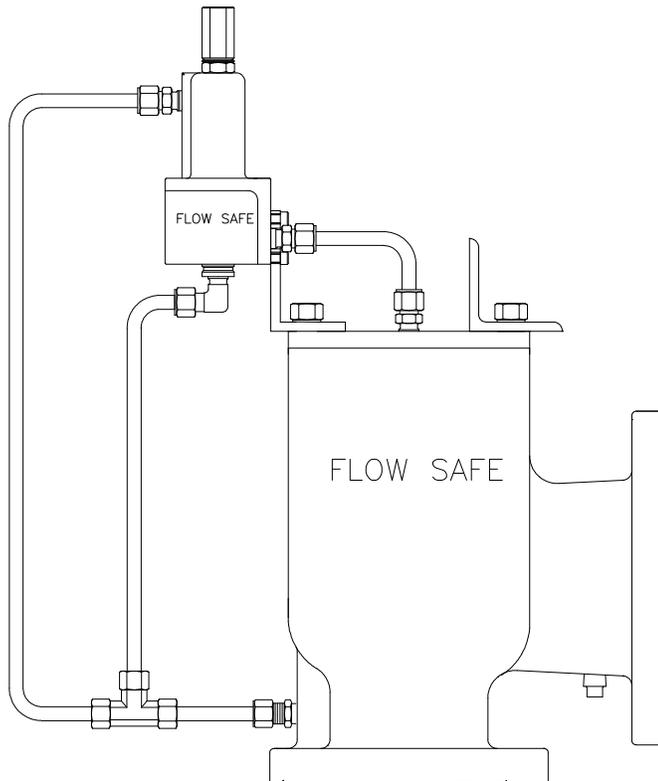




# **FLOW SAFE**

*High Performance Safety Relief Valves*

## **F70VP SERIES VACUUM RELIEF VALVE**



# **INSTALLATION, OPERATION, & MAINTENANCE MANUAL**

Revision: B  
Date of Issue: Oct. 2, 2015

Approved by: GG  
Project Engineer

jwo  
Engineering Projects Director

## TABLE OF CONTENTS

<u>Topic</u>	<u>Page</u>
1.0 General .....	3
2.0 Description, Operation, Service Envelope, Installation, & Startup	
2.1 Description / Operation .....	4
2.2 Service Envelope .....	5
2.3 Installation.....	6
2.4 Startup .....	6
3.0 Main Valve Maintenance	
3.1 Disassembly of the F70VP Series Main Valve .....	7
3.2 Reassembly of the F70VP Series Main Valve.....	10
4.0 Pilot Valve Maintenance	
4.1 F100 Pilot Valve (High pressure: 2 – 14.6 psi vac) .....	11
4.2 F100 Pilot Valve (Low pressure: 0.36 – 5 psi vac) .....	13
5.0 Pilot Valve Set Pressure Adjustment .....	15
6.0 Final Assembly Testing.....	16
7.0 Troubleshooting Guide .....	18
8.0 Softgoods Kits .....	19

## 1.0 GENERAL

1) This manual is intended to provide users with direction and guidance for the maintenance of FLOW SAFE F70VP Series vacuum relief valves. This manual indicates the proper method of valve disassembly, soft goods replacement, and valve reassembly. FLOW SAFE provides this manual as a guideline and reference only. It is not intended to serve as a training manual or manufacturing guide. FLOW SAFE assumes no responsibility for personal or property damage that may occur in conjunction with this manual.

2) FLOW SAFE recommends that all valves be placed on a regular maintenance schedule that includes the routine replacement of softgoods. FLOW SAFE recommends softgoods replacement every three years but cautions that each customer make their own determination and set their own schedule based upon use and environment. FLOW SAFE believes that when maintenance and reassembly is performed as outlined in this manual there is no safety hazard.

Cycling the valve at least once a year is considered to be good practice to verify operation.

3) When a new valve leaves FLOW SAFE, it has been manufactured and tested by trained and experienced personnel. When you remove a valve from your system and perform the maintenance tasks that are outlined herein you will need proper training.

Do **not** attempt to accomplish these tasks without adequate training and understanding of the valve operation.

4) Any and all stated or implied warranties that are in effect during the purchase of a new FLOW SAFE valve are null and void once the valve has been disassembled by someone other than approved FLOW SAFE personnel.

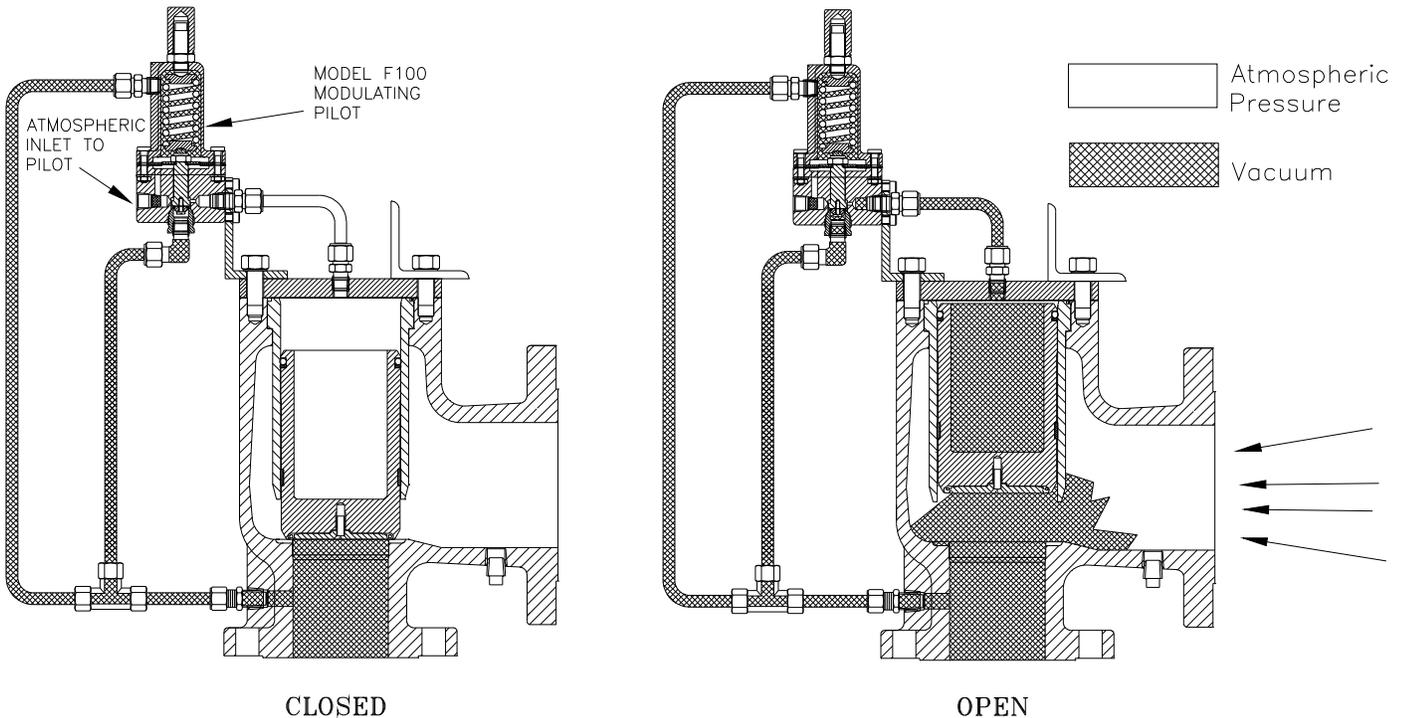
5) It is highly recommended that all instructions herein be read in full prior to any assembly, disassembly, or operation of this equipment.

6) Specific design details described in this document are subject to change without notice.

7) Should the need arise for general assistance, contact the FLOW SAFE Sales department at (716) 662-2585 or (800) 828-1036. For more detailed technical assistance, contact the FLOW SAFE Engineering department at (716) 662-2585.

## **2.0 DESCRIPTION, OPERATION, SERVICE ENVELOPE, INSTALLATION, and STARTUP**

### **2.1 DESCRIPTION / OPERATION**

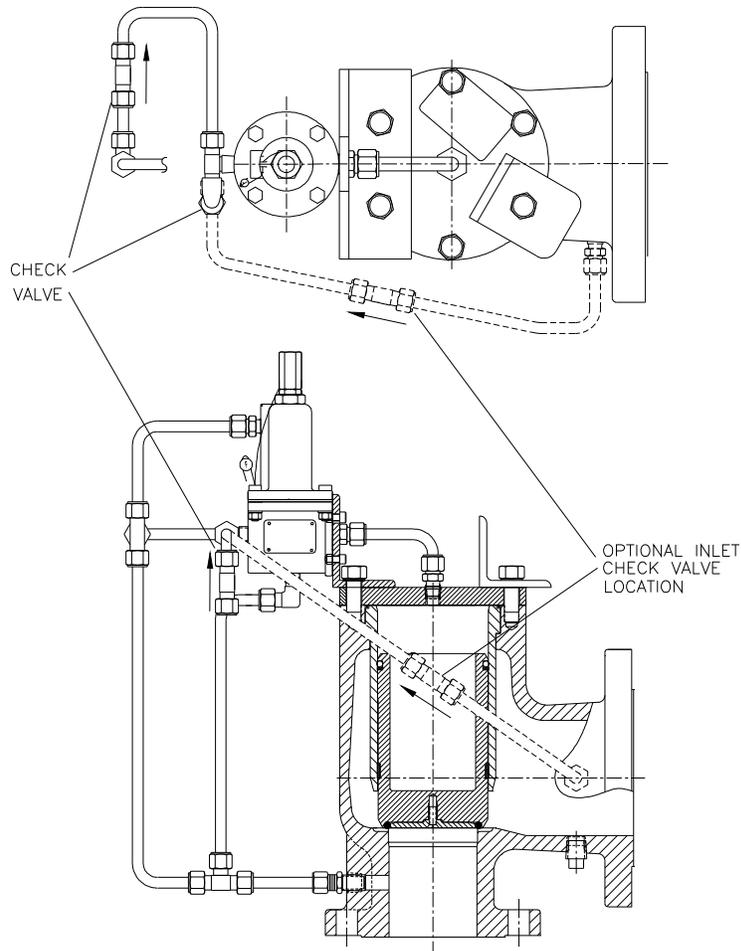


The FLOW SAFE F70VP Series vacuum relief valve provides vacuum protection with the ability to handle large volumes and provide consistent, leak-tight seating. This valve is a variation of the F70PR Series or F7000 pilot-operated relief valve, and is also intended for installations where ASME Code construction is not required. Standard construction of the main valve assembly includes threaded (in the 1 x 2 and 1-1/2 x 2 size) or ANSI 150# flanged connections.

The F70VP uses a piston in the main valve that will open under a design vacuum level. The assembly uses a modulating, flowing pilot valve (Model F100) to control piston movement at certain vacuum levels. System vacuum is present below the main valve seat, while atmospheric pressure is routed through the pilot valve and to the dome cavity of the main valve. At the designated vacuum set pressure, the pilot allows dome pressure to be drawn down to a vacuum state proportionally to demand at set pressure. The net positive upward force on the piston exerted by atmospheric pressure in the main valve outlet allows the piston to lift. Once the system vacuum condition is relieved, the pilot valve closes, which allows the dome to repressurize and main valve piston to close. When closed, atmospheric pressure exposed to the top of the piston counteracts system vacuum beneath the piston seat, creating a downward force to seat the piston. The pilot valve is leak-tight to approximately 95% of vacuum set pressure.

When furnished without a pilot, the F70VP relief valve relies on piston weight alone to open at the vacuum set point desired. Operation is the same as described herein, except that set pressure is fixed. In addition, the valve may be configured to handle a vacuum process connection at the side flange, with atmospheric inlet below the main seat. Contact Flow Safe for availability of specific vacuum set pressures and valve configurations.

For systems that normally operate on positive gage pressure, the F70VP pilot tubing must be fitted with backflow preventer check valves to keep the main valve closed when not under vacuum. A typical arrangement is shown below:



**2.2 SERVICE ENVELOPE**

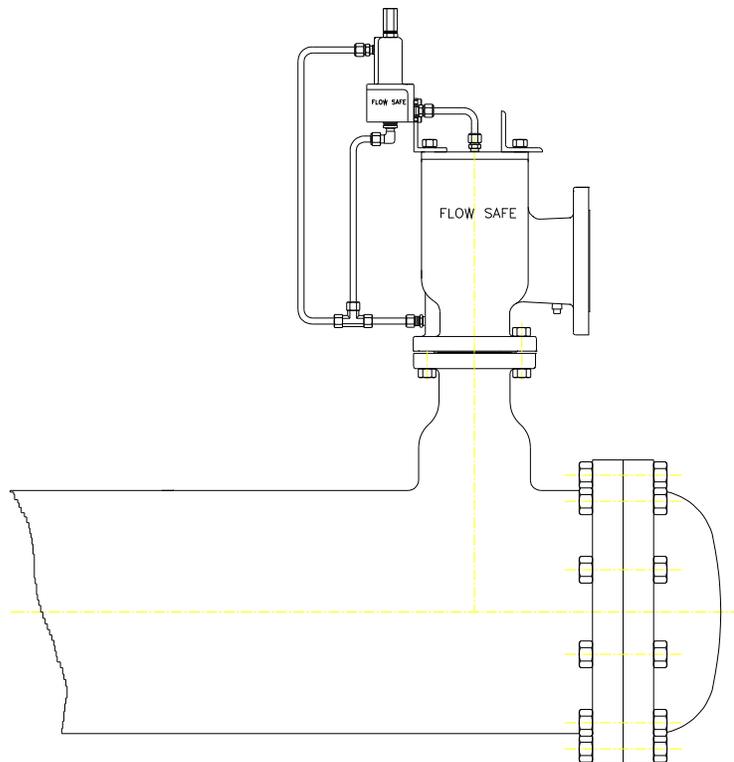
SEAT MATERIAL	PROCESS TEMP. (° F)		SET PRESSURE (3)	
	Min. (1)	Max.	Min.	Max.
Buna-N	-30	275	1 psi vac	14.6 psi vac
Viton	-30	400	1 psi vac	14.6 psi vac
EPR	-65	325	1 psi vac	14.6 psi vac
Kalrez	0	500	1 psi vac	14.6 psi vac
Neoprene (2)	-20	200	0.36 psi vac	5 psi vac

- (1) Confirm low-temperature environmental applications with factory.
- (2) Ratings based on use as low-pressure seat in 1-1/2 x 2, 2 x 3, and 3 x 4 only
- (3) "PSI VAC" as used in this document is equivalent to "negative" gage pressure; for example, 5 psi vac is approximately equal to 9.7 psia.

## 2.3 INSTALLATION

Prior to installation, check that the vacuum set pressure on the nameplate is as specified, and meets system requirements. The F70VP Series vacuum relief valve should be installed in the upright position as shown below, in accordance with accepted piping practices.

If a block valve is used below the relief valve, it should be opened before operating the system. This block valve should be locked open during normal system operation.



## 2.4 STARTUP

Foreign particles or dirt can damage the valve and make it inoperative. Prior to installation, clean out the piping thoroughly. A screen may be fastened to the open side flange on the main valve to prevent the introduction of debris. If the valve is not installed immediately, inlet and outlet connections should be protected and covered.

As soon as the valve is installed, the system may be brought to its operating pressure. Verify that the valve seat is leak-tight, in accordance with Section 6.0.

The valve is now ready for service. Inspection and maintenance should be performed on a regular basis, typically once a year, depending on the service conditions.

**3.0 MAIN VALVE MAINTENANCE**

**3.1 DISASSEMBLY OF THE F70VP SERIES MAIN VALVE**

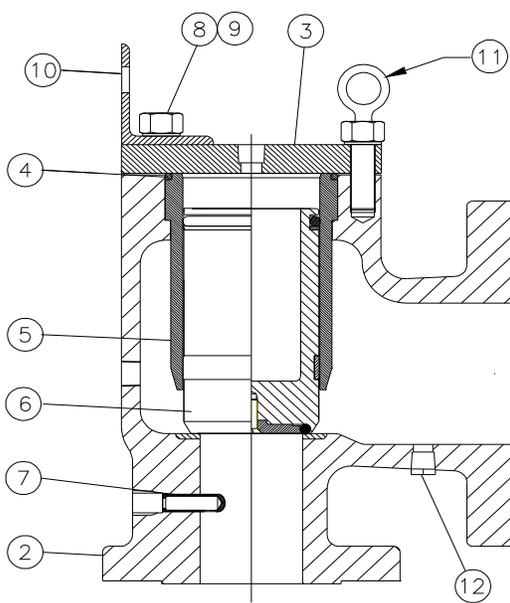
(See parts lists and illustrations on Pages 7 - 9)

**CAUTION:** It is extremely dangerous to attempt to disassemble any valve while it remains in service connected to a pressure or vacuum source.

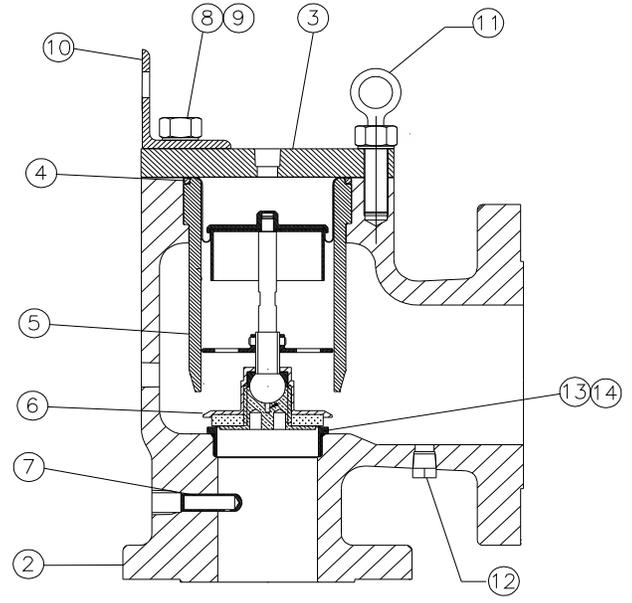
- 1) Remove the valve from service, or safely isolate the system before disassembling the valve and performing maintenance.
- 2) If necessary, remove the pilot valve and interconnecting tubing. See Section 4.0 for pilot valve maintenance.
- 3) Remove the cap bolts and lockwashers (Items 8, 9 – Pg. 8) and any lifting lugs (Item 11 – Pg. 8) to remove the cap (Item 3 – Pg. 8).
- 4) With the cap removed, remove the top liner seal (Item 4 – Pg. 8). If the valve is a low pressure 1-1/2 x 2, 2 x 3, or 3 x 4, the rolling diaphragm (Item 13 – Pg. 9) must be carefully lifted up.
- 5) Carefully reach into the valve and remove the piston assembly (Item 6 – Pg. 8). Larger pistons may have an interior threaded hole into which a cap bolt can be inserted to use for lifting. In high pressure assemblies, do not be alarmed if the liner (Item 5 – Pg. 8) comes out with the piston assembly. Care must be taken during this removal because any damage might result in an eventual sealing problem when the valve is reassembled.
- 6) The liner may then be removed; again, care must be taken not to damage the liner. Do not attempt to pry or force the liner out as you may score the surface and cause a sealing problem. Note that on valves 4" x 6" and larger, there is a second liner O-ring seal in the main valve counterbore where the liner is supported.
- 7) To remove the piston seat (Item 3 – Pg. 9), remove the retainer bolt/screw (Item 1 – Pg. 9), for the high pressure version, and retainer (Item 2 – Pg. 9). The low pressure retainer is threaded and needs to be unscrewed.
- 8) If the low pressure seat insert (Item 13 – Pg. 8) is damaged, unscrew it and remove the accompanying seal (Item 14 – Pg. 8) from the main valve body.
- 9) As required, install new main valve softgoods per the instructions in Section 3.2. Replacement soft goods are listed in Section 8.0 of this manual.

<b>MAIN VALVE PARTS LIST (Refer to illustrations -- Pg. 8)</b>	
<b>Item No.</b>	<b>Description</b>
2	Body
3	Cap
4	Liner seal(s)
5	Liner
6	Piston assembly
7	Pickup tube
8, 9	Cap bolts and lockwashers
10	Pilot mounting bracket (1-1/2x2 – 3x4, and all LP)
11	Lifting lug
12	Plug
13, 14	Seat insert and seal (LP only)
15	Seal and lock nut (not used on newer 3/8 NPT pickup tube connection)

**Assembly Illustration: 1-1/2" x 2" through 3" x 4"**

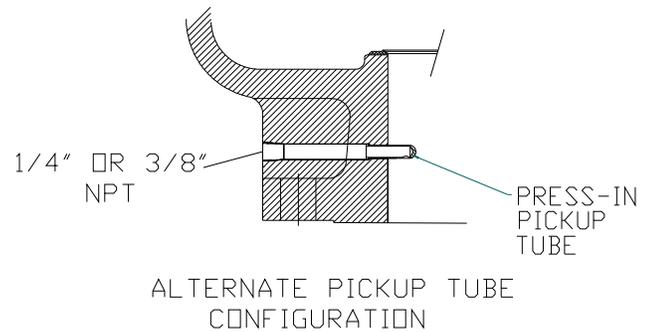
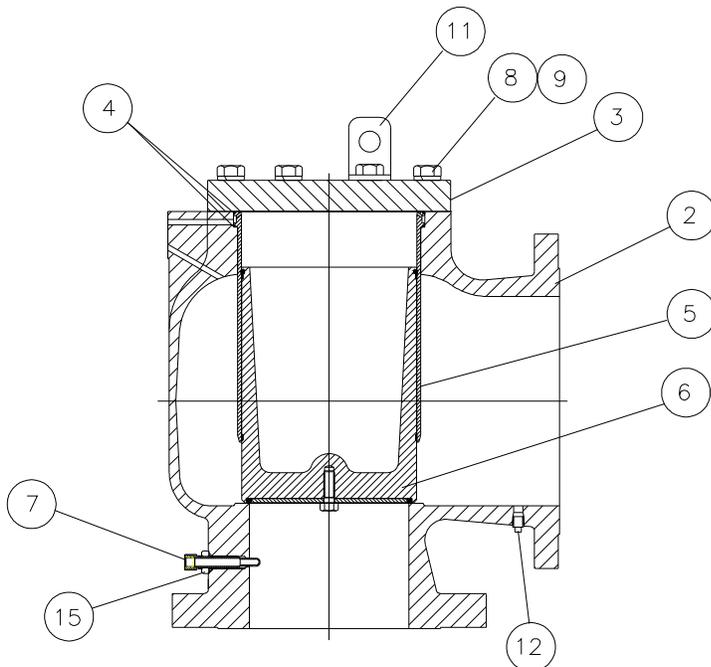


**HIGH PRESSURE  
MAIN VALVE SUBASSEMBLY  
( 5 psi vac. – 14.6 psi vac.)**

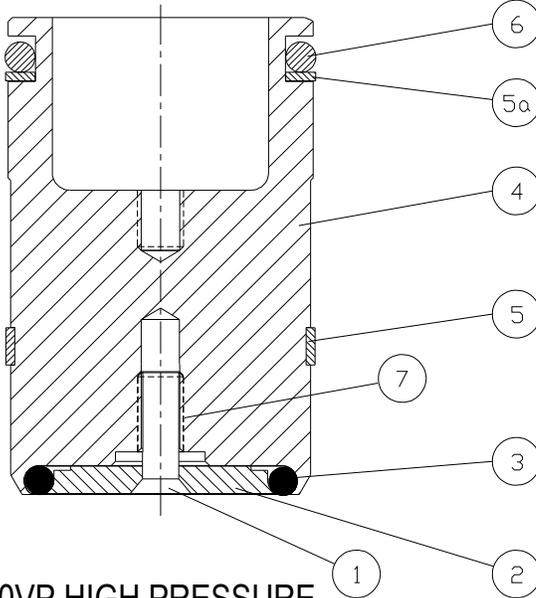


**LOW PRESSURE  
MAIN VALVE SUBASSEMBLY  
( 0.36 psi vac. – 5 psi vac.)**

**Assembly Illustration: 1" x 2" and 4" x 6" through 12" x 16"**

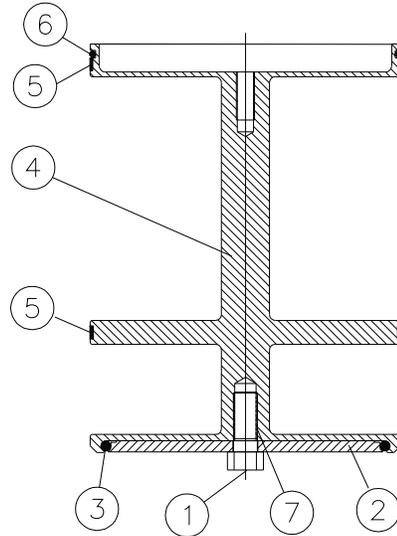


**Piston Assembly Illustrations**



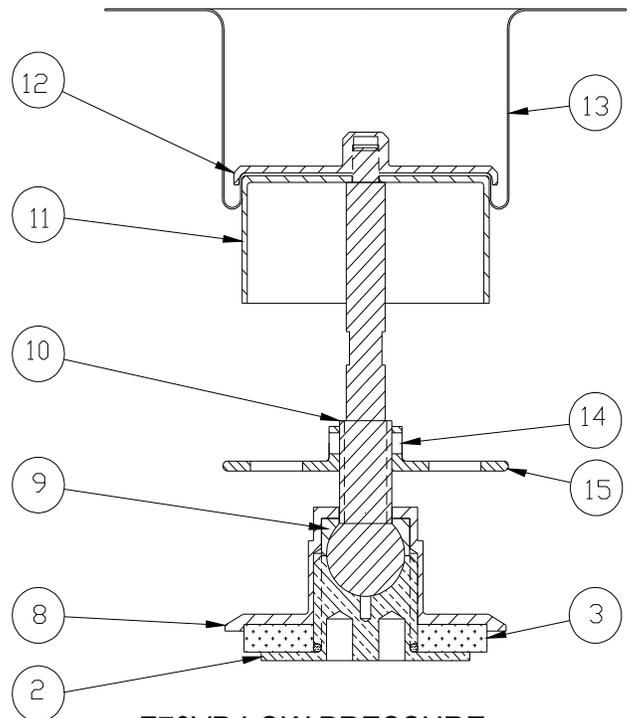
**F70VP HIGH PRESSURE  
PISTON ASSEMBLY, 1x2 – 3x4**

(On 4x6 and up: Qty. of 2 Item 5, no Item 5a;  
Item 5a optional on smaller sizes)



**F70VP LOW PRESSURE  
PISTON ASSEMBLY  
4 x 6 & 6 x 8**

<b>PISTON ASSEMBLY PARTS LIST</b>	
<b>Item No.</b>	<b>Description</b>
1	Retainer screw
2	Seat retainer
3	Seat
4	Piston body
5	Wear ring ("Slydring")
5a	Backup ring
6	Piston seal
7	Heli-Coil
8	Skirt
9	Bushing
10	Stem
11	Diaphragm guide
12	Diaphragm retainer
13	Rolling diaphragm
14	Set screw
15	Guide ring



**F70VP LOW PRESSURE  
PISTON ASSEMBLY  
1-1/2 x 2, 2 x 3, & 3 x 4**

**3.2 REASSEMBLY OF THE F70VP SERIES MAIN VALVE**

- 1) Reassembly of these valves is basically the reverse of disassembly. Care must be taken in the handling of all items, particularly sealing surfaces and softgoods. All parts should be clean and free of any debris or contaminants.
- 2) Reinstall the liner (Item 5 – Pg. 8) and liner seals (Item 4 – Pg. 8) into the body. Do not nick or excessively stretch the liner seal O-rings. The bottom O-ring (for 4 x 6 and larger) may be carefully set in its sealing area in the body before the liner is inserted, or it may be fitted onto the liner and, if necessary, held in place with a suitable lubricant (e.g., Molykote). The top liner seal should be lightly pressed into place in its groove, such that it is evenly spread around the liner circumference and will not be pinched when reinstalling the valve cap.
- 3) Insert the main seat (Item 3 – Pg. 9) into the bottom of the piston, using care to position the seat completely within the piston O-ring groove. NOTE that any scratches, gouges, or particles on the seat may result in a sealing problem. Carefully position the retainer plate (Item 2 – Pg. 9) over the seat. For high-pressure pistons, insert the retainer bolt (Item 1 – Pg. 9) and tighten firmly [NOTE: Female thread in piston must have locking thread insert (Item 7 – Pg. 9)]. For low pressure pistons, the retainer is threaded and needs to be tightened.
- 4) Install the piston seal and backup ring (if provided), or rolling diaphragm, as applicable. A light lubricant (e.g., Molykote or Lubriplate # 105) may be applied to the O-ring.
- 5) Fit the wear rings (Item 5 – Page 9) in their proper groove around the piston assembly. While holding the wear rings (especially the free ends) in place, lower the piston assembly into the liner. The piston should move freely up and down, with very little resistance from the seal and wear rings, and should fall through the liner on its own weight. It is critically important that this installation result in even seating of the soft seat onto the nozzle lip in the valve body.
- 6) After checking placement of the top liner seal [see Step (2)] and low pressure rolling diaphragm, if applicable, the valve cap can be positioned on top of the body.
- 7) The cap bolts, with washers, can then be reinserted. Apply anti-seize compound to bolt threads. The following torque values are recommended:

<u>Main Valve Size</u>	<u>Cap Bolt Size</u>	<u>Torque (ft-lbs)</u>
1-1/2x2	1/4-20UNC	8 - 10
1x2, 2x3, 3x4, 4x6	1/2-13UNC	50
6x8, 8x10, 10x12, 12x16	3/4-10UNC	120

- 8) If removed previously, reinstall the pilot valve and tubing. The pilot mounting bolts should be treated with Loctite or Vibra-tite, if available, and firmly tightened.
- 9) The main valve is now completely assembled, and should be tested per Section 6.0 before being returned to service.

## **4.0 PILOT VALVE MAINTENANCE**

### **4.1 F100 PILOT VALVE (HIGH PRESSURE: 2 – 14.6 psi vac)** (See Illustration on Page 12)

#### **A. Disassembly**

**CAUTION:** It is extremely dangerous to attempt to disassemble any valve while it remains in service connected to a pressure or vacuum source.

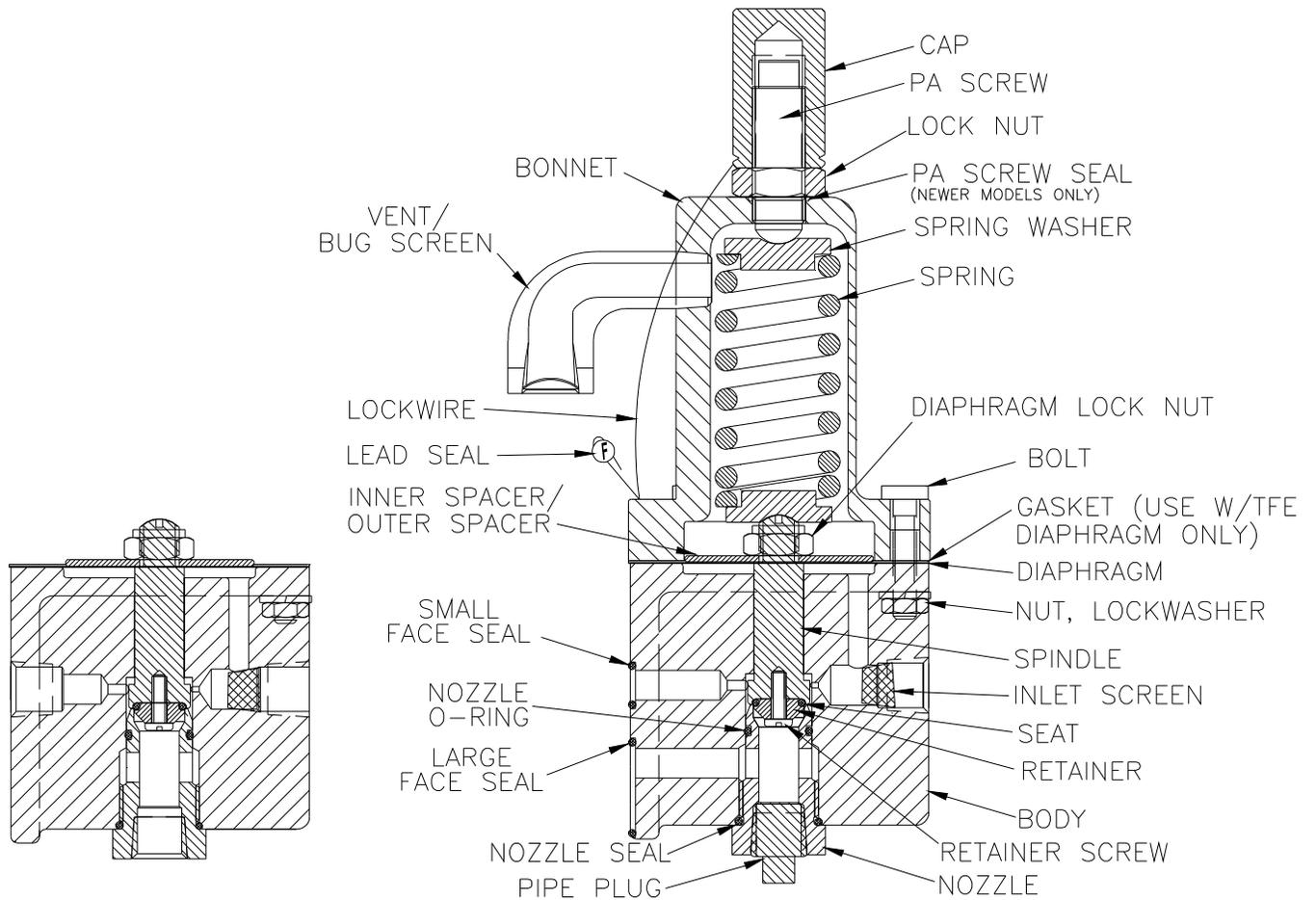
- 1) Remove the pilot valve from the main valve, or safely block the incoming pressure before disassembling the valve and performing maintenance.
- 2) Unscrew the pressure adjustment (PA) screw cap from the PA screw. Loosen the lock nut.
- 3) Loosen but do not remove the PA screw from the bonnet.
- 4) Using a 7/16" wrench, remove the bolts, nuts, and lockwashers that hold the valve body and bonnet in place. Separate the bonnet from the body. Remove spring and two spring washers.
- 5) With a 9/16" wrench on the diaphragm lock nut and screwdriver in the top of the spindle, loosen the lock nut from the spindle.
- 6) Remove inner/outer spacer(s) from the top of the valve body. Remove the diaphragm from the spindle by unscrewing it counterclockwise.
- 7) Turn the pilot valve body over and, using a 7/8" wrench, remove the nozzle and spindle. Unscrew retainer screw from spindle. Remove the retainer and seat.
- 8) Replacement soft goods are listed in Section 8.0 of this manual.

#### **B. Assembly**

**NOTE:** Exercise care in handling softgoods, nozzles, and other sealing surfaces.

- 1) Confirm vacuum setting and associated parts required per Section 5.0.
- 2) Place the valve body in a vise.
- 3) Apply Loctite to retainer screw and use it to attach seat and retainer to spindle. Insert spindle into the body. Lightly lubricate nozzle O-ring with Dow Corning 33 or equal, fit over nozzle, and then tighten nozzle into body with nozzle seal. Check that there is vertical movement of spindle assembly (0.030" minimum). With spindle in down position, check that the spindle shoulder is within +0.010" / -0.005" of top surface of body.
- 4) Carefully assemble the diaphragm to the top of the spindle by slowly turning the diaphragm clockwise on the spindle threads until it bottoms on the shoulder. Make sure that there are no tears or rips in the diaphragm material.
- 5) Assemble the spacer(s) and lock nut to the spindle. With a wrench on the nut, and a screwdriver in the top of the spindle, tighten the parts together. Apply a small drop of Loctite to the nut threads. Make sure that the spacer is centered to the extent possible.
- 6) Assemble the spring and spring washers atop the spindle.
- 7) Assemble the bonnet over the spring / washers onto the top of the diaphragm / body. **NOTE:** The gasket (shown in drawing) is only needed with the Teflon/FEP diaphragm and is installed above the diaphragm; use of the gasket with a Buna-N or Viton diaphragm may result in leakage.
- 8) Insert bolts through the four holes in bonnet and body, and fasten washers and nuts.
- 9) Tighten the bolts to a torque of 5 - 6 ft-lbs.
- 10) Insert the PA screw into the top of the bonnet and install the lock nut and seal.
- 11) Attach PA screw cap to top of PA screw, but do not tighten.
- 12) Attach the bug screen to the bonnet, if necessary, so that it is facing downwards.
- 13) The pilot valve is now completely assembled and ready to be set per Section 5.0.

**Assembly Illustration: F100 Pilot Valve (High Pressure)**



**BRACKET-MOUNT BODY**

2 x 3 AND 3 x 4 MAIN VALVES

**DIRECT-MOUNT BODY**

1 x 2, 1-1/2 x 2, 4 x 6 AND  
LARGER MAIN VALVES

**4.2 F100 PILOT VALVE (LOW PRESSURE: 0.36 to 5 psi vac)** (See Illustration on Page 14)

**A. Disassembly**

**CAUTION:** It is extremely dangerous to attempt to disassemble any valve while it remains in service connected to a pressure or vacuum source.

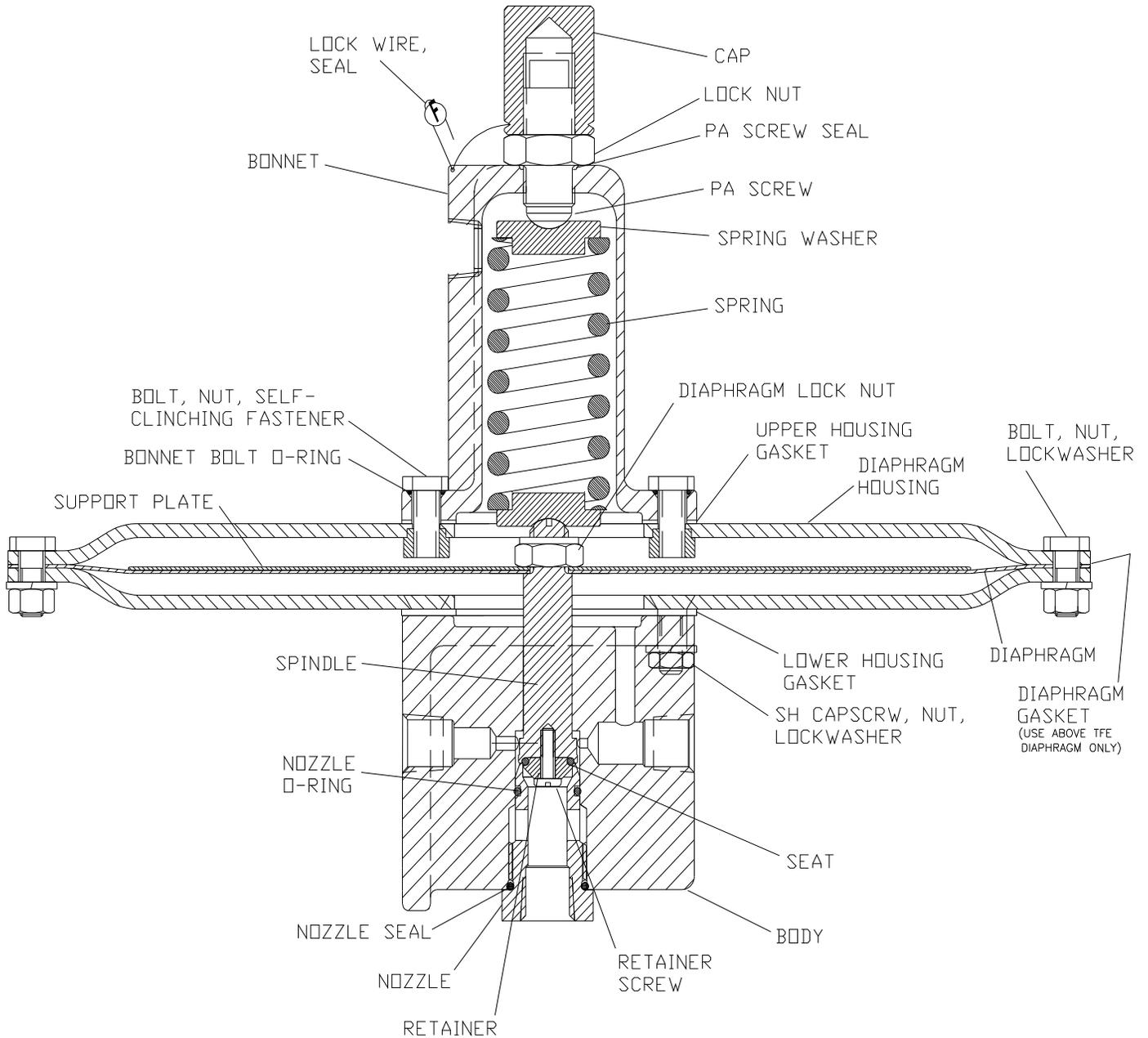
- 1) Remove the pilot valve from the main valve, or safely block the incoming pressure before disassembling the valve and performing maintenance.
- 2) Unscrew the pressure adjustment (PA) screw cap from the PA screw. Loosen the lock nut.
- 3) Loosen but do not remove the PA screw from the bonnet.
- 4) Using a 7/16" wrench, remove the bolting that holds the two halves of the diaphragm housing in place. With the housing separated, the spring, two spring washers, diaphragm, support plate, and top of the spindle will be accessible.
- 5) With a 9/16" wrench on the diaphragm lock nut and screwdriver in the top of the spindle, loosen the lock nut and remove it from the spindle.
- 6) Remove support plate from the top of the spindle. Remove the diaphragm from the spindle by unscrewing it counterclockwise.
- 7) Turn the pilot valve body over and, using a 7/8" wrench, remove the nozzle and spindle. Unscrew the retainer screw from the spindle. Remove the retainer and seat.
- 8) Replacement soft goods are listed in Section 8.0 of this manual.

**B. Assembly**

**NOTE:** Exercise care in handling softgoods, nozzles, and other sealing surfaces.

- 1) Confirm pressure setting and associated parts required per Section 5.0.
- 2) Place the valve body in a vise.
- 3) Apply Loctite to retainer screw and use it to attach seat and retainer to spindle. Insert spindle into the body. Lightly lubricate nozzle O-ring with Dow Corning 33 or equal, fit over nozzle, and then tighten nozzle into body with nozzle seal. Check that there is vertical movement of the spindle assembly (0.030" minimum).
- 4) Carefully assemble the diaphragm to the top of the spindle by slowly turning the diaphragm clockwise on the spindle threads until it bottoms on the shoulder. Make sure that there are no tears or rips in the diaphragm material.
- 5) Assemble support plate and diaphragm lock nut to spindle. Apply a small amount of Loctite to nut threads. With a wrench on the nut, and a screwdriver in top of spindle, tighten the parts together.
- 6) Assemble the spring and spring washers atop the spindle.
- 7) Assemble the bonnet and upper diaphragm housing over the spring / washers onto the top of the diaphragm / body. For Teflon diaphragms only, use a diaphragm gasket on top of diaphragm. If the bonnet had previously been separated from the upper diaphragm housing, reassemble those two parts with upper housing gasket and bonnet bolt O-rings before joining the two halves of the housing. Permatex sealant (or equal) should be applied to the bonnet bolt threads.
- 8) Insert bolts through the 15 sets of holes in the diaphragm housing halves, fasten washers and nuts, and tighten to a torque of 5 - 6 ft-lbs. Be careful not to damage the diaphragm during this procedure.
- 9) Insert the PA screw into the top of the bonnet and install the lock nut and seal.
- 10) Attach PA screw cap to top of PA screw, but do not tighten.
- 11) Attach the bug screen to the bonnet, if necessary, so that it is facing downwards.
- 12) The pilot valve is now completely assembled and ready to be set per Section 5.0.

**Assembly Illustration: F100 Pilot Valve (Low Pressure)**



**5.0 PILOT VALVE SET PRESSURE ADJUSTMENT**

**NOTE:** When set on a test stand with atmospheric pressure in the pilot bonnet, positive set pressures in “PSIG” are equivalent to vacuum set pressures in “PSI VAC” that will be expected in service with vacuum-side tubing connected to the bonnet.

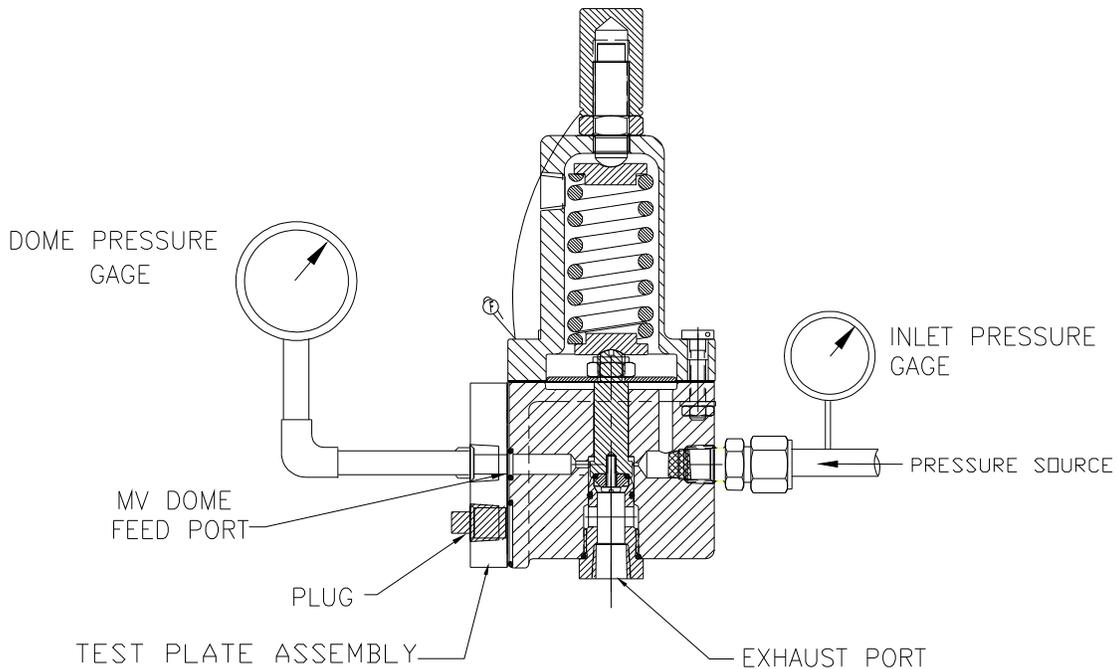
- 1) The set pressure for the F100 pilot valve is adjusted by turning the pressure adjusting (PA) screw or changing spring. The pilot may be adjusted  $\pm 3\%$  beyond the nameplate setting, not to exceed service ratings listed in Section 2.2. This is a flowing, modulating pilot valve.
- 2) Contact FLOW SAFE for assistance with replacement springs. Once the proper parts have been selected, the valve can be reassembled per Section 4.1 or 4.2.
- 3) Set pressure adjustments are made by turning the PA screw clockwise (in) to increase the set pressure and counter-clockwise (out) to decrease the set pressure. Depending on test equipment available, the valve may be set as described in (4) or (5) below.
- 4) Test procedure with pilot tested separately using a test plate assembly (available from Flow Safe) as shown in the figure on Page 16:
  - a) Slowly increase inlet pressure to set point, which occurs when pilot exhaust is first detected at the exhaust port shown in the figure. Before set point is reached, dome pressure and inlet pressure should increase at approximately the same rate. Tighten down PA screw lock nut.
  - b) Continue to increase pressure, up to approximately 105% of set pressure, until the dome gage drops. Dome pressure should drop to the value listed in the table below. These values indicate the point at which the main valve piston is able to open (based on the area differential between the piston top and main seat).

<u>F70VP Valve Size</u>	<u>Dome Pressure % at Set Point *</u>	<u>F70VP Valve Size</u>	<u>Dome Pressure % at Set Point *</u>
1 x 2	50 %	3 x 4 HP	68 %
1-1/2 x 2 LP	56	4 x 6	76
1-1/2 x 2 HP	63	6 x 8	80
2 x 3 LP	61	8 x 10	84
2 x 3 HP	63	10 x 12	78
3 x 4 LP	65	12 x 16	73

\* Dome pressure as a percentage of set pressure

*Example:* For a high-pressure 3x4 set at 10 psi vac. (10 psig on test stand) to begin discharging through the outlet, the overpressure must be enough for the pilot to vent off dome pressure until it drops to approx. 6.8 psig (0.68 x 10).

- c) If dome pressure drops to the specified value, slowly begin to lower inlet pressure until the pilot closes and exhaust leakage stops. This leakage should stop at an inlet pressure greater than or equal to 95% of the set pressure. If the leakage does not stop, discontinue the test and disassemble the valve and check parts.
  - d) Repeat the test to verify repeatable performance.
- 5) Test procedure on full assembly with pilot mounted on main valve (assumes system vacuum will act on bottom connection below main valve seat):
  - a) Connect the main valve side connection (flange or threads) to the test air source. Also route a line from the air source to the 1/4” NPT pilot inlet on the back side of the pilot body.
  - b) Increase test pressure to set point. The pilot should actuate (exhaust), allowing the main piston to crack open. As air flow is increased, the piston should modulate farther open.
  - c) As test pressure decreases to a few percent below set pressure, the pilot should close, allowing the main piston dome volume to repressurize and close the piston.
  - d) Adjust the PA screw as necessary, and repeat the test to verify repeatable performance.



F100 PILOT VALVE TEST ARRANGEMENT

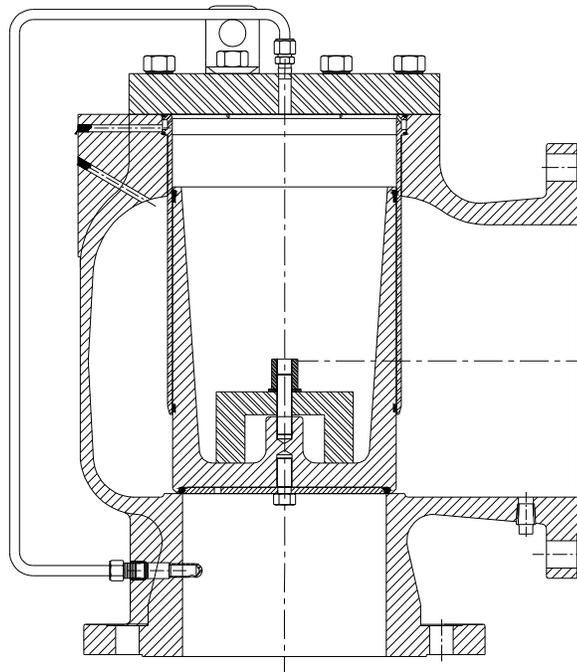
**6.0 FINAL ASSEMBLY TESTING**

- 1) Assemble the pilot valve, if included, to the main valve or its mounting bracket with four 5/16"-24UNF mounting bolts and nuts. Tighten the bolts securely. For assemblies without pilot, install the tubing between the pickup tube connection and cap.
- 2) Install and tighten all tubing connections, including any backflow preventer check valves.
- 3) Mount the assembly to the test stand as follows:

**NOTE:** Valves specially configured for atmospheric inlet below the main seat are mounted with the side flange toward the vacuum process. In this case, reverse the main valve connections noted in (a) and (b) below.

- a) If a vacuum test system is available, mount the bottom valve flange to the system. Draw a vacuum of about 90% of the designated "PSI VAC" set pressure.
- b) If using a positive-pressure test stand, connect the main valve side connection to the stand, leaving the bottom (process) connection open to atmosphere. Pressurize the assembly to about 90% of the "PSIG" equivalent of the designated "PSI VAC" set pressure.
- 4) Check for leaks at all joints, including tubing connections, cap, cap bolts, and main valve seating area. There should be no leaks anywhere.
- 5) Verify that valve opens at set pressure by continuing to raise vacuum level or positive test pressure to nameplate set pressure. Main piston should crack open at set pressure, but may not lift substantially if there is insufficient volume in the test system.
  - a) If the assembly includes a pilot, set pressure may be adjusted as described in Section 5.0, Step (5).
  - b) For valves with fixed set pressure (no pilot), opening pressure is dependent on the piston's weight and low sliding friction between the piston and liner. Ensure that any attachments to the piston interior are present and secure.

- 6) To check backflow preventer operation:
  - a) Connect the main valve process connection to test air source. Pilot inlet should be open to atmosphere.
  - b) Raise test pressure to 5 – 10 psig. Backflow preventer check valves should route pressure to the pilot bonnet and pilot inlet simultaneously, keeping the pilot closed and routing air into the main valve dome to seat the piston. Check outlet for indications of leakage.
  - c) Slowly vent off pressure from test source. Disassemble and check/clean main valve and backflow preventer check valve sealing surfaces if any leaks were detected. Reassemble component(s) and repeat test.
- 7) Once testing is complete, the valve assembly is ready for installation. If applicable, flange protectors should be installed and other protective measures taken during transport.



**F70VP Assembly – Fixed Set Point**

**7.0 TROUBLESHOOTING GUIDE**

<b>Symptom</b>	<b>Possible Cause</b>	<b>Remedy</b>
The main valve leaks around the cap or cap bolts.	Cap bolt(s) loose, or insufficient / uneven bolt torque.	Retighten the cap bolts per Section 3.2.
	Sealing surface on cap is damaged.	Repair defect or replace cap.
	Upper liner seal is damaged or contaminated.	If damaged, replace with new seal(s). If contaminated, clean and reinstall.
	Air trapped in cap bolt hole(s).	Wait until leakage stops (applicable to very recent cap reinstallation only).
The main valve leaks through the bottom (system) connection.	Damage to, or contamination on, piston seat or main valve nozzle, piston seal / sealing surface, lower liner seal / sealing surface, or backflow preventer check valve seating surfaces.	Disassemble the valve, remove the piston and liner, and examine seat(s), seals, and sealing surfaces under magnification. If damaged, replace with new part(s); if contaminated, clean and reinstall.
	Dome is not loading properly through the pilot.	Check pilot or tubing for obstructions; clean / unplug.
The main valve does not open.	Pilot valve not set correctly.	Check set point on pilot. Ensure correct pressure units are being used ("psi vac" vs "psia").
	Vacuum not maintained in pilot bonnet or main valve dome (region between cap and top of piston).	Ensure tube fitting in bonnet is tight. Verify that Teflon seal is installed under pressure adjustment screw lock nut. If no pilot, verify tubing and connections to main valve cap are tight.
	Inlet screen or tubing to pilot is plugged.	Clean / unplug line.
	Pilot internals are blocked or damaged.	Disassemble pilot; check / clean parts.
	Main valve piston is seized.	Disassemble the valve and examine surfaces for debris/damage. Clean or replace parts as necessary.
The main valve does not close, or opens above vacuum set point.	Obstruction in main valve, pilot valve, or tubing to main valve.	Clean / unplug. Remove any debris between piston and liner. Provide system filtration if necessary.
	Pilot diaphragm is leaking.	Disassemble pilot valve, remove and inspect diaphragm. Replace diaphragm.
	Backflow preventer check valves missing or installed backwards, or leak.	Check for proper installation and seat-tightness.
	Piston or liner seal is leaking.	Disassemble the valve, remove the seals and examine. Clean or replace, as necessary.

**8.0 SOFTGOODS KITS**

<u>X / Y / Z = Seat / Seal / Diaphragm Material</u>		<u>D = Seat Hardness</u>	
Code		Code	
<b>B</b>	Buna-N	<b>3</b>	Extra soft: ≤ 1 psig
<b>V</b>	Viton	<b>5</b>	Soft: ≤ 50 psig
<b>E</b>	EPR / EPDM		
<b>Z</b>	Kalrez		
<b>C</b>	Chemraz		
<b>N</b>	Lo-temp nitrile		
<b>T</b>	Teflon – FEP film (diaphragms only)		

*Most common materials listed; contact Flow Safe for availability of other materials.*

**8.1 MAIN VALVE SOFTGOODS**

Valve Size	Softgoods Kit Part Number	
	High Pressure Piston Assembly	Low Pressure Piston Assembly
<b>1 x 2</b>	VPHP-01X02- <b>DXY</b>	-----
<b>1-1/2 x 2</b>	VPHP-15X02- <b>DXY</b>	VPLP-15X02- <b>DXY</b>
<b>2 x 3</b>	VPHP-02X03- <b>DXY</b>	VPLP-02X03- <b>DXY</b>
<b>3 x 4</b>	VPHP-03X04- <b>DXY</b>	VPLP-03X04- <b>DXY</b>
<b>4 x 6</b>	VPHP-04X06- <b>DXY</b>	VPLP-04X06- <b>DXY</b>
<b>6 x 8</b>	VPHP-06X08- <b>DXY</b>	VPLP-06X08- <b>DXY</b>
<b>8 x 10</b>	VPHP-08X10- <b>DXY</b>	VPLP-08X10- <b>DXY</b>
<b>10 x 12</b>	VPHP-10X12- <b>DXY</b>	-----
<b>12 x 16</b>	VPHP-12X16- <b>DXY</b>	-----

Contents (See drawings & parts lists on Pages 5, 7, 8, 9):

	<u>Qty.</u>		<u>Qty.</u>
Wear ring (HP, below 4x6)	1	Backup ring (below 4x6)	1*
(4x6 and up)	2	Seal, pickup tube (4x6 and up)	1**
Liner / cap seal (below 4x6)	1	Diaphragm (LP, below 4x6)	1
(4x6 and up)	2	Check valve seat	2***
Seat	1		
Piston seal	1		

\* optional; may not be used in all constructions

\*\* not needed for NPT-style connections

\*\*\* if backflow preventer provided

**TITLE: F70VP Series  
Vacuum Relief Valve**

**Rev. B  
Page 20 of 20**

---

**8.2 PILOT VALVE SOFTGOODS**

<b><u>F100 Pilot Softgoods Kit:</u></b>	P/N F100V-BLP-DXYZ	Low pressure, bracket-mount
	F100V-BHP-DXYZ	High pressure, bracket-mount
	F100V-DHP-DXYZ	High pressure, direct-mount

Contents (See drawings on Pages 12 & 14):

	<u>Qty.</u>		<u>Qty.</u>
Seat	1	Diaphragm gasket (for Teflon diaphragm only)	1
Diaphragm	1	Upper housing gasket (LP only)	1
Nozzle O-ring	1	Lower housing gasket (LP only)	1
Nozzle seal	1	PA screw seal	1
Small face seal (direct-mount only)	1	Bonnet bolt O-ring (LP only)	4
Large face seal (direct-mount only)	1		