spirax sarco®

INSTALLATION AND MAINTENANCE INSTRUCTIONS

IMI 3.017 **April 1998**

Combination Pilot Operated Regulators Types 25PT, 25PE, 25TE & 25PTE

IMPORTANT: Read carefully the instructions for both the valve and control pilots **before** installing the regulator.

Installing the Valve

Unpack Carefully

Do not lift the regulator by the flexible tubing or control pilot. Grasp the body of the main valve firmly when lifting. Do not bend sharply or kink the flexible tubing. The valve is completely assembled with the exception of the pressure pilot sensing line fittings.

Valve Piping

1. A typical hookup sketch as shown in Fig. 1 will aid in planning a correct installation.
2. Piping on the downstream side of the valve should be sized properly so as not to restrict steam flow.
3. Swage nipples are recommended for changes in pipe sizes.
4. Before installing the valve, be sure the piping is free of foreign material, scale, etc.
5. Make certain the arrow cast on the valve body is pointing in the direction of flow.
6. Valve should always be installed in a horizontal line. (See Fig. 1).

Bypass

1. A bypass connection 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 temperature regulator.

Steam Line Drain Trap

To insure proper operation of the valve and avoid premature wear, it is recommended that a steam trap be installed on the steam supply line. (See Fig. 1).

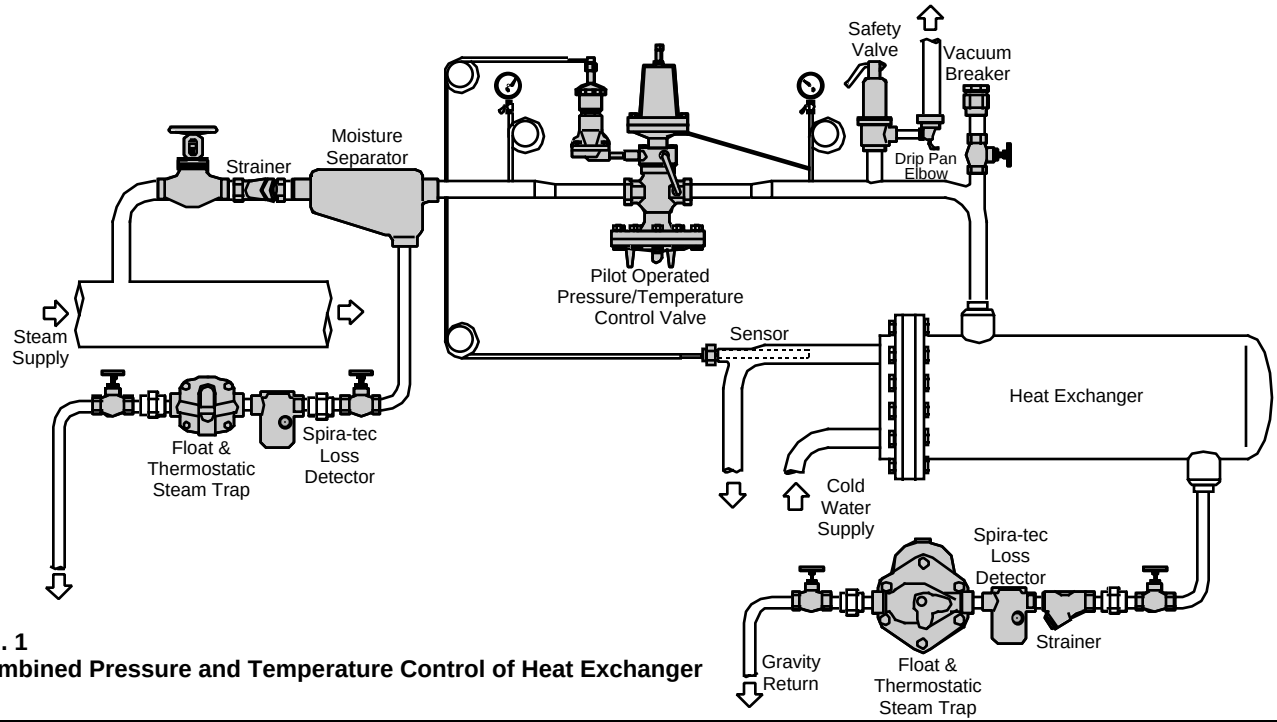


Fig. 1
Combined Pressure and Temperature Control of Heat Exchanger

Pipeline Strainers

1. It is strongly recommended that strainers be installed before the pressure temperature regulating valve and steam traps. (See Fig. 1)

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

Stop Valves

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

Electric Pilot Wiring, Type PE/TE/PTE

1. Check nameplate on electric pilot for correct voltage and service conditions.

2. Wiring must comply with local and national electrical codes.

3. Solenoid enclosure is provided with hole to accommodate standard 1/2 inch conduit connection.

4. The solenoid enclosure can be rotated to facilitate wiring by loosening the cap nut. (See Fig. 6).

Pressure Pilot Sensing Line, Type PT/PE/PTE

1. Copper tubing (5/16" OD) can be used for the sensing line with suitable compression fittings or as an alternative 1/4" piping can be used.

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

3. When the pressure temperature regulator is serving a single piece of equipment, the pilot line can be connected to the steam space of the equipment.

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

5. The control 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 line connection.

Temperature Pilot, Type PT/TE/PTE

Depending upon the installation, the position of the calibrated dial of the pilot, as received, may not be easily observed by the operating personnel. To change the calibrated dial position, loosen hexagon nut (K), (Fig. 3) and rotate the entire adjustment assembly to a position that can be easily observed. Retighten hexagon nut (K).

Thermostatic Bulb and Tubing

1. Carefully uncoil the flexible tubing avoiding sharp bends and kinks.
2. Support flexible tubing to protect it against mechanical damage.

3. Keep flexible tubing away from hot pipe lines or other hot surfaces.

4. Attach thermostatic bulb to unit to be controlled. Make certain that the entire bulb is exposed to the medium being controlled. Accuracy of regulation depends on the bulb being located in a representative location with adequate circulation over it.

5. If a separable socket is used for the temperature bulb, it is recommended that the socket be packed with a heat transfer compound to minimize lag in response to temperature changes caused by the insulating air layer between bulb and socket.

How it Works

Normal positions before startup are with the main valve and electric pilot closed, pressure pilot open, and temperature pilot open. On startup, entering steam passes in series through all pilot valves into the diaphragm chamber and out through the control orifice. As flow through the pilot valves exceeds flow through the orifice, control pressure increases in the main diaphragm chamber, and that opens the main valve.

Electric Pilot

Functions as an on/off override to the other pilots. When it is energized and open, the pressure or temperature pilot regulates any change in steam flow required.

Pressure Pilot

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 force below that diaphragm balances the compression force of the spring above it, the pressure pilot valve throttles. Control pressure in the main diaphragm chamber positions the main valve so that maximum steam pressure will not be exceeded.

Temperature Pilot

As the medium being heated approaches the desired temperature, liquid in the bulb expands through the capillary tubing into the bellows and throttles the temperature pilot valve. The pilot valve delivers just enough steam to the main diaphragm chamber to provide steam flow through the main valve to maintain pre-set temperature.

When no steam is required. The main valve closes tight to provide dead-end shut off. The temperature setting can be changed by turning the calibrated adjustment dial. The maximum delivery pressure can be changed by adjusting the pressure pilot spring.

Start-Up

1. First make certain that all stop valves are closed. The electric pilot must be energized open.

2. Turn the pressure pilot adjustment 2D (Fig. 3) counter-clockwise until spring is slack.

3. Adjust the temperature pilot to the temperature required by turning the red adjustment knob 3C. Caution: **Do not** loosen Allen set screw in the red temperature knob.

4. 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.

5. Slowly adjust pressure pilot spring at 2D turning clock-wise until reduced pressure required is indicated on pressure gauge downstream of valve.

6. After the system has stabilized itself, check thermome-ter temperature. Readjustment of the temperature pilot (red knob 3C) may be necessary. Note: In the event the temperature indicated on the calibrated dial does not agree with the thermometer, the temperature pilot can be recalibrated to match the thermometer as described on page 6.

7. Important–Retighten all pilot flange connections to insure steam tight joints.

Maintenance

General Inspection

While a program of planned maintenance is always to be recommended, the Spirax Sarco 25 series regulator will give long and trouble-free service if correctly selected, installed and kept reasonably free of dirt and foreign mat-ter. 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.

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.

Electric Pilot, Inspection of Solenoid and Internal Parts (Refer to Fig. 6)

1. Shut off steam supply to valve and turn off electrical power.

2. Unscrew solenoid housing nut and remove housing, coil and housing base plate.

3. Base assembly (4J) is now accessible for removal with hexagon or adjustable open end wrench.

4. Valve head, spring and seat are now accessible for inspection, cleaning and replacement, if necessary. When replacing seat, use compound on threads (remove excess). Tighten to 75 in./lb. torque.

Temperature Pilot, Inspecting and Replacing Valve Head and Seat (Refer to Fig. 3)

Note: Inspecting and replacing parts, if necessary, can be done without removing the pilot from the main valve. However, if more convenient, the entire pilot can be removed from the main valve by removing the four cap screws.

Exception: To replace the seat in low pressure (15 psi and below) 2-1/2", 3", 4" and 6" valves, the entire pilot must be removed from the main valve or mounting bracket.

1. Unscrew hexagon nut (K) and remove temperature adjustment assembly.

2. The pilot valve head assembly (3E), which includes the springs, Teflon seal, and valve head, can then be with-drawn and inspected.

3. If it is found after inspection that the head is worn, the entire assembly should be replaced. (Refer to Repair Parts List P9-650).

4. The pilot valve seat can be removed for inspection using a 1/2" hexagon socket wrench.

5. If the seat shows signs of wear, the seat should be replaced including a new seat gasket.

Pressure Pilot, Inspecting and Replacing Valve Head and Seat (Refer to Fig. 3)

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

2. Pilot valve head and seat are contained in one complete assembly. (See Fig. 3).

3. To remove head and seat assembly (2H), unscrew hexagon nut, 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 Head Stem Guide (Refer to Fig. 3)

The important thing to check is to make sure that the pilot head stem moves freely through the guide. This can be determined by removing the complete pilot from the main

valve and turning adjustment (2D) so as to move the head replacement to an open and closed position. Should cleaning or replacement be required, proceed as follows:

1. Remove the pilot diaphragm cap screws (2C).

2. Remove pilot yoke (2B) and pilot diaphragm (2F).

3. The stem guide assembly can then be removed with a 7/8" hex socket wrench.

Inspecting and Replacing Pressure Pilot Valve Diaphragms (Refer to Fig. 3)

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

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

3. The 2 metal diaphragms (1H) 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. Application of a plastic compound on the casting surface, such as Garlock 101, is recommended.

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

7. Tighten all cap screws uniformly.

Valve Sizes 1/2" thru 4"

Inspecting and Replacing Main Valve Head and Seat (Refer to Figs. 3 and 5).

1. Unscrew copper tubings at (J) and (L).

2. Disconnect pressure control line at the pressure pilot connection.

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

4. Remove main valve cover, strainer, screen, and head spring.

5. Head can then be removed by simply withdrawing with a pliers or similar tool.

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

7. 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.

8. If it is necessary to replace the valve seat, this can be removed from the valve body using a standard hexagon socket. (Valve sizes 1/2" to 2"). When replacing the valve seat, a new gasket should be used to insure a tight joint. 2-1/2" thru 6" valves contain raised lugs for removal and seal metal-to-metal without a gasket. Replacement heads and seats should be lapped in.

Valve Sizes 1/2" thru 4"

Inspecting and Replacing Main Valve Diaphragms (Refer to Figs. 3, 4 and 5).

1. Unscrew copper 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 (1F) 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.

7. Before reassembling diaphragms in 1/2" thru 4" sizes, main valve head must be in place and held 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.

6" Valve Only

Inspecting and Replacing Main Valve Diaphragms, Seat, and Head Assembly (Refer to Fig. 7).

Diaphragms

1. Unscrew copper tubing connections (G) to lower diaphragm chamber.

2. Remove main valve diaphragm bolts (1C) and drop lower diaphragm case.

3. The 2 metal diaphragms (1H) should be inspected and replaced if they have become distorted or fractured.

4. Clean any accumulation of dirt from the diaphragm case and orifice (H).

Servicing the Main Valve Head and Seat

5. Loosen the diaphragm plate set screw and remove the diaphragm plate (1G).

6. Remove the top cover bolts (1A) and cover.

7. Remove the stem and head assembly from the valve. Inspect the head and seat for wear.

8. Check for body erosion around the seat ring.

9. Replacement seats and heads should be lapped in, and minor wear can also be corrected by lapping with 400 grit compound.

10. On re-assembly be sure diaphragm plate (1G) is set at 27/64" and set screw securely tightened.

Recalibration of Temperature Adjustment Dial

The temperature adjustment dial can be recalibrated after servicing or to match the calibration of a thermometer on a particular application installed next to the temperature bulb. To recalibrate, proceed as follows:

1. The control bulb must be immersed in a temperature within the range of the calibrated dial.

2. With steam pressure on the valve, turn temperature adjustment knob (3C) slowly clockwise until main valve shuts off flow of steam.

3. Turn temperature adjustment knob (3C) counterclockwise slightly, just enough to start a slight flow of steam.

4. Loosen small Allen set screw in red temperature adjustment knob (3C) using a 3/32" hex Allen set screw wrench and pull know upwards off its rubber support.

5. Rotate red temperature knob until temperature on dial matches temperature reading at the control bulb, then push knob downwards over the rubber support.

6. Retighten Allen set screw. Note: No attempt should be made to recalibrate the temperature pilot for temperatures beyond the range shown on the calibrated dial. If the temperature range is to be changed, the entire pilot assembly including the thermostatic systems must be replaced.

Replacement of Thermal System

1. Loosen hexagon nut (M) and withdraw thermostatic bellows.

2. Insert replacement system in a similar manner making certain to tighten hexagon nut (M). Caution: **Do not** over-tighten.

3. All replacement systems are interchangeable for the same range and generally readjustment of the temperature dial is not required. However, should this be necessary, follow the instructions as described under "Recalibration of Temperature Adjustment Dial," above.

Note: For replacement parts refer to Spirax Sarco Parts List P21.

Size	1/2" & 3/4"	1"	1-1/4" & 1-1/2	2"	2-1/2"	3"	4"	6"
Dim A	1/16"	5/64"	3/32"	1/8"	13/64"	13/64"	1/4"	27/64"

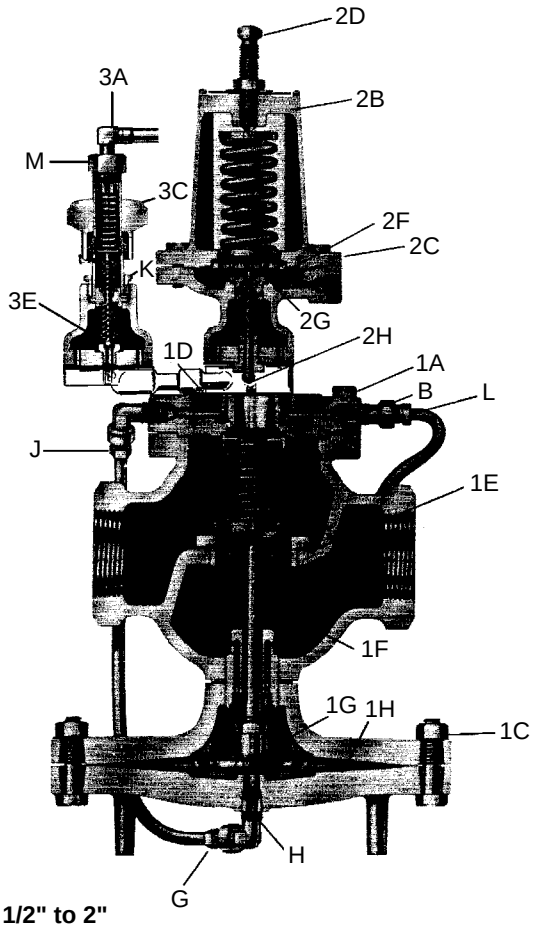


Fig. 3
Sizes 1/2" to 2"

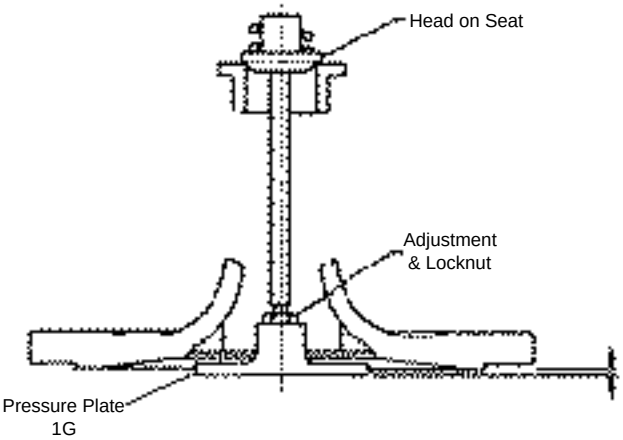


Fig. 4 Note in 1/2" thru 4" sizes, top of valve must be completely assembled and head must be on seat when measuring dimension "A" and when reassembling diaphragms.

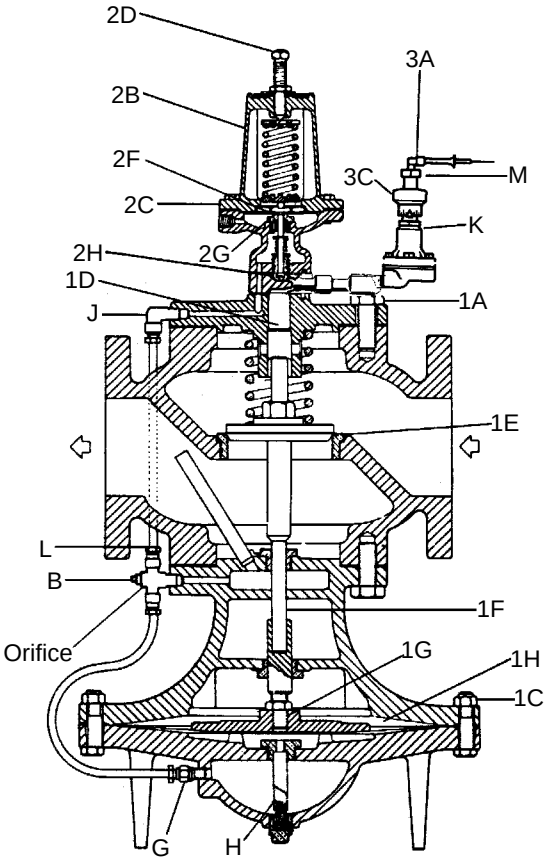


Fig. 5
Sizes 2-1/2" to 4"

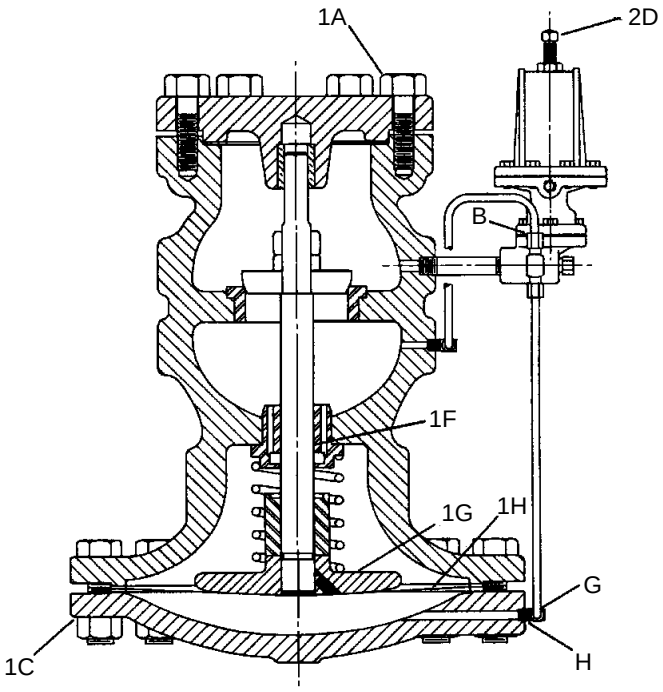


Fig. 7
6" Size

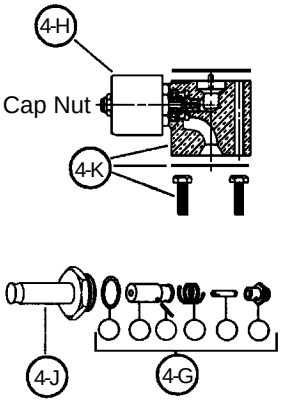
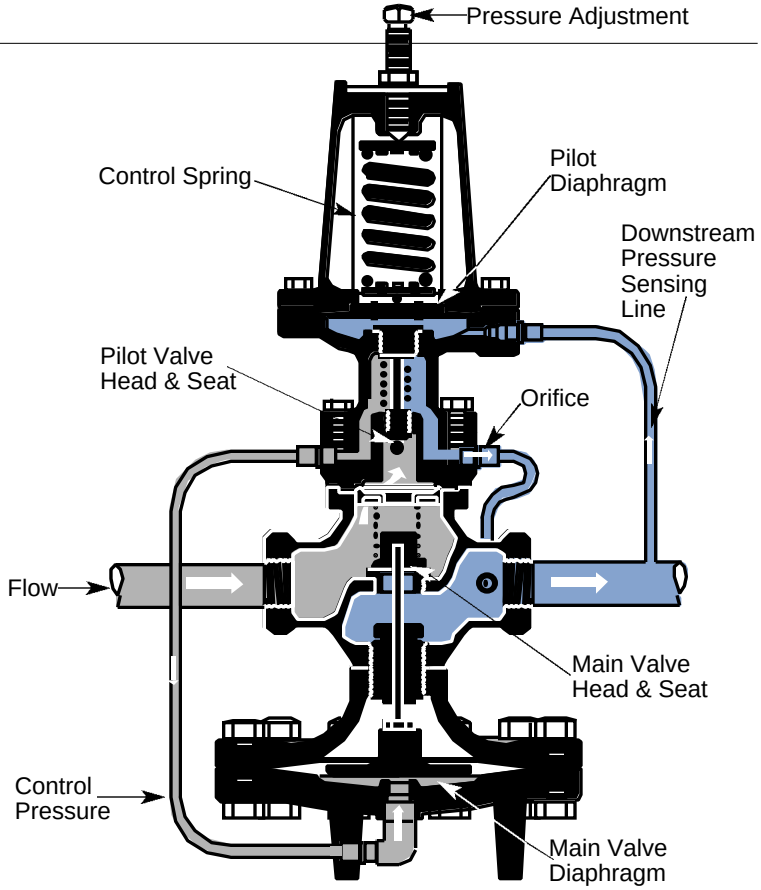


Fig. 6
Electric Pilot



Troubleshooting

Refer to Figs. 3, 5, & 7

Symptom	Cause	Check and Cure
1. Controlled temperature or pressure overrides the set point.	1. (a) Control not properly set.	1. (a) Adjust knob (3C) or (2D) to lower setting.
	(b) Thermo bulb not in representative location.	(b) Check actual temperature at bulb with glass thermometer. If necessary, relocate bulb.
	(c) Dirt under pilot valve (2H) or (3E) or spindles sticking.	(c) Set knob (3C) to temperature higher than bulb temperature. Remove tubing connection at (J). Loosen adj. (2D) until steam flow from pilot body stops. Then tighten (2D) slightly. Steam should flow. If not, pilot (2H) must be removed and cleaned or replaced. Tighten screw (2D) until steam flows from body. Turn adj. (3C) to temperature lower than bulb temperature. Steam flow should stop. Alternately adjust (3C) up and down. Steam flow should alternately start and stop. If not, remove (K) and clean or replace pilot head and seat.
	(d) Valve oversized.	(d) Check actual load against valve rating. Reduce maximum outlet pressure by loosening screw (2D).
	(e) Dirt in orifice (B) or (H), or pressure sensing line may be plugged.	(e) Inspect and clean.
	(f) Dirt under main valve or valve head and seat worn.	(f) Set knob (3C) or (2D) to lowest setting. Disconnect tubing at (G). Valve should close. If it doesn't, remove bolts (1A) and clean main valve.
	(g) Defective thermal system. (RARE).	(g) Experience over the years has shown that failure of the thermal system (other than mechanical damage) is very rare. Only after all of the "checks" listed on the troubleshooting chart have been pursued should the following test be made to determine if the thermal system is defective. i. Disconnect copper tubing connection at (J) ii. Immerse thermal system bulb in a temperature 20° above dial setting. Allow to saturate for approximately 5 minutes. iii. Open steam supply stop valve to allow steam to flow to temperature regulator. iv. Under these conditions steam should not flow from copper tubing connection (J) which shows that the thermal system is satisfactory. v. If steam should flow from tubing connection (J), exert pressure downward with thumb on thermal system elbow connection (3A). If this pressure seats pilot valve head and stops steam flow, the thermal system is probably defective.

Troubleshooting
(Continued)

Symptom	Cause	Check and Cure
2. Temperature too low or valve does not open.	2. (a) Faulty electric pilot control circuit or actuating device.	2. (a) Check electrical system for correct solenoid opening and closing by switch or timer.
	(b) Control not properly set.	(b) Adjust knob (3C) to higher setting.
3. Erratic Control .	3. (a) Thermo bulb not in representative location.	3. (a) See 1. (b) above.
	(b) Heating surface may be waterlogged due to defective steam trap.	(b) Inspect and repair if necessary.
	(c) Valve undersized.	(c) Check actual load against rating of valve. Increase maximum delivery pressure by tightening adj. (2D).
	(d) Main valve diaphragm (1H) cracked.	(d) Remove tubing at (G). Crack bypass valve. If steam blows from diaphragm case, replace diaphragms (1H).
	(e) Orifice at (B) or (H) blocked.	(e) Inspect and clean.
	(f) Supply steam pressure too low.	(f) Check and correct.
	(g) Valve screen (1D) blocked.	(g) Remove bolts (1A). Inspect strainer and clean.
	(h) Line strainer partially or completely blocked.	(h) Inspect and clean.
	(i) Pilot valve (2H) or (3E) sticking, dirty or defective.	(i) See 1(c) above.
	(j) Dirt or foreign material on main valve stem and guide (1F).	(j) Remove, inspect and clean.
4. Delivery pressure too low.	4. (a) Valve not properly adjusted.	4. (a) Adjust screw (2D) to desired pressure.
	(b) Valve undersized.	(b) Check actual load against valve rating.
	(c) Upstream pressure too low.	(c) Check and correct.
	(d) Main diaphragm leaking.	(d) See 2(d) above.
	(e) Orifice (b) missing.	(e) Replace proper fitting.
5. Valve fails to close.	5. (a) Faulty electric pilot control circuit or actuating device.	5. (a) See 2(a) above.
	(b) Bypass valve open or leaking.	(b) Check and repair as required.
	(c) Pilot sensing line blocked (or not installed).	c) Remove, inspect, clean or install.
	(d) Pressure pilot diaphragm ruptured (water or steam coming from pilot at spring retainer area).	(d) Replace pilot diaphragm assembly (2F).
	(e) Pilot assembly or main valve seat threads leaking.	(e) Check casting in seat area for erosion.
	(f) Main valve diaphragms reassembled without return spring and main valve cover holding valve head closed. (1/2" thru 4" sizes only).	(f) With main valve cover installed, loosen all main valve diaphragm bolts (1C) and then retighten.