5, ZINC PLATED
112	CASE BOLT	STEEL GR. 5, ZINC PLATED
114	LOWER CASE CAPSCREWS	ALLOY STEEL, BLACK FINISH
120	INDICATOR ROD	PVC
106A	DIAPHRAGM WASHER	STEEL, ZINC PLATED
99	TOP PLATE	STEEL, EPOXY COATED
100	TOP PLATE BOLTS	STEEL GR.5 ZINC PLATED
84	CLEAR ENCLOSURE	CLEAR POLYCARBONATE
85	INDICATOR ROD BUSHING	BRONZE
86	INDICATOR ROD SPRING *	SPRING STEEL
87	ENCLOSURE CAP	POLYETHYLENE
123	SPRING *	SPRING STEEL
88	ENCLOSURE CAP O-RING *	BUNA-N, 70 DURO

FIGURE #34

* RECOMMENDED SPARE PARTS
** AS SUPPLIED, (DUCTILE IRON A536 GR. 65-45-12, CAST IRON A126 CLASS B, 316 STAINLESS STEEL CF-8M, ALLOY 20 CF-7M, CAST STEEL WCB

AA - AIR TO OPEN - AIR TO CLOSE

TYPE "AA" PNEUMATIC ACTUATOR

General: The valve can be optionally equipped with a variety of options including:

- Hand wheel Opening/Closing Device (See Figure 29)
- Adjustable Opening/Closing Travel Stops (See Figure 29)
- Four-Way Solenoid with Regulator and Gauge (See Figure 28)
- Dual Limit Switches (See Figure 32)
- Positioner (See Figure 19, 30, 31)
- Transducer, Feedback Devices (See Figure 21)

Installation: See Page 1

Connect the closing air supply line to the 1/4" NPT female pipe connection of the upper diaphragm case (P/N 104). Connect the opening air supply line to the opening air supply line to the opening on the side of the lower diaphragm case (P/N 110). Operating pressure should not exceed 100 PSI. A regulator is highly recommended, remember only use enough air pressure to open or close the valve. This will significantly increase the diaphragm valves life. This is especially important with double acting actuators. Make sure that the opening air pressure is turned on and that the pressure is correct. The unit is ready for operational service.

Start-Up and Trouble Shooting: If the diaphragm valve does not fully close when air is supplied to the actuator, check to see that the correct closing air pressure is being used, that there are no loose connections, and that any solenoid valve or other device in the air line is functioning properly.

It is advisable at start-up to open the control valve(s) and flush out the lines to remove any sediment or foreign matter, which may be trapped in the valve body. Sediment may prevent the valve from fully closing and/or sealing drop tight. It could also permanently damage the seat area or diaphragm.

Note: Diaphragm valves displace fluid in closing. Therefore, they are not suitable for use in "locked line" conditions.

Maintenance: Provided that the unit has been properly specified as to body material, lining, body diaphragm, actuator size, etc., very little maintenance is required.

Replacing the Actuator Diaphragm and Actuator Bushing O-Rings:

1. Relieve or drain the line pressure in the pipeline and make sure that the operating air pressure is exhausted from the actuator.

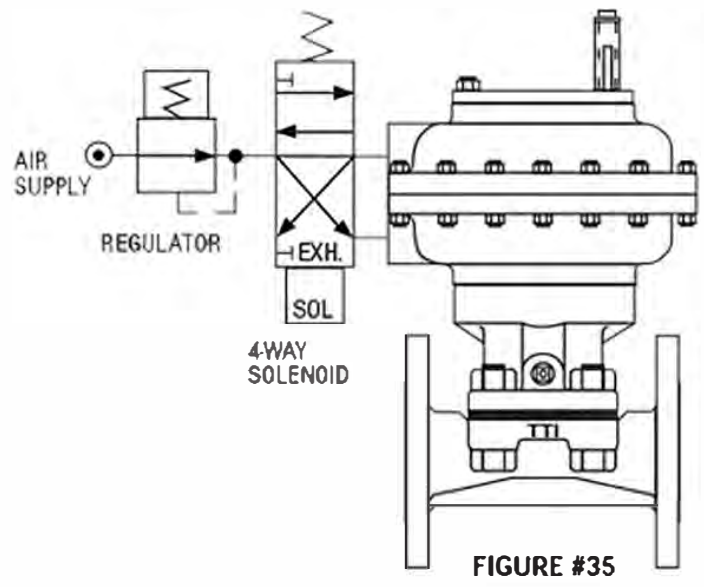


FIGURE #35

"AA" AIR-AIR, DOUBLE ACTING
(ON-OFF Control)

This actuator/accessory package is designed to open the valve when compressed air is admitted into the lower chamber and closes the valve when compressed air is admitted into the upper chamber.

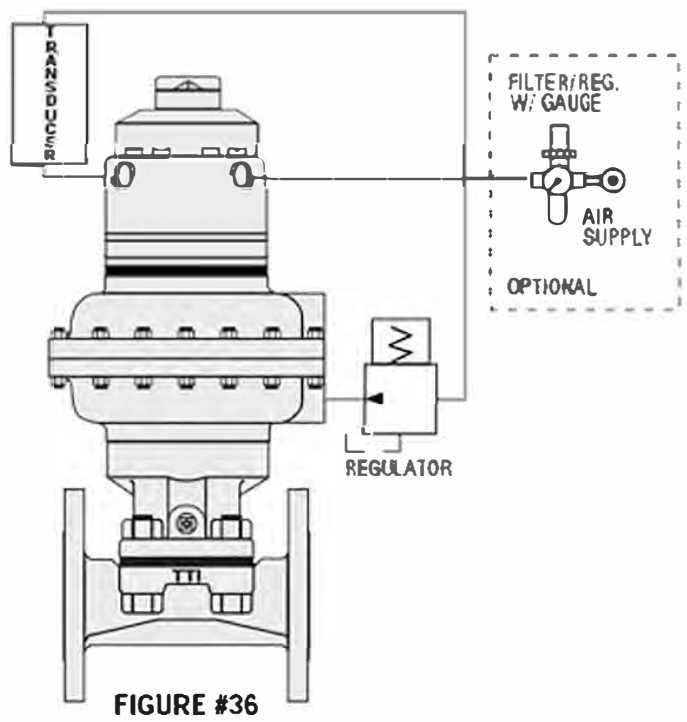


FIGURE #36

"AA" AIR-AIR, DOUBLE ACTING
(AUTOMATIC THROTTLING)

This actuator/accessory package is provided with a positioner to accurately throttle the valve for pressure, liquid, level, flow, temperature, and other control requirements. A transducer is generally supplied to provide valve modulation proportional to an electric signal (most often 4-20 MA).

2. (Refer Figure 37, Page 30). Loosen and remove the case nuts (P/N 111) from the case bolts (P/N 112) around the outer rim of the actuator and lift off the upper diaphragm case (P/N 104).

3. Loosen the diaphragm nut (P/N 106) at the center of the diaphragm and remove the nut, washer, upper diaphragm plate (P/N 107), and actuator diaphragm (P/N 108). Note that the curved ends of the actuator plates are always facing the diaphragm.

4. At this point is desired the actuator bushing O-rings (P/N 32 inner seal) can be replaced. Remove the lower diaphragm plate (P/N 109), lower case cap screws* (P/N 114) and remove the lower diaphragm case* (P/N 110). Unscrew counterclockwise actuator bushing (P/N 31) and slip it off actuator shaft (P/N 30). Remove O-rings (P/N 32, 33, 34) and carefully install new ones. While the lower diaphragm case (P/N 110) is removed the gasket (P/N 117) can be replaced if desired. Then reassemble unit. (A suitable Teflon based lubricant can be applied to the actuator shaft for easier installation of actuator bushing).

*Note: P/N 114 and P/N 110 need only to be removed if replacing flat-top gasket P/N 117.

5. Place the new diaphragm (P/N 108), upper diaphragm plate (P/N 107), and nut with washer (P/N 106) on the threaded end of the actuator shaft (P/N 30), and tighten the nut being careful to see that the thru holes of the diaphragm match those in the lower diaphragm case (P/N 110).

6. Now insert the case bolts (P/N 112) upward through the lower diaphragm and install the upper diaphragm case, being careful to see that the air connection is rotated to the correct position.

7. After installing the case nuts (P/N 111) tighten them with a wrench evenly all around. Reconnect the air line and the unit is now ready for operational service.

Replacing the Valve Body Diaphragm:
Depending on the type of service for which the valve is being used, it may be necessary to periodically replace the body diaphragm.

1. Remove or drain pressure from the pipeline into which the diaphragm valve is installed.

2. Make sure that the operating air pressures are exhausted from the actuator.

3. Loosen and remove the bonnet nuts (P/N 23) and lift off the bonnet and actuator assembly from the valve body. Activate air supply in upper diaphragm case (P/N 104) to lower body diaphragm assembly (until compressor pin (P/N 17) is below bottom of flat-top bonnet (P/N 2A).

4. Using a hole punch (see Figure 20), drive compressor pin (P/N 17) out to remove compressor (P/N 16) and body diaphragm (P/N 19).

5. Remove diaphragm cap screws (P/N 20) to release body diaphragm (P/N 19) from the compressor (P/N 16) and replace with new diaphragm. (Diaphragm must be compatible with process fluid.) Do not over tighten diaphragm cap screws (P/N 20) and tighten evenly when reassembling.

6. Reinstall compressor pin (P/N 17) in compressor (P/N 16) and through actuator shaft hole (P/N 30), being sure compressor pin (P/N 17) is installed evenly on each side.

Note: Correct hole punch diameter (see Figure 20) should be used to avoid damaging compressor pin (P/N 17) during assembly and reassembly.

7. With the new diaphragm in place, mount the bonnet and actuator on the valve body and install the bonnet bolts and nuts (P/N 22, 23). At this time, the nuts should be finger-tight.

8. Now apply closing air pressure to the actuator to seat the valve diaphragm in the body for alignment. Then reopen the valve and tighten nuts evenly to torques given on Figure 4 and 5, Page 1. The unit is now ready for operational service. After valve has been in service for 24 hours at operating pressure and temperature re-torque bonnet bolts.

AA - AIR TO OPEN - AIR TO CLOSE

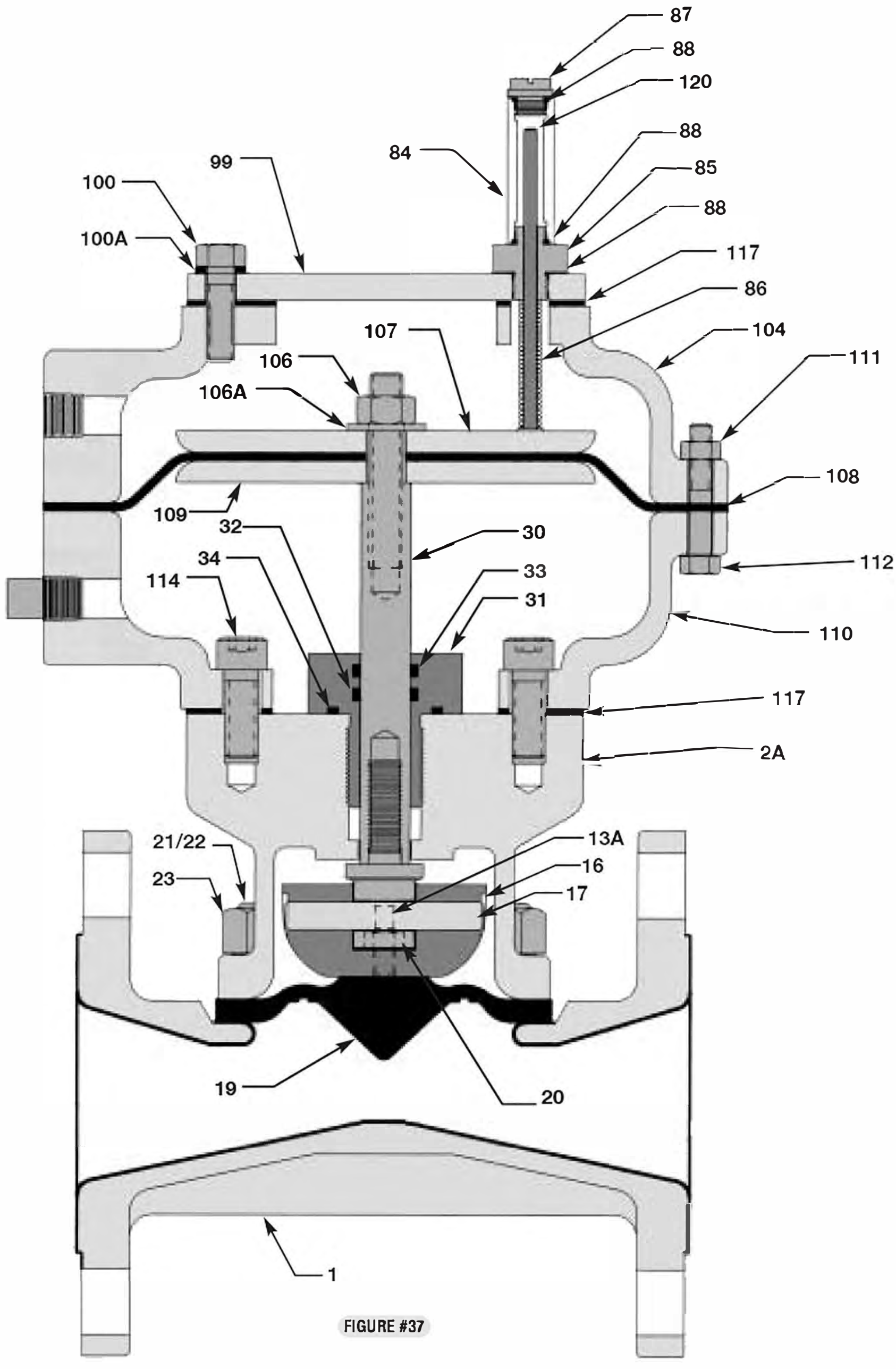


FIGURE #37

AA - AIR TO OPEN - AIR TO CLOSE

Tru-Tech Diaphragm Valve, Pneumatic Operated
"AA" Double Acting, Air to Open, Air to Close, Fails Part Open
Material List

NO.	DESCRIPTION	STANDARD MATERIAL
1	BODY	**
2A	FLAT-TOP BONNET	CAST IRON A126 CLASS B
13A	TELL-TALE PIPE PLUG	POLYURETHANE
16	COMPRESSOR	CAST IRON A126 CLASS B
17	COMPRESSOR PIN *	STEEL, (COMM.)
19	DIAPHRAGM *	MATERIAL AS SPECIFIED
20	DIAPHRAGM CAPSCREWS	18-8 STAINLESS STEEL
21/22	BONNET STUDS OR BOLTS	STEEL GRADE 2, ZINC PLATED
100A	TOP PLATE BOLT SEAL	STEEL GRADE 2, ZINC PLATED, BUNA-N
23	BONNET NUTS	STEEL GRADE 2, ZINC PLATED
30	ACTUATOR SHAFT ASSEMBLY	303 STAINLESS STEEL
31	ACTUATOR BUSHING	NYCAST NYLOIL
32	ACTUATOR BUSHING INNER SEAL *	BUNA-N, 70 DURO
33	ACTUATOR BUSHING WIPER RING *	BUNA-N, 70 DURO
34	ACTUATOR BUSHING LOWER SEAL *	BUNA-N, 70 DURO
104	UPPER DIAPHRAGM CASE	CAST IRON A126 CLASS B
106	DIAPHRAGM NUT	STEEL ZINC PLATED, HIGH STRENGTH
107	UPPER DIAPHRAGM PLATE	DUCTILE IRON GR. 65-45-12
108	ACTUATOR DIAPHRAGM *	NITRILE RUBBER W/NYLON
109	LOWER DIAPHRAGM PLATE	DUCTILE IRON GR. 535 GR. 65-45-12
110	LOWER DIAPHRAGM CASE	CAST IRON A126 CLASS B
117	GASKET *	NITRILE RUBBER
111	CASE NUT	STEEL GR. 5, ZINC PLATED
112	CASE BOLT	STEEL GR. 5, ZINC PLATED
114	LOWER CASE CAPSCREWS	ALLOY STEEL, BLACK FINISH
120	INDICATOR ROD	PVC
106A	DIAPHRAGM WASHER	STEEL, ZINC PLATED
99	TOP PLATE	STEEL, EPOXY COATED
100	TOP PLATE BOLTS	STEEL GR.5 ZINC PLATED
84	CLEAR ENCLOSURE	CLEAR POLYCARBONATE
85	INDICATOR ROD BUSHING	BRONZE
86	INDICATOR ROD SPRING *	SPRING STEEL
87	ENCLOSURE CAP	POLYETHYLENE
88	ENCLOSURE CAP O-RING	BUNA-N, 70 DURO

FIGURE #38

* RECOMMENDED SPARE PARTS

** AS SUPPLIED, (DUCTILE IRON A536 GR. 65-45-12, CAST IRON A126 CLASS B, 316 STAINLESS STEEL CF-8M. ALLOY 20 CF-7M. CAST STEEL WCB

DIAPHRAGM VALVE BODY LININGS AVAILABILITY

SOFT NATURAL RUBBER: Good in either wet or dry abrasive services, water, and some acids and alkalis. Soft natural rubber has one of the best abrasion resistances when strong chemicals are not present. Temperature -30 to 180°F

HARD RUBBER: Hard rubber is a good general chemical resistant lining that can be used in higher temperatures than its soft counterpart. Temperature -30 to 200°F

GRAPHITE BASED HARD RUBBER: Graphite hard rubber has a good chemical resistance and at higher temperatures than the normal hard and soft natural rubbers. Max Temperature 250°F

EPDM: (Ethylene Propylene Diene Monomer) The most popular general-purpose material. Excellent chemical resistance to a wide variety of corrosive elements including acids, caustics and hot water. It is abrasion resistant and good for high temperature services. EPDM has poor oil resistance. It is also satisfactory for intermittent steam sterilization. Temp -30 to 300°F

NEOPRENE: Widely used in wastewater applications. A good choice for general-purpose chemical resistance where the media contains entrained oils. It also resists aldehydes, certain alcohols, fertilizers, explosives, petroleum, air, acids alkalis, and is abrasive resistant. Finally, in most cases is interchangeable with Buna-N (Nitrile) Rubber. Temperature -30 to 200°F

BUNA-N: (Nitrile Butadiene Rubber) is a general-purpose oil resistant polymer known as nitrile rubber. It is a copolymer of butadiene and acrylonitrile. Buna-N has a good solvent, oil, water, and hydraulic fluid resistance. It displays good compression set, abrasion resistance, and tensile strength. Nitrile should not be used in highly polar solvents such as acetone and methyl ethyl ketone, nor should it be used in chlorinated hydrocarbons, ozone, or nitro hydrocarbons. In most cases it is interchangeable with Neoprene. Max Temperature 275°F

BUTYL: A good choice for gases because it has a very low vapor and gas permeability. Also good for many acids and alkalis. Good for applications involving steam sterilization. Temperature -20 to +250°F

CHLOROBUTYL: Chlorobutyl has excellent abrasion and corrosion resistant properties. The maximum recommended temperature for Chlorobutyl is 180°F.

POLYPROPYLENE: A general purpose lining with good chemical and temperature resistance. Utilized for water treatment, chemical processing, most plating fluids, and steel mill pickling lines, foodstuff, and drinking water. Temp: -10 to +200°F

ECTFE (HALAR): (Ethylene Chlorotrifluoroethylene) Excellent wear and abrasion qualities, excellent corrosion resistance, low coefficient of friction, and excellent electrical properties. Maximum use temperature 350°F

ETFE (TEFZEL): (Ethylene Tetrafluoroethylene) Outstanding resistance to chemicals and strong acids. Also has high abrasion resistance for tough services. Below 350°F has no known solvent.

PTFE (XYLAN): (Polytetrafluoroethylene) Good wear resistance, low coefficient of friction, and fair corrosion resistance. Use Temperature 450-500°F

DIAPHRAGM VALVE BODY LININGS AVAILABILITY

PFA: (Perfluoroalkoxy) Good wear and abrasion qualities, excellent corrosion resistance, low coefficient of friction, and excellent release capabilities. Max use temperature 525°F

PVDF (KYNAR): (Polyvinylidene Fluoride) Offers very low permeability. A strong, tough abrasion resistant fluorocarbon material resistant to most acids, bases, and organic solvents. It is ideally suited to handling wet or dry chlorine, bromine, and other halogens. Temperature -10 to +275°F.

FEP: (Fluorinated Ethylene Propylene) Good wear and abrasion qualities, excellent corrosion resistance, low coefficient of friction, and excellent release characteristics. Max use temperature 400°F

VITON: Offers exceptional resistance to oils, most chemicals and many solvents at elevated temperatures. It can be used in most applications involving mineral acids, salt solutions and chlorinated hydrocarbons. Viton is not recommended for ammonia, its derivatives or polar solvents, e.g. Acetone. -20 to 300°F

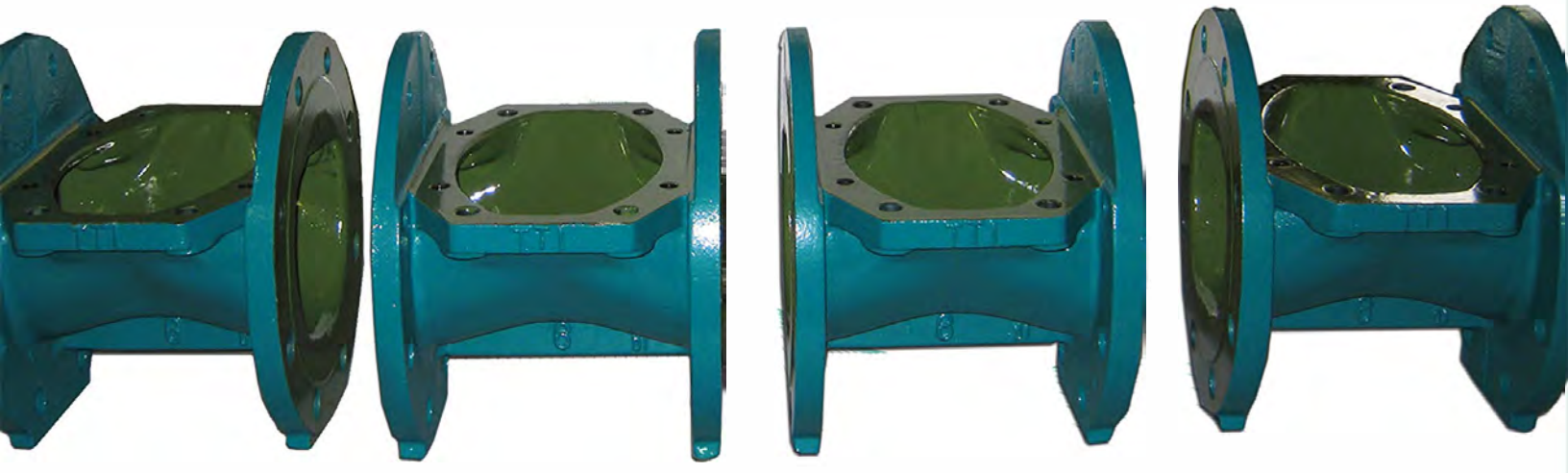
BLUE GLASS (CHEM): Intended for viscous chemical applications such as wastewaters where a smooth lining is necessary to prevent process media from sticking to the walls of the valve.

GREEN GLASS (NON-CHEM): Intended for non-chemical applications such as wastewaters where a smooth lining is necessary to prevent viscous fluids from sticking to the walls.

POLYURETHANE: Polyurethane has excellent abrasion resistance. Temperature -30-150°F

FDA EPOXY: Good wear and abrasion qualities, good corrosion resistance. Max use temperature 212°F.

PVC: PVC has resistance to a variety of chemicals including oxidizing acids and provides excellent abrasion resistance. Max use temperature 160°F.



NOTES

TRU-TECH VALVE

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