



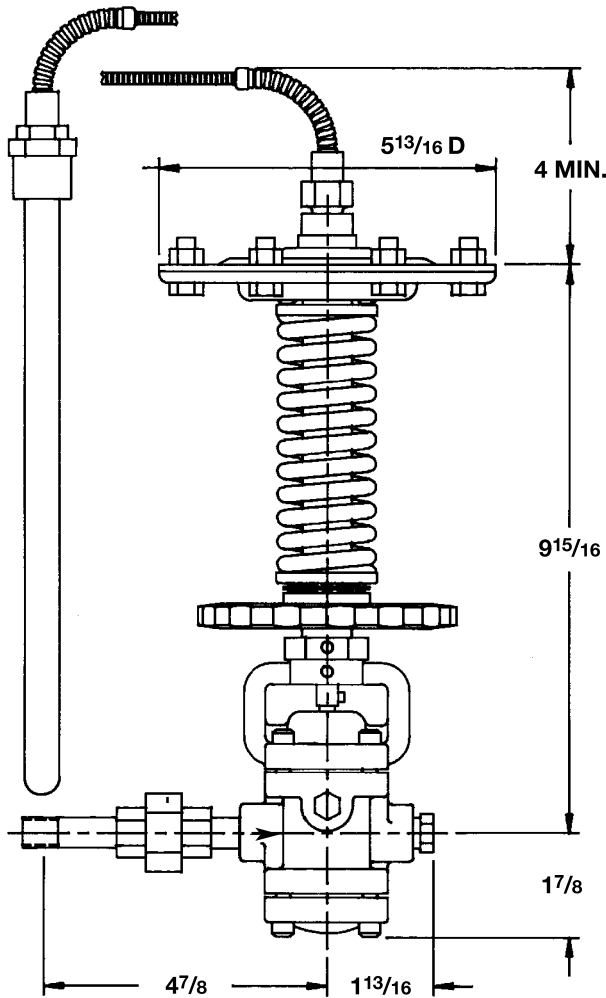
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# Technical Data

SD 4511A

**SPENCE ENGINEERING COMPANY, INC.** 150 COLDENHAM ROAD, WALDEN, NY 12586-2035

## TYPE T14 & T14D TEMPERATURE PILOT



T14 PILOT

The combination of a Spence Type T14 or Type T14D Pilot with a Spence Type E or Type C Main Valve produces a temperature regulator or a combined pressure and temperature regulator in a single pilot-operated valve.

This pilot is recommended for use with storage heaters, jacketed kettles and vats.

### RATINGS (Maximum Inlet Conditions)

Material	Construction	Pressure	(Temperature)
Cast Iron	Screwed Ends	250 PSIG	450°F
	Flanged ANSI 125	125 PSIG	450°F
	Flanged ANSI 250	250 PSIG	450°F
Cast Bronze	Screwed Ends	250 PSIG	450°F
Cast Steel	Screwed Ends	300 PSIG	600°F
	Flanged ANSI 150	150 PSIG	500°F
	Flanged ANSI 300	300 PSIG	600°F
	Flanged ANSI 600	600 PSIG	600°F

### TEMPERATURE RANGES

- 20° to 120°F
- 50° to 150°F
- 70° to 170°F
- 120° to 220°F
- 150° to 300°F
- 170° to 270°F
- 250° to 350°F
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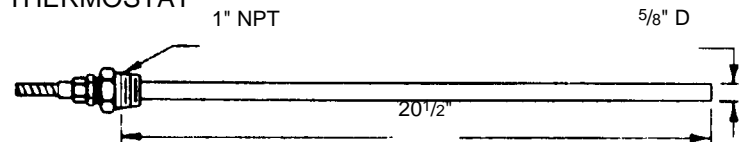
### THERMOSTAT ASSEMBLY

Standard Thermostat Assemblies and Wells:

- Stainless Steel
- Bronze

Flexible tubing and capillary are available to 50 feet.

### THERMOSTAT



Style #700 bronze bulb with 10 feet of brass flexible tubing will be furnished unless otherwise specified. For other bulb styles, see SD9501.

### OPTIONS

- Thermostat Well
- Adjustment Indicator
- Dial Thermometer
- Integral Mount Body

SD 4511A/9811

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## OPERATING PRINCIPLE

The regulator is operated by its initial steam pressure. The main valve is normally closed, being held so by initial pressure on the disc and by an internal main spring. The pilot is opened when the temperature at the thermostat bulb is lower than the setting of the temperature adjusting spring.

When steam is turned on, it flows to the pilot through the connecting nipple and union (see Fig. 1). At the No. 8B tee on the pilot outlet, the flow divides. One branch is connected to bleedport No. 4A and the other to restriction elbow No. 5A and the underside of the main valve diaphragm. Bleedport No. 4A restricts the flow, builds pressure under the diaphragm and opens the main valve. Restriction No. 5A steadies the operation of the regulator.

As the temperature of the heated medium rises, vapor pressure is generated in the thermostat bulb and transmitted to the pilot temperature diaphragm. When the vapor pressure becomes sufficient to over-balance the combined thrust of the temperature adjusting and pressure limit springs, the regulator throttles to maintain the set temperature.

When a Type D Pressure Pilot is added (Type T14D), the operation remains the same as described above except the delivery pressure is limited to the setting of this pilot. On decreasing load, the temperature pilot reassumes the control and throttles the delivery pressure as required to maintain the desired temperature. For additional information on the Type D Pilot, please refer to SD4111.

## RECOMMENDED INSTALLATION

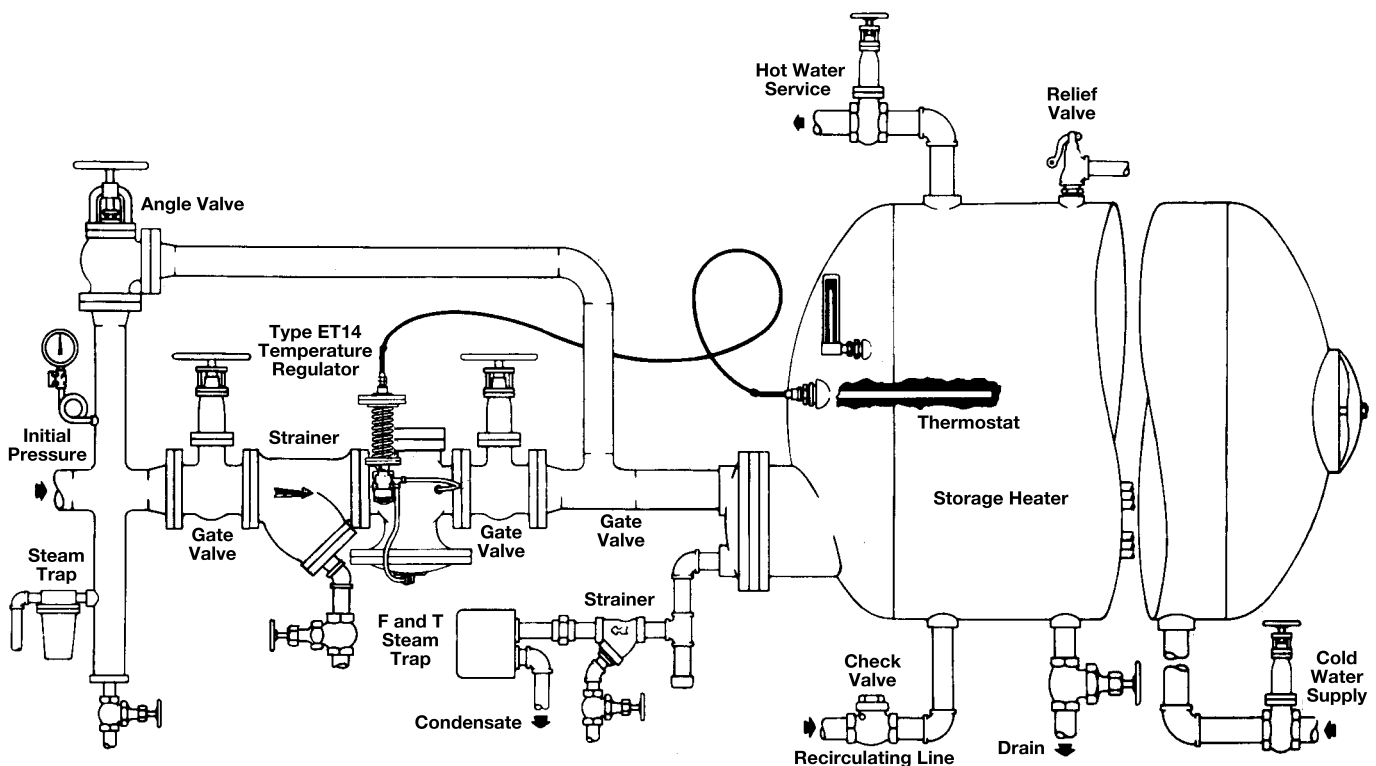


FIGURE 1

# INSTALLATION

## PLANNING

Locate the regulator in a horizontal pipe. Prevent water hammer and erratic operation by providing a trap ahead of the regulator. Avoid damaging effects of scale and dirt in pipelines by using a strainer to protect the regulator. Provide a three valve bypass to facilitate inspection of the regulator without interrupting service.

The preferred thermostat position is horizontal. When vertical or slanting, the tip end of the bulb must point downward. Locate the thermostat as close to the heater outlet as practical. Expose the entire length of the bulb to the active flow leaving the heater. If the pressure rating of the heater or connected equipment is less than the initial steam pressure, provide a safety valve.

Hot water and similar liquid systems require a relief valve to prevent dangerous overpressure due to expansion. Instantaneous heaters, when operated on intermittent demand (as in domestic water heating), require the following conditions for best temperature regulation.

- Constant forced recirculation of fluid through the heater.
- Omission of thermostat well to reduce temperature lag. Use of a thermostat compatible with the heated medium is preferred over the use of a standard thermostat installed in a well which is compatible with the heated medium. When the use of a well is unavoidable, an appropriate heat transfer medium should be installed between the well and the thermostat.

## MAIN VALVE

Flush the piping system thoroughly to clear it of welding beads, scale, sand, etc. Mount the main valve with diaphragm chamber down and arrow on body pointing in the direction of flow. Screwed end valves should be mounted in unions.

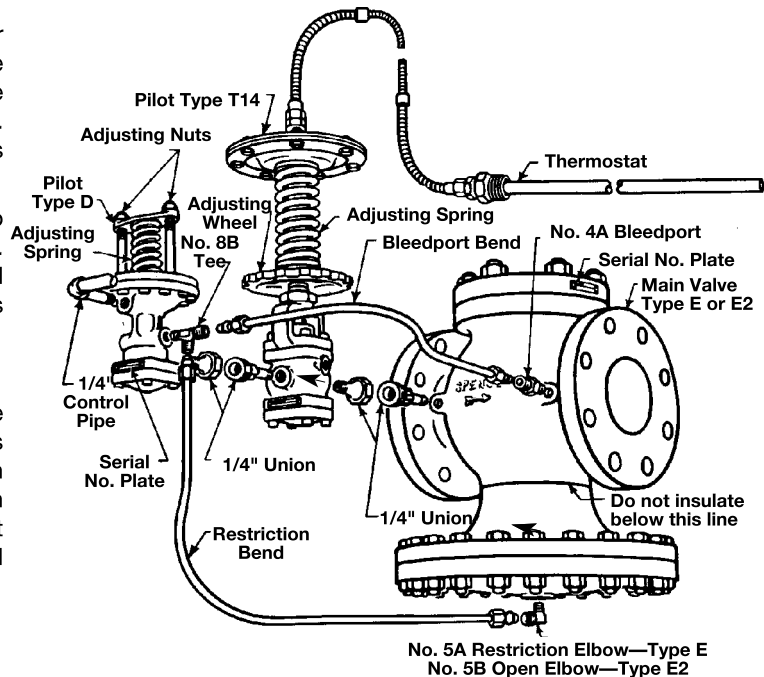


FIGURE 3

## PILOT

Mount the pilot on either side of the main valve by means of 1/4" nipple and union provided. Make this connection the the 1/4" pipe tap at the inlet side of the main valve as shown in Figure 2.

Screw No. 4A bleedport fitting into the 1/8" pipe tap at the outlet side of the main valve body. Note bleed orifice in this fitting – vital to operation of regulator.

Screw No. 8B tee into 1/8" pipe tap in pilot. Select tap facing downstream.

Screw No. 5A elbow containing restriction orifice into 1/8" pipe tap on underside of main valve diaphragm chamber. If the initial pressure or pressure drop is less than 15 psi, a No. 5B open elbow without orifice.

Connect tubing bends as illustrated in Fig. 2. Valves with condensation chamber are fitted up according to Figure 3.

## CONTROL PIPE (required for T14D only)

Use 1/4" pipe for this line which connects the pilot pressure diaphragm chamber (Fig. 2) to the desired point of pressure control. On instantaneous heaters with steam in shell, tap the control pipe into the shell. Otherwise, enter the delivery steam pipe at point of entrance to heater. Pitch the control pipe away from the pilot and avoid water pockets. Insulation may be applied to the upper portion (globe and flanges) of the main valve. Do not insulate the diaphragm chamber or any part of the pilot (Fig. 1).

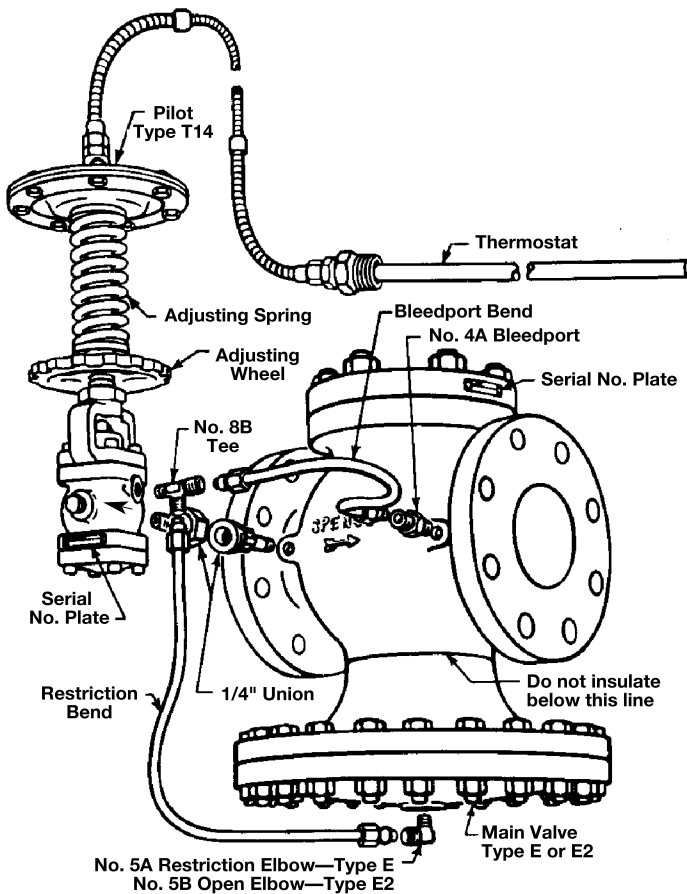


FIGURE 2

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## START-UP AND SETTING

**For ET14:** Close bypass and open outlet stop valve. Blow down strainer. Gradually open inlet stop valve. Turn temperature adjusting wheel (Fig. 1) to obtain desired control temperature.

**For ET14D:** Close bypass, open 1/4" control pipe valve and turn up the temperature adjusting wheel (Fig. 1) until 1/2" of thread is exposed. Back off pressure adjusting screw to remove all compression from D Pilot adjusting spring.

Crack open the outlet stop valve. Crack open the inlet stop valve, blow down strainer and then slowly open the inlet valve wide. Gradually compress D Pilot adjusting spring until the valve opens and takes control at set pressure. Open outlet stop valve slowly and adjust temperature by turning adjusting wheel until desired operating temperature is reached.

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## TROUBLE SHOOTING

### FAILURE TO OPEN OR SAGGING DELIVERY PRESSURE

1. Adjusting spring on pilot may have been tampered with.
2. Initial pressure may be down due to partially closed supply valve, clogged strainer or other obstruction.
3. Bleedport may have been omitted and an open coupling substituted.
4. Orifice in No. 5A restriction elbow may be plugged.
5. Control pipe may be plugged. Most likely points of obstruction are at shutoff valve and entrance to delivery main.
6. Make sure heater is properly trapped and free of condensate.
7. Main valve diaphragm may be broken. Check the main valve with air pressure in diaphragm chamber before dismantling.
8. Leak in the thermostat bulb may allow heated fluid pressure if sufficiently high to back up into the thermal system to hold pilot closed.

### FAILURE TO CLOSE – OVERHEATING

1. Adjusting spring on pilot may have been tampered with.
2. By-pass may be leaking.
3. Thermostat located too far from instantaneous heater outlet.
4. Thermostat may be kinked or broken or have lost it's fill. Alternately warm and cool thermostat 10°F above and below it's set point. If thermostat is operative, the pin between the lever and pressure diaphragm will become loose and snug as the temperature stem on opposite end of the lever moves up and down.
5. Orifice in bleedport may be plugged.
6. A lift of condensate to a hot well may require more pressure in heater than the heated medium. Arrange drainage of the heater by gravity or install a pump to lift condensate.
7. Main valve or pilot may be held open by foreign matter. To determine which valve leaks:
  - a. Close stop valves and 1/4" control pipe valve if D Pilot is used.

- b. Remove bleedport bend so pilot will exhaust to atmosphere.
- c. Turn down temperature adjusting wheel and bypass some steam to the heater to overheat the thermostat and close the temperature pilot.

**For Type T14:** Crack open inlet stop valve. If steam issues from 8B tee on pilot, there is an obstruction under it's seat or the thermostat is defective.

**For Type T14D:** Compress adjusting spring on Type D pilot. If steam issues from 8B tee, temperature pilot has an obstruction under it's seat or the thermostat is defective. If temperature pilot is tight, turn up adjusting wheel until steam flows. Release compression on D Pilot adjusting spring to see if pilot closes tight. Open and close several times to wash seat.

Steam blowing back from bleedport means main valve disc is held open by foreign matter.

Steam may wash the obstruction from the seat if the valve is made to open wide. This can be accomplished if the temperature pilot is set well above temperature of liquid in tank heater and if the control pipe of the D Pilot is installed beyond the outlet stop valve. Reassemble bleedport bend and place regulator in operation. Then, slowly open and close outlet stop valve.

- d. Leakage of either valve requires dismantling to correct.

### ERRATIC TEMPERATURE CONTROL

1. Thermostat installed too far from heater outlet.
2. Improper trapping or erratic discharge of trap.
3. Lift of condensate to hot well may require more pressure than that called for by the medium flowing through the heater. Arrange to drain condensate by gravity or lift it with a pump.
4. Sticky check valve in return line.
5. Poor circulation through heater. Constant circulation should be employed.
6. Valve too large for the heater or heater too large for the load.
7. Valve installed too far from heater.

## INSPECTION

Under normal conditions, complete dismantling at regular intervals is not recommended. A valve kept relatively free of dirt will function for years with minimum attention.

After the first few days of operation and twice per year:

- 1 - Inspect for dirt collected at bleedport 4A and restriction elbow 5A.
- 2 - Inspect all joints for leakage. Keep bolts tight. Never allow a leak to persist.

## THERMOSTAT REPLACEMENT

Do not, under any circumstances, loosen the bolts on the diaphragm chamber of the Type T14 Temperature Pilot or attempt to dismantle the thermostat element. The system is filled with volatile fluid which, if lost, will render the pilot inoperative. To replace, proceed as follows:

- 1 - Cool the thermostat bulbs of original and replacement elements below the low end of their temperature range (See range tag on flexible tubing). Maintain bulbs at this temperature during replacement process.
- 2 - Back off temperature adjusting wheel (10) to within a turn or two of the barrel nut (22). This will allow temperature diaphragm plate (4) to remain seated in correct alignment on balls (5) and will release all compression on bellows stem assembly (12).  
***Unless pilot is upright, balls will fall out of position.***
- 3 - Remove diaphragm nuts (2) and detach thermostat assembly (11) from pilot. Similarly, detach shipping plate from replacement thermostat.

***When removing diaphragm nuts, be sure cowl assembly (28) does not turn in bonnet (24). If movement is observed, reset position as per instructions for temperature stem position adjustment below.***

- 4 - Install replacement thermostat on pilot and install shipping plate on original thermostat. Tighten bolts evenly.

## BELLOWS SEAL REPLACEMENT

If steam blows out around temperature stem (8) at bonnet (24), the bellows seal is defective and must be replaced. Proceed as follows:

- 1 - Remove set screw (23) and bonnet bolts (18).
- 2 - Remove cowl assembly (28) and bonnet (24) from body (25).
- 3 - Fit 5/8" deep socket wrench on nut at the end of bellows assembly (12) and remove it from bonnet (24).
- 4 - Install new bellows following instructions for replacing seat rings.
- 5 - Be sure bellows stem fits into coupling on temperature stem (8) and tighten set screw (23).

## DISMANTLING

- 1 - Remove bonnet bolts (18) and lift off cowl assembly (28).
- 2 - Remove disc (14) and clean seat (15).
- 3 - Remove blind flange bolts (18) and clean screen (16).

## ASSEMBLY

- 1 - Reassemble the pilot in the reverse of the procedure described above.

## SEAT AND DISC REPLACEMENT

- 1 - Examine the seat and disc sealing surfaces for nicks or other signs of damage by pipeline debris. If sealing surfaces are damaged, they must be replaced.
- 2 - Remove the seat ring (15) from the body with a socket wrench. Clean the body threads of old sealing compound using a wire brush. Apply new sealing compound (Copaltite or equal) sparingly to the threads and shoulder of the new seat ring. Let stand until tacky before assembling into the pilot body.
- 3 - When seat or disc is replaced, the sealing surfaces must be lapped.

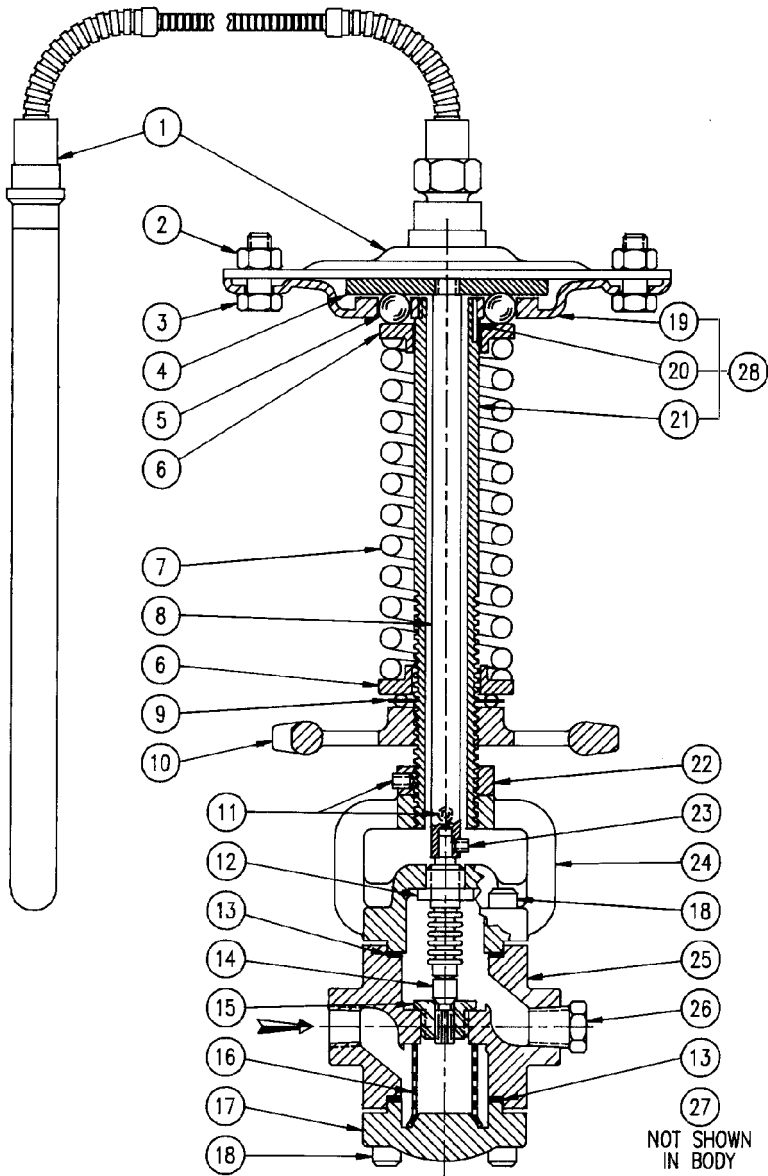
***Lap sparingly using 500 grit lapping compound and light pressure. Heavy grinding may cause galling, wide sealing surfaces and a grooved disc, all of which tend to produce leakage.***

After the sealing surfaces are lapped in, disassemble and clean all parts.

## T14 PILOT SETTING

The temperature stem adjustment is factory set and locked by a barrel nut (2). If the setting is accidentally disturbed, readjust as follows:

- 1 - Leave pilot connected to main valve. Remove thermostat assembly (1).
- 2 - Clamp a steel flat bar to the cowl (19) so that the pressure plate (4) is flush with the diaphragm seat on cowl (19).
- 3 - Disconnect bleedport bend (tubing between tee at pilot outlet and bleedport fitting in outlet end of main valve).
- 4 - Crack inlet stop valve until steam issues from tee fitting on pilot outlet. Should pilot be blocked closed by temperature stem (8), loosen bonnet set screw (11) and stem set screw (23). Rotate cowl assembly (28) upward to raise barrel (21) until steam flows.
- 5 - If barrel nut (22) prevents cowl assembly from turning down far enough or is above bonnet (24) when steam stops flowing, remove sealing wax and loosen set screw (11).
- 6 - Lock this adjustment by tightening set screw (11) in bonnet (24). Turn down barrel nut (22) fast against bonnet and tighten it's set screw (11) and the stem set screw (23).
- 7 - Reassemble thermostat (1).



**TYPE T14 PILOT**

ITEM NO.	PART NAME	MATERIAL	PART NO.
1	Thermostat Assembly	—	—
2	Diaphragm Nut	Steel	05-02992-00
3	Diaphragm Bolt	Steel	05-05634-00
4	Pressure Plate	Iron	04-03602-01
5	Pressure Plate Balls	Alloy Steel	05-00553-00
6	Temp. Spring Button	Steel	04-01052-00
7	Temp. Adjusting Spring	Steel	05-05122-00
8	Temperature Stem	Aluminum	04-05654-00
9	Bearing	Steel	05-00550-00
10	Handwheel	Iron	04-02502-00
11	Bonnet Set Screw	Steel	05-04874-00
12	*Bellows Stem Assembly	Bronze Steel	07-60302-00 07-60536-00
13	*Gasket	Non-asbestos Flexitalic	05-02378-00 05-11718-00
14	*Disc	Stainless Steel	04-01776-00
15	*Seat Ring	Stainless Steel	04-04057-90
16	*Screen Steam	Monel	04-04700-00
17	Blind Flange	Iron Bronze Steel	04-02151-00 04-02153-00 04-11678-00
18	Blind Flange & Bonnet Bolt	Steel Steel	05-04803-00 05-11719-00
19	Cowl	Steel	04-01525-00
20	Groove Pin	Stainless Steel	05-03243-00
21	Barrel	Aluminum	04-01247-00
22	Barrel Nut	Steel	04-02908-00
23	Stem Set Screw	Steel	05-04872-00
24	Bonnet	Iron Bronze Steel	04-00976-00 04-00978-00 04-10021-01
25	Body	Iron Bronze Steel	04-00741-00 04-00761-00 04-10912-01
26	Pipe Plug 1/4 NPT	Steel Brass	04-03772-00 04-03771-00
27	Pipe Plug 1/8 NPT	Steel Brass	04-03769-00 0403770-00
28	Cowl Assembly	Steel/Aluminum	07-00334-00
	Repair Kit	Cst Iron/Bronze	07-06606-00
	Repair Kit	Steel	08-09110-01

\*These parts furnished in Repair Kit

When ordering parts, it is essential that the pilot type, service and serial number be stated.

Select part by item number, but order by part number. Specify complete part number when ordering.

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