# Spence™ Types ET14 and E2T14 Integrally Mounted Temperature Regulators

**⚠ WARNING**

**Failure to follow these instructions or to properly install and maintain this equipment could result property damage and personal injury or death.**

**Types ET14 and E2T14 temperature regulators must be installed, operated and maintained in accordance with federal, state and local codes, rules and regulations and Emerson instructions.**

**If the valve vents gas or a leak develops in the system, service to the unit may be required. Failure to correct issue 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 Types ET14 and E2T14 temperature regulators.**

## Introduction

### Scope of the Manual

This manual provides instructions for the installation, troubleshooting, maintenance and setting of Types ET14 and E2T14 regulators. Refer to the following documents for the complete details.

1. VCIMD-14973 for Type T14 temperature pilot.
2. VCIMD-14961 for Type E main valve.
3. VCIMD-14935 for Type E2 main valve.

***Figure 1.*** *Type ET14 Pilot-Operated Temperature Regulator*

### Product Description

Types ET14 and E2T14 are pilot-operated temperature regulators. These regulators are combination of Type T14 temperature pilot and a Type E or E2 main valve

The Types ET14 and E2T14 Regulators are designed to control the temperature of storage-type heaters and to position the main valve to maintain the temperature in case of failure of the controlling temperature pilot.

These regulators do not control reduced pressure. If initial steam pressure exceeds the pressure rating of the heater, a safety valve should be installed.

## Specifications

This section lists the specifications for the TypeT14 Temperature Pilot and Types E and E2 main valves. Factory specifications are stamped on the nameplate fastened on the pilot and main valve at the factory.

**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

**Types E and E2 Main Valve**

**Valve Sizes**
**Type E:** NPS 3/8, 1/2, 3/4, 1, 1-1/4, 1-1/2, 2, 2-1/2, 3, 4, 5, 6, 8, 10, 12 / DN 10, 15, 20, 25, 32, 40, 50, 65, 80, 100, 125, 150, 200, 250 and 300
**Type E2:** NPS 3/4, 1, 1-1/4, 1-1/2, 2, 2-1/2, 3, 4, 5, 6, 8 and 10 / DN 20, 25, 32, 40, 50, 65, 80, 100, 125, 150, 200 and 250

**End Connection Styles**
**Types E and E2:** NPT, CL125, CL150, CL250, CL300
**Type E:** CL600

**Pressure Rating**[1]
**Type E:** See Table 1
**Type E2:** 15 psig / 1.03 bar

**Temperature Rating**[1]
**Type E:** See Table 1
**Type E2:** 250 °F/ 121 °C

**Rated Flow Coefficient**
See Tables 2 and 3

**Main Valve Material**
**Type E:** Cast Iron and Cast Steel
**Type E2:** Cast Iron

**Approximate Weight**
See Tables 4 and 5

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

***Table 1.*** *Type E Main Valve Pressure and Temperature Rating*[1]

| MAIN VALVE MATERIAL | END CONNECTION | PRESSURE RATING | | TEMPERATURE RATING | |
|---|---|---|---|---|---|
| | | psig | bar | °F | °C |
| Cast Iron | 250 NPT | 250 | 17.2 | 406 | 207 |
| | CL125 | 125 | 8.62 | 450 | 232 |
| | CL250 | 250 | 17.2 | 450 | 232 |
| Cast Steel | 300 NPT | 300 | 20.7 | 600 | 315 |
| | CL150 | 150 | 10.3 | 500 | 260 |
| | CL300 | 300 | 20.7 | 600 | 315 |
| | CL600 | 600 | 41.4 | 600 | 315 |

1. Ratings based on maximum inlet conditions.

***Table 2.*** *Type E Main Valve Rated Flow Coefficients*

| SEAT FACTOR | VALVE SIZE, NPS / DN | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3/8 / 10 | 1/2 / 15 | 3/4 / 20 | 1 / 25 | 1-1/4 / 32 | 1-1/2 / 40 | 2 / 50 | 2-1/2 / 65 | 3 / 80 | 4 / 100 | 5 / 125 | 6 / 150 | 8 / 200 | 10 / 250 | 12 / 300 |
| Full | 1.5 | 2.8 | 5.4 | 8.8 | 14.1 | 19.8 | 31 | 44 | 74 | 109 | 169 | 248 | 444 | 706 | 1113 |
| Full 75% | - - - - | 2.1 | 4.0 | 6.6 | 10.6 | 14.8 | 23.3 | 33 | 56 | 82 | 127 | 186 | 333 | 530 | 835 |
| Full 50% | - - - - | 1.4 | 2.7 | 4.4 | 7.0 | 9.9 | 15.5 | 22 | 37 | 55 | 85 | 124 | 222 | 353 | 557 |
| Normal | 0.65 | 1.5 | 4.8 | 7.5 | 10.4 | 14.6 | 17.6 | 24 | 43 | 78 | 115 | 151 | 249 | 377 | 631 |
| Normal 75% | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | 18 | 33 | 59 | 87 | 114 | 187 | 283 | 474 |
| Normal 50% | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | 12 | 22 | 39 | 58 | 76 | 125 | 189 | 316 |

***Table 3.*** *Type E2 Main Valve Rated Flow Coefficients*

| SEAT FACTOR | REGULATOR SIZE | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 3/4 / 20 | 1 / 25 | 1-1/4 / 32 | 1-1/2 / 40 | 2 / 50 | 2-1/2 / 65 | 3 / 80 | 4 / 100 | 5 / 125 | 6 / 150 | 8 / 200 | 10 / 250 | 12 / 300 |
| Full | 7.6 | 11.7 | 18.9 | 27.4 | 44 | 68 | 96 | 143 | 202 | 255 | 465 | 748 | 1118 |
| 70 to 75% | - - - - | 8.8 | 13.2 | 19.2 | 30.8 | 47.6 | 67.2 | 100 | 141 | 178 | - - - - | - - - - | - - - - |
| 46% | - - - - | - - - - | - - - - | 12.3 | - - - - | 30.6 | - - - - | 64.4 | - - - - | 115 | - - - - | 336 | - - - - |

***Table 4.*** *Type E Main Valve Approximate Weight*

| VALVE SIZE | | END CONNECTION STYLE | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | NPT | | CL125 | | CL150 | | CL250 | | CL300 | | CL600 | |
| NPS | DN | lbs | kg | lbs | kg | lbs | kg | lbs | kg | lbs | kg | lbs | kg |
| 3/8 | 10 | 14 | 6.35 | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - |
| 1/2 | 15 | 14 | 6.35 | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | 20 | 9.07 |
| 3/4 | 20 | 18 | 8.16 | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | - - - - | 28 | 12.7 |
| 1 | 25 | 23 | 10.4 | 24 | 10.9 | 26 | 11.8 | 27 | 12.2 | 31 | 14.1 | 32 | 14.5 |
| 1-1/4 | 32 | 33 | 15.0 | 36 | 16.3 | 37 | 16.8 | 40 | 18.1 | 41 | 18.6 | 45 | 20.4 |
| 1-1/2 | 40 | 43 | 19.5 | 45 | 20.4 | 47 | 21.3 | 51 | 23.1 | 55 | 24.9 | 58 | 26.3 |
| 2 | 50 | 62 | 28.1 | 67 | 30.4 | 73 | 33.1 | 72 | 32.7 | 78 | 35.4 | 83 | 37.6 |
| 2-1/2 | 65 | - - - - | - - - - | 82 | 37.2 | 95 | 43.1 | 100 | 45.4 | 100 | 45.4 | 130 | 59.0 |
| 3 | 80 | - - - - | - - - - | 110 | 49.9 | 125 | 56.7 | 130 | 59.0 | 140 | 63.5 | 175 | 79.4 |
| 4 | 100 | - - - - | - - - - | 200 | 90.7 | 210 | 95.3 | 235 | 107 | 230 | 104 | 310 | 141 |
| 5 | 125 | - - - - | - - - - | 280 | 127 | 295 | 134 | 315 | 143 | 310 | 141 | 490 | 222 |
| 6 | 150 | - - - - | - - - - | 385 | 175 | 420 | 191 | 455 | 206 | 470 | 213 | 655 | 297 |
| 8 | 200 | - - - - | - - - - | 657 | 298 | 700 | 318 | 735 | 333 | 710 | 322 | 1070 | 485 |
| 10 | 250 | - - - - | - - - - | 1260 | 572 | 1240 | 562 | 1430 | 649 | 1300 | 590 | - - - - | - - - - |
| 12 | 300 | - - - - | - - - - | 2070 | 939 | 2060 | 934 | 2145 | 973 | 2140 | 971 | - - - - | - - - - |

***Table 5.*** *Type E2 Main Valve Approximate Weight*

| VALVE SIZE | | END CONNECTION STYLE | | | |
|---|---|---|---|---|---|
| | | NPT | | FLANGE | |
| NPS | DN | lbs | kg | lbs | kg |
| 3/4 | 20 | 18 | 8.16 | - - - - | - - - - |
| 1 | 25 | 19 | 8.62 | 21 | |
| 1-1/4 | 32 | 30 | 13.6 | 33 | |
| 1-1/2 | 40 | 36 | 16.3 | 40 | |
| 2 | 50 | 50 | 22.7 | 57 | |
| 2-1/2 | 65 | - - - - | - - - - | 70 | |
| 3 | 80 | - - - - | - - - - | 98 | |
| 4 | 100 | - - - - | - - - - | 135 | |
| 5 | 125 | - - - - | - - - - | 185 | |
| 6 | 150 | - - - - | - - - - | 250 | |
| 8 | 200 | - - - - | - - - - | 415 | |
| 10 | 250 | - - - - | - - - - | 690 | |

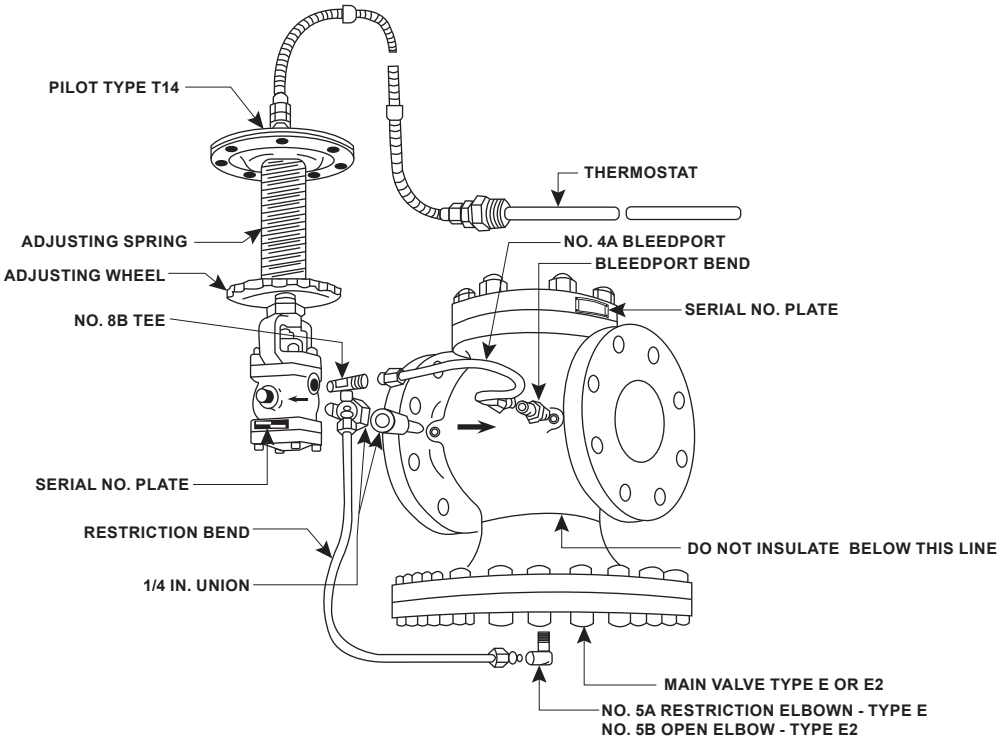


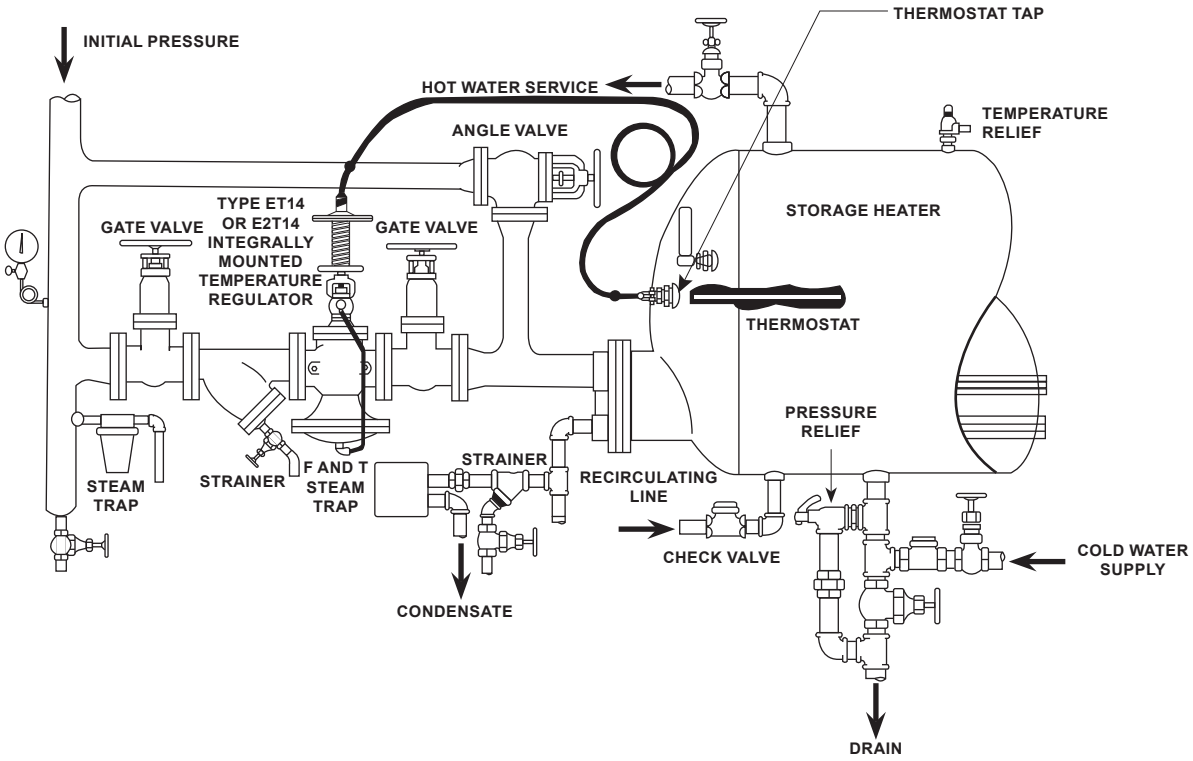

***Figure 2.*** *Type T14 Tubing Bends Connection*

## 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.




**RECOMMENDED INSTALLATION OF TYPE ET14 OR E2T14 INTEGRALLY MOUNTED TEMPERATURE REGULATOR**

***Figure 3.*** *Type ET14 or E2T14 Integrally Mounted Temperature Regulator Installation Drawing*

## Installation

**⚠ WARNING**

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

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

**Under enclosed conditions or indoors, escaping gas may accumulate and be an explosion hazard. In this case, the vent should be piped outdoors.**

### Planning

1. Locate the regulator in a straight run of horizontal pipe as shown in Figure 3.
2. For safety and economic life, provide a drip leg, steam trap and strainer ahead of the regulator.
3. Provide a three-valve by-pass to facilitate inspection of the regulator without interrupting service.
4. Allow sufficient clearance above and below the regulator to permit disassembly.
5. Provide a safety valve if required.
6. Liquid heating systems require a relief valve to prevent overpressure due to thermal expansion.

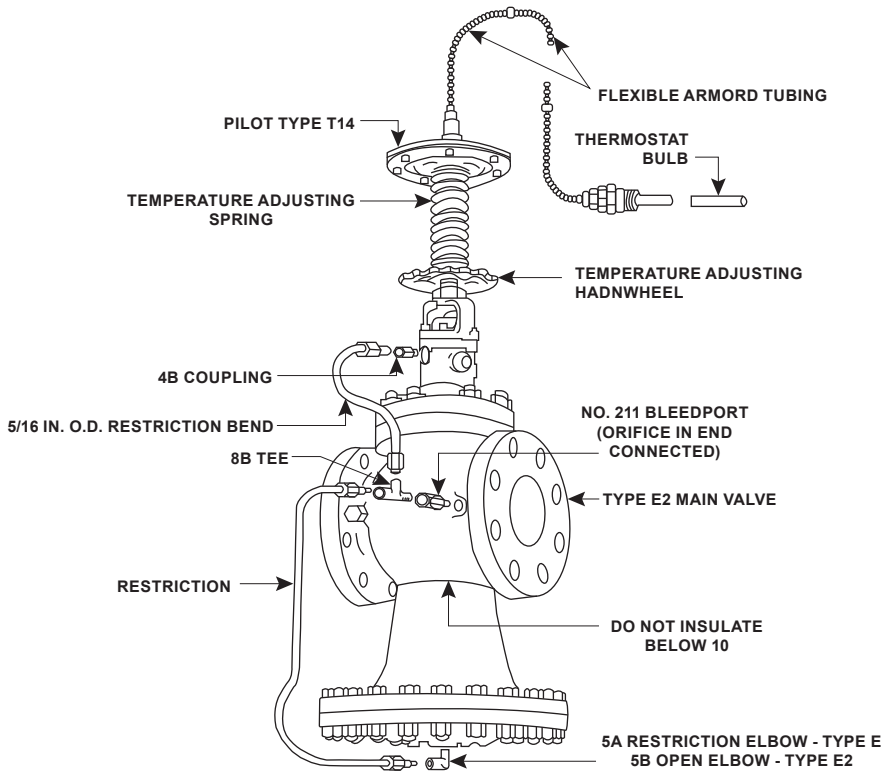



***Figure 4.*** *Type ET14 or E2T14 with Integrally Mounted Pilot Assembly Drawing*

## Thermostat Installation

1. Mount the bulb in a horizontal position if possible. Otherwise, mount with the tip end of the bulb lower than the capillary end.
2. Storage heaters generally provide a thermostat tap located as shown in Figure 3.
3. If a pumped recirculation loop is used, mount the thermostat bulb in the tank outlet pipe so that its entire length is exposed to the flow.

## Main Valve Installation

1. Flush the piping system to remove dirt and debris.
2. Mount the main valve with diaphragm down and the arrow on the valve body pointing in the direction of the flow.

## Pilot Installation

1. Remove protective covers from main valve top flange and pilot flange. Mount pilot to main valve as shown in Figure 4.
2. Screw No. 211 bleedport fitting into the 1/8 NPT pipe tap on the outlet side of the main valve body. Note the orifice in this fitting–vital to the operation of the regulator. Screw No. 8B tee fitting into the No. 211 fitting. (Refer to Figure 4.)
3. Screw No. 4B coupling fitting into 1/8 NPT pipe tap in pilot.
4. Screw No. 5A elbow fitting (No. 5B for Type E2 valve) into 1/8 NPT pipe tap on the underside of the main valve diaphragm. Note the orifice in the No. 5A fitting (No. 5B fitting for Type E2 valve has no orifice.)
5. Connect the two tubing bends provided as shown in Figure 4.

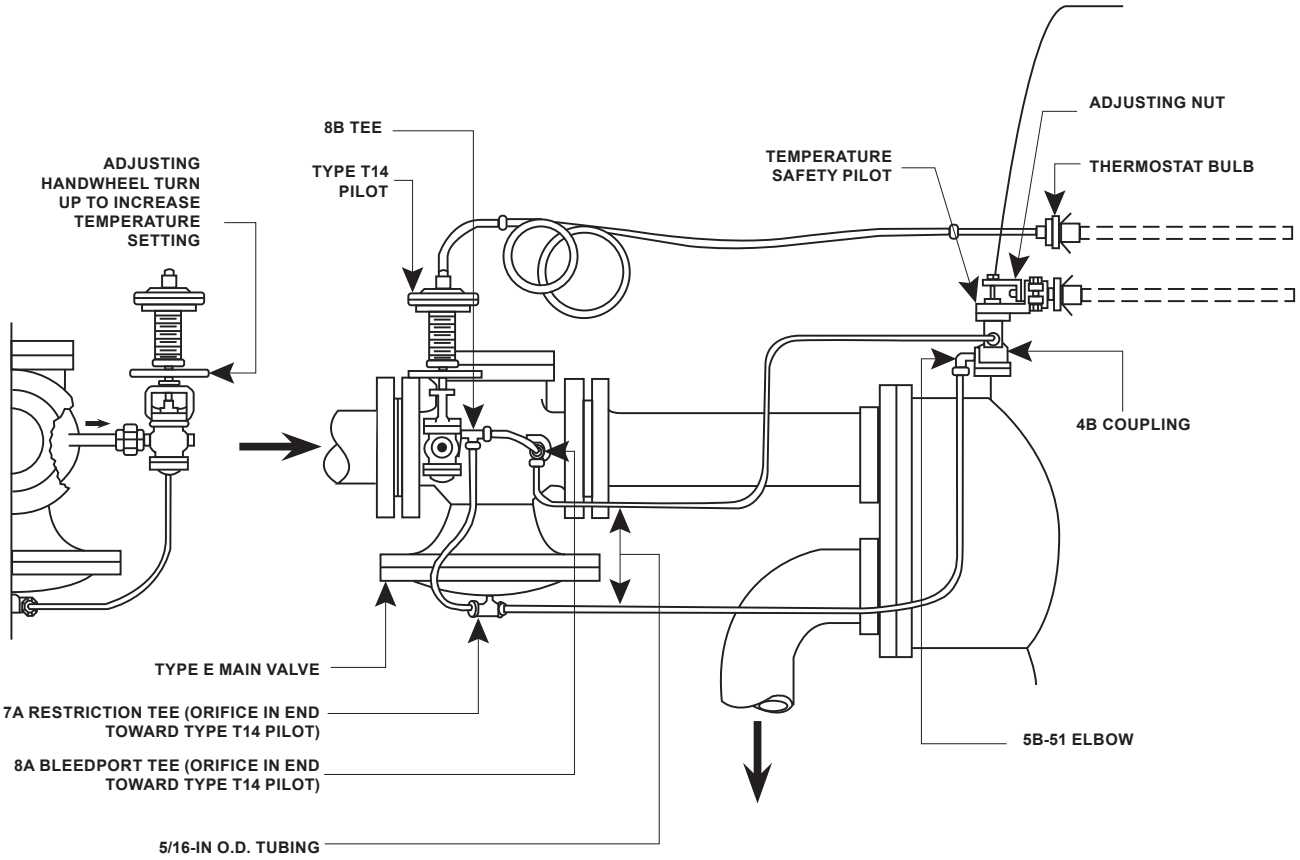



***Figure 5.*** *Type T14 Pilot Adjustment*

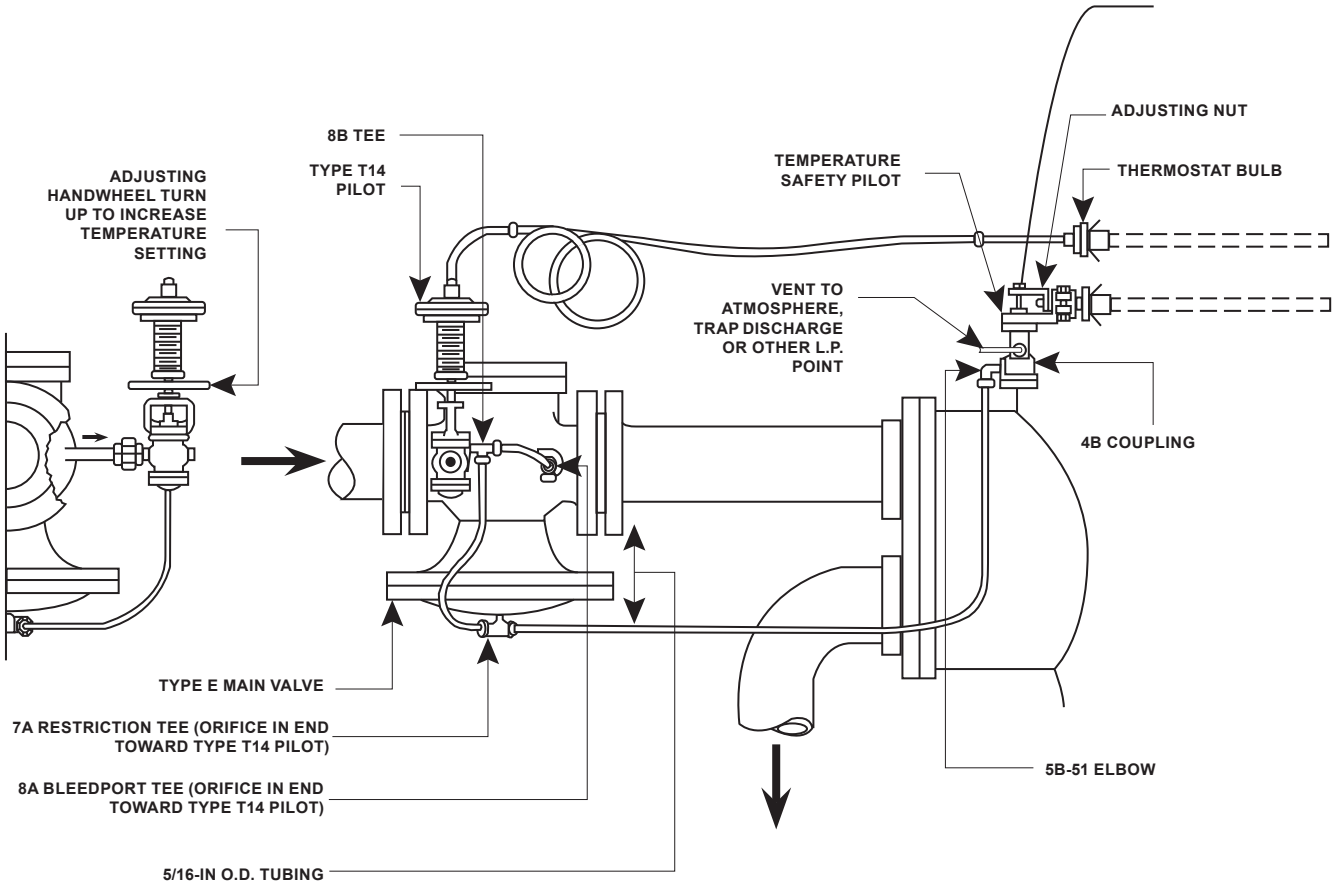



***Figure 6.*** *Type T14 Pilot Adjustment (Vent to Atmosphere)*

## Insulation

Insulation may be applied to the globe and flanges of the main valve. Do not insulate the diaphragm chamber or any part of the pilot. (See Figure 4)

## Start-Up

**WARNING**

**Never open a regulating valve without positive indication that the inlet side is free of condensate.**

1. Close by-pass valve and open outlet stop valve.
2. Crack inlet stop valve. Blow down strainer.
3. Open inlet stop valve gradually. Turn temperature adjusting handwheel to obtain desired control set point (See Figure 3.) Turning the handwheel up raises the temperature set point.

## Adjustment

The temperature safety pilot is factory set at the temperature shown on the order. Should it be necessary to change the setting in the field proceed as follows:

1. While the valve is passing steam and controlling the temperature at the desired level, check the safety pilot setting. To do this, turn adjusting screw clockwise slowly until the downstream pressure begins to sag. This in turn will cause a reduction in the temperature and is an indication that the safety pilot has taken over control.
2. Turn up handwheel on temperature pilot to raise the temperature. Then increase the setting on the safety pilot by turning the adjusting screw counter-clockwise, all the time watching the delivery pressure gauge and thermometer. When temperature stops rising, it equals the temperature pilot setting and the point at which the safety pilot will take over the control in case of failure of the temperature pilot.
3. When the desired safety pilot setting is reached, turn down the hand-wheel on the temperature pilot until it is controlling at the desired temperature.

## 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 regulator from system pressure and relieving all internal pressure from the regulator.**

**Regulator 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 regulator.**

**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.**

1. Under normal condition, periodic dismantling of the regulator is not recommended. A valve kept relatively free of dirt will function for years with minimal attention.
2. The following inspections should be made after the first few days of operation and twice a year thereafter:
   a. Check the No. 211 bleedport and No. 5A elbow for dirt accumulations. Clean as required.
   b. Inspect all joints for leakage. Keep bolts and fittings tight. Never allowa leak to persist.

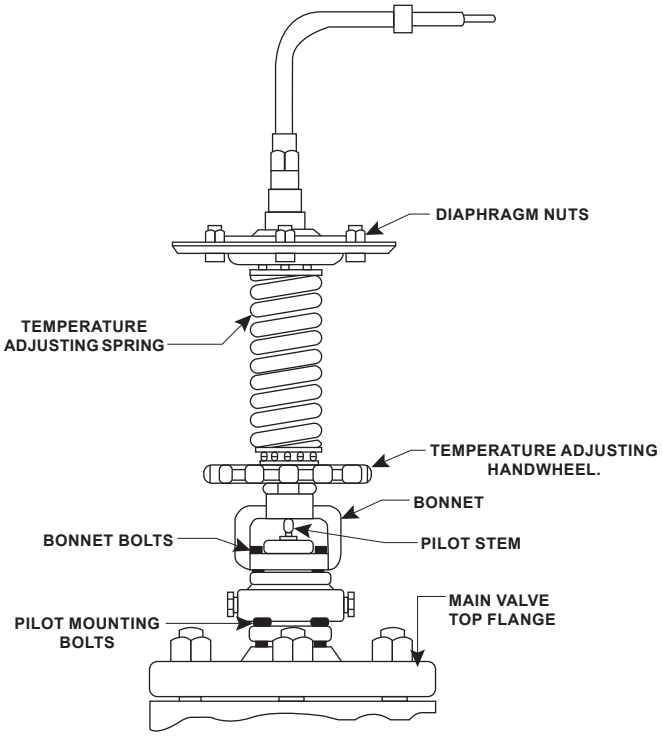



***Figure 7.*** *Type T14 Pilot Assembly Drawing*

3. Never attempt to disassemble a thermostat element. To replace a thermostat, follow the thermostat replacement procedure exactly.

## Thermostat Replacement

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. Refer to Figure 4. Back off temperature adjusting handwheel to remove all tension on temperature adjusting spring.
3. Remove diaphragm nuts (Figure 7) and detach thermostat assembly from pilot. Similarly detach shipping plate from replacement thermostat.
4. Install replacement thermostat on pilot and install shipping plate on original thermostat.

## Dismantling and Grinding

1. To disassemble Main Valve:
   a. Remove pilot, bends and elbow fitting.
   b. Remove top flange.
   c. Connect adjustable pressure source (air or water) to 1/8 NPT tap on underside of diaphragm.
2. To Dismantle Pilot:
   a. Remove bonnet bolts (Figure 7) and remove top works.
   b. Lift out disk. Clean its flutes and seating surface
3. To Grind Main Valve or Pilot Disk
   a. Use very fine (400 grit) compound with light pressure. Grind sparingly. Heavy pressure can damage the material and cause leakage.
   b. Reface a damaged surface before grinding in.
   c. After grinding, clean parts with kerosene or trichlor solvent.

## Troubleshooting Guide

1. Erratic Temperature Control:
   a. Heater return trap discharging erratically or improperly installed (Inspect trap.)
   b. Thermostat bulb improperly installed. Refer to Planning section.
   c. Pilot disk sticking (Inspect and clean as required).
2. Underheating:
   a. Pilot setting incorrect (Readjust Pilot).
   b. Restricted supply steam (Check for partially closed stop valve, clogged strainer or obstructed pipe.
   c. No. 211 bleedport omitted or No. 5A elbow fitting clogged (Inspect each orifice).
   d. Pilot disk sticking (Check and clean as required).
   e. Heater improperly trapped (Inspect trap).
   f. Defective thermostat. Refer to Thermostat Operational Check Section.
3. Overheating
   a. Pilot setting incorrect (Readjust pilot).
   b. No. 211 Bleedport fitting clogged (Inspect office).
   c. By-pass valve leaking (Inspect by-pass valve).
   d. Defective thermostat. Refer to Thermostat Operational Check Section.
   e. Main valve or pilot held open by foreign matter. To pinpoint problem:
      1. Close stop valves and remove beleedport tubing bend. Back off temperature adjusting handwheel.
      2. Crack inlet stop valve.
      3. If steam issues from No. 8B tee, the main valve is hung open.
      4. If steam issues from No. 4B coupling, the pilot is hung open.
      5. Close inlet stop valve and replace bleedport tubing bend.
      6. Steam may wash away the foreign matter if the valve is made to open wide. Otherwise dismantle valve to clear the problem.

## Thermostat Operational Check

1. Remove thermostat bulb from heater.
2. Mark pilot steam where it emerges from the bonnet (Figure 7).
3. Alternately heat and cool bulb at least 10°F / 12°C above and below its setting. If the element is operative, the motion of the mark will be apparent.

## Parts Ordering

When corresponding with your local Sales Office about this regulator, always reference the service and serial number.

## Parts List

Refer to the following documents for complete parts list and assembly drawings.

1. VCIMD-14973 for Type T14 temperature pilot.
2. VCIMD-14961 for Type E main valve.
3. VCIMD-14935 for Type E2 main valve.

SpenceValve.com

**Emerson**

**Americas**
McKinney, Texas 75069 USA
T +1 800 558 5853
+1 972 548 3574

**Europe**
Bologna 40013, Italy
T +39 051 419 0611

**Asia Pacific**
Singapore 128461, Singapore
T +65 6777 8211

**Middle East and Africa**
Dubai, United Arab Emirates
T +971 4 811 8100





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