

November 2021

# Spence T61 Series Pneumatic Temperature Controller

## 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 controller 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 controller 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 T61 Series Pneumatic Temperature Controllers.

## Introduction

### Scope of the Manual

This manual provides instructions for installation, maintenance and parts information for the T61 Series pneumatic temperature controllers.



Figure 1. T61 Series Pneumatic Temperature Controller

## Product Description

The T61 Series Temperature Controller is ideal for wide ranging, fast changing loads on instantaneous heaters and other difficult process applications. The cascade principle, normally used only on instrument type regulators, is the basis for this design.

T61 Series, used with a properly selected A Series Pilot or Control Valve, continuously adjusts a pressure regulator to the required heater pressure. This action, coupled with the fast response of a bimetallic thermostat, gives exceptional results. Added convenience and economy results from the wide (200°F / 93°C) adjustable range and the low air consumption (0.35 cfm / 0.59 m<sup>3</sup>/h). These controllers have adjustable proportional band as well as over temperature protection.

**Type T61:** For applications where air control signal decreases as process temperature increases.

# T61 Series

## Specifications

The Specifications section gives some general specifications for the T61 Series pneumatic temperature controller. The nameplates give detailed information for a specific controller as built in the factory.

<b>Available Configurations<sup>(1)</sup></b> <b>Type T61:</b> Reverse Acting	<b>Air Connections</b> 1/8 NPT
<b>Maximum Air Supply</b> 32 psi / 2.21 bar	<b>Air Consumption</b> <b>Normal:</b> 0.35 SCFM / 0.59 m <sup>3</sup> /hr <b>Maximum:</b> 0.70 SCFM / 1.19 m <sup>3</sup> /hr
<b>Maximum Signal Pressure</b> 2 psi / 0.14 bar below supply	<b>Proportional Band Adjustable</b> 1/4 to 2 psi per 1°F / 0.02 to 0.14 bar per 17.2°C
<b>Maximum Inlet Pressure<sup>(2)</sup></b> 250 psi / 17.2 bar	<b>Construction Materials</b> <b>Body:</b> Bronze <b>Seal:</b> Viton® <b>Spool:</b> Brass <b>Seat:</b> Stainless steel <b>Spring:</b> Stainless steel
<b>Maximum Inlet Temperature<sup>(2)</sup></b> 400°F / 204°C	<b>Approximate Weight</b> 2-3/4 lbs / 0.68 kg
<b>Temperature Ranges<sup>(2)</sup></b> <b>Type T61:</b> 50 to 250°F / 10 to 121°C	
<b>Mounting</b> 1/2 NPT	

1. Reverse Acting is when air control signal decreases as process temperature increases. Direct Acting is when air control signal increases as process temperature increases.  
2. The pressure/temperature limits in this Instruction Manual or any applicable standard limitation should not be exceeded.

## Principle of Operation

### When Used with Regulator

The regulator is operated by its initial steam pressure. It is normally closed, being held so by initial pressure on the disc and by an internal main spring. The pressure pilot is actuated by means of an air signal applied to its diaphragm. This signal is received from the temperature pilot as a result of the temperature bulb sensing a drop in temperature from the control setting.

When steam is turned on, it flows through the pressure pilot (Figure 3) to No. 8B tee. 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.

Steam flowing to the heater develops a rising delivery pressure which feeds back through the control pipe to the pressure pilot diaphragm. As this pressure approached a balance with the air pressure signal supplied by the temperature pilot, the pressure pilot throttles. This, in turn, allows the main valve to assume a position to maintain the set temperature.

As the temperature at the outlet of the heater increases, it causes the T61 Series controller to reduce the loading pressure and this, in turn, will cause the pressure regulator to modulate the steam flow to the heater.

### When Used with Pneumatic Control Valve

The T61 Series controller sends a proportional air signal from 0 psi / 0 bar to a maximum of 30 psi / 2.07 bar (not greater than 2 psi / 0.14 bar less than the supplied pressure) within a 10 degree span. The pilot will increase signal as the temperature falls, which will either open or close the control valve, depending upon actuator configuration.

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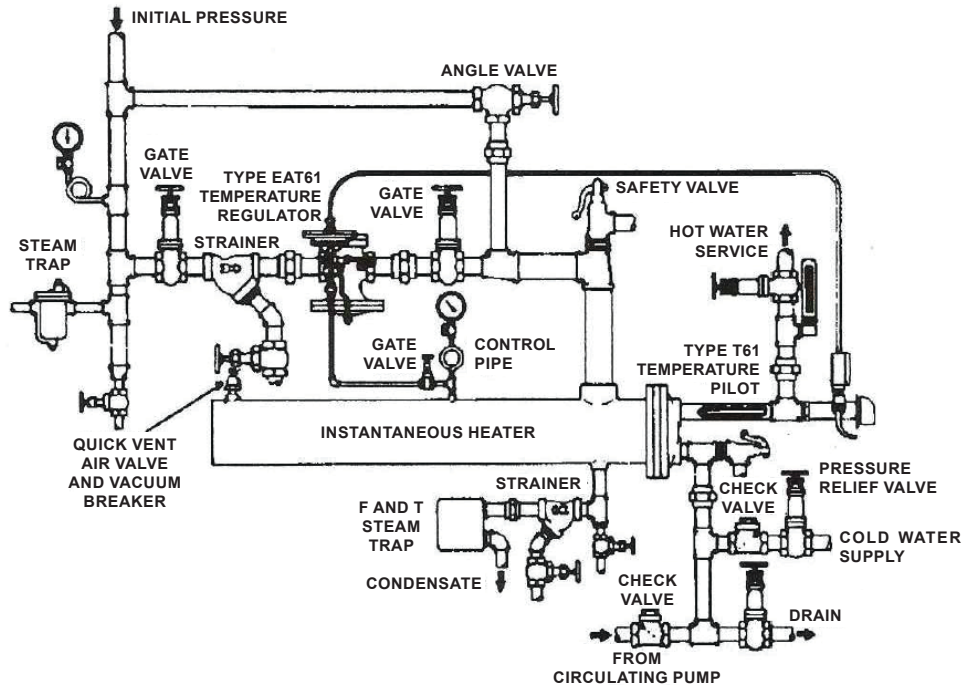


Figure 2. T61 Series Typical Installation

## Installation

### WARNING

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

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

### CAUTION

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

Ensure to blow out all lines before making final connections.

## 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.

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## 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 with the bulb projecting entirely into the liquid or air being controlled.

### Note

**If the body is not in a horizontal position with air gauges on top, loosen the set screw (key 5) on bottom of body nearest the bulb and rotate the body to horizontal position.**

2. Retighten the set screw.
3. Connect a reliable source of clean compressed air (not to exceed 32 psi / 2.21 bar) to the inlet of the pilot.
4. Set the supply air at 2 psi / 0.14 bar above the maximum desired air signal. If air is available at a higher pressure, install a pressure reducing valve.
5. Connect pilot outlet to 1/4 in. / 6.35 mm tap on top of pressure pilot.

## Start-up and Setting



### WARNING

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



### CAUTION

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

1. Shut off supply air.
2. Set temperature adjusting knob at the lowest temperature setting.

3. Turn on supply air. The supply air should be set at 2 psi / 0.14 bar above the maximum desired air signal.

### Note

**If air is available at a higher pressure, install a pressure reducing valve. No more than 1 to 2 lbs / 0.45 to 0.91 kg should show on the control air gauge (supplied with the T61 Series controller).**

4. Gradually turn up temperature adjusting knob until rising loading air pressure causes regulator to open. Continue raising temperature setting in this fashion until desired control temperature is reached.
5. The T61 Series controller is factory set so that 5 degrees variation above and below the controlled temperature will cause the loading air pressure to vary approximately 8 lbs / 3.63 kg. The factory setting produces satisfactory control.
6. If closer control is desired, the sensitivity of the T61 Series controller can be increased by turning the sensitivity screw (key 7) clockwise. This will cause the control temperatures to move to a position below the set point. This effect must then be corrected by readjusting the temperature adjusting knob (key 4).
7. Adjust slowly, turning the sensitivity screw no more than 1/8 turn and allow two to three minutes after each adjustment for the system to settle out. Practical range of adjustment of the sensitivity screw is 1/2 turn from the factory setting.
8. After final setting is reached, release the set screw in the temperature adjusting knob and reposition it so that the indicator is aligned with the temperature being controlled. Retighten set screw.
9. If the hunt develops (a steady swinging temperature) when the sensitivity is increased, the temperature pilot is being called on to function at a setting finer than the installation will permit. At this point, factors such as thermostat location, reexamine trapping and valve size.
10. If the regulator swings immediately on startup and does not settle out and decreasing the sensitivity by turning the sensitivity screw (key 7) counterclockwise cannot be tolerated, restudy the installation as a whole.

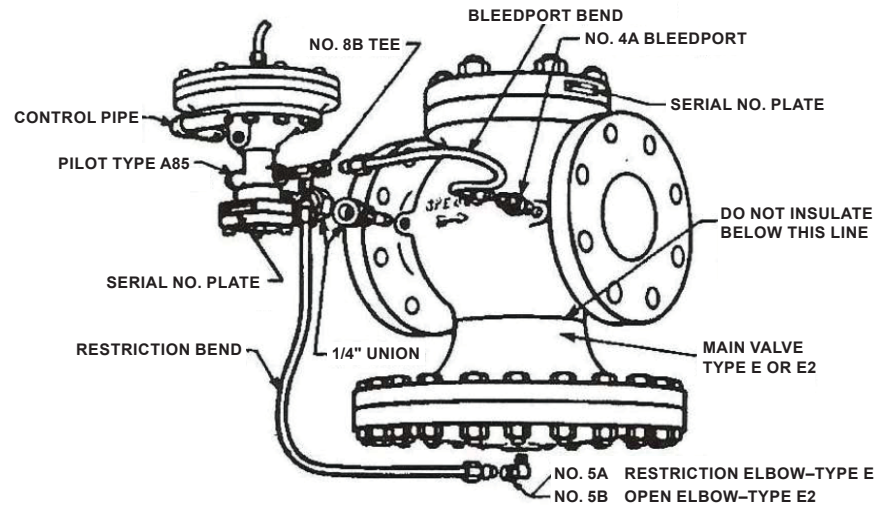


Figure 3. T61 Series Tubing Bends Connection

## 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 controller from system pressure and relieving all internal pressure from the controller.

Controllers 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 controller.

Due to normal wear or damage that may occur from external sources, this controller 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 T61 Series Temperature Controller or attempt to dismantle the thermostat element. The system is filled with volatile fluid which, if lost, will render the pilot inoperative.

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.

- 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.

## 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 controller from system pressure and relieving all internal pressure from the controller.

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**Controllers 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 controller.**

## Failure To Open

1. Check supply gauge to be sure it shows 2 psi / 0.14 bar higher than the required signal pressure.
2. Turn adjusting knob to top of temperature range. Pressure should go to within 2 or 3 lbs / 0.91 or 1.36 kg of supply pressure. If not, check for dirt in sensitivity screw and ball seating surface.

## Failure to Close of Overriding Delivery Pressure

1. Adjusting knob may have been tampered with.
2. If air pressure will not bleed down when adjusting knob is turned to bottom of range, it is likely that vent is plugged. Sensitivity screw (key 7) improperly adjusted (open too wide).

## Erratic Control

1. Fast over and under rides are the result of fast load changes, usually accentuated by the thermostat being located at a point where it cannot immediately sense a change in conditions.

## Installation Faults

1. Poor circulation through heater. Constant circulation should be employed.
2. Traps on the return may be discharging erratically or may be improperly installed.
3. Sticky check valve.
4. High lift to condensate hot well. Gravity drainage from heater should be arranged or return pumped installed.

## Dismantling

1. Remove sensitivity screw (key 7) and clean.
2. Unlock knob set screw. Loosen and move adjusting knob (key 4) out to clear stop on dial plate and lock to shaft.

3. Unscrew spool (key 3) from body by rotating adjusting knob counterclockwise.
4. Carefully examine O-rings (key 6) for nicks and other defects.
5. Examine spool (key 3) and ball (key 2) for defects.
6. Clean spool and ball with air pressure.
7. Reassemble.

## Testing and Calibrating

### *Reverse Acting*

For reverse acting pilots, control pressure decreases with increasing temperature.

1. Plug the pilot control air port and apply supply pressure 2 psi / 0.14 bar above the control range to the supply air port.
2. Open the sensitivity screw (key 7) one turn while establishing a steady system temperature.
3. Turn the spool (key 3) clockwise to the point where the invar rod, ball and seat are in contact. The control gauge should show pressure near the top of the control range.
4. Turn the spool counter-clockwise until the control pressure is at the middle of the range.
5. Continue to turn the spool counter-clockwise until the low end of the range is reached.
6. Adjust the sensitivity screw as required so this occurs within a 5° change on the dial. The control pressure should vary from the minimum to the maximum (15 or 30 psi / 1.03 or 2.07 bar) with a 10° change of the dial setting. When used with an A-pilot the minimum is 3 psi / 0.21 bar, when used with a control valve the minimum is the lower end of the bench range.

## 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.

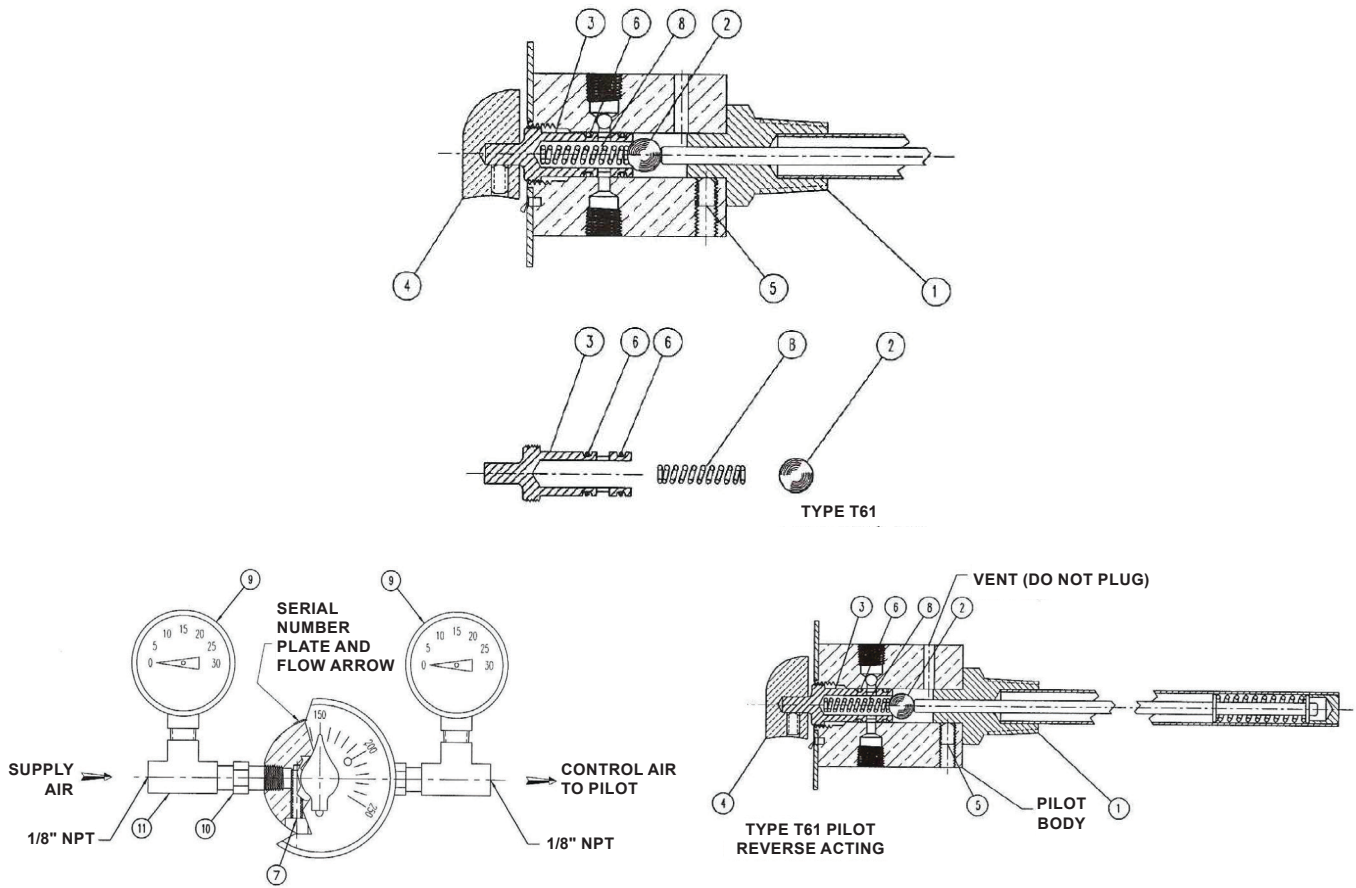


Figure 4. T61 Series Assembly

## Parts List

Key	Description	Part Number	Key	Description	Part Number
Repair Parts Kit			5	Body Set Screw, Steel	WAL05-11134-00
	Type T61, Reverse Acting	WAL08-11507-00	6*	Spool Sealing Rings, Viton®	WAL05-04004-00
1	Bulb Assembly Bronze Stainless steel	WAL07-40190-03 WAL07-40191-03	7*	Sensitivity Screw, Steel	WAL05-07930-00
2*	Ball, Stainless steel	WAL05-07709-00	8*	Valve Spring, Stainless steel	WAL05-05175-00
3*	Spool Reverse Acting Types T61, Brass	WAL04-07741-00	9	Pressure Gauge	WAL05-17460-00
4	Adjusting Knob, Plastic	WAL05-07927-00	10	1/8 Nipple, Brass	WAL05-17459-00
			11	1/8 Tee, Brass	WAL05-17458-00

\*These parts furnished in Repair Kit  
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