spirax sarco®

INSTALLATION AND MAINTENANCE INSTRUCTIONS

IMI 3.100 **April 2002**

2" Class 300 25-Series Pressure Regulator

Unpack Carefully
Do not lift the regulator by the tubing. Grasp the body of the valve firmly when lifting. If installed, do not lift the regulator by the tubing.

Piping
1. Typical hookup sketches as shown in Figs. 1, 2 and 3 will aid in planning a correct installation.

2. Piping on the downstream side of the valve should be increased so as not to restrict flow. See Steam Velocity Chart for recommended pipe sizes.

3. Swage nipples are recommended for changes in pipe sizes.

4. Before installing the valve make sure the piping is free of foreign material, scale, etc.

5. Make certain the arrow cast on valve body is pointing in the direction of flow.

6. Valve should always be installed in a horizontal position. (See Figs. 1, 2 and 3.)

7. Press gauges installed on both sides.

Pilot Pressure Sensing Line
1. Copper or stainless steel tubing (1/4" OD) can be used for the sensing line with suitable compression fittings or as alternative 1/4" piping can be used.

2. Connect the sensing line to a straight portion of the piping 10 pipe diameters from the nearest fitting downstream from the valve and approximately 1 foot from elbows, tees, valves and other restrictions. (See Figs. 1, 2 and 3.)

3. When the reducing valve is serving a single piece of equipment, the sensing line can be connected to the steam space of the equipment.

4. Install a small gate valve in the sensing line so that this can be closed when servicing the regulator.

5. The sensing line must be pitched downward from the main valve to insure proper drainage.

6. To permit accurate setting of the pressure regulator, a pressure gauge should be installed as close as possible to the pilot sensing line connection.

Bypass
1. A bypass connection, as shown in Figs. 1, 2 and 3 is recommended so that the valve can be serviced without shutting down the equipment.

2. The bypass valve should be the same size as the pressure regulator.

Steam Line Drain Trap
1. To insure proper operation of the valve and avoid premature wear, it is recommended that a 1/2" Spirax Sarco thermodynamic steam trap be installed on the steam supply line. (See Figs. 1, 2 and 3.)

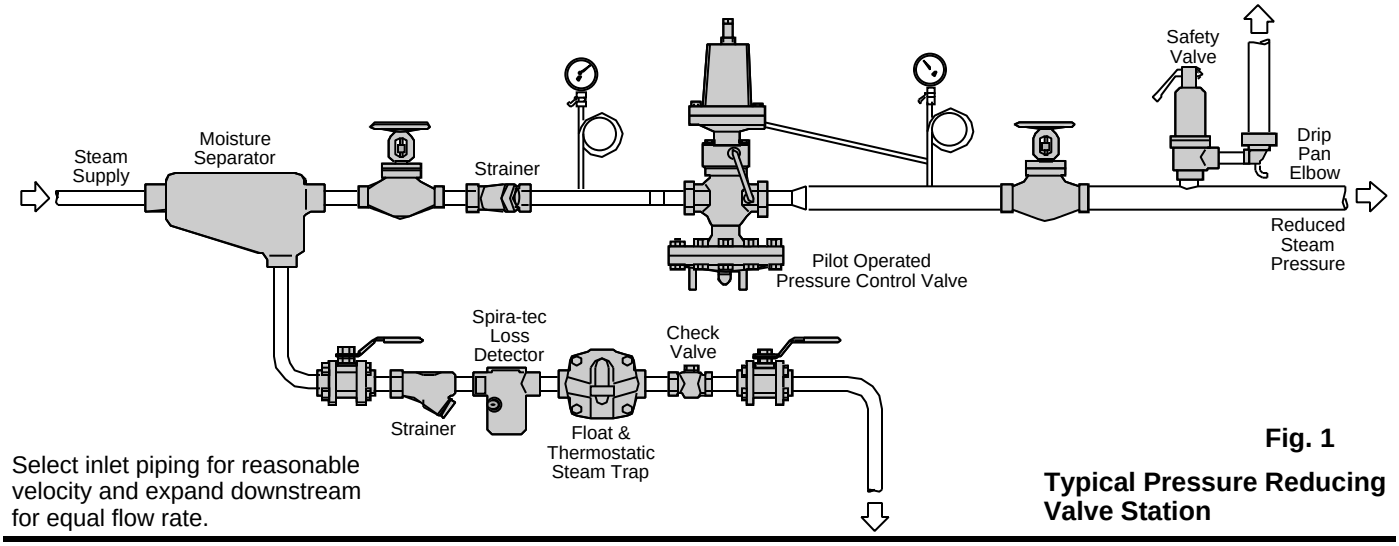
2. A steam trap should also be installed in the downstream piping at the heel of each rise, between all reducing valves installed in series, and ahead of any manual or automatic valve. This will prevent condensate accumulation that can result in waterhammer damage.

Pipeline Strainers
1. It is strongly recommended that strainers be installed before the reducing valve and steam traps.

2. Make certain adequate clearance is provided for screen removal and blowdown connection between strainer and valve body.

Stop Valves
All stop valves on the supply side, as well as on the downstream side of the pressure reducing valve and sensing line, should be of the gate type so as to insure full rated capacity and good control.

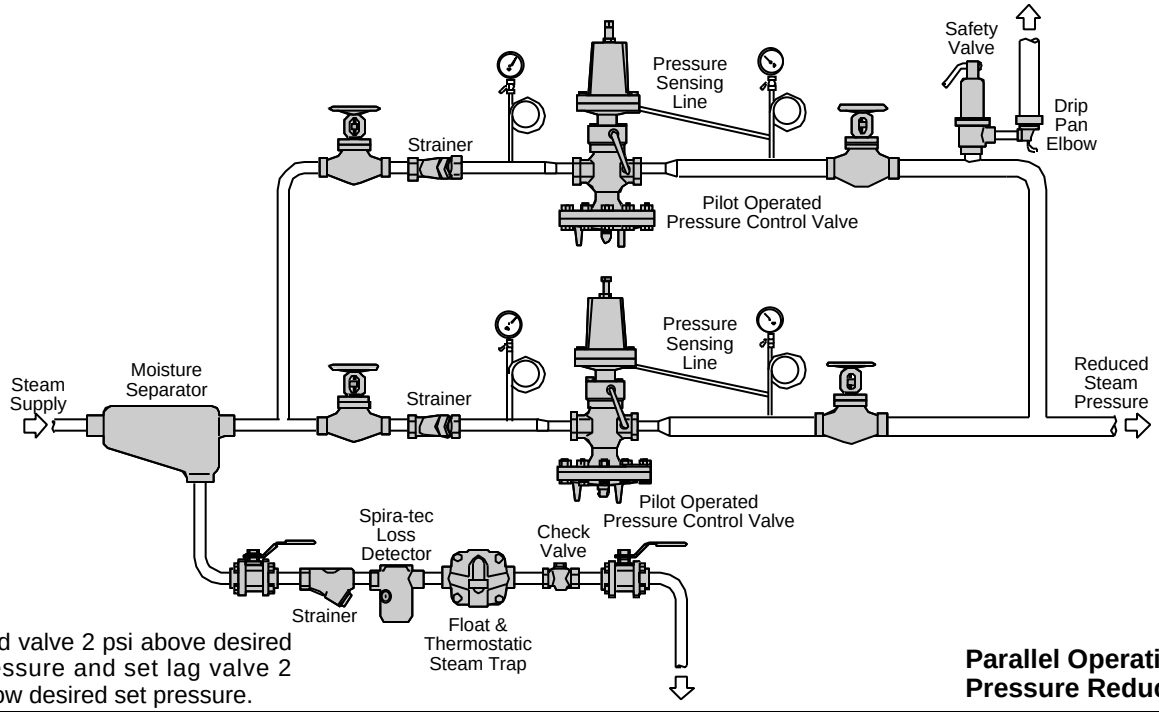
Separators
1. It is strongly recommended that separators be installed upstream of regulator complete with trap set. (For more information, refer to IMI 3.000)
2. See Fig. 3 for proper installation.



Select inlet piping for reasonable velocity and expand downstream for equal flow rate.

Fig. 1

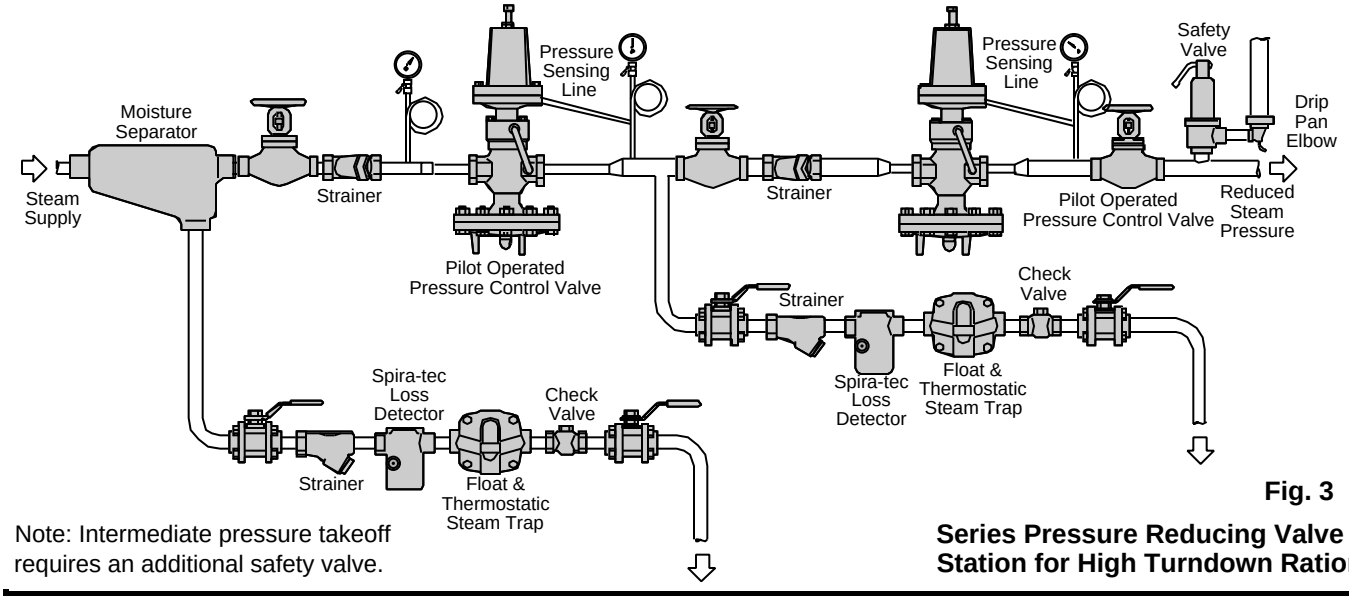
Typical Pressure Reducing Valve Station



Set lead valve 2 psi above desired set pressure and set lag valve 2 psi below desired set pressure.

Fig. 2

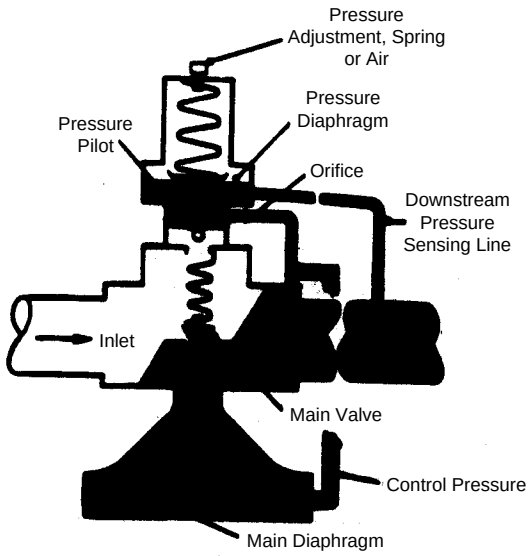
Parallel Operation of Pressure Reducing Valves



Note: Intermediate pressure takeoff requires an additional safety valve.

Fig. 3

Series Pressure Reducing Valve Station for High Turndown Rations



How the 25P & 25PA Work

Normal positions before start-up are with the main valve closed and the pilot valve held open by spring force. Entering steam passes through the pilot valve into the main diaphragm chamber and also out through the control orifice. As flow through the pilot exceeds flow through the orifice, control pressure increases in the diaphragm chamber and opens the main valve. As steam flows through the main valve, the increase in downstream pressure feeds back through the pressure sensing line to the underside of the pressure diaphragm. When the force below that diaphragm balances the compression force of the spring above it, the pilot valve throttles. The control pressure maintained in the main diaphragm chamber positions the main valve to deliver just enough steam for the desired delivery pressure. Adjustment of the spring above the pressure diaphragm changes the downstream pressure set point. When steam is no longer required, the sensing line pressure increases closing the pressure pilot and the control pressure bleeds back through the control orifice. This allows the main valve to hold the desired reduced pressure, and it may close tight for a dead-end shutoff.

Start-up (Refer to Fig. 5)

1. First make certain that all stop valves are closed.

2. Remove pilot spring cover, then turn the pressure pilot adjustment (2D) counter-clockwise until spring is slack. Make certain spring remains in vertical position and centered in its retainers.

   Air Loaded PA Pilots must have no P supplied to them.

3. Open stop valves in the following order:

   a. Open stop valve ahead of steam trap on steam supply line. This will insure water free steam at the regulator inlet when put into operation.

   b. Open small gate valve on pressure sensing line.

   c. Open downstream stop valve.

   d. Slowly open inlet stop valve.

4. Slowly adjust pilot spring at (2D) turning clockwise until reduced pressure required is indicated on pressure gauge downstream of valves.

5. Once the system has stabilized itself, it may be necessary to make re-adjustment of pilot spring (2D). Replace spring cover, then tighten adjustment locknut.

6. *Important*—Retighten all pilot flange connections to insure steam tight joints.

	Recommended Torque
2A Screws	13-15 ft. lbs.
2C Screws	15-20 ft. lbs.

7. Air Loading PA Pilot requires air loading as indicated in the following table:

Desired Outlet Steam Pressure P2 psig	**5**	**10**	**25**	**50**	**75**	**100**
Inlet Pressure P1 psig	**10 psig to 100 psig**					
Approximate Air Set Pressure psig	**11 to 13.5**	**16 to 16.8**	**31 to 33.5**	**56 to 58**	**80 to 81**	**102 to 103**

Troubleshooting

(Refer to Figs. 5)

Symptom	Cause	Check and Cure
1. Controlled pressure overshoots under normal load conditions	1. (a) Dirt or foreign material between pilot valve seat and head.	1. (a) Loosen screw (2d). Remove stainless steel tubing connection at (J). With steam on valve, if steam flows from stainless steel tubing connection at (J), remove pilot head and seat assembly (2H) and clean or replace.
	(b) Foreign particles between main valve head and seat.	(b) Inspect and clean head and seat
	(c) Orifices (B) and (H) or pressure sensing line may be plugged.	(c) Remove, inspect and clean.
2. Controlled pressure overshoots only on light loads.	2. (a) Main valve head and seat worn or dirt between them.	2. (a) Inspect and clean head and seat.
	(b) Valve may be severely oversized.	(b) Adjust screw (2D) to give desired pressure under light loads.
	(c) Bypass valve not shut tightly or leaking.	(c) Check and repair as required.
	(d) Dirt or foreign material on main valve stem and guide (1F).	(d) Remove, inspect and clean.
3. Valve fails to open.	3. (a) Main valve diaphragm ruptured.	3. (a) Unscrew stainless steel tubing connection at (G) and crack bypass valve. If steam flows from main valve diaphragm case, diaphragm is defective and must be replaced.
	(b) Orifice (H) is plugged	(b) Remove and clean.
	(c) Pilot valve seat is plugged with dirt.	(c) Remove head and seat assembly (2H). Inspect and clean or replace.
	(d) Screen (1D) is plugged	(d) Inspect screen and clean.
	(e) Pipeline strainer blocked.	(e) Inspect and clean.
	(f) Pilot valve adjustment (2D) not properly adjusted.	(f) Adjust screw (2D) to desired pressure.
4. Delivery pressure low.	4. (a) Pilot valve adjustment (2D) not properly adjusted.	4. (a) Adjust screw (2D) to desired pressure.
	(b) Valve undersized.	(b) Check actual load against valve rating.
	(c) Steam supply pressure too low.	(c) Check and correct.
	(d) Main valve diaphragm ruptured.	(d) Unscrew stainless steel tubing connection (G) and crack bypass valve. If steam flows from diaphragm case, diaphragm is defective and must be replaced.
	(e) Bleed orifice (B) missing.	(e) Replace proper fitting.
5. Valve fails to close.	5. (a) Bypass valve open or leaking.	5. (a) Check and repair as required.
	(b) Pilot sensing line blocked (or not installed).	(b) Remove, inspect, clean or install.
	(c) Pilot ruptured (water or steam coming from pilot at spring retainer area).	(c) Replace pilot diaphragm assembly.
	(d) Pilot assembly or main valve seat threads leaking.	(d) Check casting in seat area for erosion.
	(e) Main valve diaphragm reassembled without return spring and main valve cover holding valve head closed.	(e) With main valve cover installed, loosen all main valve diaphragm bolts (1C) and then retighten to recommended torque of 55-60 ft. lbs.

Maintenance

General Inspection (Refer to Fig. 5)

While a program of planned maintenance is always to be recommended, the Spirax Sarco 25P valve will give long and trouble-free service if correctly selected, installed and kept reasonably free of dirt and foreign matter. Dirt and foreign matter are most likely to collect during installation and later trouble can be avoided by inspecting the installation after a few days. Check the following:

1. Clean all pipeline strainers. (Remove screens to clean.)

2. Check the main valve seat (1E) and protective screen (1D).

3. Inspect and clean orifices (B) and (H).

4. Check all joints for leakage.

Servicing Procedure (Refer to Fig. 5)

To determine which part of a malfunctioning pressure reducing valve requires maintenance, refer to the troubleshooting chart and follow this servicing procedure to check the tightness of the seal.

1. With all stop valves closed and the valve cooled down, remove the stainless steel tubing from connector (J), being careful not to bend it.

2. Close the pilot valve (2H) by turning the pressure adjustment (2D) counter-clockwise until the spring is slack.

3. Stand clear of the tubing connectors and open the inlet stop valve slightly so that a small amount of steam reaches the valve inlet and pilot.

4. Open and close the pilot valve a few times by turning the pressure adjustment (2D) and observe the steam flow from tubing connector (J). When the pilot valve is closed, there should be no steam flow from the connectors; if there is some steam flow, it indicates that the pilot valve assembly (2H) is faulty and must be replaced.

5. With both pieces of stainless steel tubing removed, the main valve head and seat are held closed and should not pass any steam. Observe the downstream orifice connector (B). Steam flow from this connector indicates that the main valve head and seat are leaking and require servicing.

Inspecting and Replacing Pilot Valve Head and Seat (Refer to Fig. 5)

1. Remove 4 (2A) pressure pilot flange cap screws and lift off pressure pilot. Visual examination can be made of the pilot valve head and seat.

2. Pilot valve head and seat are contained in one complete assembly.

3. To remove head and seat assembly (2H), unscrew hexagon, using 11/16" hex wrench.

4. If it is found that either the head or seat is worn, the entire assembly should be replaced.

Inspecting and Replacing Pilot Valve Diaphragms (Refer to Fig. 5)

1. Turn adjustment screw (2D) counterclockwise until spring is slack.

2. Remove cap screws (2C). Pilot yoke (2B) can then be removed.

3. The 2 metal diaphragms (2F) can then be inspected for distortion or possible fracture as a result of abnormal operation.

4. At the same time any accumulation of dirt or foreign material should be removed from the lower diaphragm pilot case.

5. When replacing diaphragms, make certain casting surface is clean to insure a steam tight joint.

6. Position pilot yoke on lower diaphragm pilot casting making certain that the yoke is properly centered.

7. Tighten all cap screws uniformly to a recommended assembly torque of 15-20 ft. lbs.

Inspecting and Replacing Main Valve Head and Seat (Refer to Fig. 5)

1. Unscrew stainless steel tubing connections at (J).

2. Remove main valve cover cap screws (1A).

3. Remove main valve cover, strainer screen (1D), spring support disc and head spring.

4. Head (1B) can then be removed by simply withdrawing with a pliers or similar tool.

5. Inspection should then be made to determine if scale or other foreign material prevented tight closure of the head and seat.

6. If the head or seat shows signs of wear, this can be corrected by grinding, using a fine grinding compound (400 grit) providing the wear is not too severe. Check for body erosion.

7. If it is necessary to replace the valve seat, this can be removed from the valve body using a standard hexagon socket. When replacing the valve seat, a new gasket should be used to insure a tight joint.

Inspecting and Replacing Main Valve Diaphragms (Refer to Figs. 5)

1. Unscrew stainless steel tubing connection at (G).

2. Remove main valve diaphragm bolts (1C).

3. This will allow the lower diaphragm case to be removed.

4. The 2 metal diaphragms (1H) should be inspected to insure that they have not become distorted or possibly fractured as a result of abnormal operating conditions.

5. At the same time any accumulation of dirt or foreign material should be removed from the diaphragm case.

6. The valve stem should also be checked to make sure it is free to move and that there is no scale or foreign material lodged in the guide bushing (1F).

7. **Before reassembling diaphragms, main valve head must be in place and head in a closed position with the return spring and main valve cover.**

8. Make certain pressure plate (1G) is set properly. (Refer to Fig. 4.)

9. Care should be taken in centering the diaphragms properly and equalizing bolt take-up uniformly. Recommended screw assembly torque is 55-60 ft. lbs.

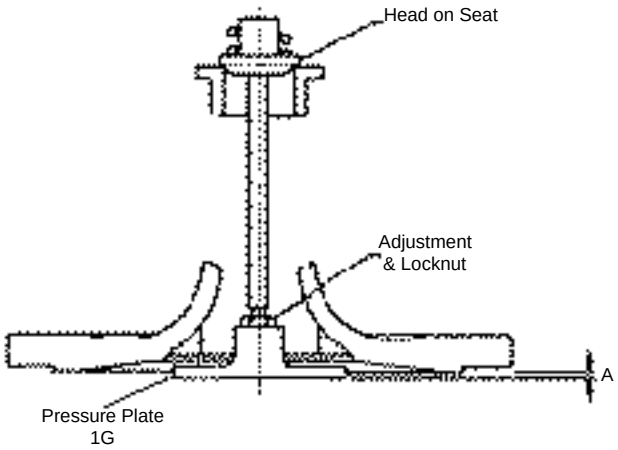


Figure 4 - Top of valve must be completely assembled and head must be on seat when adjusting pressure plate and when re-assembling diaphragms to insure “A” = 1/8" for 2" valve.

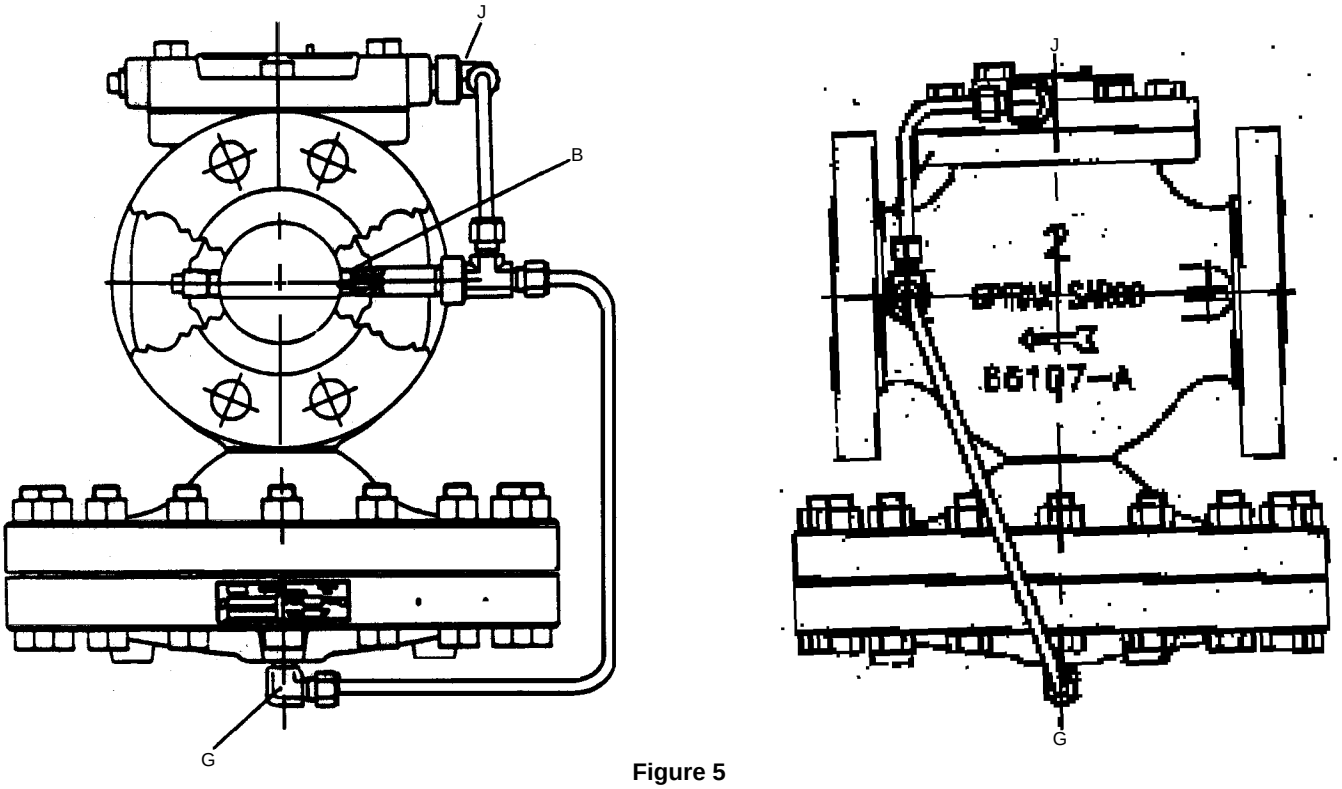


Figure 5

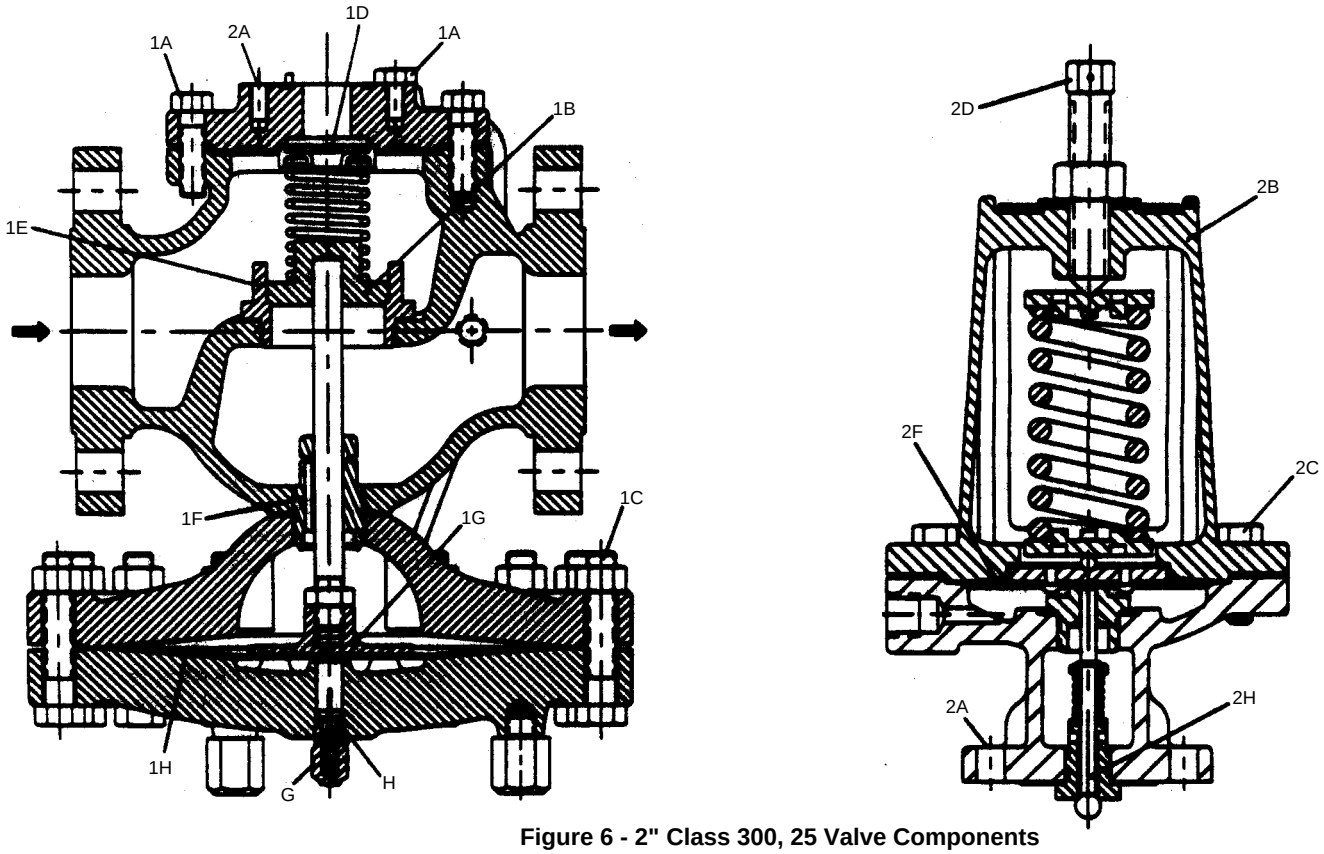


Figure 6 - 2" Class 300, 25 Valve Components

How to Size Piping for 25-Series Regulators

Principle

When steam pressure is lowered through a reducing valve, the steam expands creating a higher velocity. The extreme velocities that must exist across reducing valve seats cannot be tolerated in pipes supplying the valves and leading from them. Erosion and noise would be prohibitive.

It is recommended practice in heating systems to limit velocities to between 4,000 and 6,000 feet per minute. Higher velocities are often acceptable outdoors and in plants where the environment is already noisy.

This chart lists steam capacities of pipes under various pressure and velocity conditions.

Example

Given a steam heating system with a 100 psig inlet pressure ahead of the pressure reducing valve and a capacity of 1,000 pounds per hour at a reduced pressure of 25 psig, find the smallest sizes of upstream and downstream piping for reasonable steam velocities.

Upstream Piping

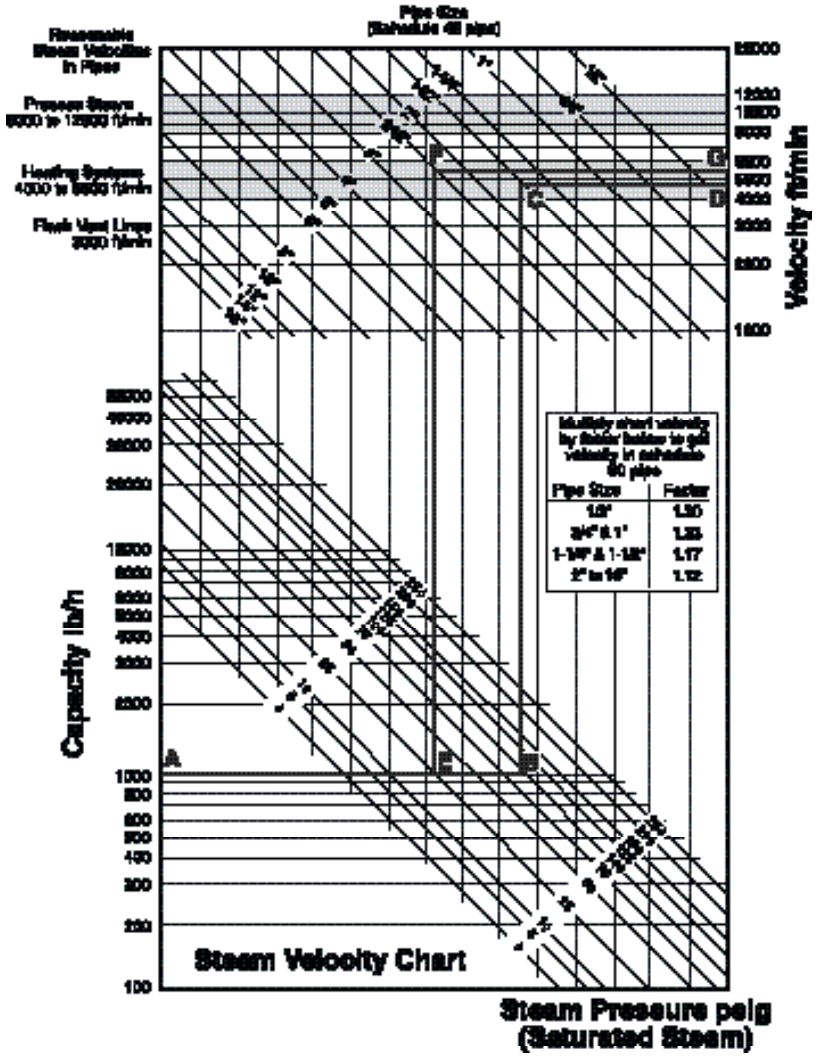
Enter the velocity chart at point A for 1,000 pounds per hour. Proceed horizontally to point B where the 100 psig diagonal line intersects.

Follow up vertically to point C where an intersection with a diagonal line falls inside the 4,000 to 6,000 feet per minute velocity band. Actual velocity (see point D) is about 4,800 feet per minute for 1-1/2 inch upstream piping.

Downstream Piping

Enter the velocity chart at point A for 1,000 pounds per hour. Proceed horizontally to point E where the 25 psig diagonal line intersects.

Follow up vertically to point F where an intersection with a diagonal line falls inside the 4,000 to 6,000 feet per minute velocity band. Actual velocity (see point G) is about 5,500 feet per minute for 2-1/2 inch downstream piping.



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