Series HSP
Pressure Pilot Regulating Valve

Installation

Operations &

Maintenance

Manual

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HSP Specifications

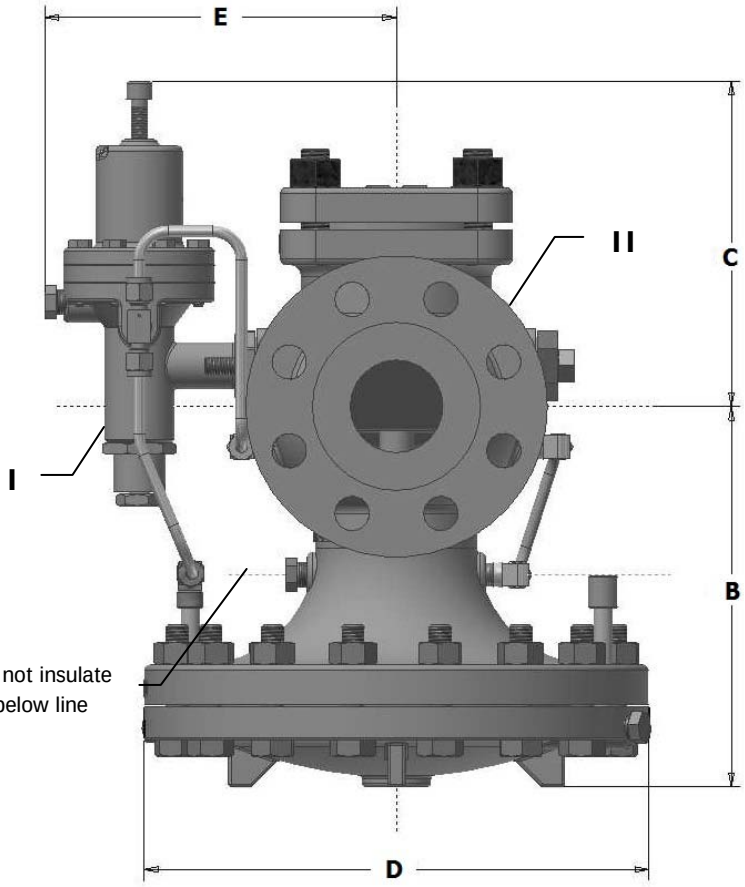

Figure 1: HS Pressure Regulating Valve

Item	Description
I	Pilot Assembly
II	Main Valve Assembly

HSP Valve Pressure-Temperature Ratings	
150# Flanges	150psi @ 566°F
300# Flanges	450psi @ 650°F

Pressure Adjusting Range for Pilot Spring	
Pressure	**Color**
5-40 PSIG	Yellow
25-100 PSIG	Blue
75-300 PSIG	Red

Note: Y, B, or R is indicated on the pilot at the adjustment screw to provide the pressure reducing spring range

Size	Flange Face to Face		B	C*	D	E**	F	Weight (lb)
	150PSI	300PSI						
1	5 1/2	6	6 11/32	6 11/16	7 1/8	6 23/32	0.12	45
1 1/2	6 7/8	7 3/8	7 9/16	6 13/16	9	7 7/16	0.152	60
2	8 1/2	9	8 1/4	7	10 7/8	7 5/8	0.178	95
3	10	10 3/4	8 7/8	7	13 3/4	8 5/8	0.25	160
4	11 7/8	12 1/2	10 7/8	7	14 3/4	9 3/4	0.299	245

All dimensions are in inches unless noted differently
* With Pilot Screw at max height and applying no load to Spring
** Based on approximate position of plug

Principle of Operation

The HSP Pilot Operated Pressure Regulating Valve is designed to maintain a consistent downstream pressure for steam applications.

1. High pressure steam enters the Main Valve Body and fills the chamber above the Seat in the main body.
2. The high pressure steam moves to the Pilot Base where a stainless steel screen captures unwanted dirt and particles. This allows cleaner steam to pass through to the pilot base.
3. Turning the Pilot Adjusting Screw clockwise compresses the Adjusting Spring. The Adjusting Spring applies pressure to the Pilot Diaphragm which opens the Pilot Valve.
4. The steam then travels through the Pilot Valve to the External Transmission Tubing. This then fills the area under the Main Valve Diaphragm.
5. T he pressure under the Main Valve Diaphragm pushes the stem upward which lifts the Main Valve Disc off the Seat, which allows the upstream steam to flow to the downstream piping.
6. The Pilot Sensing Line, which is recommended to be a minimum of 10 pipe diameters downstream from the valve, also fills with steam. The steam then builds pressure under the Pilot Diaphragm to balance the spring force and allow the Pilot to throttle to maintain a constant downstream pressure.
7. When the valve must close, the Bleed Orifice will allow pressure to exit the area under the Main Valve Diaphragm and into the downstream piping

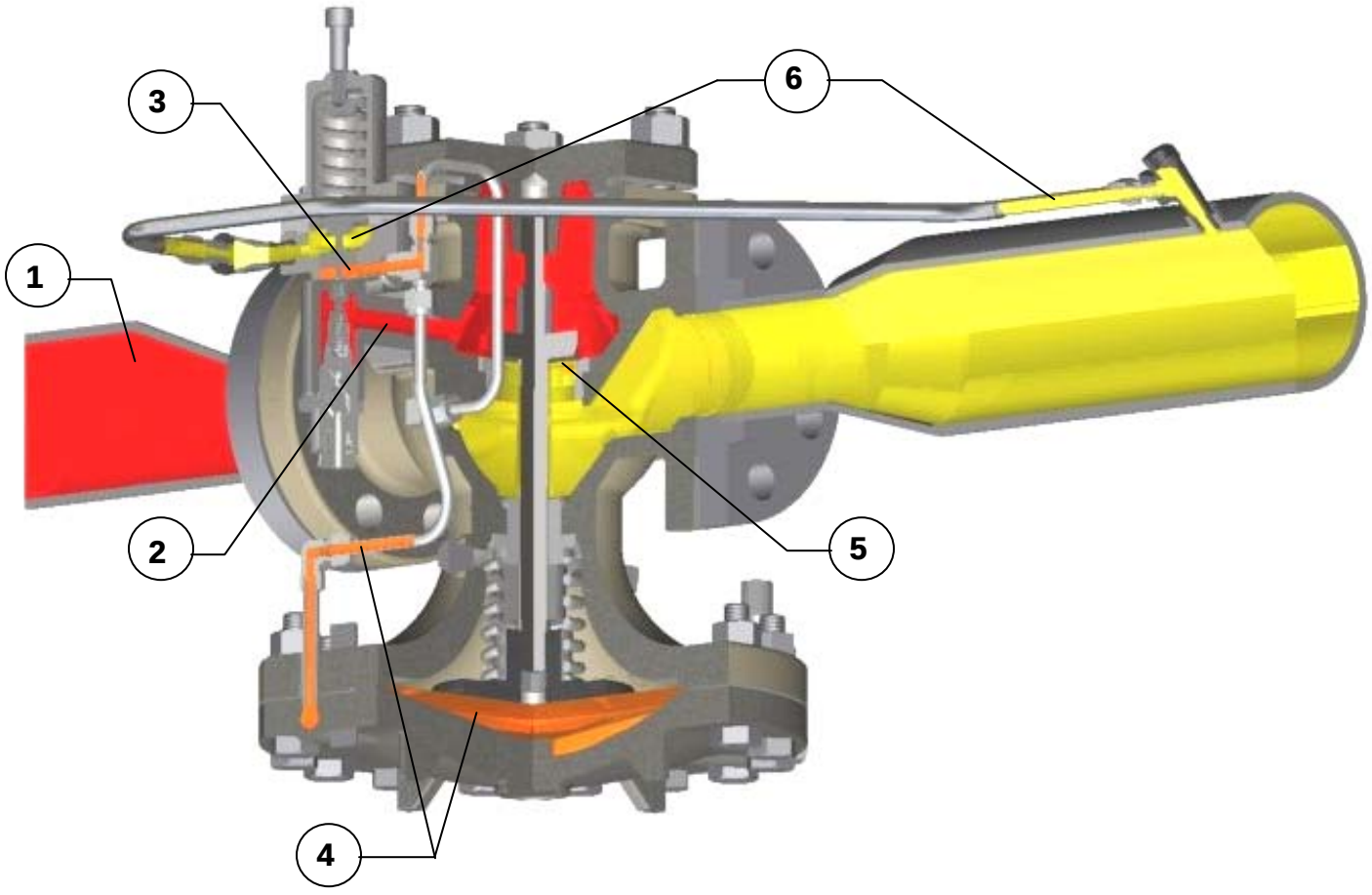

Figure 2: Valve Operations

Installation

A Recommended Notes for System

1. Piping will need to be adequately sized to handle the flow, velocity, and pressure requirements for the regulator's application.
2. Piping upstream should generally be 1-2X larger and downstream should be 2-3X larger than the valve to eliminate flow restrictions.
3. An eccentric reducer at inlets will reduce the risk of water hammer by removing a potential condensate collection point.
4. To prevent condensate from possibly damaging the regulator or pipe, an adequately sized drip leg with steam trap should be installed prior to the regulator.
5. A strainer with blow down valve is recommended before all regulator installations. The strainer should be in the horizontal position to prevent any collection of condensate. Pipeline debris and scale can damage internal valve components, potentially leading to poor operation and/or failure.
6. A bypass line may be added with gate valves before and after the HS Regulating Valve. A globe valve is recommended to throttle the bypass line.
7. To ensure proper operation, follow the recommended guideline of 10 pipe diameters minimum straight run lengths of pipe before and after a regulator.
8. Pressure gauges should be installed before and after the regulator to confirm operation. A siphon loop and isolation valve should be installed prior to the gauge.

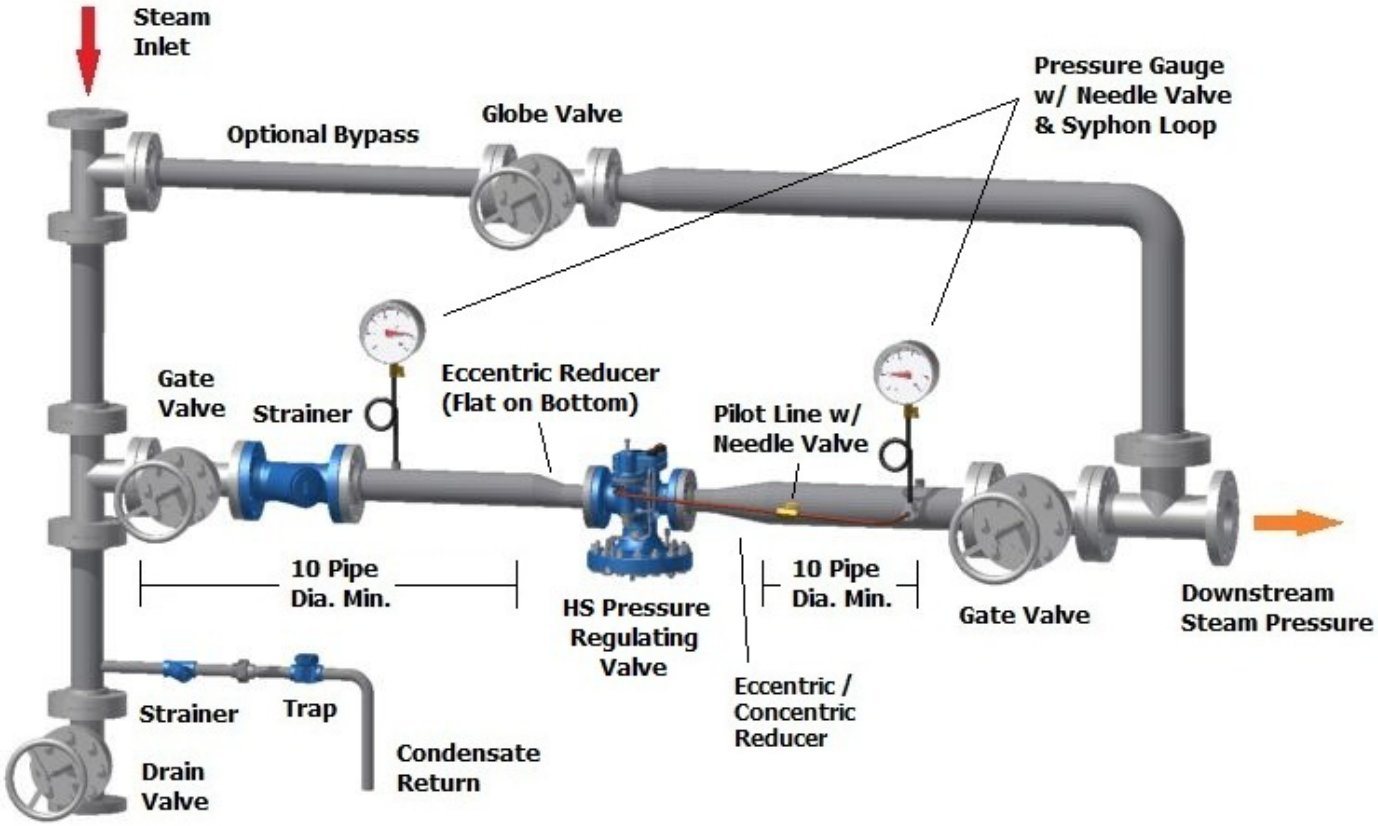

Figure 3: Recommended Valve Installation

B Valve Installation

1. Verify steam supply is safely shut off.
2. Clean out existing pipe to remove scale and debris buildup. Buildup in the lines could cause damage to the regulator.
3. The valve shall be installed in the horizontal position with the diaphragm positioned on the bottom.
4. Verify the direction of flow is in the correct orientation. An arrow on the regulator body will confirm the flow's direction.
5. When installing the flange bolts, tighten evenly and in a star pattern.

C Pilot Installation

1. Assemble the pilot to the valve body making sure the gasket is properly seated between the pilot and main body. Be sure to tighten the bolts evenly.
2. Install the pilot sensing line, which should be ¼" stainless steel tubing.
3. The pilot sensing line should be connected from the pilot valve to the downstream piping with the following recommendations:
   a. A minimum of 10 pipe diameters straight run length of pipe after the regulator
   b. The location should have a minimum amount of turbulence
   c. The sensing line should slope down and away from the pilot to prevent condensate from entering the pilot.
   d. A needle valve is recommended to be installed in the sensing line for fine-tuning purposes.

Start up

1. All valves in the installation need to be closed.
2. Loosen the locknut on the pilot adjusting screw and back out until the force has been released from the adjusting spring.
3. Open the valve ahead of the steam trap or other drain valve to remove all condensate from the inlet piping. Follow the same procedure for a steam trap on the outlet piping. Note: Serious damage to the piping system and PRV could occur from the effects of water hammer.
4. Open the pilot isolation valve in the pilot sensing line after the condensate has been removed from the system.
5. Verify that the bypass valve is closed, and slowly open the outlet gate valve.
6. Slowly open the inlet gate valve for the main valve and verify there are no indications of water hammer conditions.
7. Blowdown the main inlet strainer and the pilot strainer.
8. Turn the pilot adjusting screw slowly clockwise until the valve begins to open and pass steam downstream.
9. Adjust the pilot screw until the desired pressure is reached. Allow time for pressure changes to occur due to the piping system volume.
10. After the system has stabilized check the downstream pressure and readjust the pilot screw as required.
11. Inspect the piping system and valve for any leaks and tighten as required. Then tighten the locknut for the pilot adjusting screw.

Maintenance

Proper maintenance is significant for reliable operation of the valve. Frequency of cleaning and maintenance performed are dependent on the conditions of the steam system.

A General Service Inspection

1. Inspect all connections for leaks and tighten as required.
2. Blow down or clean the pilot and all pipe line strainers in the system.
3. Verify the pressure is properly set after blow down and readjust if necessary.

Note: At a minimum, these maintenance operations should be performed a few days after the valve has been initially installed and shortly after the start up during each heating season.

Orifices

There are 2 different orifices located on the Valve. The Tee Bleed orifice is located on the Pilot and supplies a pressure relief path back to the main valve body. The end of the Tee with the orifice, which has an indicator mark, should be installed with the orifice side up as shown in Figure 4. The Elbow Diaphragm orifice is located outside the main valve body opposite of the diaphragm cover.

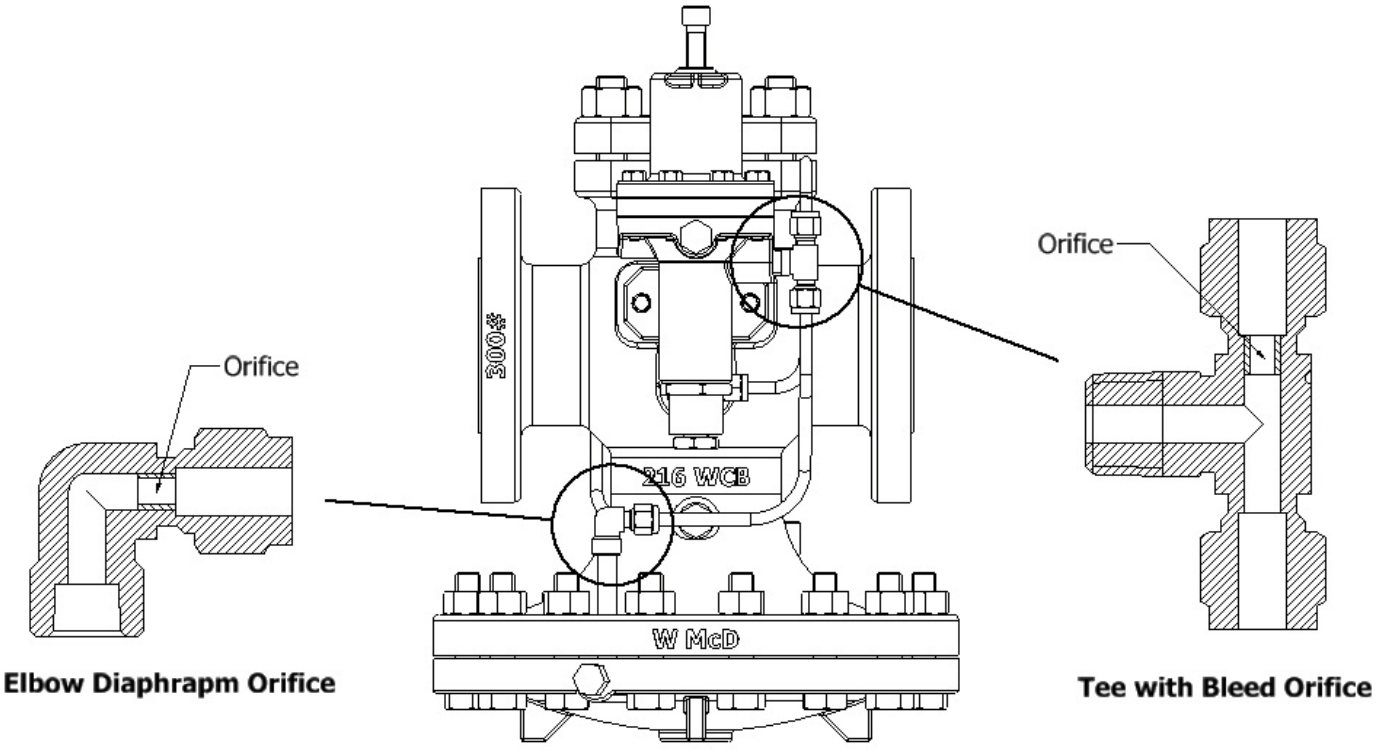

Figure 4: Orifice Locations

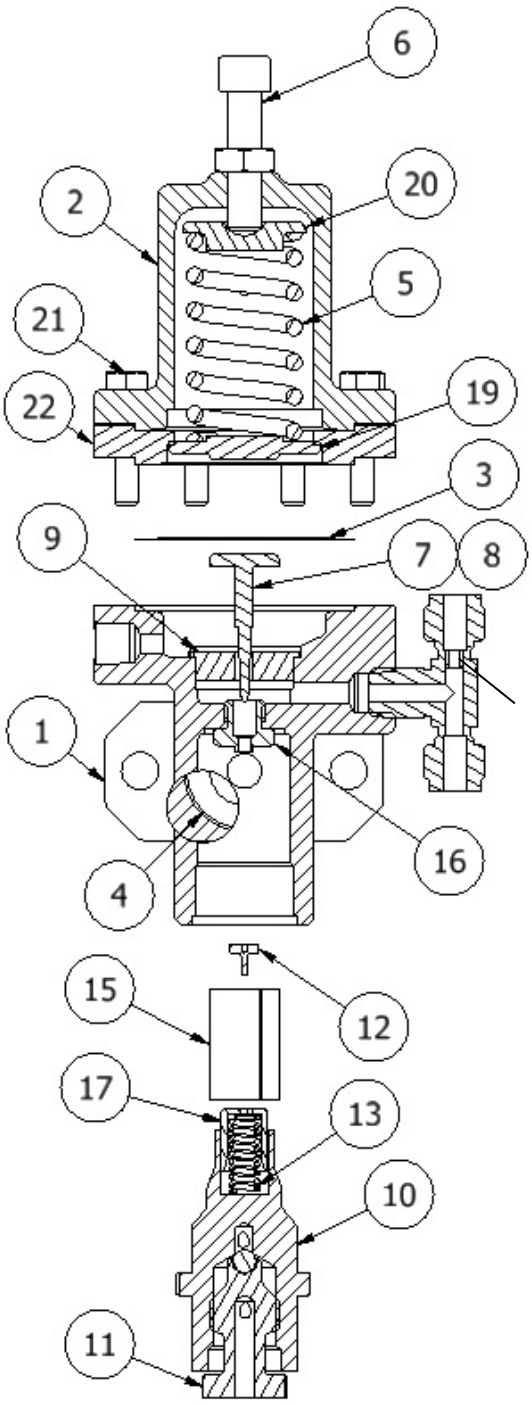

Figure 5: Pilot Assembly

PILOT ASSEMBLY		
ITEM	**DESCRIPTION**	**MATERIAL**
1	Pilot Body	Steel
2	Cover	Steel
3	Diaphragm	Bronze
4	Gasket	Flexicarb / SS
5	Adjusting Spring	Stainless Steel
6	Adjusting Screw	Steel
7	Stem	Stainless Steel
8	Stroke Limiter	Stainless Steel
9	Bushing	Stainless Steel
10	Blowdown Body	Stainless Steel
11	Blowdown Stem	Stainless Steel
12	Disc	Stainless Steel
13	Main Spring	Stainless Steel
14	Gasket	Stainless Steel
15	Screen	Stainless Steel
16	Seat	Stainless Steel
17	Spring Cup	Stainless Steel
18	Pipe Plug, ¼ NPT*	Steel
19	Spring Button	Stainless Steel
20	Upper Spring Button	Stainless Steel
21	Cap Screws	Steel
22	Spacer	Steel

*Not shown in drawing view

CAUTION

Allow pilot to cool before disassembly. Condensate trapped in the system has the potential to cause burns or serious injury.

B Pressure Pilot Service

1. Turn the pilot adjusting screw counter-clockwise to remove all compression from the pilot spring.
2. Shut off the inlet gate valve and verify the downstream pressure is zero.
3. Remove the pilot cover cap screws and cover.
4. Inspect the metal diaphragm for cracks and wrinkles. Replace as required.
5. Clean any debris from inside the pilot assembly and diaphragm surfaces.
6. Unscrew the blowdown body assembly from the pilot.
7. Inspect the seat and disc for wear or damage. Replace as required.
8. Inspect and clean the pilot screen.
9. Disconnect the tubing lines from the tee on the pilot and clean the orifice as required.
10. Reassemble the blowdown valve assembly and tighten back into the pilot body.
11. Reseat the diaphragm and reassemble the pilot cover making sure to tighten the bolts evenly.

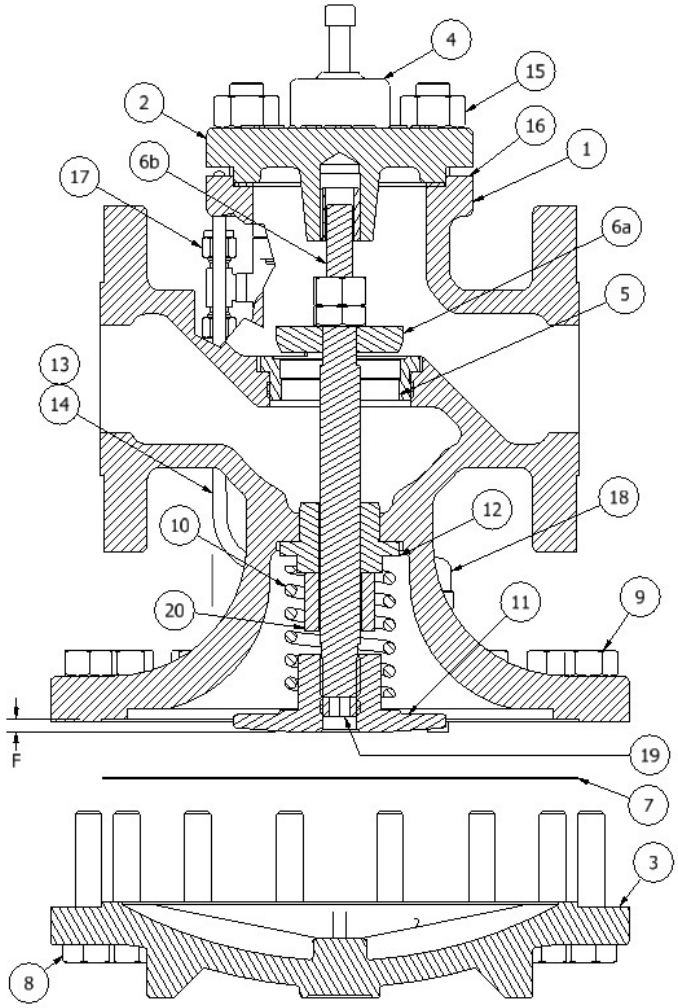

Figure 6: Main Valve Assembly

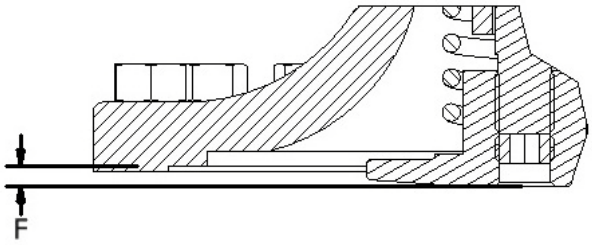

Figure 7: F Dimension Detail

Size	F
1	0.120
1 1/2	0.152
2	0.178
3	0.250
4	0.299

Note: The F dimension shall be from the diaphragm step of the main body to the bottom center of the Diaphragm Plate.

MAIN VALVE ASSEMBLY		
ITEM	**DESCRIPTION**	**MATERIAL**
1	Body	Steel
2	Cover w/ Bushing	Steel
3	Diaphragm Cover	Steel
4	Pilot	-
5	Seat	Stainless Steel
6	Stem & Disc Assembly	Stainless Steel
7	Diaphragm	Bronze
8	Cover Bolts	Steel
9	Cover Nuts	Steel
10	Spring	Stainless Steel
11	Diaphragm Plate	Steel
12	Stem Guide	Bronze
13	Control Tubing	Stainless Steel
14	Tubing Fittings	Stainless Steel
15	Cover Nuts	Steel
16	Cover Gasket	Grafoil
17	Branch Tee, Bleed Orifice	Stainless Steel
18	Diaphragm Orifice Elbow	Stainless Steel
19	Dia. Plate Lock Screw	Stainless Steel
20	Travel Stop	Stainless Steel

C Main Valve Service

CAUTION	**Allow valve to cool before disassembly. Condensate trapped in the system has the potential to cause burns or serious injury. Use caution while disassembling all components as condensate may leak from within the valve assembly.**

1. Close the inlet & outlet gate valves. Bleed the pressure through the blowdown valve on the pipe line strainer. Verify that the inlet and outlet pressure is zero before proceeding. Note: Outlet gate valve should be closed when pressure is at zero to prevent any downstream condensate from entering the valve.
2. Disconnect the tubing line to the diaphragm chamber at A. See Figure 8.
3. Inspect the orifice for debris or damage. Clean or replace as required.
4. Slightly loosen the main valve diaphragm nuts.
5. Then continue to loosen the nuts opposite the side of working and pry the cover from the valve body, if necessary. Allow the condensate to drain away from where you are working.

   Note: The diaphragm cover may be heavy – Care should be taken to properly support it to avoid damage and/or personnel injury.
6. Gently pry the diaphragm loose from the valve body and allow any condensate to drain away from your working position.
7. Once drained, continue to remove all diaphragm nuts and cover.
8. Inspect the metal diaphragm for small cracks or wrinkles. Replace as required.
9. Loosen the lock screw for the diaphragm plate and then remove plate itself. Caution: The main valve spring is exerting significant force on the diaphragm plate. Proceed slowly.
10. Remove the top cover nuts and cover plate.
11. Remove the stem and disc assembly from the valve and inspect the components for wear. Minor wear can be corrected by lapping disc and seat together with 400 grit lapping compound.
12. Inspect the disc and seat for signs or debris which could have caused leakage.
13. Check for erosion around the valve body of the seat ring and the seat ring itself. Replace or clean as required. If replaced, seat and disc should be lapped.
14. Reassemble the valve stem assembly and secure the top cover. Tighten the nuts evenly.
15. Clean the diaphragm, diaphragm plate, and gasket surfaces then reassemble making sure the travel stop is installed properly.
16. Verify that the diaphragm plate setting is correct. See dimension F, Figure 7, and confirm that it is set to the value shown in the table.
17. Verify that the diaphragm plate is securely fastened to the stem with the locking screw. Use High Temp Thread Locking Sealant as required.
18. Confirm valve stem is operating properly by pushing up on the diaphragm plate.

    Note: Use caution as condensate may be trapped in the upper portion of the valve body if valve was not disassembled completely.
19. Center the diaphragm on the cover. The bolts will assist with centering.
20. Tighten the bolts evenly on the diaphragm cover.
21. Reinstall the tubing line to the diaphragm chamber.
22. After system is started again, recheck all fasteners for tightness.

Valve Troubleshooting

The most common field problem with the HSP Series regulating valves is that they become saturated with condensate or water. The valves are designed to operate on steam and may perform erratically or fail to operate at all if the valve and/or pilot contain significant water. It is imperative to verify all water is drained from the valve and pilot before attempting to diagnose a malfunctioning valve.

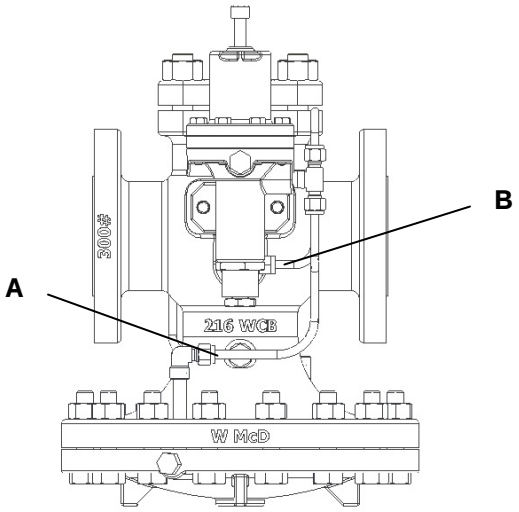

Figure 8: Tubing Location Detail

REGULATOR WILL NOT COME UP TO PRESSURE OR TEMPERATURE

1. Shut off inlet gate valve to regulator and make sure downstream pressure is zero.
2. Check Pilot Strainer for blockage as well as the upstream pipeline strainer.
3. Inspect Elbow Diaphragm Orifice for blockage and Diaphragm for rupture.
4. Check that the Bleed Orifice at the Male Branch Tee is clean and not missing.

PRESSURE OVERRIDES SET POINT: ISOLATE REGULATOR FROM PILOT FOR TESTING

1. Shut off inlet block valve to regulator and make sure downstream pressure is zero.
2. Adjust the pilot to the closed position by backing out the adjustment screw until there is no compression on the spring.
3. Disconnect the pilot tube at the regulator diaphragm which is indicated as point "A" in the illustration above. Also disconnect the smaller pilot tube at the side of the regulator body designated point "B" in the above illustration.
4. Stand clear of the tube connections and open the block valve upstream of the Main Valve only partially to limit the steam pressure to the regulator. Full line pressure is not necessary for this test. **Note:** Do not exceed 10 psi or damage to the main valve diaphragm may result.
5. Regulator seat test - With the long pilot tube disconnected at point 'A' the regulator should be closed. If there is steam blowing out of the body side connection at point "B", the main valve and seat are leaking and require inspection for condensate or debris that is holding the valve off the seat or erosion of the sealing surfaces.
6. Pilot seat test - With the pilot closed there should not be any steam coming out of the long tubing at point "A". If there is steam flow, the pilot is not closing off and must be inspected for debris or seat erosion. Try running the adjustment screw in & out a few times to clear the debris. If that is not successful, the pilot must be cleaned, repaired or replaced.

System Troubleshooting

PROBLEM	POSSIBLE	CAUSE CORRECTION
1. Cannot set valve to give high enough downstream pressure requirements	a) Valve undersized	a) Check capacity of valve against load
	b) Downstream piping undersize	b) Check velocity of steam in piping system
	c) Pilot valve spring not adjusted properly	c) Readjust desired reduced pressure
	d) Pilot adjusting spring not correct	d) Check color code of spring against spring range in literature
	e) Inlet or outlet gate valve partially closed	e) Open valves
	f) Upstream pipeline strainer blocked	f) Clean strainer screen
	g) Pilot screen clogged	g) Clean screen
	h) Inlet pressure too low causing reduced capacity thru valve	h) Check with gage and correct as required
	i) Diaphragm orifice blocked	i) Check and clean orifice, Do not remove clean-out wire
	j) Bleed orifice fitting missing, installed wrong or eroded	j) Inspect and check against cut-away drawing
	k) Main valve diaphragms failed	k) Replace diaphragms
2. Downstream pressure over rides set pressure under load conditions	a) Valve is extremely oversized	a) Check catalog for rated capacities
	b) Bypass valve open	b) Close valve
	c) Pilot valve adjusting spring set too high	c) Readjust to desired reduced pressure
	d) Bleed orifice blocked	d) Inspect and clean
	e) Dirt in pilot seat or stem guide	e) Clean pilot head and seat assembly
	f) Foreign object lodged between main valve disc and seat	f) Check main valve disc and seat. Check stem guide bushing for binding
	g) Pilot diaphragms ruptured	g) Replace pilot diaphragms
	h) Main valve seat thread leaking	h) Check body in seat ring area for erosion
3. Valve will not open	a) Adjusting spring not set	a) Adjust setting
	b) Upstream isolation valve closed	b) Check and open valve
	c) Upstream pipeline strainer blocked	c) Clean strainer screen
	d) Pilot screen blocked	d) Remove and clean
	e) Pilot stem and guide bound with dirt	e) Inspect and clean
	f) Bleed orifice missing or installed wrong	f) Inspect and check against cut-away drawing
	g) Diaphragm orifice blocked	g) Inspect and clean. Do not remove clean out wire
	h) Main valve diaphragms ruptured	h) Replace main valve diaphragms
4. Valve will not close	a) Bypass valve open	a) Close bypass valve
	b) Pilot sensing line not installed	b) Install pilot sensing line
	c) Bleed orifice blocked	c) Inspect and clean
	d) Dirt in pilot seat or guide	d) Inspect and clean
	e) Inspect and clean	e) Replace pilot diaphragms
	f) Foreign object lodged between main valve disc and seat	f) Inspect, clean and repair

HSP Series Valve Capacities

Full Port Regulating Valve - Capacities

FULL PORT CAPACITIES - (Steam lbs/hr)													
Inlet Pressure (PSIG)	Outlet Pressure (PSIG)	1"	1-1/2"	2"	3"	4"	Inlet Pressure (PSIG)	Outlet Pressure (PSIG)	1"	1-1/2"	2"	3"	4"
CV Factors		11	21	37	71	113	CV Factors		11	21	37	71	113
								45	1950	3700	6600	12700	20200
5	0	250	500	800	1600	2600	90	60	1700	3200	5700	10900	17400
	2	230	440	770	1500	2400		75	1200	2300	4100	7900	12600
	0	325	600	1100	2100	3600		50	2100	4100	7300	14000	22200
7	2	300	575	1000	2000	3100	100	60	2000	3800	6700	12900	20500
	3	275	525	900	1800	2800		80	1400	2700	4800	9200	14700
	0	425	850	1500	2800	4600		60	2700	5200	9100	17500	28000
10	2	400	800	1400	2700	4300	125	75	2400	4600	8200	15700	25000
	5	300	600	1000	2000	3200		100	1800	3500	6200	11900	19000
	0	475	900	1600	3100	4900		75	3100	6000	10600	20400	32400
12	4	400	800	1400	2700	4300	150	100	2700	5100	9000	17400	27700
	7	375	700	1200	2400	3800		125	1900	3600	6400	12300	19600
	3	550	1000	1800	3500	5600		85	3700	7100	12500	24000	38200
15	5	500	900	1700	3200	5200	175	125	2900	5600	9900	18900	30100
	8	400	800	1300	2600	4200		150	2100	4100	7300	14000	22200
	5	625	1200	2100	4000	6400		100	4200	8000	14100	27100	43100
20	10	550	1000	1800	3500	5600	200	125	3700	7100	12600	24100	38400
	12	500	950	1600	3200	5100		150	3100	6000	10600	20300	32300
	7	775	1500	2600	5000	7900		120	4600	8700	15400	29500	47000
25	10	700	1300	2400	4600	7300	225	150	4200	8000	14100	27200	43300
	15	600	1100	2000	3900	6200		175	3900	7400	13100	25200	40100
	12	800	1500	2700	5200	8300		130	5100	9700	17100	32900	53400
30	15	750	1400	2500	4900	7800	250	150	4700	9100	16000	30800	49000
	20	650	1200	2100	4100	6500		200	3500	6700	11900	22800	36200
	18	1000	1900	3300	6400	10300		160	5920	11310	19220	38230	60840
40	25	850	1600	2800	5400	8700	300	175	5625	10740	18925	36320	57800
	30	700	1400	2500	4700	7600		200	5155	9840	17340	33275	52960
	20	1200	2300	4100	7800	12400		175	6910	12950	22100	42700	68250
50	30	1100	2000	3600	6900	11000	350	225	6600	12340	21000	40400	64600
	40	800	1500	2700	5200	8300		325	5860	10900	18500	35900	57400
	30	1350	2600	4600	8900	14200		200	7980	14800	22000	48800	78000
60	35	1250	2400	4300	8200	13100	400	250	7550	13800	23800	46200	73950
	50	850	1600	2900	5600	8900		300	6700	12100	21200	41000	65200
	35	1650	3200	5600	10800	17200		225	8970	16000	22000	55000	87600
75	50	1350	2600	4600	8900	14100	450	300	8500	15000	26900	52100	83200
	60	1150	2200	3900	7400	11800		350	7540	13300	23900	46200	73900

Note: For inlet pressures in shaded area, use low pressure main valve.

Reduced Port Regulating Valve - Capacities

REDUCED PORT CAPACITIES - (Steam lbs/hr)

Inlet Pressure (PSIG)	Outlet Pressure (PSIG)	1"	1-1/2"	2"	3"	4"	Inlet Pressure (PSIG)	Outlet Pressure (PSIG)	1"	1-1/2"	2"	3"	4"
CV Factors		5.6	13.3	18.8	41.7	74	CV Factors		5.6	13.3	18.8	41.7	74
								45	916	2177	3077	6825	12112
5	0	59	140	197	438	777	90	60	789	1874	2648	5874	10425
	2	53	128	181	401	712		75	585	1389	1964	4357	7731
	0	82	195	276	613	1088		50	1018	2419	3419	7584	13458
7	2	79	187	265	587	1042	100	60	940	2234	3158	7006	12432
	3	74	177	250	554	983		80	706	1676	2367	5254	9324
	0	117	279	395	876	1554		60	1290	3063	4329	9603	17041
10	2	115	274	387	858	1523	125	75	1176	2793	3948	8757	15540
	5	102	242	342	758	1346		100	882	2095	2961	6568	11655
	0	141	335	473	1051	1865		75	1527	3628	5128	11376	20187
12	4	133	316	446	990	1758	150	100	1315	3123	4414	9791	17374
	7	115	272	385	854	1515		125	975	2316	3274	7261	12885
	3	173	410	580	1287	2284		85	1800	4272	6939	13396	23771
15	5	166	395	558	1238	2198	175	125	1440	3421	4835	10725	19032
	8	149	354	500	1111	1972		150	1060	2518	3558	7893	14008
	5	227	541	764	1696	3009		100	2037	4838	6838	15168	26916
20	10	204	483	684	1517	2692	200	125	1836	4360	6164	13672	24262
	12	188	447	632	1401	2486		150	1556	3695	5223	11584	20557
	7	282	670	948	2102	3730		120	2238	5360	7514	16667	29577
25	10	269	640	905	2006	3561	225	150	1972	4684	6621	14686	26061
	15	235	559	790	1751	3108		175	1663	3950	5583	12384	21976
	12	323	768	1085	2408	4273		130	2511	5964	8431	18700	33184
30	15	305	726	1025	2275	4037	250	150	2352	5586	7896	17514	31080
	20	263	625	883	1958	3475		200	1764	4190	5922	13136	23310
	18	420	998	1410	3128	5551		160	3015	7160	10120	22450	39840
40	25	367	872	1232	2734	4852	300	175	2865	6800	9615	21330	37850
	30	311	739	1044	2317	4111		200	2625	6235	8810	19545	34680
	20	539	1280	1809	4013	7121		175	3560	8280	2450	25360	45020
50	30	470	1117	1579	3502	6216	350	225	3370	7850	10830	24020	42650
	40	353	838	1184	2627	4662		325	3000	6970	9630	21360	37910
	30	611	1451	2051	4550	8074		200	4070	9460	2450	28980	51450
60	35	573	1361	1924	4268	7573	400	250	3860	8970	12380	27460	48750
	50	390	926	1309	2904	5154		300	3430	7970	11010	24410	43330
	35	780	1853	2619	5809	10308		225	4580	10650	2450	32600	57890
75	50	657	1561	2207	4895	8687	450	300	4340	10090	13930	30890	54840
	60	529	1257	1777	3941	6993		350	3860	8970	12380	27460	48750

Note: For inlet pressures in shaded area, use low pressure main valve.