



ANDERSON GREENWOOD SERIES 500 PILOT OPERATED SAFETY RELIEF VALVES INSTALLATION AND MAINTENANCE INSTRUCTIONS

Before installation these instructions must be fully read and understood



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Installation and maintenance instructions for Anderson Greenwood Series 500 Pilot Operated Safety Relief Valves (POSRV).

The intent of these instructions is to acquaint the user with the installation and maintenance of this product.

Please read these instructions carefully.

1 GENERAL VALVE DESCRIPTION AND START-UP

1.1 Operation

The Anderson Greenwood pilot operated safety-relief valves utilize the principle of pressurizing the top, or large area, of a differential area piston with line pressure to hold the piston closed up to set pressure. At set pressure the pilot valve relieves, partially evacuating the dome (volume above piston) and the piston lifts permitting discharge from the main valve. When the pilot reseats, line pressure is diverted to the dome closing the main valve. The set pressure range is 15 psig to 720 psig.

1.2 Installation

Either or both inlet and outlet may be standard ANSI flanges and the valve should be installed in accordance with accepted piping practices. 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 for shut-off is used in the remote pilot supply line, be sure it is opened before pressurizing the system or opening the isolating block valve, where installed.

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 Startup

There must be pressure at the valve inlet to establish a differential in force across the piston and "load" it in the closed position. Pressure must pass through the pilot supply tube and pilot, and exert force on the top of the piston.

On normal plant start-up, the valve loads itself without incident as plant pressure increases. It is not uncommon that slight leakage past the main seat occurs until system pressure reaches five to ten pounds. This amount of pressure is sometimes needed to form the PTFE seat to nozzle surface.

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 valves may briefly vent to the atmosphere past the main seat before the dome gets pressurized- it will then close off positively. To minimize this venting, open the block valve slowly.

2 MAIN VALVE MAINTENANCE

2.1 Disassembly

Remove the cap from the body. Remove the piston and liner. A cap bolt may be threaded into hole in top of piston to aid in removal. Through holes in seat retainers 2", 3" and 4" sizes are threaded to assist in disassembly. Remove the soft goods from the piston. If the piston is equipped with a wedge ring, clean and retain it for use during assembly. The dipper

tube is swaged in place and no attempt should be made to remove it. Refer to Figure 1 for parts description and location. The nozzle and nozzle seal should not be removed unless the nozzle is damaged or the seal is leaking.

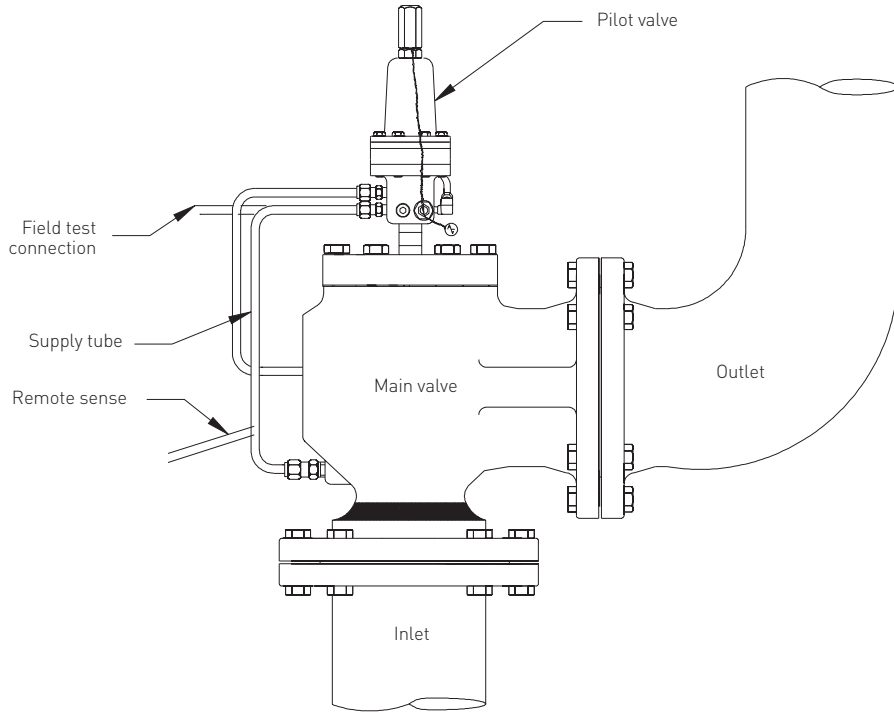
2.1.1 Nozzle and nozzle seal disassembly

Refer to Figure 2 for parts description and location.

1. Place liner in body and piston, without seat or seat retainer, into liner and on top of nozzle.
2. Place appropriate spacer (see Table I) on top of piston and then the cap over the spacer.
3. Thread the appropriate number of cap bolts (see Table I) into threaded holes on top of body. If two bolts are used, they should be 180° apart. When using four bolts, they should be 90° apart.
4. Tighten cap bolts evenly to the torque listed in Table I to compress nozzle seal.
5. Use a punch or bar with a light hammer and tap on the nozzle retainer teeth to loosen the nozzle retainer. Unthread nozzle retainer approximately 1/2 turn.
6. Loosen cap bolts to remove load from nozzle. Remove components from main valve.

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2.2 Main valve nozzle rework

Should the main valve nozzle seating face become nicked or scratched such that the main valve seat does not seal, the imperfections can be removed by polishing the nozzle face with 400 grit sandpaper on a flat surface plate. Certain critical nozzle dimensions and finishes must be maintained and those are shown in the figure and table below.

2.3 Assembly

2.3.1 Nozzle and nozzle seal installation

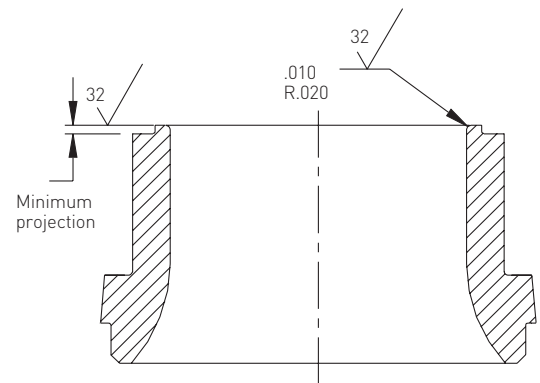
1. Place nozzle seal and nozzle in body.
2. Place nozzle retainer over nozzle and thread into body until it stops on nozzle shoulder. Do not lubricate nozzle retainer threads or mating body threads.
3. Repeat steps 1 through 4 of disassembly procedure to compress nozzle seal.

4. Use a punch or bar with a light hammer and tap on the nozzle retainer teeth to snug the nozzle retainer threads.
5. Loosen cap bolts to remove load from spacer and remove spacer from valve.

Replace seat, piston and liner seal. Apply a light coat of Dow Corning #33 silicone lubricant on all threads after cleaning. Do not use any lubricant on the soft goods.

When installing the cap, make sure it is seated squarely into body. Torque cap bolts uniformly so as not to "cock" cap. See Table II for torque values. Such a condition may result in leakage at the liner seal or cause the piston and liner to bind.

Valve size and type	Min. nozzle projection height (in)
1.5" Series 546	.045
2" Series 546	.055
3" Series 546	.055
4" Series 546	.055
6" Series 546	.070
8" Series 546	.070
1.5" Series 566	.055
2" Series 566	.055
3" Series 566	.055
4" Series 566	.070
6" Series 566	.070
8" x 88" Series 566	.070
8" x 10" Series 566	.070
10" Series 566	.070



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TABLE I

Valve size and type	Spacer P/N	Cap bolt thread	# Cap bolts to use	Cap bolt torque [ft-lbs]
1.5" x 3/8" Series 546 (G and H Orifice)	06.5612.003	.500-20 UNF	2	41
1.5" x 1/2" Series 546 (G and H Orifice)	06.5612.003	.625-18 UNF	2	51
2" Series 546	06.5612.005	.500-20 UNF	4	27
3" Series 546	06.5612.007	.500-20 UNF	4	35
4" Series 546	06.5612.008	.750-16 UNF	4	130
6" Series 546	06.5612.009	.750-16 UNF	2	82
6" Series 546	06.5612.009	.875-14 UNF	2	95
8" Series 546	06.5612.010	.875-14 UNF	4	123
8" Series 546	06.5612.010	1.000-14 UNS	4	140
1.5" Series 566	06.5612.005	.500-20 UNF	2	19
2" Series 566	06.5612.007	.500-20 UNF	2	31
3" Series 566	06.5612.008	.750-16 UNF	2	113
4" Series 566	06.5612.011	.625-18 UNF	2	63
6" Series 566	06.5612.012	.750-16 UNF	2	88
8" x 88" Series 566	06.5612.013	.875-14 UNF	4	119
8" x 10" Series 566	06.5612.014	1.125-12 UNF	10	89
10" Series 566	06.5612.015	1.125-12 UNF	10	90

PARTS LIST

Item	Part name
1	Body
2	Piston
3	Liner
4	Nozzle ^[1]
5	Seat ^[2]
6	Seat retainer
7	Seat retainer bolt
8	Cap
9	Dipper tube
10	Piston seal ^[2]
11	Nozzle seal ^[1]
12	Liner seal ^[2]
13	Retaining ring
14	Cap bolt
15	Lock washer
16	Dome spring
17	Nozzle retainer
18	Wedge ring ^[3]

NOTES

1. Do not replace unless required.
2. Recommended spare parts for repair.
3. Used on 4" sizes and larger Series 546 and 3" and larger Series 566.

See Section 7 for soft goods repair kit part number.

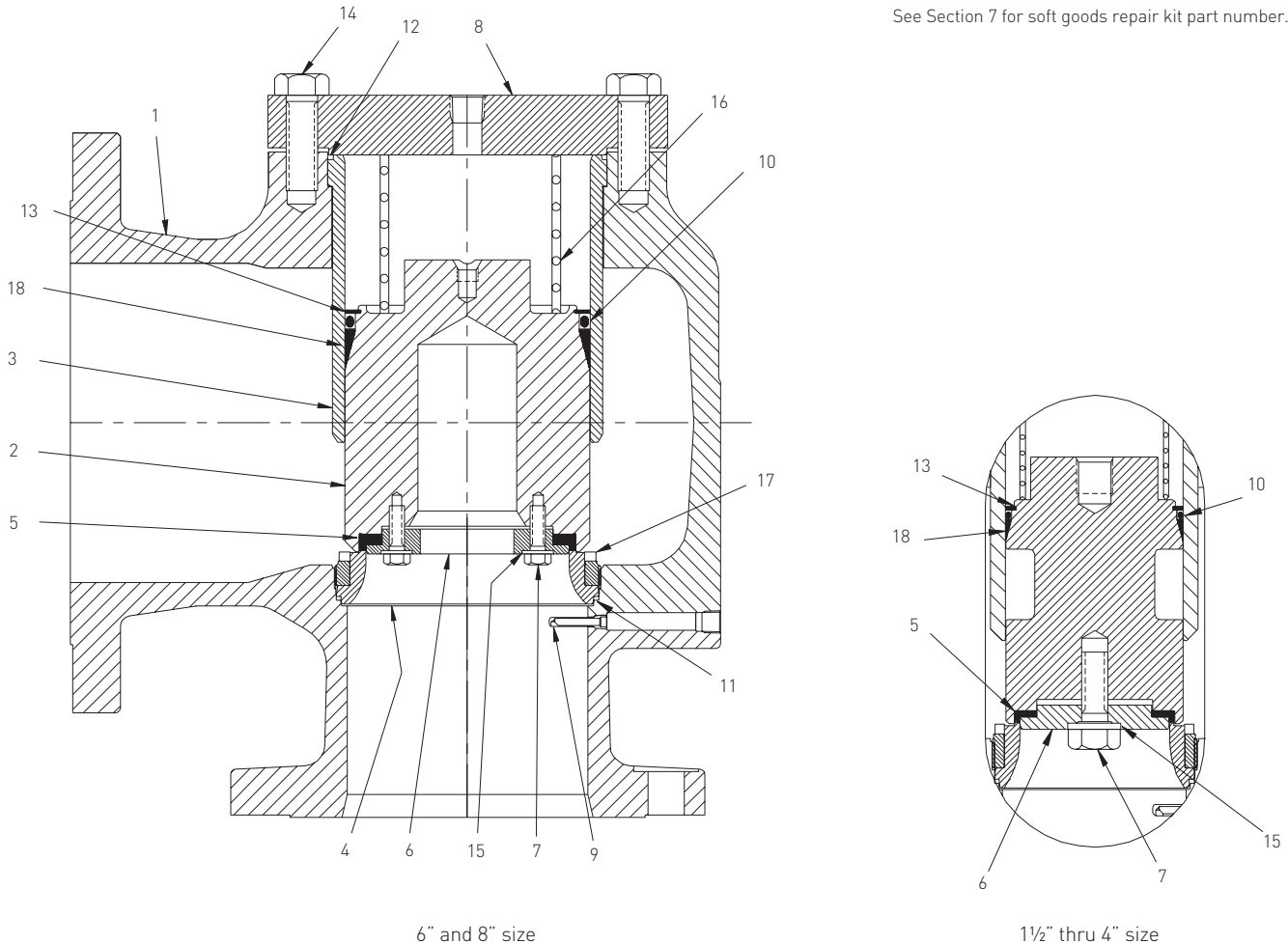


FIGURE 1

ANDERSON GREENWOOD SERIES 500 PILOT OPERATED SAFETY RELIEF VALVES
 INSTALLATION AND MAINTENANCE INSTRUCTIONS

TABLE II

Bolt size	Torque (ft-lbs)
1/4	7
5/16	12
3/8	21
7/16	33
1/2	45
9/16	59
5/8	97
3/4	130
7/8	202
1	271
1 1/8	408

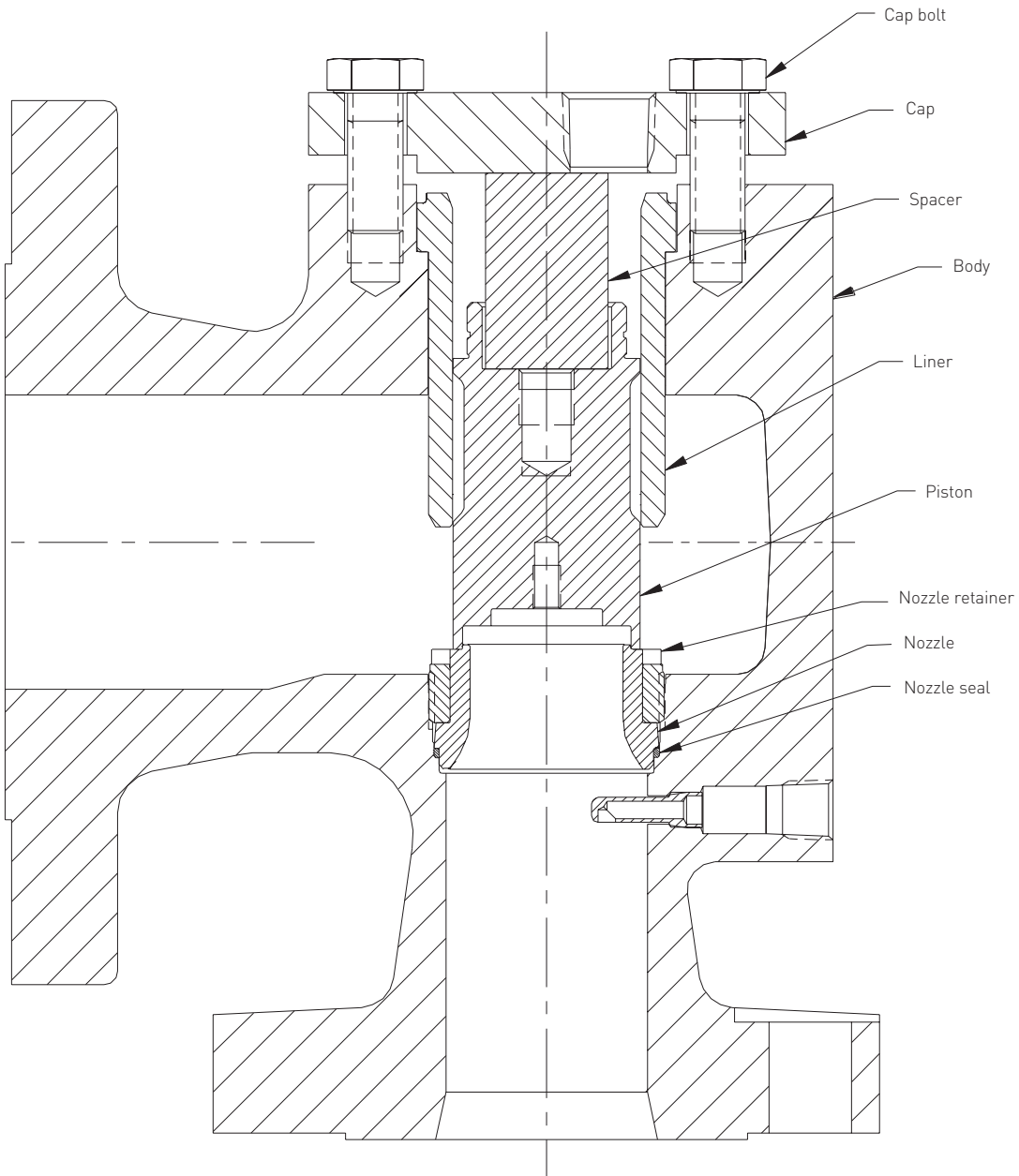


FIGURE 2

ANDERSON GREENWOOD SERIES 500 PILOT OPERATED SAFETY RELIEF VALVES

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3 PILOT MAINTENANCE

3.1 Disassembly

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

NOTE

If pilot is equipped with a lift lever, the lift lever handle assembly must be unscrewed from cap before continuing with disassembly. Hold lift lever in position shown in Figure 8, unscrew bushing (Item 14) from cap and remove handle assembly (Items 13, 14, 15, 32 and 45).

Unscrew and remove cap. Loosen jam nuts and release spring compression by backing out adjusting screw. Remove bonnet, spring and spring washer. Remove lift lever adapter, rod and support spring where used.

Loosen spindle nut before loosening jam nuts. The spindle jam nuts serve as wrench flats on the spindle. Remove remainder of accessible parts except spindle. Remove nozzle with a $\frac{3}{8}$ " square drive socket extension. Remove the spindle assembly by pushing it up through the body.

3.2 Assembly

Assemble pilot in reverse order of disassembly. Take care not to scratch the sealing face of the seat or nozzle. If scratched or nicked, it must be replaced or lapped to prevent leaking. Lubricate all screw threads and bearing end of spring washers with NG-165 Never-Seez lubricant. Use Dow Corning No. 33 Silicone grease on all surfaces of the spring washer bearing if installed. Lubricate the sealing flange of the nozzle to prevent galling. Do not lubricate spindle, lower end of spindle seat, nozzle face, or PTFE seals.

3.3 Pilot diaphragm assembly

3.3.1 Boost diaphragm (lower diaphragm)
Install upper diaphragm shield on top of lower diaphragm shield. Install boost diaphragm (Item 55) over spindle on top of the lower and upper diaphragm shield, with spindle gaskets (Item 56) and diaphragm gaskets (Item 54 or 57) on both sides of the diaphragm. For pressure below 120 psi, use a PTFE diaphragm with FEP diaphragm gaskets. For pressure between 121 psi to 180 psi, use a Hastelloy® diaphragm with FEP diaphragm gaskets. For pressure above 180 psi, use a Hastelloy® diaphragm with Peek diaphragm gaskets. Install boost plate (item 8) on top of the boost diaphragm.

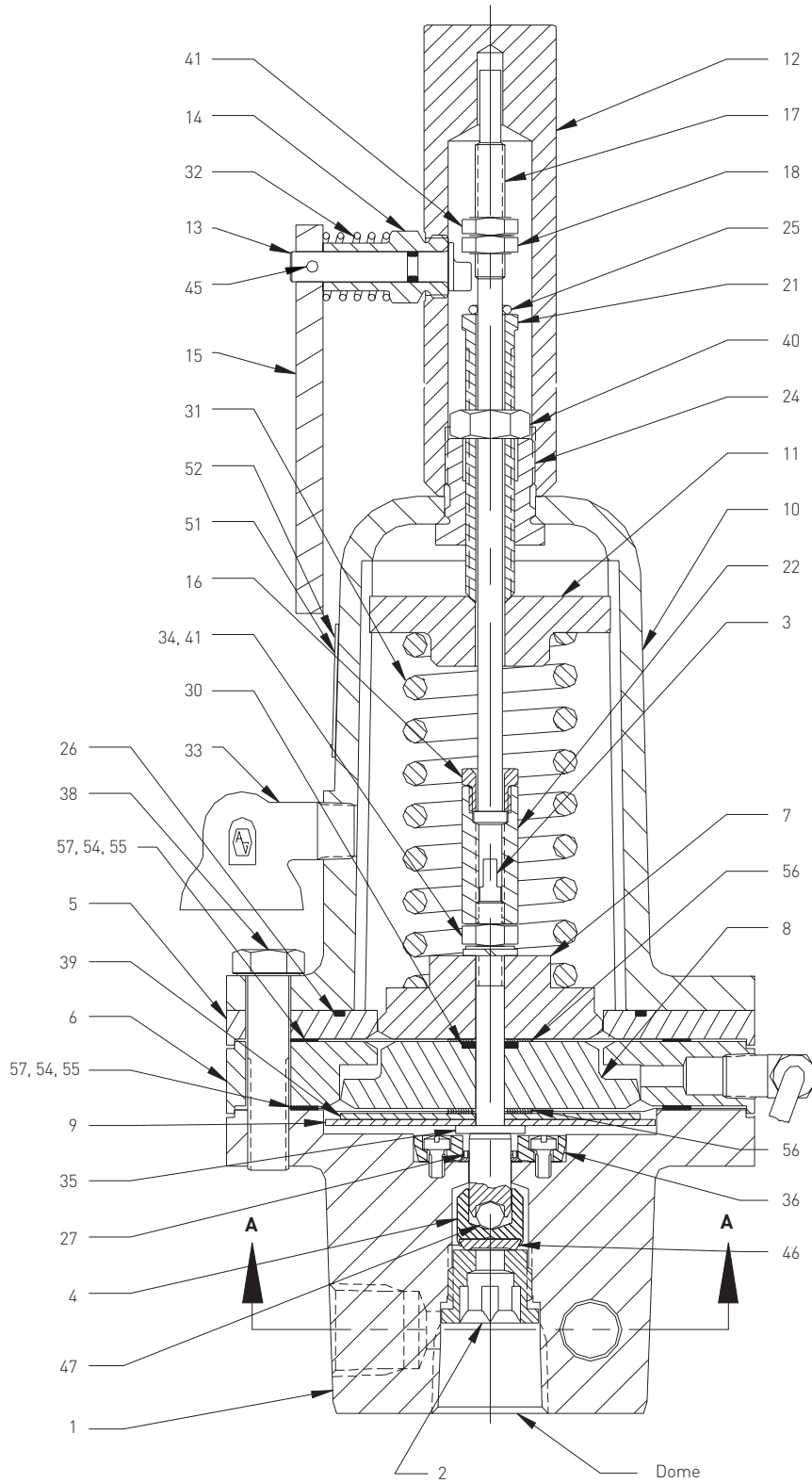
3.3.2 Sensing diaphragm (upper diaphragm)
Install sense diaphragm (Item 55) on top of spacer ring, with a diaphragm gasket and a spindle gasket below the diaphragm. For set pressure up to 30 psi, use a PTFE diaphragm with a FEP diaphragm gasket. For pressure between 30 psi to 180 psi, use a Hastelloy® diaphragm with a FEP diaphragm gasket. For pressure above 180 psi, use a Hastelloy® diaphragm with a PEEK diaphragm gasket.

3.4 Bolt make-up (item 38)

Tighten the six $\frac{3}{8}$ " case bolts alternately opposite each other to approximately 32-36 ft-lbs.

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PARTS LIST

Item	Description
1	Body
2	Nozzle
3	Spindle
4	Seat socket
5	Diaphragm support
6	Spacer ring
7	Sense plate
8	Boost plate
9	Diaphragm shield, lower
10	Bonnet
11	Spring washer
12	Lift lever cap ⁽¹⁾
13	Lift lever cam ⁽¹⁾
14	Lift lever bushing ⁽¹⁾
15	Lift lever handle ⁽¹⁾
16	Lift rod bushing ⁽¹⁾
17	Lift lever rod ⁽¹⁾
18	Lift lever nut ⁽¹⁾
21	Pressure adjustment screw
22	Lift lever coupling
24	Bonnet screw
25	Retaining O-ring ⁽¹⁾
30	Boost plate seal
31	Spring
32	Cam spring ⁽¹⁾
33	Bonnet vent
34	Lockwasher
35	Shim washer
36	Seal retainer
38	Bolt
39	Diaphragm shield, upper
40	Jam nut
41	Jam nut
45	Spring pin ⁽¹⁾
46	Seat
47	Ball
51	Nameplate
52	Drive screw
54	Diaphragm gasket-FEP
55	Diaphragm
56	Spindle gasket
57	Diaphragm gasket-PEEK

⁽¹⁾ Use with lift lever option only.

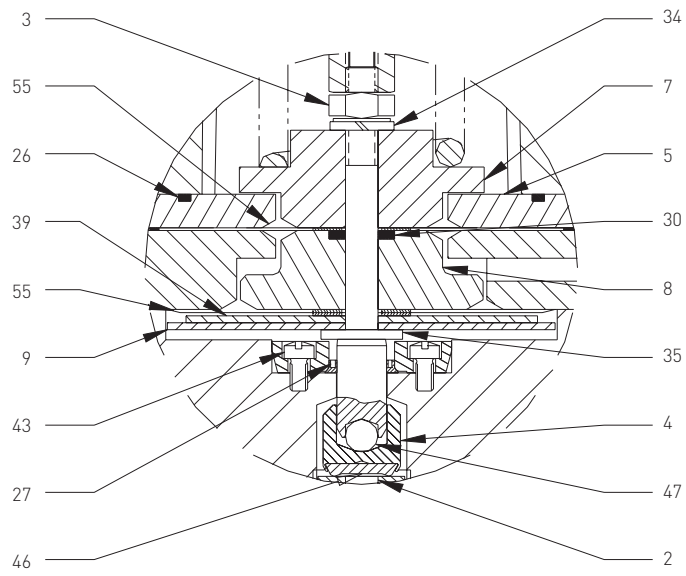
NOTE

Refer to next page for Section A - A and 276-720 psig.

FIGURE 3
 15-275 psig

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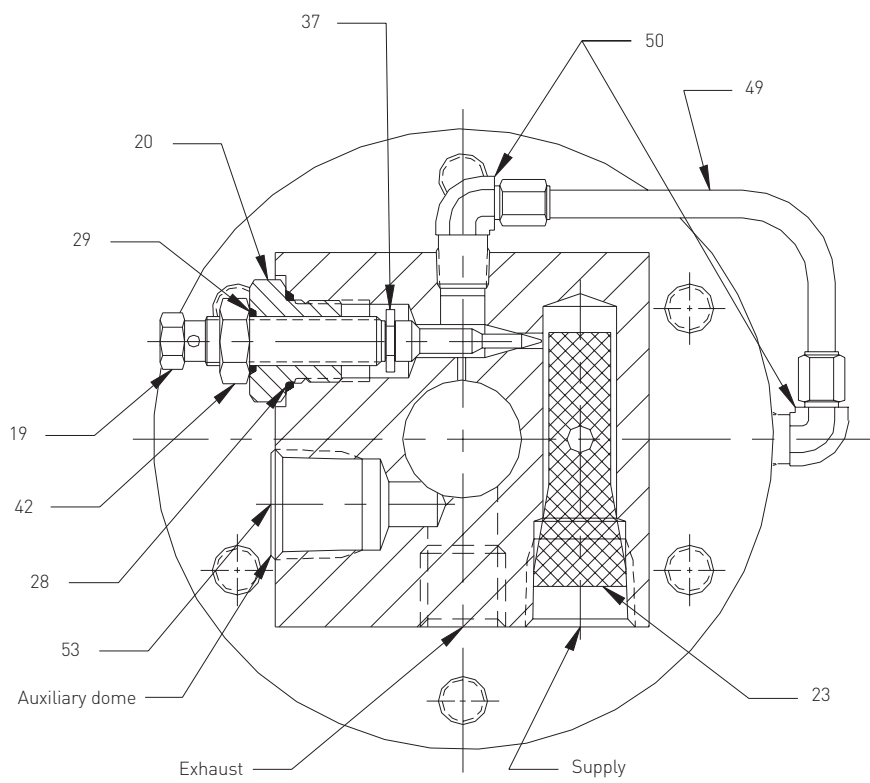
INSTALLATION AND MAINTENANCE INSTRUCTIONS



276-720 psig

PARTS LIST

Item	Description
2	Nozzle
3	Spindle
4	Seat socket
5	Diaphragm support
7	Sense plate
8	Boost plate
9	Diaphragm shield, lower
19	Blowdown needle
20	Blowdown bushing
23	Inlet screen
26	Bonnet seal
27	Spindle seal
28	Bushing seal
29	Needle seal
30	Boost plate seal
34	Lockwasher
35	Shim washer
37	Needle retainer
39	Diaphragm shield, upper
42	Jam nut
43	Screw
46	Seat
47	Ball
49	Tubing
50	Elbow connector
53	Pipe plug
55	Diaphragm



Section A - A

ANDERSON GREENWOOD SERIES 500 PILOT OPERATED SAFETY RELIEF VALVES

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4 PILOT SET PRESSURE 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" pressure; the second the "reset" or "blowdown" pressure.

4.2 Set pressure

Set pressure is that supply pressure where the dome pressure is reduced to $70\% \pm 2\%$ of the supply. This corresponds to the initial audible discharge of gas or first steady stream of liquid from the main valve.

To adjust the set pressure, a test set up similar to that shown in Figure 4 should be used. The set pressure adjustment screw should be turned IN most of the way. Increase the supply pressure to the nameplate setting and slowly back the adjustment screw out until the dome pressure is $70\% \pm 2\%$ of the supply pressure and supply pressure meets the required set pressure tolerance of paragraph 4.5. Lock the adjusting screw with the jam nut and cycle the pilot several times to make sure the setting is correct.

4.3 Reset pressure

Reset pressure is that supply pressure where the dome pressure increases to $75 \pm 2\%$ of supply.

4.3.1 Reset pressure - modulating action

The reset pressure should be adjusted with the pilot flowing. Increase the supply pressure until the pilot opens and steady flow is obtained. With the blowdown adjustment screw turned in, slowly decrease the supply pressure to 97% to 100% of set. Turn the blowdown adjustment screw OUT until the pilot reseats. Lock the adjusting screw with the jam nut and cycle the pilot several times to make sure the setting is correct. A small interaction between set pressure and blowdown may occur. If so, re-adjust set pressure.

NOTE

If the blowdown adjustment screw is backed out more than necessary to obtain 0% blowdown, pilot action will become more sluggish and pilot crack to main valve opening pressure spread will increase.

4.4 Adjustment tolerances

All pilots can be adjusted $\pm 5\%$ beyond the nameplate setting for set pressures above 275 psig and $\pm 10\%$ for set pressures 275 psig and below.

4.5 Range of adjustment

Cracking pressure:	95% of specified set pressure
Set pressure:	$\pm 3\%$ of specified set pressure above 70 psig set ± 2 psig for 70 psig and below
Reset pressure:	Specified as a percent of set pressure modulating action (0-3%)

4.6 For steam service pilots

Set on steam, check the case bolts (Item 38) again for tightness at zero pressure. Retighten to 35-39 ft-lbs of torque, as required. Check set pressure again if bolts are retightened.

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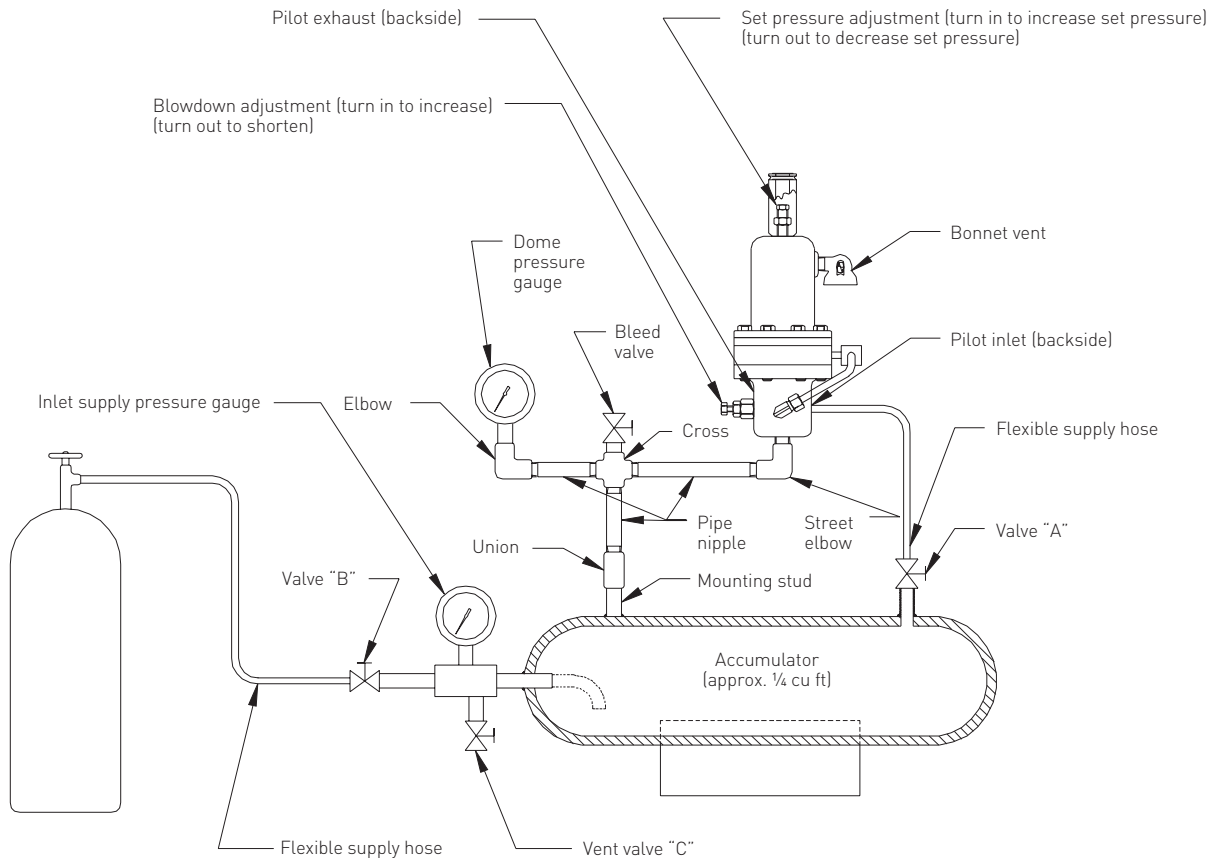


FIGURE 4

5 TESTING COMPLETE VALVE ASSEMBLY

5.1 General

The complete valve assembly should be tested for internal and external leakage and to verify main valve function using a test set-up similar to that shown in Figure 5.

5.2 Low pressure leakage check

Slowly increase the inlet pressure to 30% of the set pressure. Check for main valve nozzle, seat, and piston seal leakage at the main valve outlet. No visible leakage shall occur in one minute. To help in seating the valve seat and piston seal, the valve may be actuated several times.

5.3 High pressure leakage check

Apply pressure to the inlet equal to 90% of the set pressure. Check for leakage at the main valve outlet. Using a suitable gas or air leak detector solution, check for leakage at the cap seal and other pressure connections. No leakage shall occur at the valve outlet and no visible leakage shall be detected at the cap seal or other pressure connections in one minute.

5.4 Main valve function check

CAUTION!

This test must be performed at a slow rate of pressure increase to ensure that the main valve does not go into full lift. The pressure applied to the inlet is not to exceed 105% of nameplate set pressure.

After completing the high pressure leakage check of paragraph 5.3, verify main valve opening as follows. Remove the leakage test device from the outlet flange. Slowly increase the inlet pressure above 90% of set pressure. Continue increasing inlet pressure until an audible discharge at the valve outlet verifies main valve opening.

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6 PILOT SET PRESSURE FIELD TEST PROCEDURE

NOTE

EXTREME CAUTION and appropriate safety procedures should always be utilized when testing or servicing a safety relief valve. Any compressible fluid under pressure is dangerous.

6.1 General

The pilot set pressure on a valve set for modulating action is best determined when the main valve dome pressure is measured. From the discussion in Section 4 Pilot adjustment, set pressure is defined as that process pressure where the dome pressure is 70% of the supply pressure. Typically, this measurement can not be made since access for measuring this pressure is not available without depressurizing the dome and installing special fittings.

Alternatively, the pilot set pressure can be checked in the field if the valve is equipped with a field test accessory with an actuation indicator. An external test pressure is applied through the field test valve as shown in Figure 6. Set pressure is the pressure when the actuator indicator button retracts, or moves in.

NOTE

Use extreme caution when testing to prevent injury should the main valve open and discharge product on personnel. If 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.

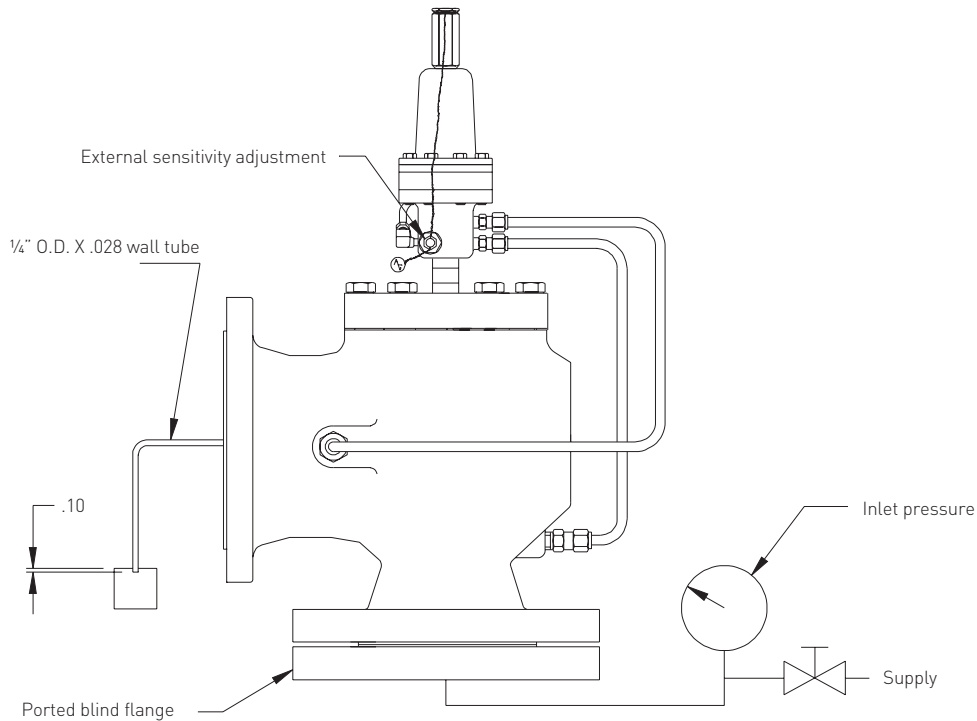


FIGURE 5

ANDERSON GREENWOOD SERIES 500 PILOT OPERATED SAFETY RELIEF VALVES

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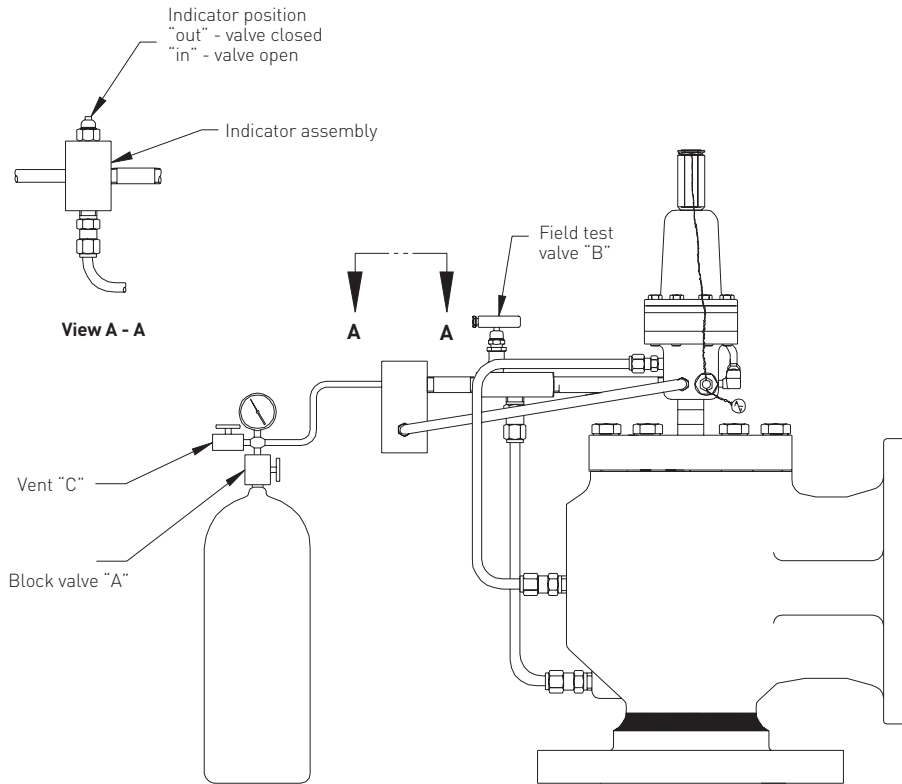


FIGURE 6

6.2 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 opens or until the actuator indicator button moves in. The 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".

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7 SOFT GOODS REPAIR KITS

The kits listed below are available from stock. To order, specify the base number and select the last three digits from the following tables. To ensure the purchase of the correct soft goods kits, the order should specify the valve model number and serial number.

Kit base number: 06.3366.XXX

TYPE 546 MAIN VALVE KIT

	Set pressure (psig)	1½ x 3	2 x 3	3 x 4	4 x 6	6 x 8	8 x 10
PTFE	All	001	002	003	004	005	006
PEEK	276-720	010	011	012	013	014	015

TYPE 566 MAIN VALVE KIT

	Set pressure (psig)	1½ x 2	2 x 3	3 x 4	4 x 6	6 x 8	8 x 88	8 x 10	10 x 14
PTFE	All	002	003	004	007	008	046	009	049
PEEK	276-720	011	012	013	016	017	047	018	048

Kit base number: 04.4959.XXX

PILOT KIT

Description	With or without lift lever
Standard soft goods	212
NACE soft goods	213
Nozzle	106

ACCESSORY KIT

Description	All pressures
Field test w/indicator soft goods	192
Backflow preventer soft goods	390
Supply filter soft goods and filter screen	417

8 PILOT CONVERSION KITS

8.1 Lift lever conversion kit

Pilot set pressure	Kit part no.
All pressures	06.3416.007