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## **INSTRUCTIONS – MAINTENANCE FOR TYPE 93T Pilot Operated Safety Relief Valves**

The intent of these instructions is to acquaint the user with the storage, installation and operation of this product. **Please read these instructions carefully before installation.**

### **WARNING**

Removal of the seal wires in an attempt to adjust and/or repair this product by unauthorized or unqualified persons voids the product warranty and may cause damage to equipment and serious injury or death to persons.

The product is a safety related component intended for use in critical applications. The improper application, installation or maintenance of the product or the use of parts or components not manufactured by Anderson Greenwood Crosby may result in a failure of the product.

Any installation, maintenance, adjustment, test, etc. performed on the Product must be done in accordance with the requirements of all applicable Anderson Greenwood Crosby Procedures and Instructions as well as applicable National and International Codes and Standards.

### **SAFETY PRECAUTIONS**

When the pressure relief valve is under pressure never place any part of your body near the pilot exhaust nor the outlet of the main valve.

The main valve outlet should be piped or vented to a safe location.

Always wear proper safety gear to protect head, eyes, ears, etc. anytime you are near pressurized valves.

Never attempt to remove the pressure relief valve from a system that is pressurized.

Never make adjustments to or perform maintenance on the pressure relief valve while in service unless the valve is isolated from the system pressure. If not properly isolated from the system pressure, the pressure relief valve may inadvertently open resulting in serious injury.

Remove the pressure relief valve prior to performing any pressure testing of the system.

The safety of lives and property often depends on the proper operation of the pressure relief valve. The valve must be maintained according to appropriate instructions and must be periodically tested and reconditioned to ensure correct function.

### **STORAGE AND HANDLING**

Pressure relief valve performance may be adversely affected if the valve is stored for an extended period without proper protection. Rough handling and dirt may damage, deform, or cause misalignment of valve parts and may alter the pressure setting and adversely affect valve performance and seat tightness. It is recommended that the valve be stored in the original shipping container in a warehouse or as a minimum on a dry surface with a protective covering until installation. Inlet and outlet protectors should remain in place until the valve is ready to be installed in the system.

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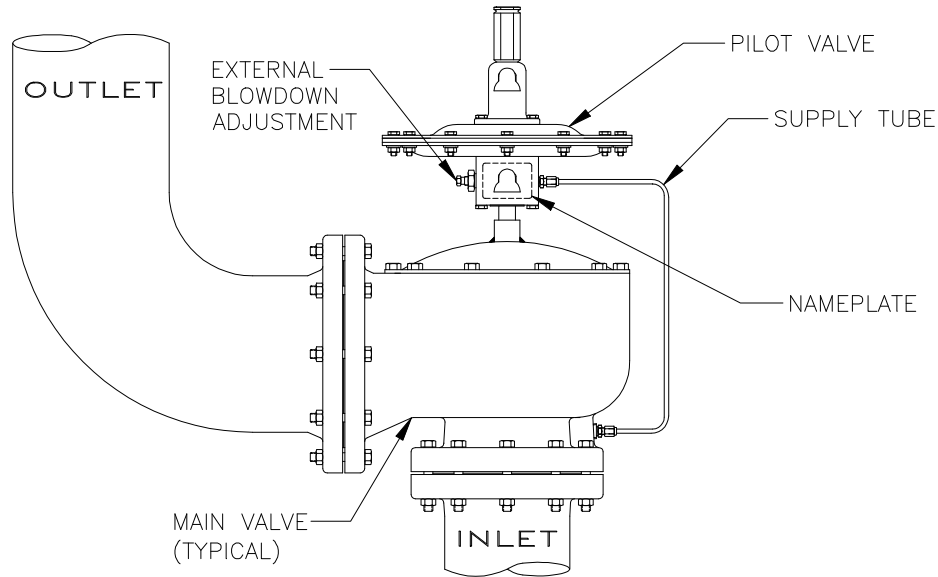
**1.0 GENERAL VALVE DESCRIPTION & START-UP**

FIGURE 1

05-9040-082-FIG1.DWG

**1.1 OPERATION**

The AGCO Pilot Operated Safety-Relief Valves utilize the principle of back-loading the top, or large area, of a differential area diaphragm with line pressure to hold the diaphragm closed up to set pressure. At set pressure the pilot valve relieves, partially evacuating the dome (volume above the diaphragm) and the seat assembly lifts permitting discharge from the main valve. When the pilot reseats, line pressure is diverted to the dome closing the main valve.

**1.2 INSTALLATION**

Both inlet and outlet may be standard ANSI or DIN flange connections and are to be installed in accordance with accepted piping practices.

The installed position of the safety valve should be in the upright position as shown in Figure 1.

When remote pressure pick-up is used the pilot supply tube is connected to a remote location rather than to the inlet neck of the valve. If a block valve is used in the remote pilot supply line, be sure it is opened before pressurizing the system or opening the isolating block valve under the main valve, if one is used.

NOTE: Remote pressure pick-up piping must have the equivalent flow area of 1/2" tubing for lengths up to 20 feet. For lengths greater than 20 feet, larger tubing or pipe should be used.

### 1.3 START-UP

There must be pressure at the valve inlet to establish a differential in force across the diaphragm and "load" it in the closed position. Pressure must pass through the pilot supply tube and pilot, and exert force on the diaphragm. On normal start-up, the valve loads itself without incident as pressure increases.

Block valves are often used under safety valves in order to isolate them when maintenance is required. When putting the safety valve in service be sure the block valve is fully opened. If the block valve is opened after system start-up, the safety valve, may briefly vent to the atmosphere before the dome gets pressurized. It will then close off positively.

## 2.0 MAIN VALVE MAINTENANCE (Refer to Figure 2)

### 2.1 DISASSEMBLY

Remove the cap bolts, lift the cap from the valve body and lift the diaphragm, seat and guide from the valve. Remove the seat bolt(s) to separate the diaphragm from the seat, guide, and retainer plates.

### 2.2 REPAIR

Inspect the nozzle seating area for nicks or scratches. If they cannot be removed with crocus cloth or fine sandpaper, the nozzle must be remachined. The nozzle may be removed from the body. Machining of the 93T nozzles should be limited to .06" material removal since the diaphragms used in these valves have a shallow dish.

To replace the film seat, remove the retainer screws and ring and lift the primary film seat and secondary seat from the seat plate. Install a new film seat by placing the film over the seat plate with the edges of the film extending beyond the outside diameter of the plate. Place the secondary seat on the film and the retainer with those in the seat plate and press the retainer down evenly over the seat plate ridge. Larger size valves may require that the retainer be pulled into place with the retainer screws. Start several screws in opposite holes using the screws to pierce through holes in the film and tighten one thread at a time.

NOTE: The film must be stretched tight and be free of wrinkles and scratches to insure a bubble tight seal.

Install the remaining screws in the seat retainer, trim the excess film from the outer diameter and cut a hole in center for the seat bolt.

### 2.3 ASSEMBLY

Reassemble the diaphragm, seat and guide in the reverse order of disassembly. Apply a light film of lubricant to all threaded parts. Care should be taken to adequately tighten the seat bolt(s) on those valves with guides to prevent the diaphragm from pulling away from the bolt under pressure.

NOTE: The 8", 10" and 12" main valve diaphragms have a 1/4" diameter hole in the center to allow dome pressure to pressurize the film seat. Make sure all replacement diaphragms have this hole. If the film seat is not pressurized, the main valve seat will seal off.

Carefully insert the guide squarely into the nozzle and lower the diaphragm assembly into place. Align the holes on the diaphragm O.D. with those on the body. The body seal gasket or ring is placed between the diaphragm and body. Replace the cap and bolts and cross-torque bolts to 50 ft-lbs.

Refer to Page 17 for Soft Goods Repair Kits.

NO.	DESCRIPTION
1	DIAPHRAGM RETAINER (2)
2	CAP
3	SEAT RETAINER
4	NOZZLE
5	PRIMARY SEAT
6	SPRING PIN (1)
7	GUIDE SPRING
8	DIPPER TUBE
9	GUIDE
10	BODY
11	SECONDARY SEAT
12	SEAT PLATE
13	DIAPHRAGM
14	TOP PLATE
15	PILOT VALVE
16	SEAL, BODY
17	GASKET, NOZZLE
18	SEAL-BOLT

(1) USED IN 6" AND LARGER VALVES ONLY.  
 (2) USED IN 3" THRU 6" SIZE ONLY.

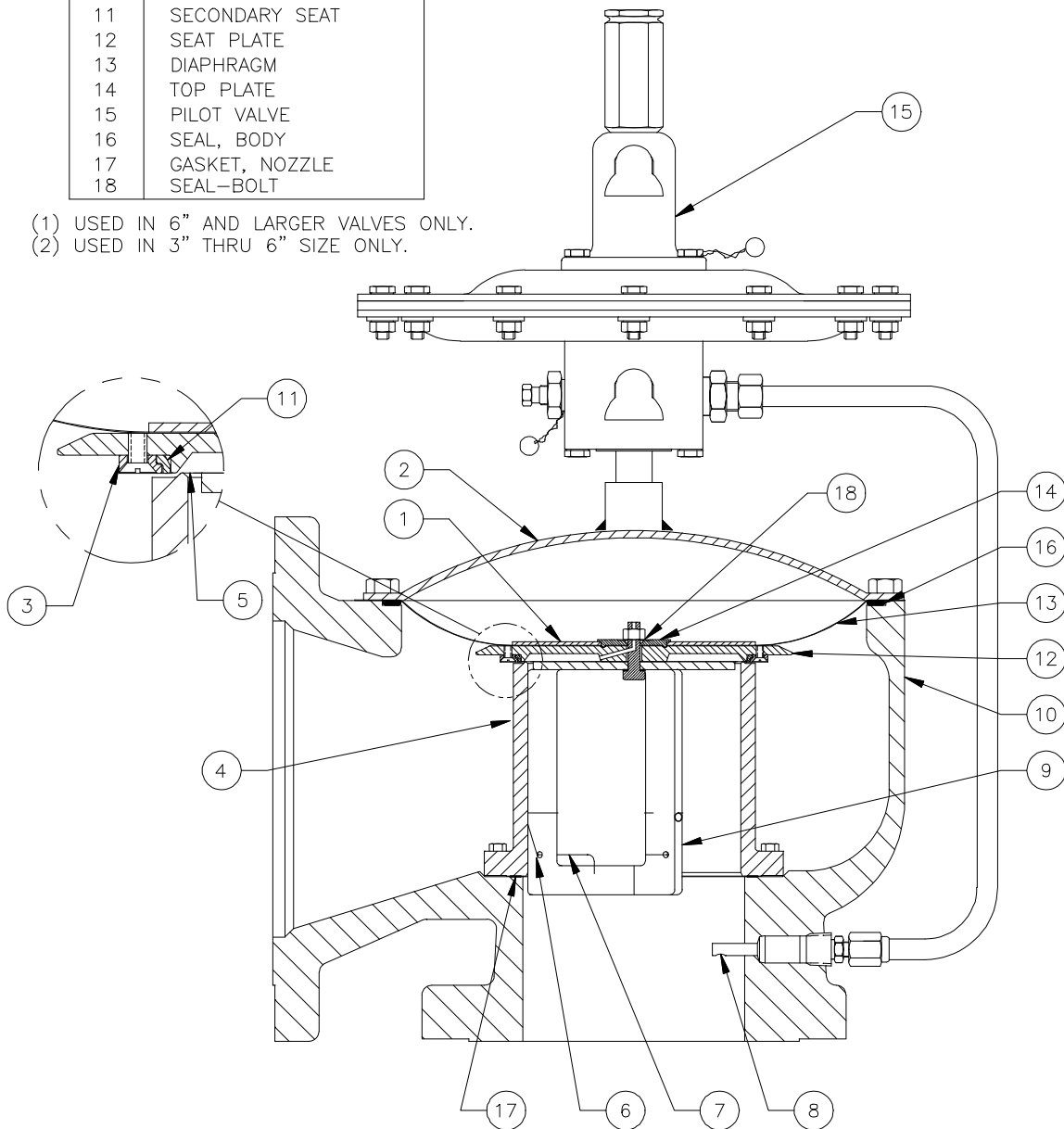


FIGURE 2

### 3.0 PILOT MAINTENANCE (Refer to Figure 3)

#### 3.1 DISASSEMBLY

To facilitate assembly, place all parts removed in an orderly arrangement so the correct parts are assembled in the proper sequence. Refer to Figure 3 for parts description and location.

3.1.1 Begin by removing spring bonnet (Remove the spring compression before attempting to remove bonnet). Remove case bolts and upper case. Loosen tube fittings on boost tube at lower case and body. Remove spindle nut while holding hex spacer. Remove diaphragms, sense boost plates and spacers. Remove lower case and spindle/seat assembly. Remove blowdown adjustment screw and supply port tube fitting.

3.1.2 Clean all parts and replace all soft goods.

The nozzles used in these pilots can be reworked, if scratched, by lapping flat to a 2 microinch finish.

#### 3.2 ASSEMBLY

Assembly is done in the reverse order of disassembly. Lubricate all screw threads and end of spring adjusting screw that bears against spring washer. Use Dow Corning No. 33 Silicone grease or equivalent. When assembling pilot, the following should be observed:

3.2.1 The holes in spindle diaphragm must be aligned with all holes in the body. The small hole in lower case must be aligned with hole in body.

3.2.2 Before tightening spindle nut, align holes in lower case, spacer ring and diaphragms with case bolts.

Tighten spindle nut snugly but not excessively. Three diaphragms are sandwiched in the spindle/stack assembly and excessive tightening will damage them. Hold the hex spacer when torquing spindle nut to prevent the stack from rotating.

Teflon diaphragms are used in the pilot. Gaskets are used with each diaphragm to aid in sealing.

Refer to Page 17 for Soft Goods Repair Kits.

NO.	DESCRIPTION
1	CAP
2	PRESSURE ADJ. BOLT
3	BONNET
4	SPRING
5	SENSE PLATE
6	UPPER CASE
7	SPACER RING
8	LOWER CASE
9	BOOST SPACER
10	SPINDLE DIAPHRAGM
12	NOZZLE
13	SEAT
14	BODY
15	VENT
17	CHECK PLATE
18	PILOT DIAPHRAGM
19	BOOST PLATE
20	SENSE SPACER
21	BLOWDOWN NEEDLE
22	SEAL, BODY
23	FILTER
24	SEAT RETAINER
25	RETAINER RING
26	BONNET GASKET
27	BUSHING SEAL </td
28	BLOWDOWN SEAL
29	DIAPHRAGM GASKETS
30	DIAPHRAGM GASKET
31	BOOST TUBE SEAL

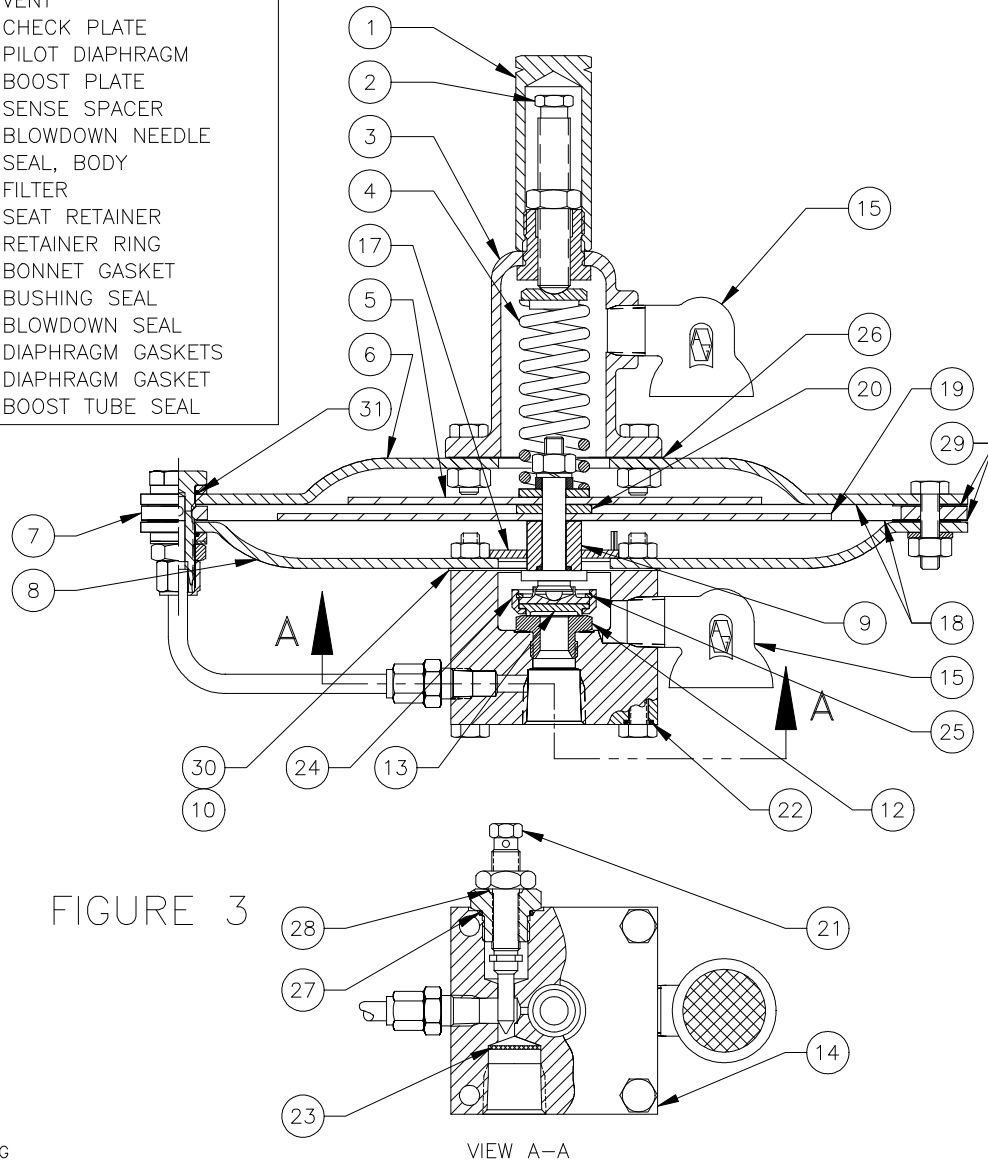


FIGURE 3

#### 4.0 PILOT ADJUSTMENT

##### 4.1 GENERAL

Two adjustments are provided; one for varying the pressure at which the pilot opens and one for varying the pressure at which the pilot closes. The first adjustment controls the "set" or "popping" pressure, the second the "reseat" or "blowdown" pressure. To adjust set pressure, a test set-up similar to that shown in Figure 4 should be used.

##### 4.2 SET PRESSURE

This adjustment is obtained by turning the pressure adjusting bolt, clockwise (in) to increase set pressure and counter-clockwise (out) to decrease set pressure.

##### 4.3 RESEAT PRESSURE

This adjustment is obtained by turning the blowdown needle adjusting screw, clockwise (in) to increase blowdown, counter-clockwise (out) to decrease blowdown. A small interaction between set pressure and reseat pressure adjustments will occur, therefore it may be necessary to readjust the set pressure after setting reseat pressure.

NOTE: If the blowdown adjusting screw has been moved or turned to either extreme, positioning it midway will aid in obtaining the corrected blowdown. There are approximately 7 to 8 turns to obtain full travel of the adjustment. Midway from either end should produce a blowdown for "snap action". For "modulating pilot action", back the adjustment screw out (counter-clockwise) to obtain the adjustment limits given in paragraph 4.5.

##### 4.4 RANGE OF ADJUSTMENT

All Pilots can be adjusted +/- 10% beyond the nameplate setting.

4.5 ADJUSTMENT TOLERANCES

Pilot (1) Action	Set Tolerance	Set Pressure Tolerance	Minimum Crack Pressure As % of Set	Supply Pressure as % of Set for Dome Pressure Recovery (2)
Snap	2"WC to 1.0 psi	+/- 3%	90	90 +/-1
	1 psi to 15 psi	+/- 3%	92 1/2	92 1/2 +/- 1/2
	-2"WC to 1.0 psi	+/- 3%	90	90 +/-1
	-1.0 psi to -14.7 psi	+/- 3%	92 1/2	92 1/2 +/- 1/2
Modulating	2"WC to 1.0 psi	+/- 3%	90	100
	1.0 psi to 15 psi	+/- 3%	92 1/2	100
	-2"WC to 1.0 psi	+/- 3%	90	100
	-1.0 psi to -14.7 psi	+/- 3%	92 1/2	100

## NOTES:

- (1) Snap Action - Dome pressure decreases rapidly with a "snap" to 15% +/- 10% of set pressure at set pressure.

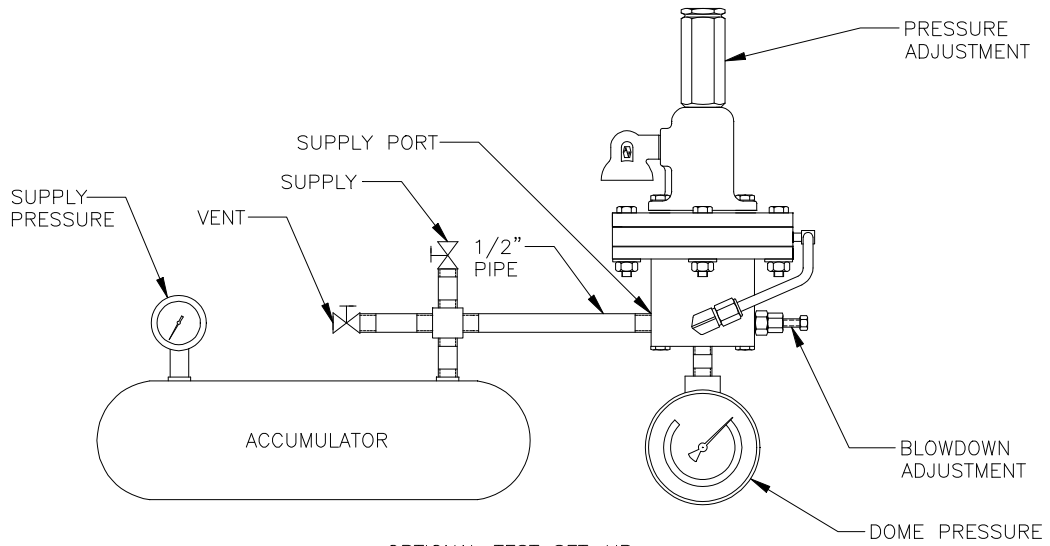
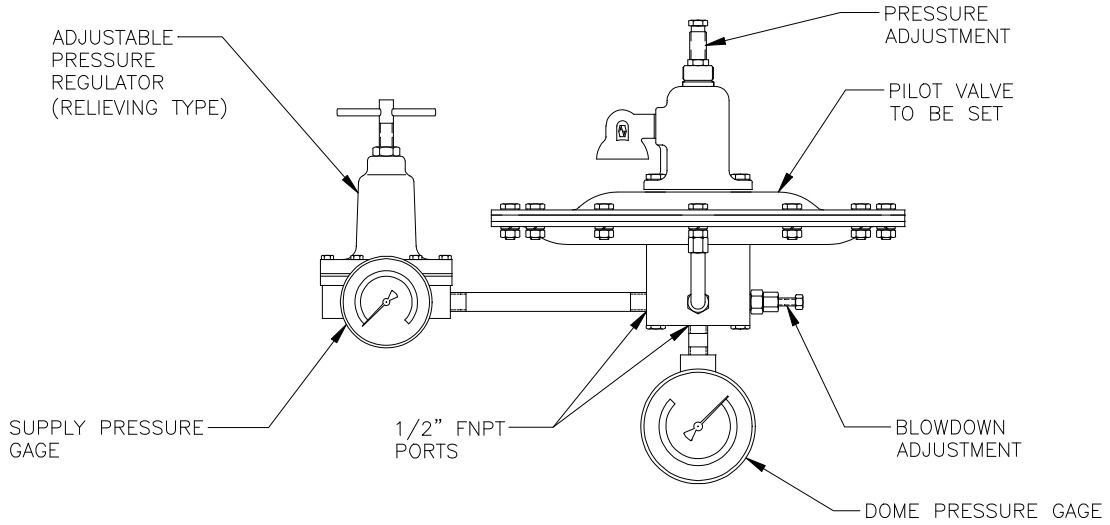
Modulating Action - Dome pressure decreases slowly to 30% +/- 5% of set pressure and recovers to 60% +/- 10% of set pressure at set pressure.

- (2) Pilot seat should be bubble tight at dome pressure recovery for "snap" pilot action and at 90% of set pressure for "modulating" pilot action non-marine.

4.6 DEFINITIONS

Set Pressure is defined as that pressure where the dome pressure is 15% of the supply pressure.

Crack Pressure is defined as the supply pressure where gas flow begins at the pilot exhaust.



OPTIONAL TEST SET-UP

FIGURE 4

5.0 ACCESSORY REPAIR

5.1 CHECK VALVE

The check valves used on the Dual Pilot, Backflow Preventer, and Field Test consist of an upper body, a lower body, and a diaphragm. Refer to Figure 5.

The check valve diaphragm is the only part that should require servicing. If the diaphragm is to be replaced, care should be taken not to scratch or distort it in the center nozzle sealing area. When reassembling the check valve, uniformly tighten the body bolts, first one side, then the opposite side until all are tight. DO NOT OVERTIGHTEN bolts as this will distort the diaphragm and cause leakage.

ITEM	DESCRIPTION
1	HEX HEAD CAP SCREW
2	UPPER BODY
3	DIAPHRAGM
4	NUT
5	LOWER BODY
6	SPRING PIN
7	LOCKWASHER
8	DIAPHRAGM SUPPORT WASHER

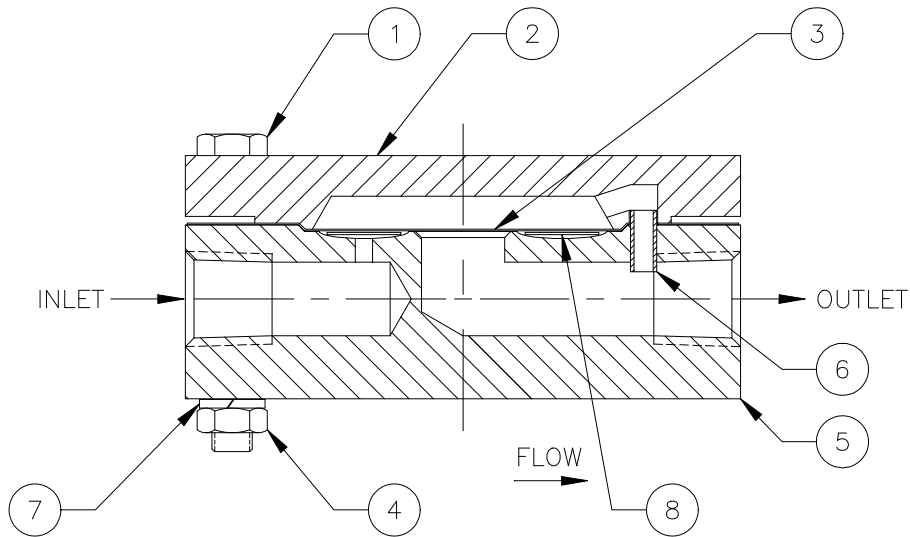


FIGURE 5

**6.0 LEAK TESTING ASSEMBLY**6.1 GENERAL

The complete valve assembly should be leak tested for internal and external leaks using a pressure equal to 10% and 90% of set.

6.2 INTERNAL LEAK TEST

Cover valve outlet with wet piece of paper and observe paper for movement. Any outward movement indicates a leak. If leakage is detected, remove paper and spray leak test solution around nozzle/seat to locate leak. Cause of leakage may be damaged nozzle seating surface or wrinkled Teflon film seat.

6.3 EXTERNAL LEAK TEST

Following the internal leak test, check for external leakage by applying leak test solution to all joints and seals. Tighten bolts or fittings as required.

**7.0 PILOT SET PRESSURE FIELD TEST PROCEDURE**7.1 GENERAL

The pilot set pressure can be checked in the field by applying an external test pressure to the pilot through the Field Test Hand Valve as shown in Figure 6.

NOTE: If the process pressure at the time of test is less than approximately 30% of the pilot set pressure, the main valve will not open. If the process pressure is greater than 30% and the main valve must remain closed, temporarily replace the pilot exhaust vent with an orifice plug having an orifice diameter of .040"/.060". This orifice must be removed on completion of Field Testing as it prevents the Main Valve from opening.

7.2 PROCEDURE

- A. Connect test gas bottle as shown in FIGURE 6.
- B. Close vent valve "C".
- C. Open Field Test Valve "B". Test gauge will read process pressure.
- D. Open Block Valve "A" SLOWLY to increase pressure until pilot "pops". The set pressure will be the pressure indicated on the test gauge at the time of pop.
- E. To remove test set up, close valves "A" and "B", open valve "C".

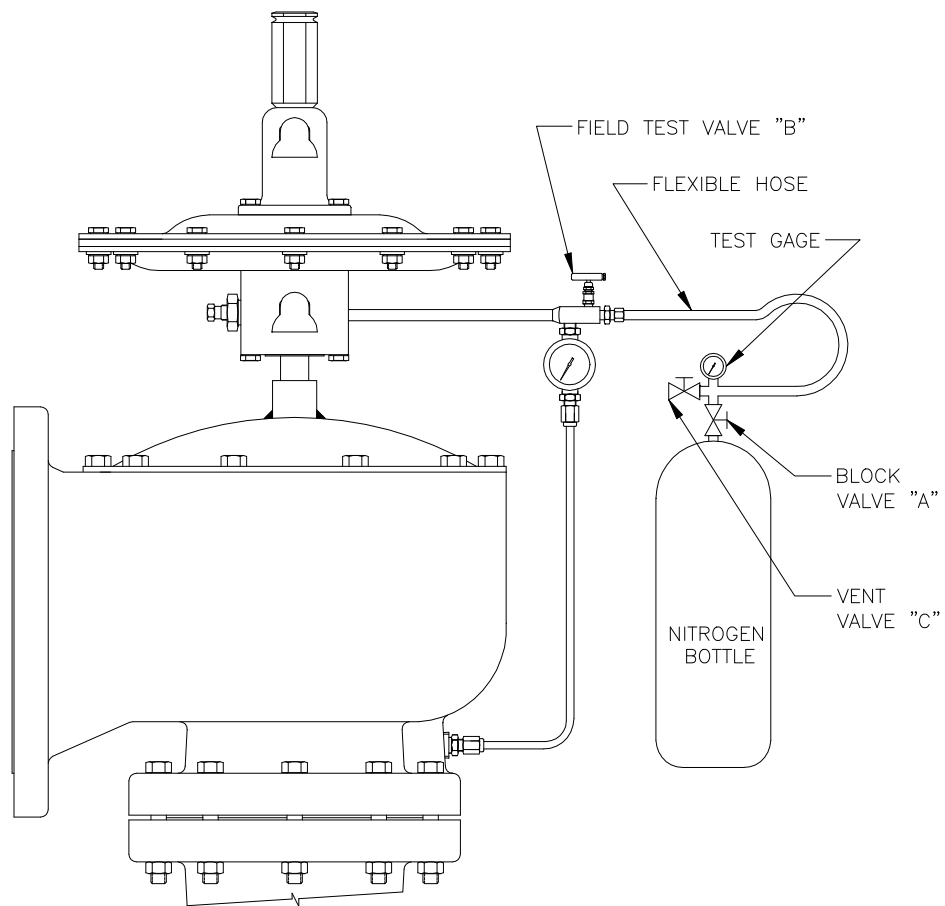


FIGURE 6

**8.0 SOFT GOODS REPAIR KITS**

Soft goods repair kits contain all the seals and seats to repair a valve. To order a kit, specify the base number and select the last three digits from the following tables. To ensure the purchase of the correct repair kit, the order should specify the valve model and serial number.

Kit Base Number: 04.4744.XXX
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**MAIN VALVE**

MATERIAL	2X3	3X4	4X6	6X8	8X10	10X12	12X16
TEFLON Below 1 psi	.083	.084	.325	.326	.327	.328	.329
TEFLON Above 1 psi	.323	.324	.325	.326	.327	.328	.329

**PILOT**

**(COMPLETE KIT CONSISTS OF DIAPHRAGM PLUS SOFT GOODS)**

LOW PRESSURE (Below 15 psi)	
VACUUM	PRESSURE
.007	.008

**BACKFLOW PREVENTER CHECK VALVE**

MATERIAL	ALL PRESSURE
TEFLON	.781