ANDERSON GREENWOOD SERIES 5200 POSRV

INSTALLATION AND MAINTENANCE INSTRUCTIONS

Before installation, these instructions must be carefully read and understood.

TABLE OF CONTENTS

1 GENERAL VALVE DESCRIPTION AND START-UP

1.1 Operation

The Series 5200 valve is designed for ASME Section I economizer and ASME Section VIII and Section XIII steam service. The valve has modulating action; the main valve will open at nameplate set, but only opening an amount proportional to the relieving capacity required. As process pressure increases, the valve will open more and be in full lift at 103% of set.

The main valve uses the principle of differential areas between the main valve dome and seat to hold the disc closed up to set pressure. At set pressure, the pilot relieves, depressurizing the volume on the top side/dome of the piston. Line pressure acting on the underside of the disc causes the disc to lift, permitting discharge from the main valve. As capacity relief of the system is satisfied, system pressure will begin to decrease. When it does, the pilot will actuate and direct system pressure to the top side of the main valve piston, closing the disc against the nozzle.

The pilot is a non-flowing type. With the main valve open and relieving at steady pressure, no process fluid flows through the pilot. When process pressure changes, the pilot actuates to change the lift of the main valve piston. During these actuations a small amount of fluid from the main valve dome flows through the pilot and is discharged through the pilot exhaust.

1.2 Installation

Both the inlet and outlet have standard ANSI flanges that should be installed in accordance with accepted piping practices. For Section I economizer applications, the valve is supplied with a body drain fitting, which should be piped away to a condensate collection system. For Section VIII and Section XIII applications, a body drain fitting is not available.

The valve can be insulated and/or heat traced to prevent freezing of condensate in the valve or tubing. The main valve cap must not be insulated as this will obstruct the convection cooling process that keeps the main valve dome filled with condensate.

This valve can be plumbed for internal or remote sense (see Figure 1). For internal sense, a sense ring with a pitot tube is installed between the valve and process flange and the pitot tube port in the sense ring is plumbed to the pilot supply port. For remote sense, the sense ring is not required and the pilot supply port can be plumbed to a remote location on the process piping. Remote pressure pick-up piping up to 100 feet [30 m] in length must have an inside diameter not less than 0.245" [6 mm], which is the same as the inside diameter of ⅜" x 0.065" wall [10 mm x 2 mm wall] seamless tubing.

For lengths greater than 100 feet [30 m], larger tubing or pipe should be used. For greater mechanical integrity of a remote sense line, consider using a minimum ¾" pipe size for remote sense line longer than 20 feet, transitioned to ⅜" tubing near the POSRV. The remote sense line should be self draining or winterized, as required.

For valves supplied with eyebolts, follow the instructions in Anderson Greenwood Pilot operated safety relief valves 05-9040-352 (VCOSI-06034 Operating and Safety Instructions) pertaining to the safe use and storage of eyebolts.

Refer to Anderson Greenwood Pilot operated safety relief valves 05-9040-372 (VCIOM-03099 Winterization Guidelines) and 05-9040-352 for more information regarding Winterization requirements.

Doc. nr. 05.9040.370 Rev. DA

1.3 Start-up

There must be pressure at the valve inlet (or at the pilot inlet/sense port for valves with remote sense) to establish a differential force across the piston/disc assembly and 'load' it in the closed position. Pressure must pass through the pilot and exert force on the top of the piston. On normal plant start up the valve will close itself as pressure increases.
In certain circumstances, block valves may be used under pressure relief valves to isolate them when maintenance is required. When putting the safety valve in service, be sure the block valve is opened fully. If the block valve is opened after system start up, the safety valve may vent briefly before the volume above the piston gets pressurized to close the piston/disc assembly. Opening the isolation valve very slowly, at the valve crack point, will introduce heat slowly to the POSRV and will avoid the inadvertent lifting of the MV seat.

1.4 Maintenance

Recommended main valve and pilot maintenance procedures, including pilot set pressure adjustment and valve assembly testing, are described in the following paragraphs. Following these procedures in a regular pressure relief valve maintenance program is recommended, to ensure satisfactory valve performance and provide optimum service life.
Should the pressure/media requirements of a pilot operated pressure relief valve be outside the capabilities of the repair facility, contact Emerson for specific instructions before starting any maintenance activity.
This manual is provided as a general guide for the maintenance of the safety valves described herein. It does not include procedures covering all valve configurations and variations manufactured by Emerson. The user is advised to contact Emerson or one of our authorized representatives for assistance with valve configurations and variations not covered in this manual.

2 MAIN VALVE MAINTENANCE

2.1 Main valve disassembly

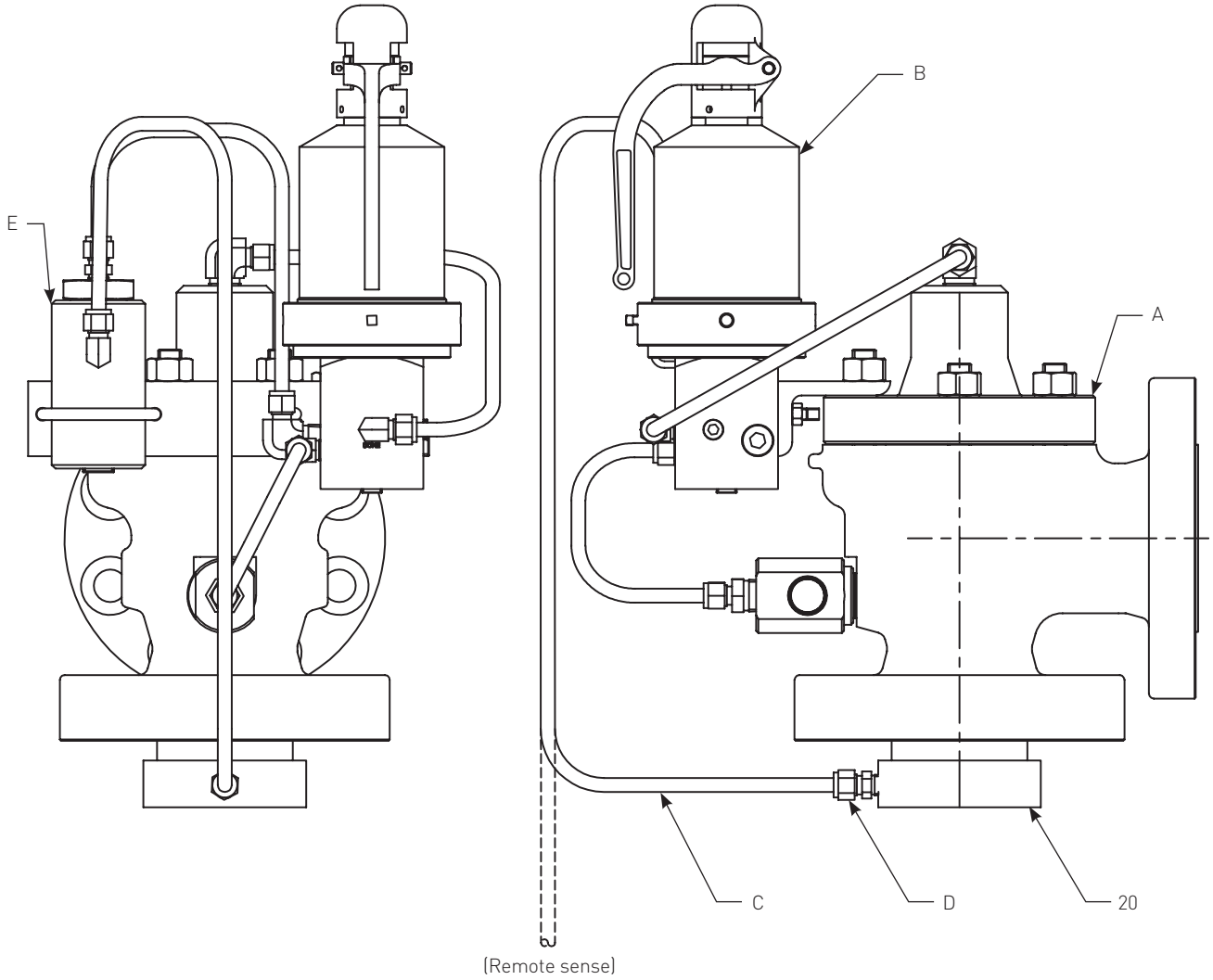
Refer to Figures 1 and 2 for main valve parts description and location.
Remove the pilot valve (B), condensate trap (E), bracket (16), sense ring (20, if installed), associated tubing (C) and fittings (D) from the main valve. Loosen the body drain fitting (17) from the main valve body (1) and discard the gasket (22). Loosen the nuts (14) holding the cap (2) to the body (1). Lift the main valve cap (2) from the body (1), exposing the liner (7), piston (6) and guide (5). Remove the main valve internal parts (4 thru 13 and 18) and discard the organic fiber upper guide gasket (18), the liner O-ring (11) and the piston O-ring (12). The stainless steel lower guide gasket (10) and PTFE wedge ring (13) typically can be cleaned and re-used.
The disc insert (8) can be removed from the disc holder (4) by threading a small bolt (see Table 1 for thread size) into the disc insert (8) and then pulling on the two parts to separate. For the valve sizes with N and P orifices, it would be difficult to pull out the disc insert by hand. Contact the factory for special instructions/tool to remove the disc insert from the disc holder.

Remove the nozzle (3) from the valve body (1). Although it is possible to recondition the nozzle seat without removing it from the valve body, the nozzle must be removed in order to fully inspect its condition, including measuring critical dimensions. To remove the nozzle, turn the valve body over taking care not to damage the cap studs (15). Turn the nozzle counterclockwise by using the wrench flats on the nozzle flange or a nozzle wrench designed to clamp onto the nozzle flange.
All parts should be inspected visually for signs of damage, erosion or corrosion. Moving parts should be inspected for any signs of galling. Guide ID, piston OD and liner ID must be measured to verify dimensions per Table 3, 'Internal Parts Critical Dimensions'.
If measurements are out of range, parts need to be replaced. Damaged valve parts should be repaired and need to be replaced if beyond repair.
Do not remove the pitot tube (21) from the sense ring (20).

TABLE 1 - DISC INSERT THREADED HOLE SIZES

Orifice size	Thread size
F, G, H, J, K, L	¼-20 UNC
M, N, P, Q, R, T	⅜-16 UNC

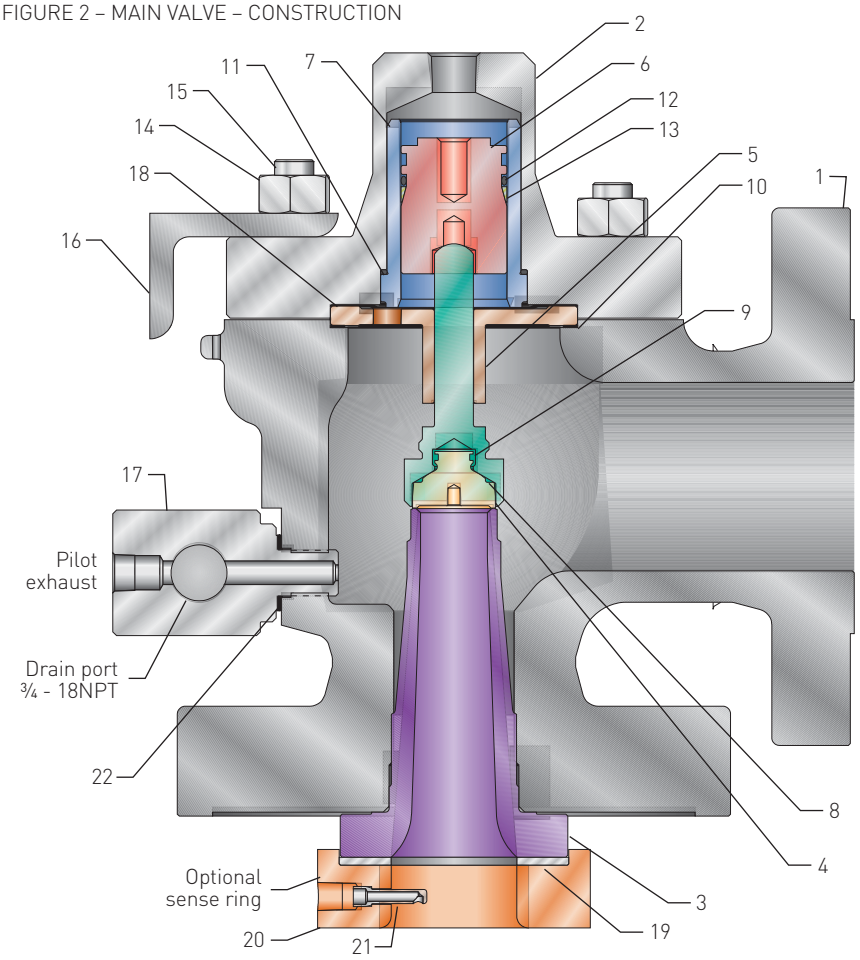
FIGURE 1 – TYPE 5247 PILOT OPERATED PRESSURE RELIEF VALVE GENERAL



ASSEMBLY

Item	Description
A	Main valve
B	Pilot valve
C	Tubing
D	Tube fittings
E	Condensate trap
20	Sense ring (optional)

FIGURE 2 – MAIN VALVE – CONSTRUCTION



MAIN VALVE PARTS

Item No.	Description
1	Body
2	Cap
3	Nozzle
4	Disc holder
5	Guide
6	Piston
7	Liner
8	Disc insert
9	Retaining clip
10	Lower guide gasket*
11	Liner O-ring*
12	Piston O-ring*
13	Wedge ring*
14	Nut
15	Stud
16	Bracket
17	Body drain fitting
18	Upper guide gasket*
19	Sense ring gasket
20	Sense ring
21	Pitot tube
22	Body drain fitting gasket*

* Included in soft goods kit. Refer to Section 9 for soft goods repair kit part numbers.

2.2 Reconditioning of main valve seats
The tightness of a valve and its proper operation depend directly on the condition of the seats. Many pressure relief valve problems are due to eroded or damaged seats.

Note: *Before lapping the nozzle or disc, refer to Table 3 and Table 4. Measure the parts as shown. If the parts measure below the minimum dimensions shown for the part, they cannot be reused and require replacement.*

The Series 5200 valve is constructed with a flat metal-to-metal seat. It is important that seating surfaces are refurbished properly by lapping with a flat cast iron lap coated with the correct lapping compound.

2.2.1 Lapping procedures
Unless the seats have been damaged badly by dirt or scale, lapping the seating surfaces should restore them to their original condition. Never lap the disc insert against the nozzle. Lap each part separately against a cast iron lapping block of the proper size. These blocks hold the lapping compound in their surface pores and must be recharged frequently. Lap the block against the seat. Never rotate the block continuously but use an oscillating motion. Extreme care should be taken throughout to make certain that the seats are kept perfectly flat. If considerable lapping is required, spread a thin coat of medium coarse lapping compound on the block. After lapping with the medium coarse compound, lap again with a medium grade compound. The first step can be omitted unless much lapping is called for. Next, lap again using a fine grade compound. When all nicks and marks have disappeared, remove the entire compound from the block and seat. Apply polish compound to another block and lap the seat.

As the lapping nears completion, only the compound left in the pores of the block should be present. This should give a very smooth finish. If scratches appear, the cause is probably dirty lapping compound. These scratches should be removed by using compound free from foreign material.
Disc inserts should be lapped in the same way as nozzles. The disc insert must be removed from the holder before lapping. Before the disc insert is placed back in the holder all foreign material should be removed from both parts. The insert must be free when in the holder.
If the disc insert is damaged too badly to be reconditioned by lapping, it should be replaced. Re-machining the insert will change critical dimensions, affect the action of the valve and is not recommended.

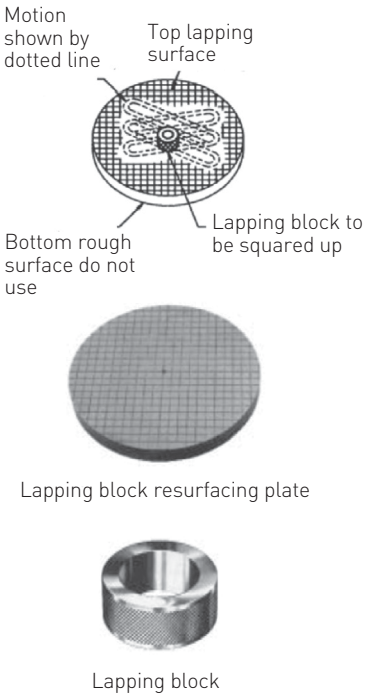
TABLE 2 – SUGGESTED LAPPING COMPOUNDS

Grit compound no.	Description
320	Medium Coarse
400	Medium
600	Fine
900	Polish

- **Lapping blocks**
  Lapping blocks are made of a special grade of annealed cast iron. There is a block for each orifice size. Each block has two perfectly flat working sides and it is essential that they retain this high degree of flatness to produce a truly flat seating surface on either the disc insert or the nozzle. Before a lapping block is used, it should be checked for flatness and reconditioned after use on a lapping plate. The block should be lapped in a figure eight motion, applying uniform pressure while rotating the lapping block against the plate as shown in Figure 3.

- **Lapping compounds**
  Experience has proven that medium coarse, medium fine and polish lapping compounds will condition any damaged pressure relief valve seat properly except where the damage requires re-machining. The lapping compounds or their commercial equivalents are shown in Table 2.

FIGURE 3 – LAPPING BLOCK AND RESURFACING PLATE



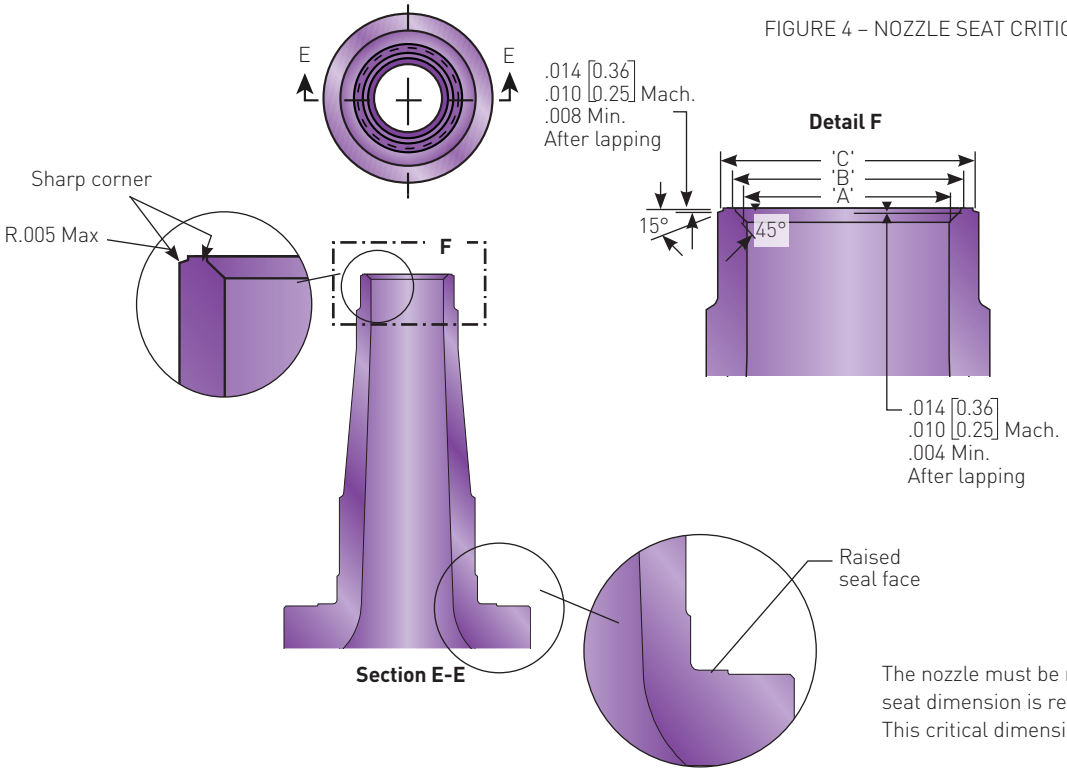
2.2.2 Machining of nozzle seats

Any machining of pressure relief valve parts should only be performed by a certified repair organization or one authorized by the manufacturer. All parts must be machined accurately per our specifications.

No pressure relief valve will be tight, nor will it operate properly unless all parts are machined correctly. The most satisfactory way to machine a nozzle is to remove it from the valve body. However, it may also be machined while assembled within the valve body. In either event, it is vitally important that the seating surfaces run absolutely true before machining.

Machining dimensions for Series 5200 metal-to-metal nozzle seats are shown in Figure 4 and Table 3. Remove only enough metal to restore the surface to its original condition. Turning to the smoothest possible finish will facilitate lapping.

FIGURE 4 – NOZZLE SEAT CRITICAL DIMENSIONS (SEE TABLE 3)



The nozzle must be replaced when minimum face to seat dimension is reached.
This critical dimension is shown in Table 3.

TABLE 3 – INTERNAL PARTS CRITICAL DIMENSIONS

		Nozzle seat critical dimensions (see Figure 4)				Guide	Piston	Liner
		Dim. 'A'	Dim. 'B'	Dim. 'C'	Dim. 'D'	I.D.	O.D.	I.D.
Orifice	Inlet rating	± .002	± .002	± .002	± .005	-0/+.002	-0/+.003	-0/+.003
1½F2	150# thru 600#	0.667	0.740	0.834	4.013	0.437	0.996	1.001
1½F2½	900# thru 1500#	0.667	0.740	0.834	4.013	0.437	0.996	1.001
1½F2½	2500#	0.667	0.740	0.834	4.633	0.442	0.996	1.001
G	150# thru 1500#	0.852	0.948	1.042	3.763	0.531	1.315	1.320
G	2500#	0.852	0.948	1.042	4.763	0.531	1.315	1.320
1½H3	150# thru 600#	1.065	1.186	1.314	3.889	0.626	1.683[3]	1.689[3]
1½H3	900# thru 1500#	1.065	1.186	1.314	5.286	0.626	1.683[3]	1.689[3]
2H3	300# thru 600#	1.065	1.186	1.314	3.889	0.626	1.683[3]	1.689[3]
2H3	900# thru 1500#	1.065	1.186	1.314	4.826	0.626	1.683[3]	1.689[3]
2J3	150# thru 300#[1]	1.363[2]	1.519	1.647	4.326	0.750	2.487[3]	2.493[3]
2J4	300#	1.363[2]	1.519	1.647	4.857	0.750	2.487[3]	2.493[3]
2J4	600# AND 900#[6]	1.363[2]	1.519	1.647	5.107	0.750	2.487[3]	2.493[3]
2J4	900[5] & 1500	1.363[2]	1.519	1.647	6.444	0.750	2.487[3]	2.493[3]
2½J4	300#	1.363[2]	1.519	1.647	4.357	0.750	2.487[3]	2.493[3]
2½J4	600# & 900#[6]	1.363[2]	1.519	1.647	5.107	0.750	2.487[3]	2.493[3]
3J4	300# thru 600#	1.363[2]	1.519	1.647	6.232	0.750	2.487[3]	2.493[3]
3J4	900# thru 1500#	1.363[2]	1.519	1.647	6.441	0.750	2.487[3]	2.493[3]
K	150# thru 300#	1.629[2]	1.816	1.944	4.701	0.906	2.487[3]	2.493[3]
K	600# thru 900#	1.629[2]	1.816	1.944	5.826	0.906	2.487[3]	2.493[3]
3L4	150# thru 300#	2.028[2]	2.264	2.392	5.045	1.562	3.681[3]	3.689[4]
3L6	600# thru 900#	2.028[2]	2.264	2.392	6.201	1.562	3.681[3]	3.689[4]
4L6	150# thru 600#	2.028[2]	2.264	2.392	5.263	1.562	3.681[3]	3.689[4]
4L6	900#	2.028[2]	2.264	2.392	6.236	1.002	3.681[3]	3.688[4]
M	150# thru 600#	2.279[3]	2.541	2.669	5.576	1.562	3.681[3]	3.689[4]
M	900#	2.279[3]	2.541	2.669	6.389	1.562	3.681[3]	3.688[4]
N	150# thru 600#	2.502[3]	2.790	2.918	6.107	1.750	3.681[3]	3.689[4]
P	150# thru 600#	3.033[3]	3.383	3.511	5.857	1.750	5.854[3]	5.861[4]
Q	150# thru 600#	3.989[3]	4.458	4.586	7.747[7]	2.000	6.431[2]	6.440[2]
R	150# thru 600#	4.800[3]	5.318	5.446	8.122[7]	2.000	6.431[2]	6.440[2]
T	150# thru 600#	6.118[3]	6.780	6.908	9.591[7]	2.000	8.443[3]	8.453[2]

NOTES:

1. Limited to 290 psig maximum set pressure.
2. Tolerance is ± .003
3. Tolerance is ± .004
4. Tolerance is ± .005
5. For WCB/WCC valve body material
6. For WC6 valve body material
7. Tolerance is ± .007

2.2.3 Machining of disc insert seats

When the damage to the disc insert seat is too severe to be removed by lapping, the disc insert may be machined and lapped provided that minimum seat height is maintained (Figure 5 and Table 4).

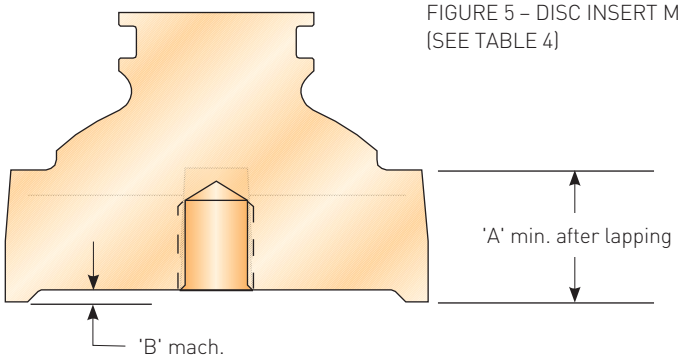


FIGURE 5 – DISC INSERT MINIMUM SEAT HEIGHT (SEE TABLE 4)

TABLE 4 - DISC INSERT MINIMUM SEAT HEIGHTS (SEE FIGURE 5)

Orifice	F	G	H	J	K	L	M	N	P	Q	R	T
'A'	0.370	0.369	0.398	0.429	0.531	0.546	0.605	0.632	0.692	0.783	0.781	0.839
'B' (min)	0.025	0.030	0.036	0.044	0.051	0.063	0.070	0.076	0.091	0.118	0.139	0.176
'B' (max)	0.027	0.032	0.038	0.046	0.053	0.065	0.072	0.078	0.093	0.120	0.141	0.178

2.3 Main valve assembly
Refer to Figure 2 for parts description and location.

2.3.1 Clean all components and inspect for any damage. Replace components if damaged.

2.3.2 Lubricate nozzle (3) threads and nozzle-to-body mating surfaces with pure Nickel 'Never-Seez' or equivalent and then screw into the body (1) and tighten with the appropriate nozzle wrench.

2.3.3 Install the retaining clip (9) onto the groove in the disc insert (8). Lubricate disc insert and disc holder (4) mating bearing surfaces with pure Nickel 'Never-Seez' or equivalent and then place the disc insert into the disc holder and push on the disc insert until it snaps into the disc holder.

2.3.4 Slide the guide (5) over the disc holder.

2.3.5 Install guide-disc holder sub-assembly (2.3.4 above) into body using the stainless steel lower guide gasket (10) and organic fiber upper guide gasket (18).

Note: *Take care when installing the guide-disc holder sub-assembly to avoid damaging the sealing surfaces of the disc or nozzle*

2.3.6 A soft goods kit will have a new liner O-ring, piston O-ring, upper and lower guide gasket, wedge ring and body drain fitting gasket. If the original wedge ring and lower guide gasket are not damaged, they can be cleaned and reused.

2.3.7 Place the wedge ring (13) on the upper end of the piston (6). Coat piston O-ring (12) with Dow Corning Molykote 33 and then slide it in place above the wedge ring.

2.3.8 Lubricate disc holder-piston bearing surface with pure Nickel 'Never-Seez' or equivalent.

2.3.9 Slide piston sub-assembly (2.3.7 above) inside the liner (7). Then place piston-liner sub-assembly onto disc holder and upper guide gasket.

2.3.10 Lubricate cap stud (15) threads with pure Nickel "Never-Seez" or equivalent and then install into the body (1) until they tighten against bottom of the body threaded hole. There should be at least two threads exposed above the nut when the valve is fully assembled. Wipe off excess lubricant.

2.3.11 Coat liner O-ring (11) with Dow Corning Molykote 33 and then slide it in place on the liner.

FIGURE 6 – NUTS TIGHTENING SEQUENCE

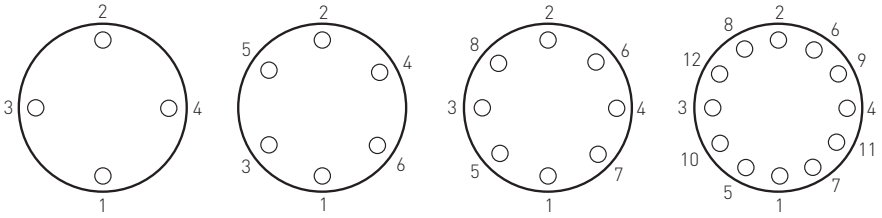


TABLE 5 - TORQUE in foot-pounds

	STL SA193-B7/BK OX		NI ALY SB637-N07718	
	MIN	MAX	MIN	MAX
Thread	(Lubricated)	(Dry)	(Lubricated)	(Dry)
½-13	60	80	80	115
⅝-11	115	165	165	235
¾-10	205	295	295	420
⅞-9	330	480	480	690

2.3.12 Slide cap (2) over the liner and studs until it rests on the upper guide gasket.

2.3.13 Place bracket (16) onto cap studs at opposite side of the main valve outlet.

2.3.14 With the cap and bracket in place, lubricate cap stud threads, nut threads and nut face with pure Nickel 'Never-Seez' or equivalent. Then install nuts on the studs finger-tight. Verify that at least 2 stud threads are exposed above the nut. Readjust stud height as required to achieve thread protrusion.

2.3.15 Tighten the nuts (14) in the sequence shown in Figure 6 to approximately one-half the minimum torque value shown in Table 5. Repeat the same sequence of tightening to the minimum torque value shown in Table 5. Then, starting with the number 1 nut, tighten each nut in order in a clockwise or counterclockwise direction to a value no greater than the maximum torque value shown in Table 5. Wipe off excess lubricant.

2.3.16 Lubricate body drain fitting (17) threads with pure Nickel 'Never-Seez' or equivalent. Install one gasket (22) onto the body drain fitting and then tighten the fitting into the body. The drain fitting must be oriented so the drain port will point downwards and the drain port piping will clear the inlet flange. If necessary, use a second gasket to orient the drain port properly while also providing a tight seal.

2.3.17 If applicable, lubricate body plug threads with pure Nickel 'Never-Seez' or equivalent. Install the gasket (22) onto the plug and then screw the plug into the body.

3 PILOT MAINTENANCE

Refer to Figure 7 for pilot valve parts description and location.

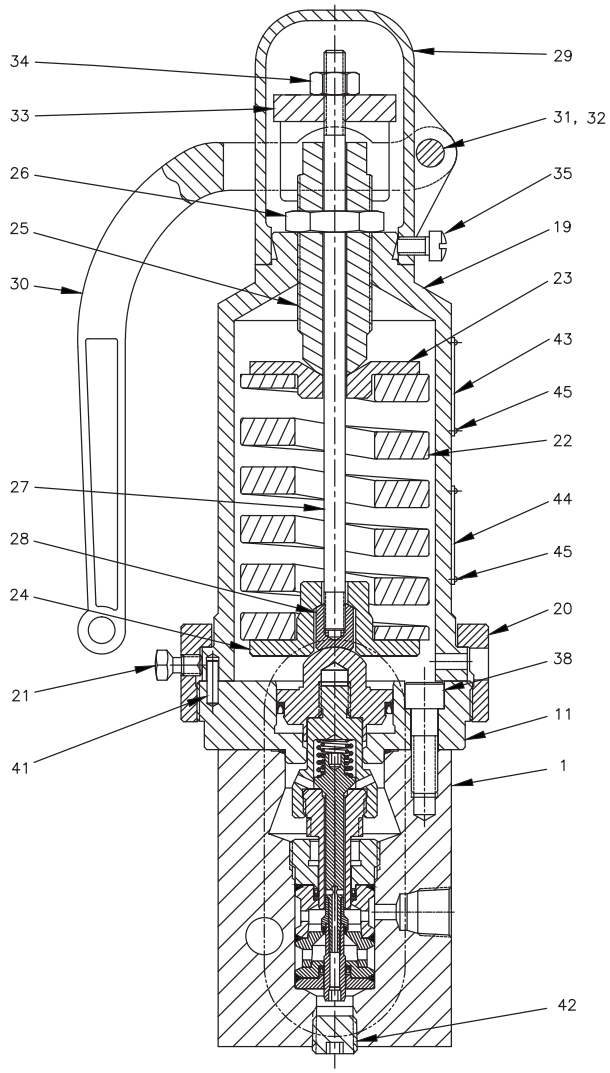
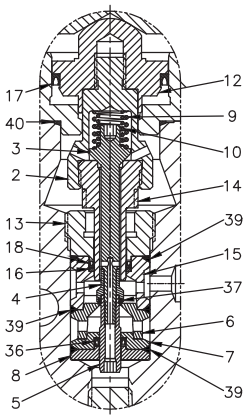


FIGURE 7 – PILOT VALVE



PILOT VALVE PARTS

Item	Description	Item	Description	Item	Description
1	Pilot body	16	Dome seal backup ring*	31	Lift lever pin
2	Piston connector	17	Piston seal*	32	Cotter pin
3	Inlet seat	18	Dome seal*	33	Spindle nut
4	Exhaust seat retainer	19	Spring bonnet	34	Hex nut
5	Exhaust seat stem	20	Bonnet ring	35	Lift lever cap screw
6	Exhaust nozzle	21	Bonnet ring screw	36	Stem seal*
7	Exhaust washer	22	Spring	37	Exhaust seat*
8	Stop washer	23	Washer spring (upper)	38	Piston plate screw
9	Outer spool spring	24	Washer spring (lower}	39	Spool/body seal*
10	Inner spool spring	25	Pressure adjustment screw	40	Body/piston plate seal*
11	Piston plate	26	Adjusting screw locknut	41	Roll pin
12	Sense piston	27	Lifting rod	42	Pipe plug – ¼" NPT
13	Bushing	28	Lifting rod bushing	43	Pilot nameplate
14	Inlet nozzle	29	Lift lever cap	44	Patents nameplate
15	Dome spool	30	Lift lever	45	Drive pin

* Is included in soft goods kit. Refer to Section 9 for soft goods repair kit part numbers.

3.1 Pilot disassembly

3.1.1 To facilitate re-assembly, place all parts removed in an orderly arrangement so that the correct parts can be assembled in the proper sequence.

3.1.2 Remove cotter pin (32), lever pin (31) and lifting lever (30). Remove the lift lever cap screw (35) and cap (29). Loosen hex nut (34)* from the spindle nut (33) and remove the spindle nut.

* For pilots using cotter pin (prior design) instead of hex nut to retain spindle nut, refer to cotter pin conversion instruction sheet 1101-27480 for replacement part numbers and procedure to replace cotter pin with hex nut.

3.1.3 Remove lock nut (26) and completely loosen the pressure adjustment screw (25). Remove the bonnet ring screw (21), bonnet ring (20) and bonnet (19). Remove bonnet ring by using a ⅜-16 UNC-2A bolt approximately 2½" long and use as a handle (or use a spanner wrench). (Note: be careful not to drop the spring (22), spring washers (23 and 24) and lifting rod (27) when removing the bonnet).

3.1.4 Slide the lifting rod bushing (28) and lifting rod through the spring washers and spring.

3.1.5 Remove four piston plate screws (38) and remove the piston plate (11) with attached sense piston (12), piston seal (17), piston connector (2), inlet seat (3), inlet nozzle (14), exhaust seat retainer (4), exhaust seat (37) and exhaust seat stem (5). Remove and discard body/piston plate seal (40).

3.1.6 Remove bushing (13) using a ½" hex drive.

3.1.7 Place pilot on its side and remove the ½" pipe plug (42) from the bottom of the valve. With a brass, ⅜" diameter, flat end rod and hammer, gently tap through the bottom hole and push the spool/body O-ring seals (39), dome spool (15), dome seal (18), dome seal backup ring (16), exhaust nozzle (6), exhaust washer (7), stem seal (36) and stop washer (8) out of body. Discard spool/body O-rings, stem seal, dome seal and dome seal backup ring.

Note: *If dome spool (15) and exhaust nozzle (6) are difficult to separate, place exhaust nozzle into a soft jawed vice. Using a flat end brass bar hold it next to the dome spool and gently tap using a hammer. Be careful not to scratch or damage the parts.*

3.1.8 Unscrew the sense piston from the piston connector by placing an open end wrench onto the flats on both parts (use soft jawed vice to hold sense piston if available). Use an acetone based solution to remove the Loctite 242 solution from the threads. Slide the piston connector through the piston plate. Holding the flats on the inlet nozzle and piston connector, unthread piston connector from inlet nozzle and remove inner spring (10) and outer spring (9).
Warning: *Remove piston seal from sense piston carefully to prevent scratching the sealing surface (O.D.) of piston. Discard piston seal.*

3.1.9 Insert a ⅛" hex drive into top of inlet seat and with another ⅛" hex drive insert into the bottom of the exhaust seat stem and unthread. Separate the exhaust seat retainer from the inlet seat. Remove exhaust seat from exhaust seat retainer and discard exhaust seat. Use an acetone based solution to remove the Loctite 242 solution from the threads.

3.2 Pilot assembly

During assembly it must be observed that all moving parts are free to move throughout their full travel without any binding.

3.2.1 Inlet seat/nozzle lapping

A slightly worn inlet seat and nozzle may be repaired by lapping. If either part is 'washed-out', they must be replaced with new parts, which must be lapped as follows:

- Before starting the lapping process, inspect the radius and finish shown on the below sketch of the inlet nozzle. The sharp corner is attained by lapping the entire top surface of the nozzle to the specified finish.
- Place inlet seat through inlet nozzle. Apply small amount of Hyprez 3L diamond lapping compound or equal to the inlet seat's conical surface. Hold the inlet nozzle in one hand and lightly lap the inlet seat with the inlet nozzle by spinning the inlet seat onto the inlet nozzle's seating surface. Minimum force shall be applied during this process.
- Start with coarse Hyprez lapping compound. Be careful and use this for a brief amount of time as it will remove material quickly. Wipe clean with solvent such as acetone and repeat with fine Hyprez lapping compound(s) as required. Note that this process may take up to 15 minutes or more. Take care to not remove material from the parts when lapping.

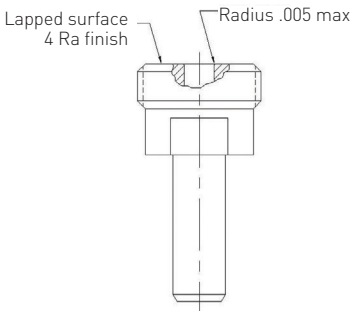
3.2.2 Clean the inlet seat and nozzle by removing the lapping compound using Varsol followed by Acetone. Afterwards, wipe with a clean lint-free cloth or towel. When dry, the seating surface should be examined to verify if an acceptable sealing surface has been achieved. A proper surface is one which exhibits a dark gray appearance with no visible scratches across the entire lapping surface.

3.2.3 Inlet seat and exhaust seat sub assembly

Carefully examine the exhaust seat to verify if one side is concave and the other side is flat. Place the inlet seat through the inlet nozzle. Slide the exhaust seat retainer onto the inlet seat. Slide the exhaust seat with the flat face down onto the exhaust seat stem. Place a small amount of Loctite 242 on the threads of the inlet seat. Thread the exhaust seat stem onto the inlet seat, squeezing the exhaust seat into the exhaust seat retainer. Using a ⅛" hex drive that is on top of the inlet seat and the exhaust stem, tighten the inlet seat onto the exhaust stem. (Be careful not to over tighten, as this may cause damage to the parts.)

3.2.4 Place the stem seal with the opening of the cup facing outward into the exhaust washer. Place stop washer into body cavity with the raised face up. Place body/spool O-ring seal into body cavity on top of the stop washer. Place exhaust washer into body cavity with the U-cup seals facing down into the cavity. Place exhaust nozzle into body cavity with the larger open end facing downward next to the exhaust washer. Place another body/spool O-ring seal into cavity.

3.2.5 Place back-up ring into dome spool. Next place dome seal on top of back-up ring with the opening of the dome seal facing up. Place dome spool into body cavity with dome seal facing up. Place final body/spool O-ring seal into body cavity. Apply a light coating of Fluorolube LG-160 oil or equivalent on threads of bushing. Thread bushing (13) into body and tighten until spool set is compressed fully metal-to-metal.



3.2.6 Place inner spool spring onto the inlet seat. Place outer spool spring over the inner spool spring onto the inlet seat. Place a small amount of Loctite 242 on the threads of the inlet nozzle. Thread on the piston connector and tighten, compressing the springs.

3.2.7 Carefully install piston seal into the groove of the piston with the opening of the seal facing outward. Carefully insert the piston into the piston plate. Place a small amount of Loctite 242 on the threads the piston connector. Thread the piston connector onto the piston and tighten using the wrench flats on both parts.

3.2.8 Place body/piston plate seal between these parts and, very carefully, guide the exhaust seat stem of the upper assembly through the bushing, dome spool seal and stem seal. (Be careful not to scratch or dent the exhaust nozzle seating surface). Also, be careful not to damage the dome seal. This assembly will stop when the exhaust seat comes in contact with the exhaust nozzle. Install the cap screws through the piston plate and into the body and tighten to 18 ft-lb (24 N-m). Place roll pin (41) into pin locator hole located near the edge of the piston plate.

3.2.9 Lift lever
3.2.9.1 Thread the lift rod bushing onto the lift rod. Place a light coat of Fluorolube LG-160 oil or equivalent to the contact surface of the bushing and bottom spring washer (24). Slide the lifting rod with bushing through the bottom spring washer.

3.2.9.2 Apply a light coating of Fluorolube LG-160 oil or equivalent on the top of the sense piston where the lifting rod bushing will contact. Place the bottom washer, bushing and lifting rod assembly on top of sense piston followed by stacking the spring and the top spring washer. Lower the bonnet over the spring and spring washer stack until the flange rests on the piston plate with the pin engaged in its respective hole in the bonnet outer rim. Apply a light coating of Fluorolube LG-160 oil or equivalent on the outer threads of the body.

3.2.9.3 Slide the bonnet ring over the bonnet and thread onto the body capturing the bonnet. Thread the ⅜" bolt used during disassembly of bonnet into the threaded hole in the bonnet ring (do not bottom). Use the bolt as a handle to tighten the ring into place. Or, use a spanner wrench and tighten using the unthreaded hole.

3.2.9.4 Place a small drop of Loctite 242 or equal on the threads of the bonnet ring screw, thread into the side of the bonnet ring and tighten.

3.2.9.5 Apply a light coating of Fluorolube LG-160 oil or equivalent on the internal threads of the bonnet and the threads of the pressure adjustment screw (25). Screw the adjustment screw into the bonnet until it contacts the top spring washer. Thread the adjustment screw nut (26) down the adjustment screw until the nut contacts the bonnet and then secure hand tight. Go to Section 6 for adjustment of pilot set pressure.

3.2.9.6 Thread spindle nut (33) onto the lift rod (27) just enough until 2 full threads on lifting rod is visible below the spindle nut. Do not thread in hex nut (34) yet. Place cap (29) on bonnet. Guide lifting lever through cap under the spindle nut and attach to cap using the lever pin. Adjust the spindle nut until there is a 1/16 inch (1.5 mm) minimum of play between the lifting lever and the spindle nut. The spindle nut may be adjusted by removing the lifting lever pin and lifting lever.

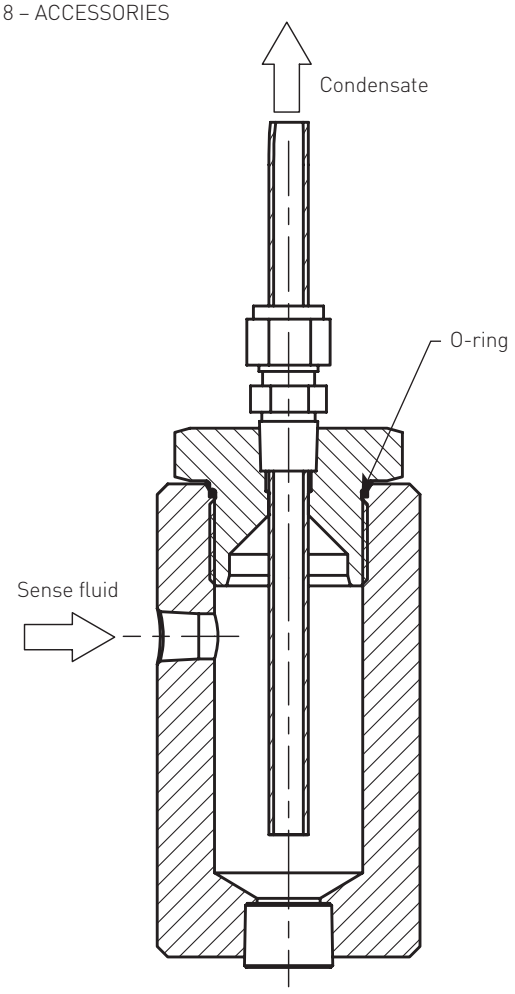
3.2.9.7 Once the spindle nut has been set, remove cap (29) and thread in hex nut (34) into lifting rod and tighten against spindle nut (33) by firmly holding spindle nut with adjustable plier. Ensure that the hex nut is attached firmly to the spindle nut. Replace cap on bonnet and position the lifting lever opposite of the valve outlet and install the cap screws. Install lock wire from lever pin to cap screw to bonnet ring screw.

4 ACCESSORIES MAINTENANCE

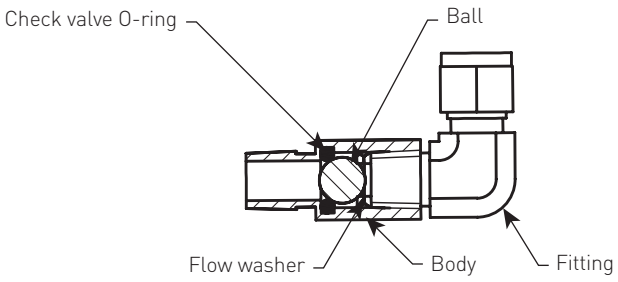
Refer to Figure 8 for parts description and location.
Every Series 5200 valve comes with a condensate trap. The PTFE O-ring between the body and bushing is replaceable. Remove the bushing from the body, discard the used O-ring and replace with the new O-ring from the soft goods kit. Lubricate bushing thread with Fluorolube LG-160 oil or equivalent. Screw the bushing back into body and tighten to 80-100 ft·lbs.
Every Series 5200 valve comes with a backflow check valve on the pilot exhaust. The check valve seal is replaceable. Remove the fitting from the check valve body. Remove the flow washer and ball. Using an O-ring pick, remove and discard the check valve O-ring. Lightly lubricate a new O-ring from the soft goods kit with Dow Corning Molykote 33 silicone grease or equivalent. Install O-ring in the body groove and replace the ball and flow washer in the correct order. Reinstall the fitting to the check valve body using PTFE tape.

The Series 5200 valve can be ordered with a field test device to check set pressure while the relief valve is in service. This device includes a shuttle and indicator. The seals can be replaced in these devices. To replace the seals, loosen the bushing from the body and remove the shuttle and seals. Lightly lubricate all seals with Dow Corning Molykote 33 silicone grease or equivalent. Install the new seals in the locations shown in Figure 8. Install the shuttles in the bodies and tighten the bushings.

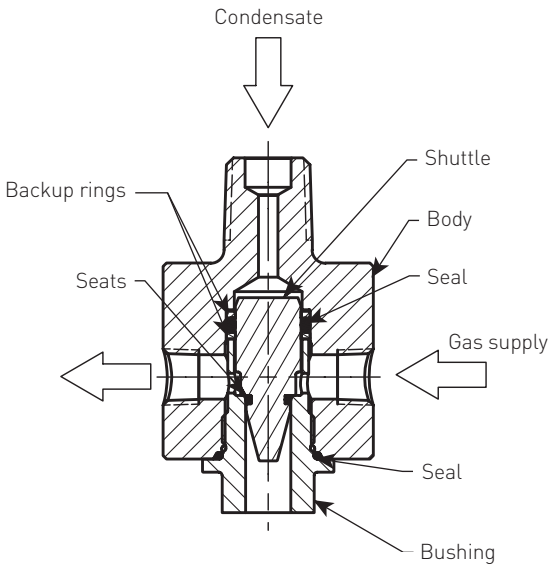
FIGURE 8 – ACCESSORIES



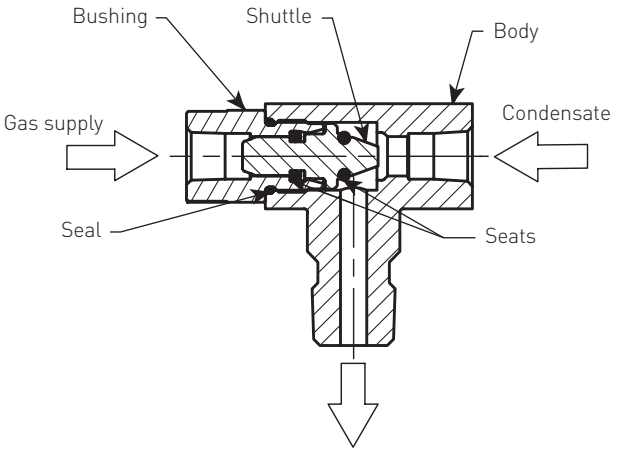
Condensate trap



Pilot exhaust backflow check valve

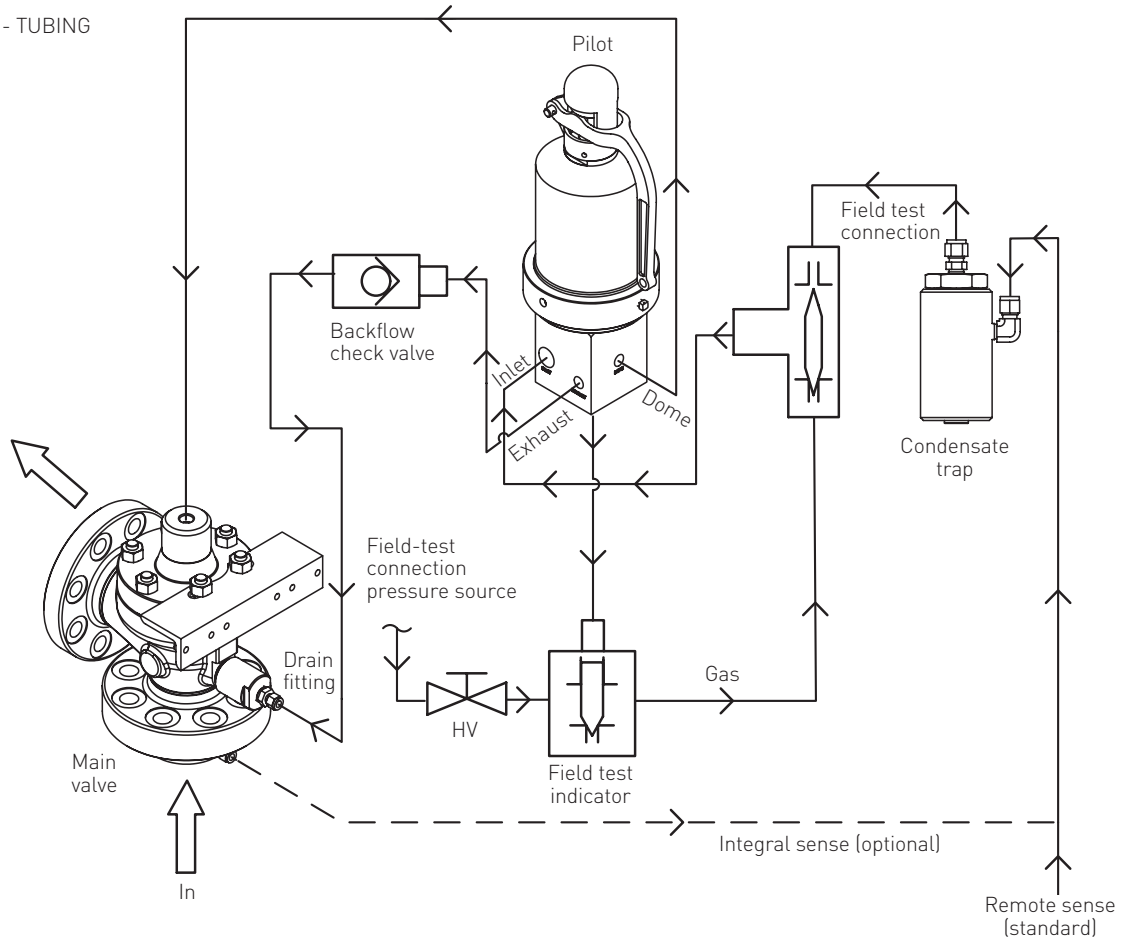


Field test indicator



Field test connection

FIGURE 9 - TUBING



5 VALVE ASSEMBLY

Reinstall the pilot to the bracket using the two studs and nuts. Reinstall the condensate trap using the U-bolt and nuts. Reinstall the fittings and tubing between the main valve, pilot, condensate trap, field test (if applicable) and sense ring (if applicable). See Figure 9 for tubing schematic.

6 PILOT PRE-SET PRESSURE ADJUSTMENT

6.1 Definitions, pilot only

Set pressure is the test pressure at which the pilot reduces the dome pressure to 'A' ± 2% of set pressure (Refer to Table 6 for the value 'A'). Cracking pressure is the test pressure at which first leak occurs at the pilot exhaust port on increasing pressure.

Reseat pressure is that supply pressure where the dome pressure equals to 'B' ± 2% of set pressure (Refer to Table 6 for the value 'B'). Dome pressure is the pressure at the dome connection of the pilot valve.

6.2 Set pressure, pilot only

The pilot can be pre-set and checked for leakage using air on a test set up similar to that shown in Figure 10. Final setting is to be performed on steam.

The adjustment screw should be turned IN most of the way. Increase the supply pressure to nameplate setting and slowly back out the adjustment screw until flow through the pilot exhaust begins. Continue to back out the adjustment screw slowly until dome pressure is per Table 6 (Dome pressure 'A') and the test pressure meets the required set pressure tolerance of section 7.5. After adjustment is completed, securely tighten the jam nut.

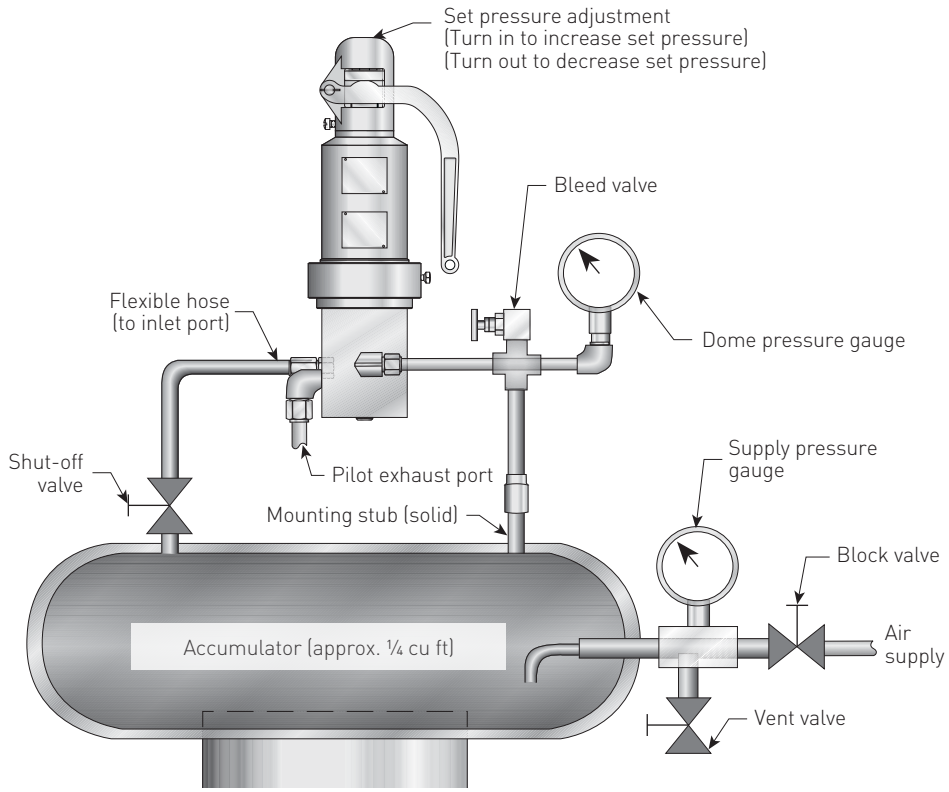
To determine reseat pressure, shut off the test pressure supply and use the accumulator vent valve to reduce the supply pressure slowly until the dome pressure is per Table 6 (Reseat pressure 'B').

Close the shut-off valve and open the bleed valve slowly. When the dome pressure gauge reading is zero, the pilot may be removed from the test set-up.

TABLE 6 – RESEAT PRESSURES AND DOME PRESSURES (VALUE AS % OF SUPPLY PRESSURE)

Orifice	Dome pressure 'A'	Reseat pressure 'B'
R	70%	75%
F, G, K, N, T	60%	65%
H	55%	60%
J, L, M, Q	45%	50%
P	35%	40%

FIGURE 10 – PILOT ADJUSTMENT STEAM TEST SET-UP



6.3 Range of adjustment
All pilots can be adjusted ± 5% beyond the nameplate setting. If a set pressure change is made that requires a new spring, consult the factory for information contained in the spring chart.

6.4 Performance requirements, pilot only
Pilot crack pressure must be at least 95% of set pressure. Refer to performance requirements, Section 7.5, for set pressure tolerance and reseat pressures.

7 VALVE ASSEMBLY TESTING

7.1 General
The complete valve assembly must be tested for leakage. The test medium should be steam.

7.2 Set pressure check
Slowly increase pressure to the valve inlet until the first audible discharge is detected. This is set pressure. Adjust set pressure as required to meet the performance requirements of Section 7.5.

Note: *Clockwise rotation of pressure adjusting bolt increases the relief pressure. Tighten the locknut after adjustment is completed.*

7.3 Leakage check

Note: *Actuate the valve a minimum of 2 times prior to testing the pilot for seat leakage.*

7.3.1 Seat tightness test must be conducted at maximum of 95% of nameplate set pressure, but not to exceed the reseating pressure of the valve. When being tested, a valve exhibiting no visible signs of leakage will be considered adequately tight.

7.3.2 There should be no visible signs of external leakage (through any fittings or joints) at 90% of nameplate set pressure.

7.4 Back pressure test
The secondary zone should be pressure tested on air at 30 psig minimum. If applicable, plug the body drain fitting port. There must be no visible sign of leakage at the body drain fitting or at the pilot exhaust tubing and fittings. After test, if applicable, remove drain fitting plug.

7.5 Performance requirements

7.5.1 Set pressure

Adjust the valve set pressure to the nameplate, within tolerances listed below.

7.5.1.1 ASME BPVC Section- I Applications:

Set Pressure, psig [barg]	Tolerance
⩽ 70 [4.83]	± 2 psig [0.14 barg]
> 70 [4.83] and ⩽ 300 [20.68]	± 3% of set pressure
> 300 [20.68] and ⩽ 1000 [68.95]	± 10 psig [0.69 barg]
> 1000 [68.95]	± 1% of set pressure

7.5.1.2 ASME BPVC Section- VIII and Section XIII Applications:

Set Pressure, psig [barg]	Tolerance
⩽ 70 [4.83]	± 2 psig [0.14 barg]
> 70 [4.83]	± 3% of set pressure

7.5.2 Blowdown

Set Pressure, psig [barg]	Maximum blowdown
< 67 [4.62]	4 psig [0.28 barg]
⩾ 67 [4.62] and < 250 [17.24]	6% of the actual set pressure
⩾ 250 [17.24] and < 375 [25.85]	15 psig [1.03 barg]
⩾ 375 [25.85]	4% of the actual set pressure

Note: *For ASME BPVC Section I applications, minimum blowdown for all safety or safety relief valves shall be 2 psig [0.14 barg] or 2% of the set pressure, whichever is greater.*

7.5.3 Minimum required lift

Inlet size (NPS)	Outlet size (NPS)	Orifice designator	Min. lift (inches)
1.5	2, 2.5, 3	F	0.207
1.5, 2	2.5, 3	G	0.265
1.5, 2	3	H	0.331
2, 2.5, 3	3, 4	J	0.424
2.5, 3	4	K	0.507
3, 4	4, 6	L	0.631
4	6	M	0.709
4	6	N	0.779
4	6	P	0.945
6	8	Q	1.243
6	8, 10	R	2.000
8	10	T	2.550

8 PILOT SET PRESSURE FIELD TEST PROCEDURE

8.1 General

The set pressure of valves equipped with the field test accessory can be checked with the valve installed, in service, using a test set up similar to that shown in Figure 11. This procedure checks the set pressure accurately.
The main valve will not open if the process pressure is less than 80-90% of the set-pressure, depending upon the valve size. If the main valve must be opened, slowly increase the test gas pressure until the main valve opens. To close the main valve, close block valve 'A' on the test gas bottle and open vent valve 'C'.

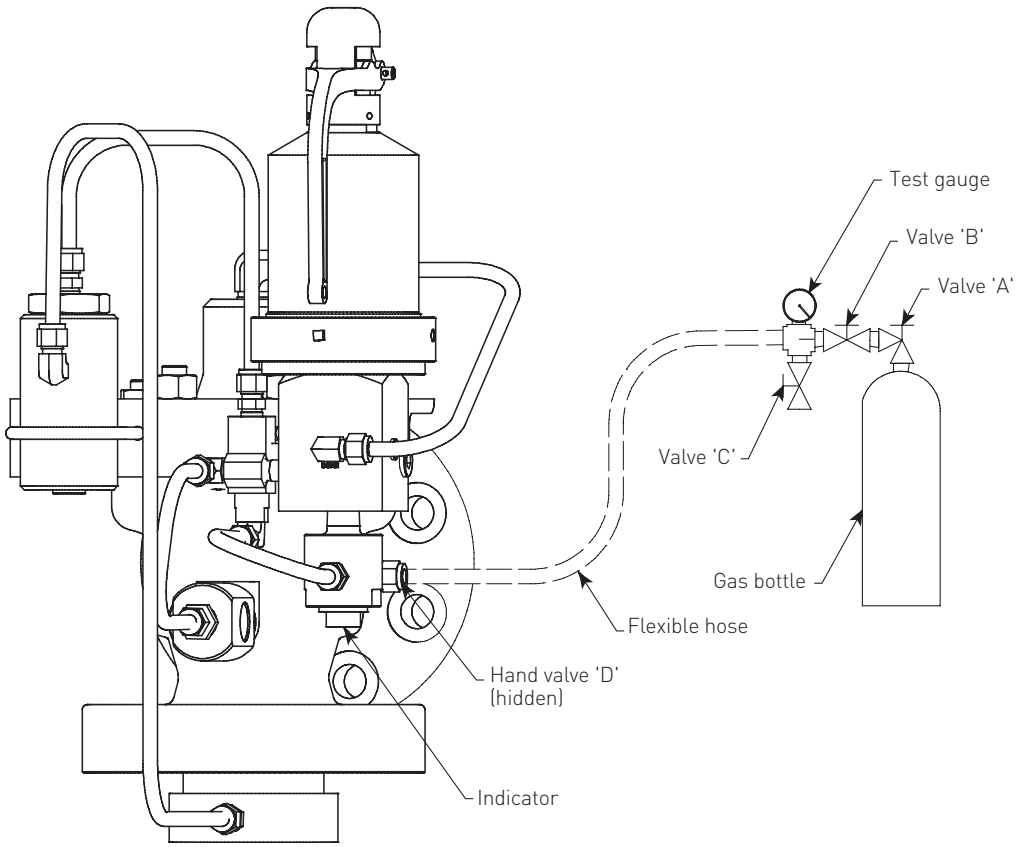
8.2 Procedure

8.2.1 Connect flex hose from test gas bottle and open hand valve 'D'.

8.2.2 Close vent valve 'C'; open block valve 'A' on gas bottle; regulate valve 'B' to slowly pressurize pilot and observe test pressure gauge. Set pressure is reached when the pressure gauge reading stalls or reduces and the indicator hisses. Close block valve 'A' then open slowly to recycle the pilot enough to be certain of the set pressure.

8.2.3 To remove set up, close block valve 'A', close hand valve 'D', open vent valve 'C' and remove flexible hose from field test fitting.

FIGURE 11 – FIELD TEST SET-UP



9 SOFT GOODS REPAIR KITS

9.1 Pilot repair kit:

Part number: 11044661

9.2 Main valve repair kits:

Orifice	Size	Inlet flange rating	Part number
F	1.5 x 2	150# - 600#	10131340
	1.5 x 2.5	900# - 2500#	10131341
G	1.5 x 2/3	150# - 600#	10131342
	1.5 x 2.5/3, 2 x 3	900# - 2500#	10131344
H	1.5/2 x 3	150# - 600#	10131346
		900# - 1500#	10131347
J	2 x 3, 2 x 4, 2.5 x 4, 3 x4	150# - 600#	10131351
	2 x 4	900# (WC6)	10131352
	2 x 4	900# (WCB)	10131353
	2.5 x 4	900#	10131352
	3 x 4	900#	10131353
	2/3 x 4	1500#	10131353
K	2.5/3 x 4	150# - 600#	10131358
		900#	10131359
L	3 x 4, 3 x 6, 4 x 6	150# - 600#	10131363
	3 x 6	900#	10131364
	4 x 6	900#	10131366
M	4 x 6	150# - 600#	10131367
		900#	10131368
N	4 x 6	150# - 600#	10131367
P	4 x 6	150# - 600#	10131370
Q	6 x 8	150# - 600#	11114194
R	6 x 8, 6 x 10	150# - 600#	11114197
T	8 x 10	150# - 600#	11114198

The set pressure range is 15 psig to 3200 psig. Model numbering is per below.

Example:	52	4	7	10	J	23	/S1

Pilot series
52 Series 5200

Main valve lift
4 Full lift, API orifice

Main valve piston type
7 Metal seat

Inlet flange rating, ANSI

05	150#	**14**	900#
10	300#	**16**	1500#
12	600#	**18**	2500#

Orifice designation
Letter API equivalent

Inlet x outlet, inches

Main valve materials
/S WCB/WCC body, SS Trim (up to 800°F [427°C])
/S3 WC6 body, SS Trim (800°F to 1000°F [538°C])
/SPL Special