Spence Type T14 Temperature Pilot

⚠ WARNING

Failure to follow these instructions or to properly install and maintain this equipment could result in an explosion, fire and/or chemical contamination causing property damage and personal injury or death.

Emerson temperature pilot must be installed, operated and maintained in accordance with federal, state and local codes, rules and regulations and Emerson Process Management Regulator Technologies, Inc. (Emerson) instructions.

If the temperature pilot vents gas or a leak develops in the system, service to the unit may be required. Failure to correct trouble could result in a hazardous condition.

Installation, operation and maintenance procedures performed by unqualified personnel may result in improper adjustment and unsafe operation. Either condition may result in equipment damage or personal injury. Only a qualified person shall install or service the Type T14.

Introduction

Scope of the Manual

This manual provides instructions for installation, maintenance and parts information for the Type T14 temperature pilots.

Figure 1. *Type T14 Temperature Pilot*

Product Description

The Spence Type T14 is a temperature pilot regulator. When combined with the Spence Type E or Type C Main Valve, it produces a temperature regulator, ET14, or a combined pressure and temperature regulator in a single pilot operated valve, ET14D.

Type T14 pilot is recommended for use with storage heaters, jacketed kettles and vats.

Specifications

The Specifications section gives some general specifications for the Type T14 temperature pilot. The nameplates give detailed information for a specific pilot as built in the factory.

Available Configurations
Type T14: Temperature Pilot

Maximum Inlet Temperature(1)
Cast Iron: 450°F / 232°C
Cast Steel: 750°F / 400°C

Maximum Inlet Pressure(1)
Cast Iron: 250 psig / 17.2 bar
Cast Steel: 600 psig / 41.4 bar

Temperature Ranges(1)
20 to 120°F / -7 to 49°C
50 to 150°F / 10 to 66°C
70 to 170°F / 21 to 77°C
120 to 220°F / 49 to 104°C
150 to 300°F / 66 to 149°C
170 to 270°F / 77 to 132°C
250 to 350°F / 121 to 177°C
290 to 390°F / 143 to 199°C
300 to 400°F / 149 to 204°C
330 to 430°F / 166 to 221°C
400 to 500°F / 204 to 260°C

Construction Materials
Body: Cast Iron, Steel
Disk and Seat: Stainless steel
Diaphragm: Bronze
Gasket: Graphite
Spring: Steel

Approximate Weights
Type T14: 13 lbs / 6 kg

Optional Accessories
Bronze or Stainless steel Thermostat
Tubing from 5 to 50 ft / 1.52 to 15.2 m
Thermostat Well
Dial Thermometer
Adjustment Indicator
Integral Mount Body

1. The pressure/temperature limits in this Instruction Manual or any applicable standard limitation should not be exceeded.

Principle of Operation

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

Steam flows to the pilot through the connecting nipple and union (see Figure 2). 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 ET14D), the operation remains the same 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 Pressure Reducing Pilot, please refer to VCIMD-14966.

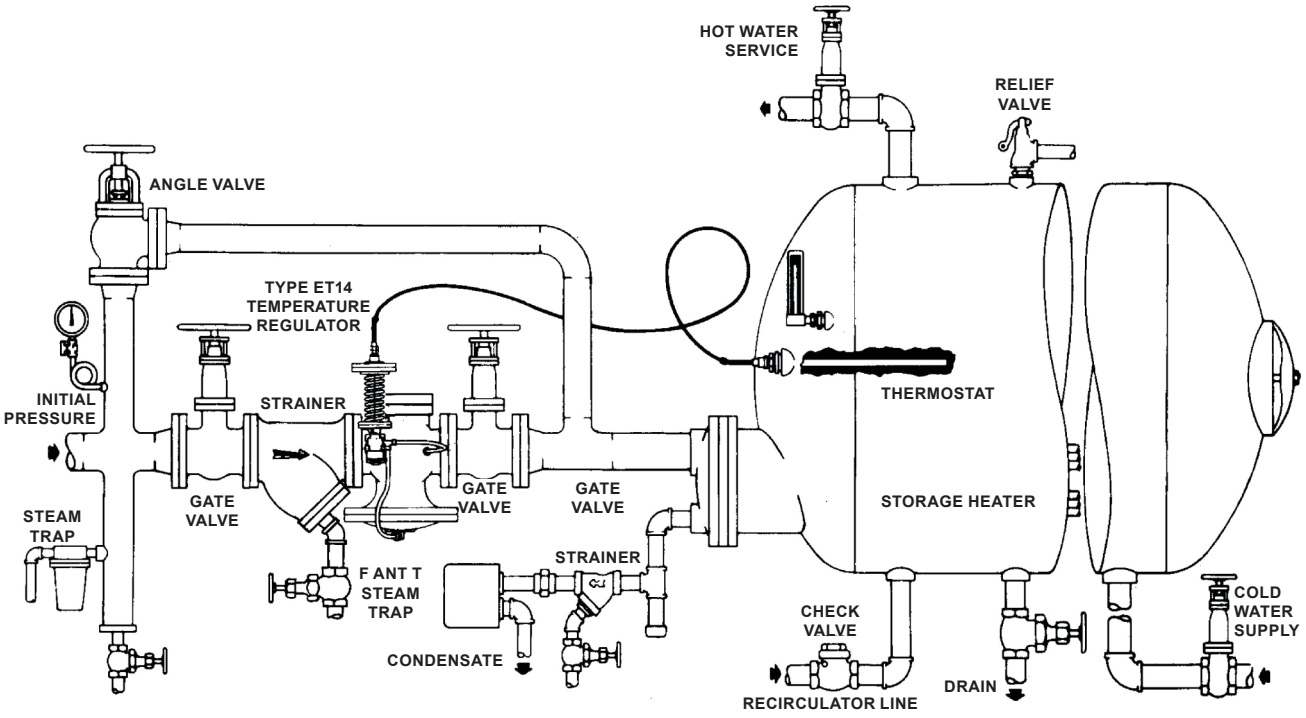

Figure 2. *Typical Installation*

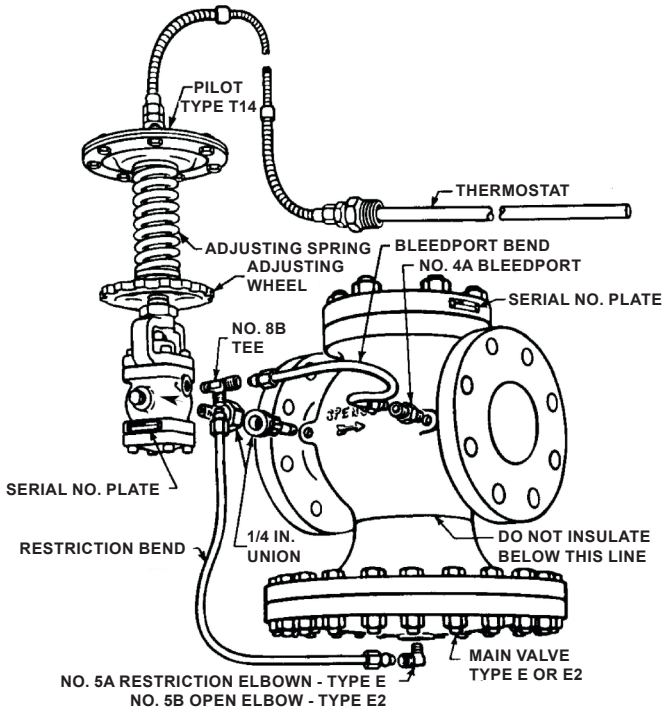

Figure 3. *Type T14 Tubing Bends Connection*

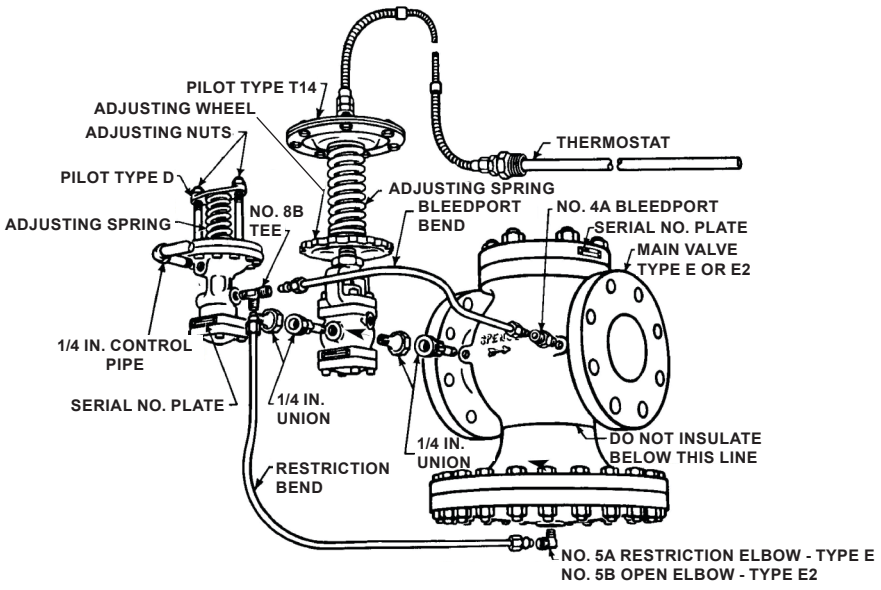

Figure 4. *Type ET14D Tubing Bends Connection*

Installation

WARNING

Personal injury or system damage may result if this pilot is installed, without appropriate overpressure protection, where service conditions could exceed the limits given in the Specifications section and/or pilot nameplate.

Additionally, physical damage to the pilot may result in personal injury or property damage due to escaping of accumulated gas. To avoid such injury and damage, install the pilot in a safe location.

All pressure equipment should be installed in a non-seismic area; should not be exposed to fire; and should be protected from thunderbolt (lightning) strikes.

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.**

Note

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.

CAUTION

The piping system must be adequately designed and supported to prevent extraordinary loads to the pressure equipment.

Planning

1. Locate the regulator in a horizontal pipe. Provide a trap ahead of the regulator to prevent water hammer and erratic operation.
2. Use a strainer to avoid damaging effects of scale and dirt in pipelines to protect the regulator.
3. Provide a three valve bypass to facilitate inspection of the regulator without interrupting service.
4. Position the thermostat horizontally. When vertical or slanting, the tip end of the bulb must point downward.
5. 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.
6. If the pressure rating of the heater or connected equipment is less than the initial steam pressure, provide a safety valve.

Main Valve

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

Pilot

1. Mount the pilot on either side of the main valve by means of 1/4 in. / 6.35 mm nipple and union provided.
2. Connect the 1/4 in. / 6.35 mm pipe tap at the inlet side of the main valve as shown in Figure 3.
3. Screw No. 4A bleedport fitting into the 1/8 in. / 3.18 mm pipe tap at the outlet side of the main valve body. Note that the bleed orifice in this fitting is vital to operation of regulator.
4. Screw No. 8B tee into 1/8 in. / 3.18 mm pipe tap in pilot. Select tap facing downstream.
5. Screw No. 5A elbow containing restriction orifice into 1/8 in. / 3.18 mm pipe tap on the underside of main valve diaphragm chamber. If the initial pressure or pressure drop is less than 15 psi / 1.03 bar, use No. 5B open elbow without orifice.
6. Connect tubing bends as illustrated in Figure 3. Valves with condensation chamber are fitted up according to Figure 4.

Control Pipe (Required for Type T14 and Type D Pilot Combination Only)

1. Use 1/4 in. / 6.35 mm pipe for this line which connects the pilot pressure diaphragm chamber (Figure 3) to the desired point of pressure control.
2. 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.
3. Pitch the control pipe away from the pilot and avoid water pockets.

Insulation

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 pilot. See Figure 2.

Start-up and Setting

WARNING

The pilot may be handling hazardous fluids. Only qualified personnel, who are familiar with the installation, should be permitted to install, readjust, inspect or maintain the pilot.

CAUTION

Insulation, may be applied to the pilot body only. Do not insulate the bonnet.

For Type ET14

1. Close bypass and open outlet stop valve.
2. Blow down strainer.
3. Gradually open inlet stop valve.
4. Turn temperature adjusting wheel (Figure 2) to obtain desired control temperature.

Type ET14D

1. Close bypass, open 1/4 in. / 6.35 mm control pipe valve. Turn up the temperature adjusting wheel (Figure 2) until 1/2 in. / 12.7 mm of thread is exposed.
2. Back off pressure adjusting screw to remove all compression from Type D Pilot adjusting spring.
3. Crack open the outlet stop valve.
4. Crack open the inlet stop valve, blow down strainer and then slowly open the inlet valve wide.
5. Gradually compress Type D Pilot adjusting spring until the valve opens and takes control at set pressure.
6. Open outlet stop valve slowly and adjust temperature by turning adjusting wheel until desired operating temperature is reached.

Maintenance

WARNING

To avoid personal injury, property damage or equipment damage caused by sudden release of pressure or explosion of accumulated gas, do not attempt any maintenance or disassembly without first isolating the pilot from system pressure and relieving all internal pressure from the pilot.

Pilots that have been disassembled for repair must be tested for proper operation before being returned to service. Only parts manufactured by Emerson should be used for repairing this pilot.

Due to normal wear or damage that may occur from external sources, this pilot should be inspected and maintained periodically. The frequency of inspection and replacement of parts depends upon the severity of service conditions or the requirement of local, state and federal rules and regulations.

CAUTION

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.

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:

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

Thermostat Replacement

To replace thermostat, 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 (key 10) to within a turn or two of the barrel nut (key 22). This will allow temperature diaphragm plate (key 4) to remain seated in correct alignment on balls (key 5) and will release all compression on bellows stem assembly (key 12). Unless pilot is upright, balls will fall out of position.
3. Remove diaphragm nuts (key 2) and detach thermostat assembly (key 11) from pilot. Similarly, detach shipping plate from replacement thermostat. When removing diaphragm nuts, be sure cowl assembly (key 28) does not turn in bonnet (key 24). If movement is observed, reset position as per instructions for temperature stem position adjustment.
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 (key 8) at bonnet (key 24), the bellows seal is defective and must be replaced. Proceed as follows:

1. Remove set screw (key 23) and bonnet bolts (key 18).
2. Remove cowl assembly (key 28) and bonnet (key 24) from body (key 25).
3. Fit 5/8 in. / 15.9 mm deep socket wrench on nut at the end of bellows assembly (key 12) and remove it from bonnet (key 24).
4. Install new bellows following instructions for replacing seat rings.
5. Ensure bellows stem fits into coupling on temperature stem (key 8) and tighten set screw (key 23).

Dismantling

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

Assembly

Reassemble the pilot in the reverse of the procedure described in Dismantling section.

Seat and Disk Replacement

1. Examine the seat and disk sealing surfaces for nicks or other signs of damage by pipeline debris. Replace the sealing surfaces if damaged.
2. Remove the seat ring (key 15) from the body with a socket wrench.
3. Clean the body threads of old sealing compound using a wire brush.
4. Apply new sealing compound (high-pressure, high-temperature sealant) sparingly to the threads and shoulder of the new seat ring. Let stand until tacky before assembling into the pilot body.
5. When seat or disk is replaced, ensure that the sealing surfaces are lapped. After the sealing surfaces are lapped in, disassemble and clean all parts.

Note

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

Type T14 Pilot Setting

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

1. Leave pilot connected to main valve. Remove thermostat assembly (key 1).
2. Clamp a steel flat bar to the cowl (key 19) so that the pressure plate (key 4) is flush with the diaphragm seat on cowl.
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.

1. If pilot is blocked by temperature stem (key 8), loosen bonnet set screw (key 11) and stem set screw (key 23).
2. Rotate cowl assembly (key 28) upward to raise barrel (key 21) until steam flows.
3. If barrel nut (key 22) prevents cowl assembly from turning down far enough or is above bonnet (key 24) when steam stops flowing, remove sealing wax and loosen set screw (key 11).
4. Lock the setting by tightening set screw (key 11) in bonnet (key 24). Turn down barrel nut (key 22) fast against bonnet and tighten its set screw (key 11) and the stem set screw (key 23).
5. Reassemble thermostat (key 1).

Troubleshooting

WARNING

To avoid personal injury, property damage or equipment damage caused by sudden release of pressure or explosion of accumulated gas, do not attempt any troubleshooting or disassembly without first isolating the pilot from system pressure and relieving all internal pressure from the pilot.

Pilots that have been disassembled for repair must be tested for proper operation before being returned to service. Only parts manufactured by Emerson should be used for repairing this pilot.

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 its fill.
5. Alternately warm and cool thermostat 10°F / 12°C above and below its 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.
6. Orifice in bleedport may be plugged.
7. 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.

1. Main valve or pilot may be held open by foreign matter. To determine which valve leaks:
   a. Close stop valves and 1/4 in. / 6.35 mm control pipe valve if Type 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 Types T14 and D Pilot Combination:

   - 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 Type 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 disk 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 Type 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.
4. Arrange to drain condensate by gravity or lift it with a pump.
5. Sticky check valve in return line.
6. Poor circulation through heater. Constant circulation should be employed.
7. Valve too large for the heater or heater too large for the load.
8. Valve installed too far from heater.

Parts Ordering

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.

Parts List

Key	Description	Part Number
Repair Parts Kit		
	Cast Iron/Bronze	WAL07-06606-00
	Steel	WAL08-09110-01
1	Thermostat Assembly	- - - - - - - - -
2	Diaphragm Nut, Steel	WAL05-02992-00
3	Diaphragm Bolt, Steel	WAL05-05634-00
4	Pressure Plate, Iron	WAL04-03602-01
5	Pressure Plate Balls, Alloy Steel	WAL05-00553-00
6	Temperature Spring Button, Steel	WAL04-01052-00
7	Temperature Adjusting Spring, Steel	WAL05-05122-00
8	Temperature Stem, Aluminum	WAL04-05654-00
9	Bearing, Steel	WAL05-00550-00
10	Handwheel, Iron	WAL04-02502-00
11	Bonnet Set Screw, Steel	WAL05-04874-00
12*	Bellows Stem Assembly	
	Bronze	WAL07-60302-00
	Steel	WAL07-60536-00
13*	Gasket	
	Non-Asbestos	WAL05-02378-00
	Flexitalic	WAL05-11718-00
14*	Disk, Stainless steel	WAL04-01776-00
15*	Seat Ring, Stainless steel	WAL04-04057-90
16*	Screen Steam, Monel	WAL04-04700-00
17	Blind Flange	
	Iron	WAL04-02151-00
	Bronze	WAL04-02153-00
	Steel	WAL04-11678-00
18	Blind Flange and Bonnet Bolt	
	Steel	WAL05-04803-00
	Steel	WAL05-11719-00
19	Cowl, Steel	WAL04-01525-00
20	Groove Pin, Stainless steel	WAL05-03243-00
21	Barrel, Aluminum	WAL04-01247-00
22	Barrel Nut, Steel	WAL04-02908-00
23	Stem Set Screw, Steel	WAL05-04872-00
24	Bonnet	
	Iron	WAL04-00976-00
	Bronze	WAL04-00978-00
	Steel	WAL04-10021-01
25	Body	
	Iron	WAL04-00741-00
	Bronze	WAL04-00761-00
	Steel (for Flexitalic)	WAL04-10912-01
26	1/4 NPT Pipe Plug	
	Steel	WAL04-03772-00
	Brass	WAL04-03771-00
27	1/8 NPT Pipe Plug	
	Steel	WAL04-03769-00
	Brass	WAL04-03770-00
28	Cowl Assembly, Steel/Aluminum	WAL07-00334-00

*These parts furnished in Repair Kit

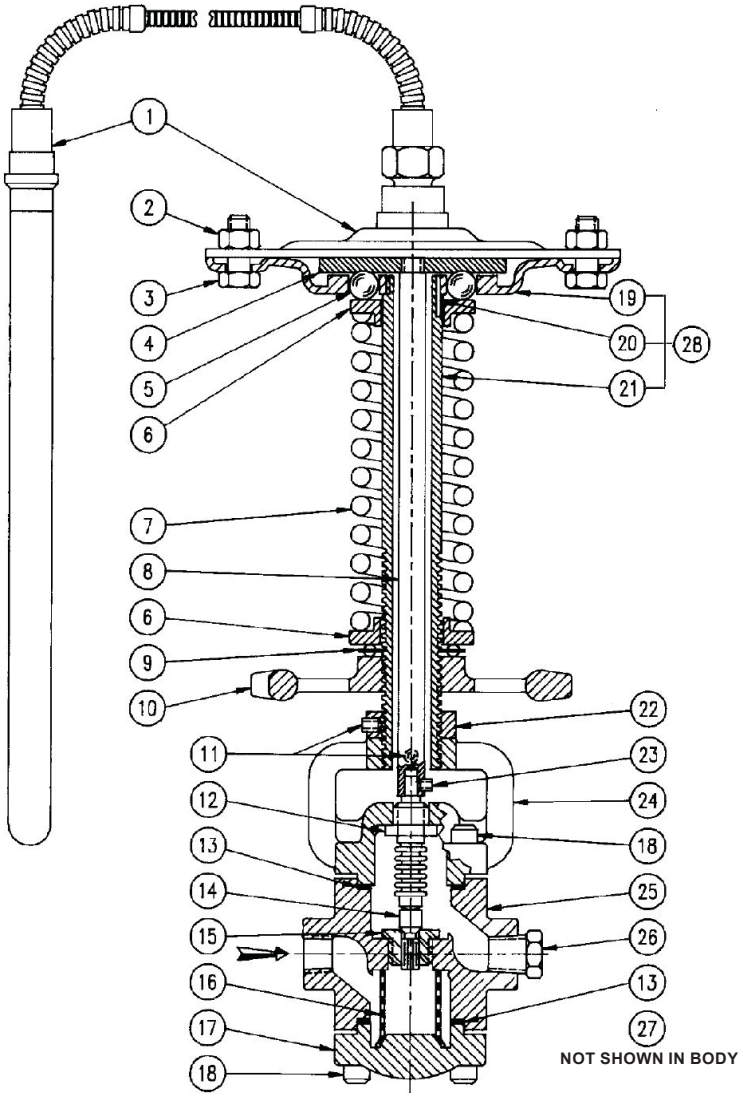

Figure 5. *Type T14 Assembly*

Type T14

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