

T-3100, T-3200, and T-3300 Series Controllers

The T-3100 and T-3300 Series proportional action pneumatic thermostats are designed to maintain temperature in accordance with the return air temperature in terminal air conditioning units. The T-3200 Series of pneumatic thermostats are designed to control pneumatic actuators in single temperature, dual pressure applications.

The T-3111 and T-3311 Series controllers are combination pneumatic thermostats and valve actuators. The T-3111 provides proportional control of a steam or water valve on a single temperature application, while the T-3311 provides control in dual temperature, dual pressure applications.

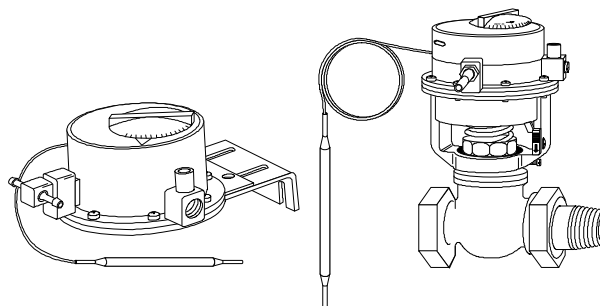


Figure 1: T-3100 Remote Mounted Thermostat and T-3311 Valve Top Thermostat

Features and Benefits	
☐ Models are Available in Direct-reverse Acting or Reverse-direct Acting	Allows seasonal change over from cooling to heating or heating to cooling automatically
☐ Direct or Reverse Acting Models Available with Liquid Filled Temperature Measuring Elements	Suits heating or cooling applications
☐ Models Available with an External or Concealed Setpoint Adjusting Screw	Field adjustable or concealed to maintain system design as commissioned
☐ Valve Top Models Compatible with VG7000 Series Valves	The T-3111 and T-3311 are direct replacements for the T-3110 and T-3310 Series Valve Top Actuators

Ordering Information

Table 1: Ordering Information

Code Number	Action (Proportional)	Element	Setpoint Adjustment	Mounting	Application
T-3100-2	Direct Acting	Bulb	External	Remote	Single Temperature
T-3100-3	Reverse Acting				
T-3111-1	Direct Acting	Bulb	External	Valve Top	Single Pressure
T-3111-2	Reverse Acting				
T-3111-3	Direct Acting	Averaging	External	Valve Top	Single Pressure
T-3111-6	Direct Acting		Concealed		
T-3200-1	DIR at 15 and 20 psig (103/138 kPa)	Averaging	Concealed	Remote	Single Temperature Dual Pressure
T-3300-1	DIR at 15 psig (103 kPa) REV at 20 psig (138 kPa)	Bulb	External	Remote	Dual Temperature Dual Pressure
T-3300-2	DIR at 20 psig (138 kPa) REV at 15 psig (103 kPa)				
T-3311-1	DIR at 15 psig (103 kPa) REV at 20 psig (138 kPa)	Bulb	External	Valve Top	Dual Temperature Dual Pressure
T-3311-2	DIR at 20 psig (138 kPa) REV at 15 psig (103 kPa)				

Dimensions

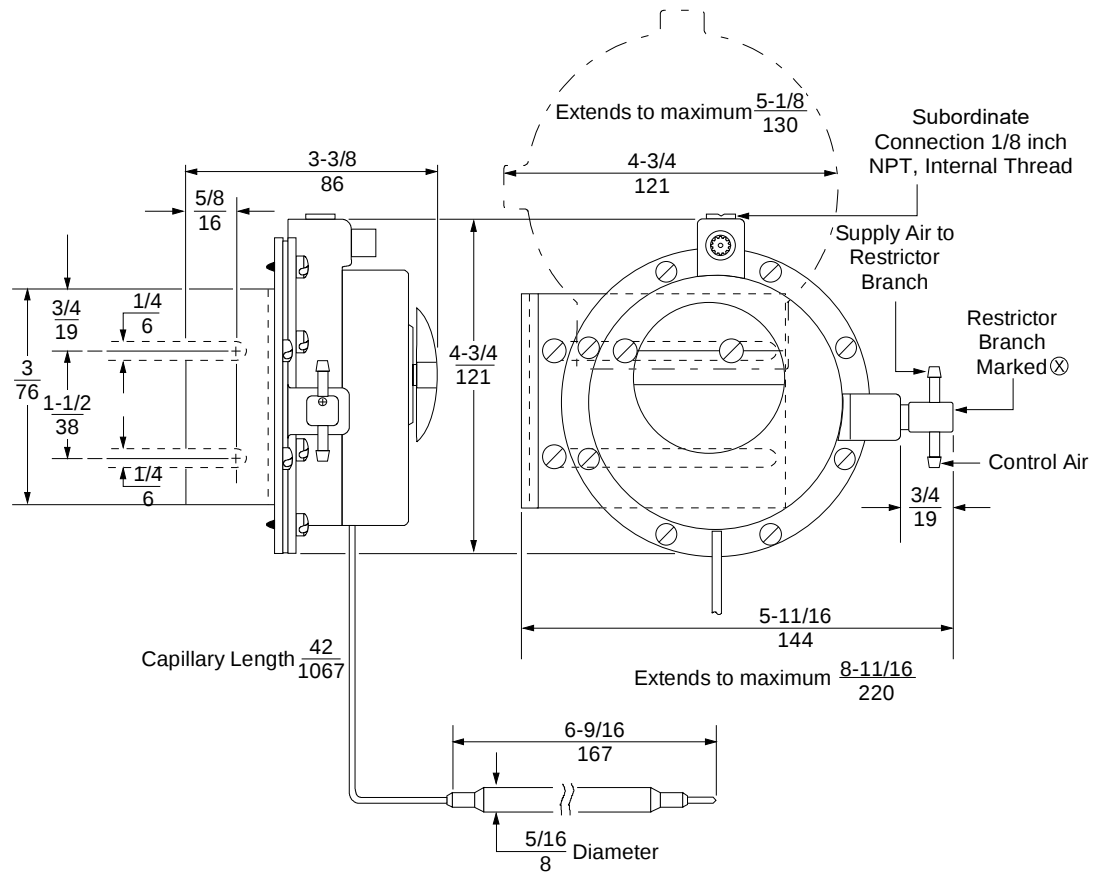


Figure 2: Dimensions and Mounting Details for T-3100, in./mm

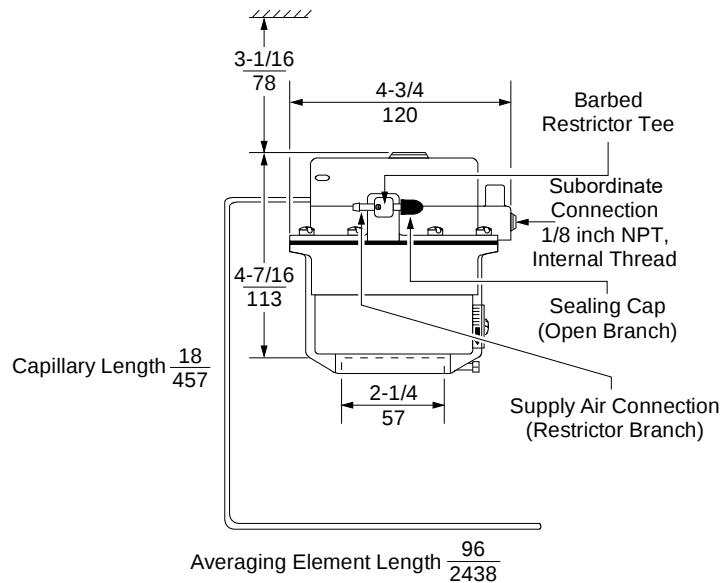


Figure 3: Concealed Adjustment for T-3111, in./mm

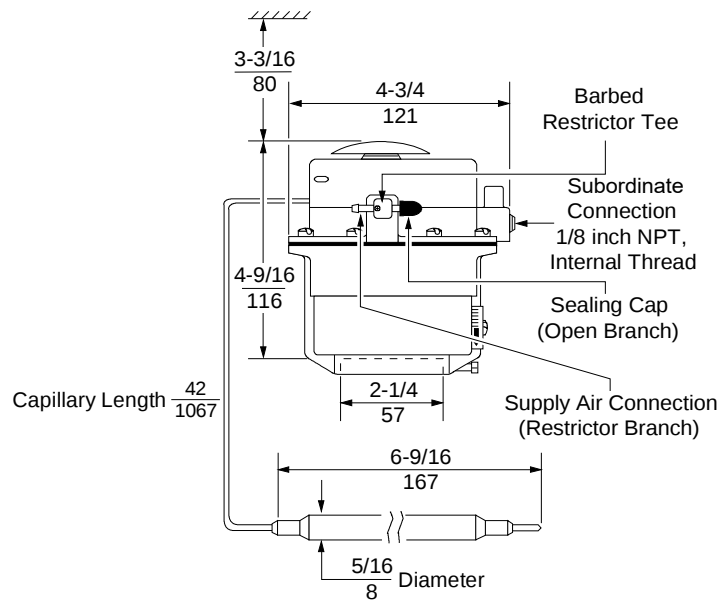


Figure 4: Exposed Adjustment for T-3111, in./mm

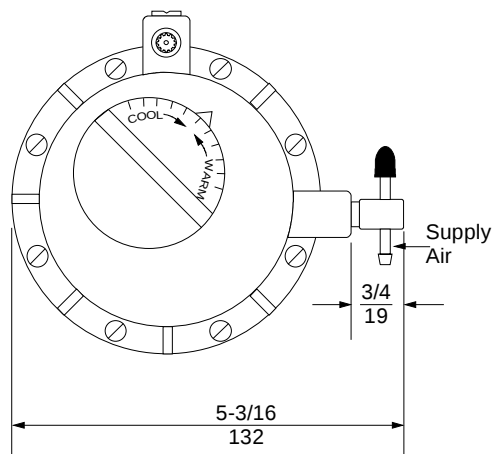


Figure 5: Mounting Details for T-3111, in./mm

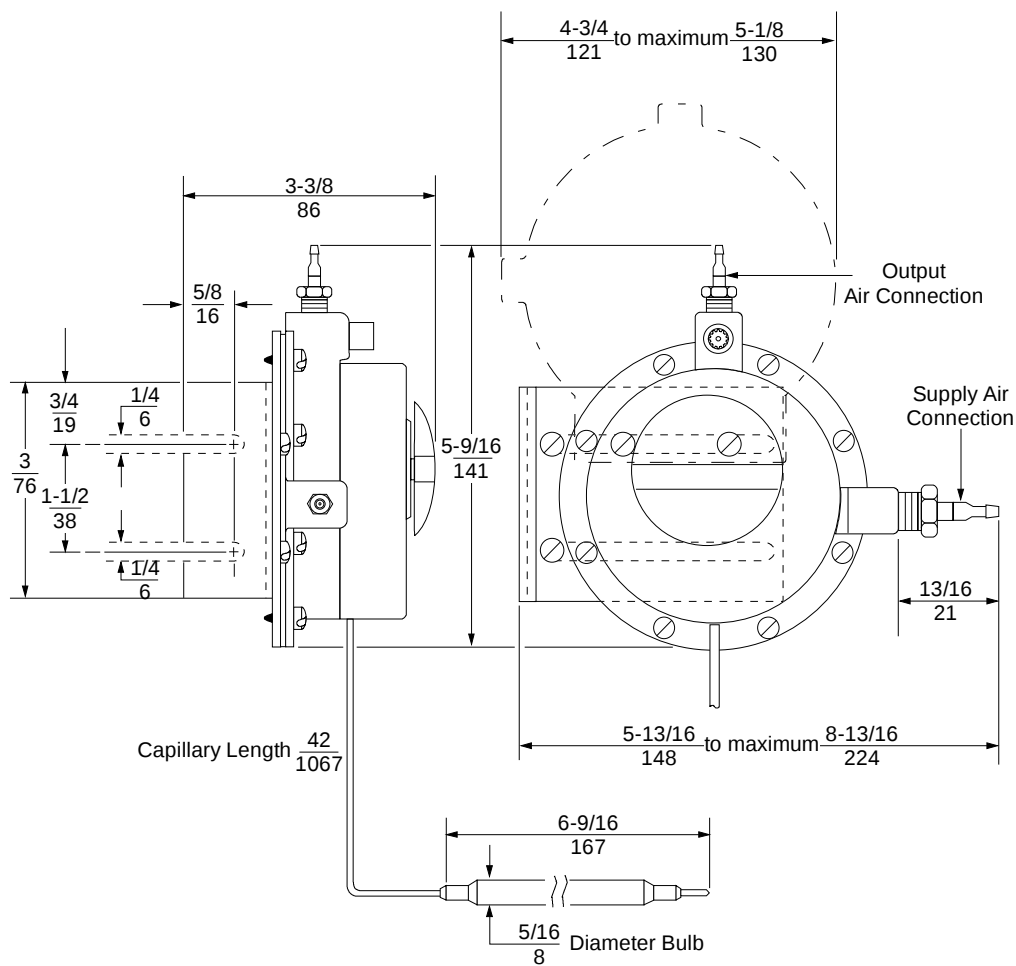


Figure 8: Dimensions and Mounting Details for T-3300, in./mm

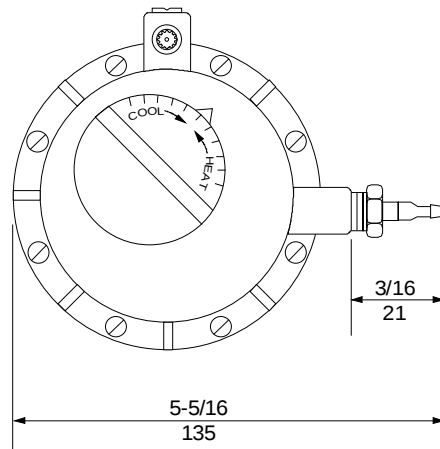


Figure 9: Mounting Details for T-3311, in./mm

Installation Procedures

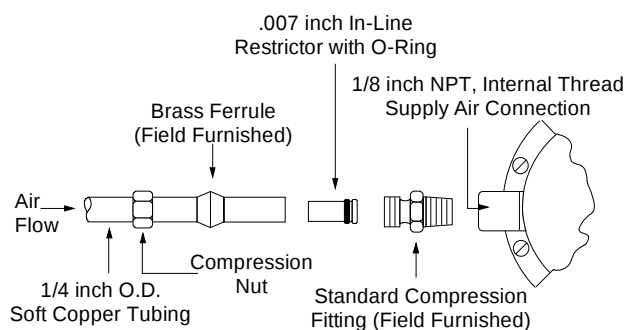
Tubing Installation

The T-3100, T-3200, and T-3300 Series Thermostats are supplied with barbed fittings for the supply and the output air connections. It is recommended that Type “FR” polyethylene tubing be used on the barbed fittings.

Note: Cut tubing off square for a good fit on the barbed fitting.

If “HP” or copper tubing is used, the barbed fitting must be removed and replaced with a compression fitting and an in-line restrictor when necessary.

Note: Figure 10 illustrates a copper tubing installation; “HP” tubing installation is the same except the brass ferrule is replaced with a thermoplastic ferrule, which is supplied with the R-3710-1007 restrictor.



**Figure 10: Copper Tubing Installation
(Use R-3710-1007 In-Line Restrictor)**

Sensing Elements

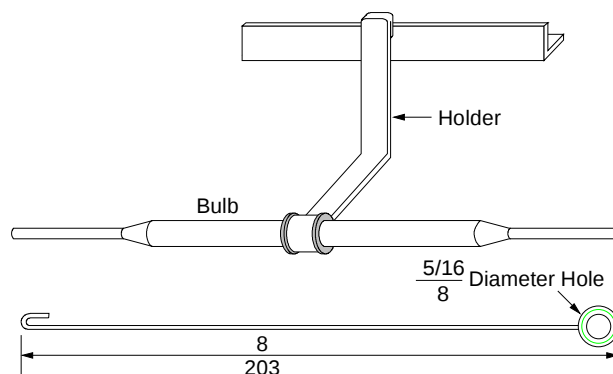
Both the bulb and the averaging sensing element must be carefully located so the elements measure only the intended air temperature. The majority of terminal air condition units are very compact and little clearance exists between coils. Also, the air flows are of widely varying temperature. Before selecting an element location, study the unit interior and make certain that the sensing element will not be affected by undesirable temperatures or mechanical damage. Avoid extremely sharp bends in the capillary which could obstruct the liquid flow.

Route the capillary so it is not in contact with extremely high or low temperature sources such as steam lines, water pipes, or coils. Be sure to route the element and capillary so that routine maintenance can be performed on the terminal unit without disturbing the element.

Bulb Element

In most cases, a bulb element will be installed in the return air chamber of the terminal air unit in the following manner:

1. Install the element behind the protective screen or grille and in a location where normal maintenance may be performed on the unit without interference.
2. Be sure the bulb will sense only the return air and will not be influenced by other temperatures.
3. Secure the bulb using holder, T-275-100 (ordered separately) which can be hung or fastened in place and bent to the desired position.



**Figure 11: Bulb Element Holder Dimensions,
in./mm (T-275-100, ordered separately)**

Averaging Element

In most cases, an averaging element will be installed in the air chamber of the terminal air unit in the following manner:

1. Install the element in a serpentine fashion across the top of the unit coil.
2. Secure the element along the entire length by using holders, T-275-101 (ordered separately), so that no part of the element touches the coil. The holder is very flexible and can be bent to any desired position.
3. On face and bypass units, the element must be placed in the space where a mixing of coil discharge air (face) and coil bypass air takes place. Install the element as close as possible to the bottom side of the discharge air grille. The element should be secured by using holders (T-275-101, ordered separately) fastened to the unit casing.

For ASHRAE Cycle III applications, the element must be installed in the mixed air (outside and return) rather than in the discharge air. Install the element so it will receive the best possible sampling of the mixture temperature using holders (T-275-101, ordered separately) fastened to the unit casing.

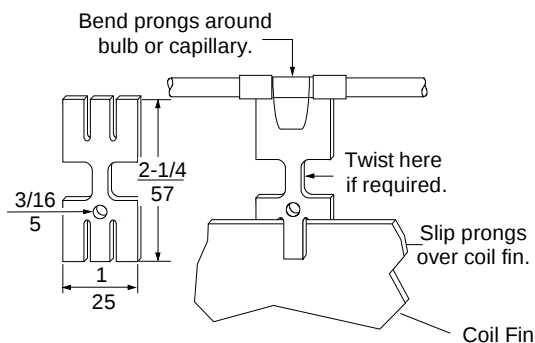


Figure 12: Averaging Element Holder Dimensions, in./mm (T-275-101, ordered separately)

Calibration Procedures

All Johnson Controls instruments are carefully tested and calibrated at the factory before shipment. If field calibration is required, it should not be started until all installation procedures are complete. If, during calibration, the temperature at the measuring element fluctuates, place the element in a stable, well-controlled temperature area such as a bucket of water, preferably 75°F (24°C) for controllers and 56°F (13°C) for low limit controllers.

Be sure the supply air to the instrument is clean and free of moisture. The adjusting dial is graduated in 1°F increments and can be removed with a flexible hex head screwdriver (JC 5309, ordered separately). It is recommended that the middle graduation be used to represent the desired temperature setpoint.

The adjusting screw for externally adjusted, Direct Acting (DIR) models is located inside the dial post and is accessible by removing the dial (refer to Figure 13, Detail A). For DIR models with concealed adjustment, it is necessary to remove the small metal button in the cover (refer to Figure 13, Detail B). A calibration tool (T-4002-5009, ordered separately) should be used to adjust the setpoint on these models.

It is necessary to remove the dial and cover for models with either Reverse Acting (REV) or low limit adjustments. Use a calibration tool (T-4002-5009, ordered separately) for Reverse Acting adjustment of the T-3100 and T-3300 Series Thermostats (refer to Figure 13, Detail C).

Be sure each T-3100 and T-3111 Thermostat has a 0.007 inch in-line restrictor installed in the supply air connection. The T-3200 instruments should have a 0.007 inch in-line restrictor in the air line between the instrument and the room thermostat.

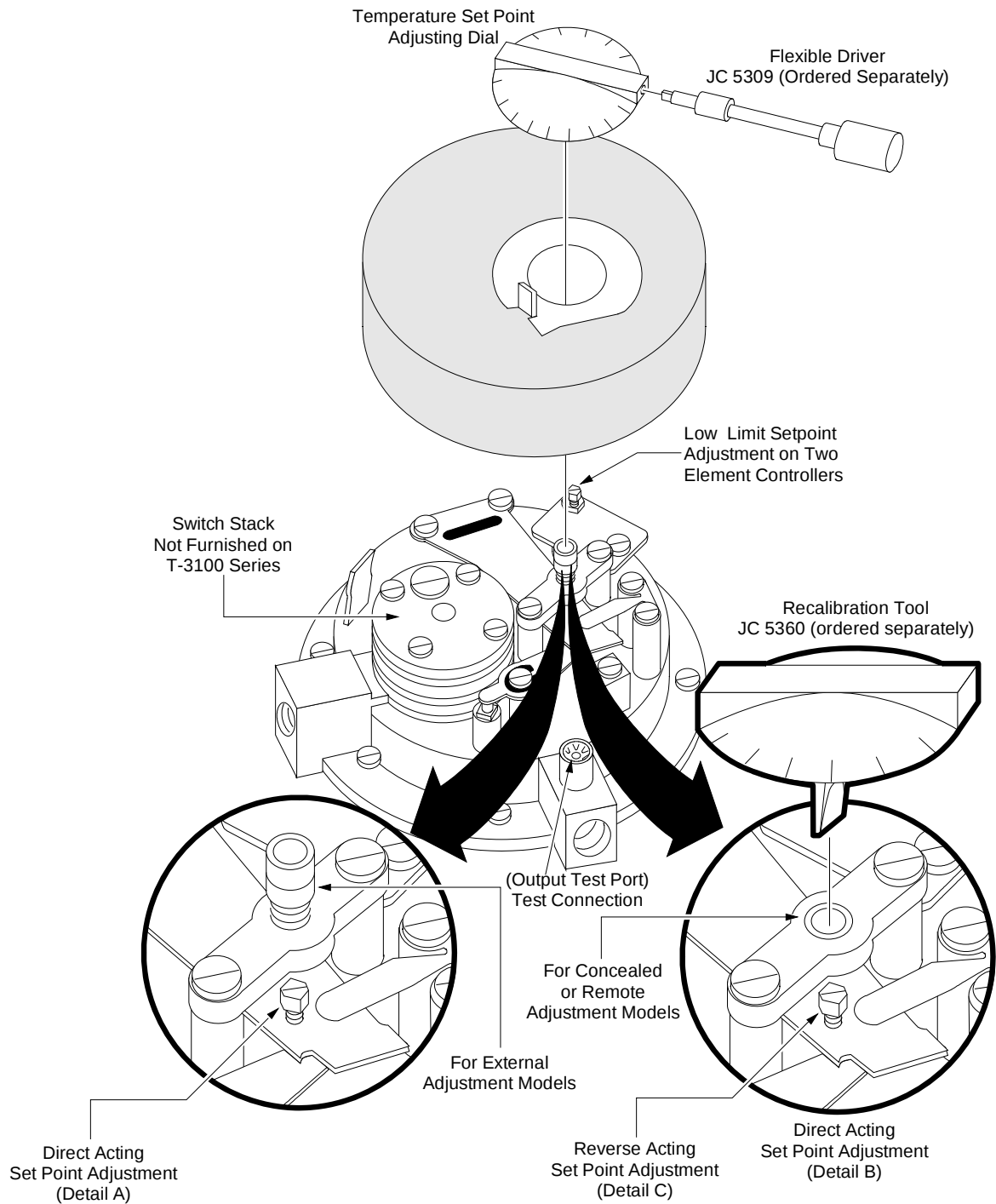


Figure 13: Setpoint Adjusting Features

Temperature Setpoint Adjustment

For T-3100 and T-3200 Series follow Steps 1 through 7.

1. Supply the instrument with the proper supply air pressure.
2. Insert the test gauge (JC 5310, ordered separately) and the probe assembly (JC 5361, ordered separately) into the output test port.

Note: For Reverse Acting thermostats it will be necessary to remove the cover in order to turn the setpoint adjustment screw.

3. Turn the setpoint adjustment screw until the pressure reading is approximately in the middle of the operating range of the actuator. For example, a 5 to 10 psig operating range would require an output pressure reading of 7.5 psig.
4. Remove the test gauge and probe assembly.
5. Determine the temperature at the measuring element.
6. Place the dial on the dial post (do not tighten) and position it to the temperature at the element. Remember that each dial increment represents one Fahrenheit degree. For models with concealed adjustment, use recalibration tool JC 5360 (ordered separately).
7. Tighten the dial and turn it to the desired setpoint.

Example: If the desired temperature setpoint is 75°F and the temperature at the element is 71°F, then place the dial on the dial post (do not tighten) and position it to 71°F or four graduations ($75^{\circ}\text{F} - 71^{\circ}\text{F} = 4^{\circ}\text{F}$) clockwise from the middle graduation (75°F), the desired setpoint.

Note: For T-3200 Series the low limit setpoint is 56°F. Use calibration tool T-4002-5009 (ordered separately). Each graduation is 9°F (5°C).

For T-3300 Series proceed as follows:

1. Supply the instrument with the appropriate air pressure for the Direct Acting (DIR) operation.
2. Insert the test gauge (JC 5310, ordered separately) and the probe assembly (JC 5361, ordered separately) into the test port (as illustrated in Figure 14).
3. Remove the knob and cover.
4. Turn the DIR screw until the output pressure is in the middle of the actuator operating range.
5. Change the supply air pressure to that required for the Reverse Acting (REV) operation.
6. Turn the REV adjusting screw until the output pressure is in the middle of the actuator operating range.
7. Remove the test gauge and probe assembly.
8. Determine the temperature at the element.
9. Attach the cover.
10. Place the dial on the dial post (do not tighten) and position it to the temperature at the element.
11. Tighten the dial and turn to the desired setpoint.

Note: If the setpoints of several instruments are to be adjusted before switching the supply pressure, be sure that the temperature at the element will not change during both stages of adjustment.

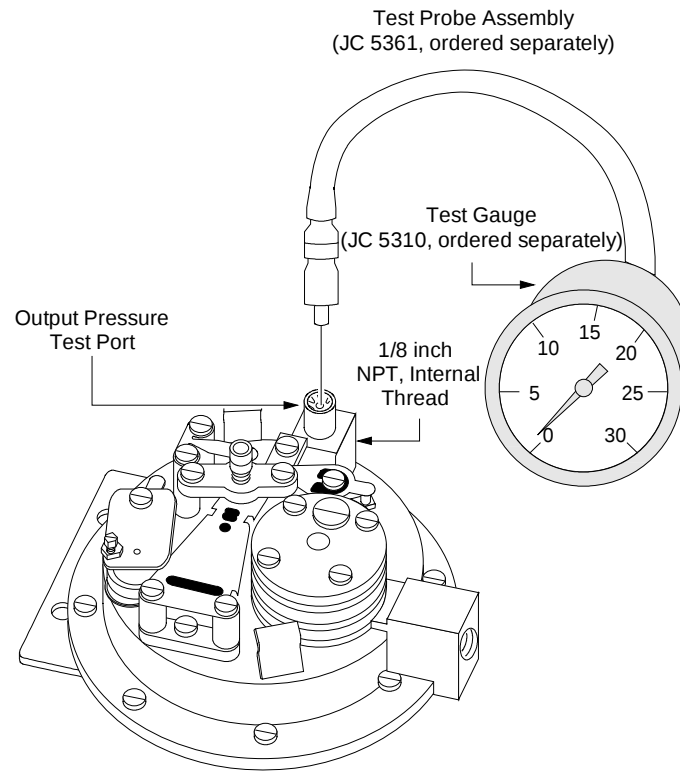


Figure 14: Test Gauge

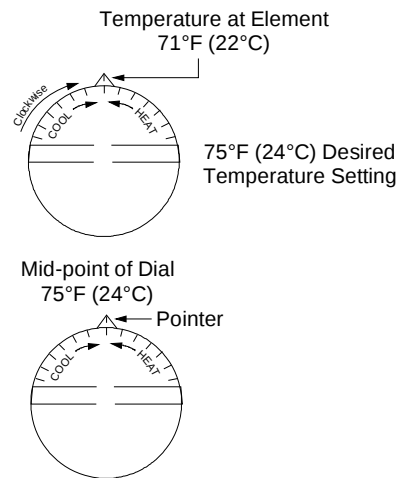


Figure 15: Temperature Setpoint Dial

Restricted Adjustment

The dial pointer on externally adjusted models has tabs which are factory set to restrict the dial adjustment to a span of 15°F (7.5°F on either side of the pointer). The restriction can be changed to the spans indicated in Table 2 by bending up the appropriate tabs and flattening the factory set tabs.

Table 2: Span Adjustment

Span		Tab	
F°	C°	F°	C°
20	11.1	± 10	± 5.6
15	8.3	± 7.5	± 4.2
10	5.6	± 5	± 2.8
5	2.8	± 2.5	± 1.0

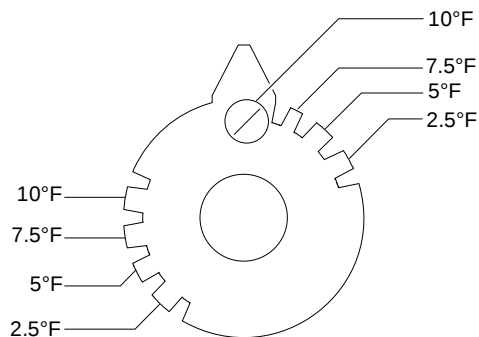


Figure 16: Restricted Adjustment

Maintenance and Troubleshooting Procedures

These instruments are designed so that a minimum of routine maintenance is required. The following procedures should be used to ensure proper operation and to locate malfunctioning components:

1. Check all air lines, connections, and diaphragms for air leaks. Make sure that the in-line restrictors are not defective.
2. Check the operation of the thermostat to be sure it is passing the correct control signal and that it is functioning properly. Make sure it has the proper supply air pressure and that air is exhausting from the control port. The port must exhaust continuously to ensure proper operation of the thermostat.
3. Check that the temperature measuring element has not been damaged or moved from its intended sensing position.
4. Check that the valve packing nut is tight enough to prevent leaks, but not so tight that the packing becomes distorted and binds the stem; usually finger tight is sufficient. If the valve is leaking around the centerpiece, tighten it with the appropriate wrench.
5. Verify that the valve seats completely when the actuator is fully stroked. If there is fluid flow after the plug is seated, the seat, plug, or disc may be worn or scored and should be repaired or replaced.
6. If there are subordinate actuators, make sure the actuators are operating in the proper sequence and adjusted correctly.

Accessories

Table 3: Accessories (Order Separately)

Description	Code Number
Hex Head Flexible Screwdriver	JC 5309
Control Line Test Gauge and Adaptor	JC 5310
Recalibration Tool	JC 5360
Test Probe Assembly	JC 5361
Averaging Element Holder for 3 inch (76 mm) Coil (See Figure 17.)	Order QEO-1 from Temperature Control Specialties 2800 Laura Lane Middleton, WI 53562 (608) 836-9034
Restrictor Tee (.007 inch)	R-3710-1007
"B" Bulb Holder	T-275-100
Averaging Element Holding Clip	T-275-101
Supply Inlet Filter (Order in multiples of 100.)	T-3100-605
Calibration Tool	T-4002-5009
Averaging Element Holder for Radius Bends (minimum 3-1/2 in. (See Figure 18.)	TE-6001-8
Diaphragm for Exposed Actuator V-3000-1 only	V-3000-600



Figure 17: QEO-1, Averaging Element Holder

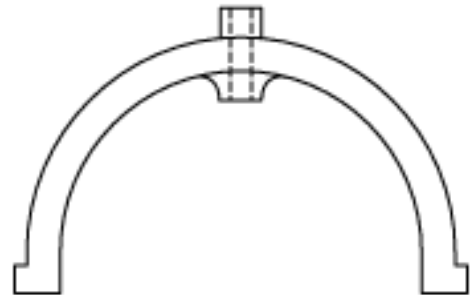


Figure 18: TE-6001-8, Averaging Element Holder

Repair Procedures

Actuators

To replace the diaphragm, follow Steps 1 through 7 below.

1. Remove the eight screws holding the thermostat to the integral actuator.
2. Lift the thermostat exposing the diaphragm and remove the piston.
3. Turn the new diaphragm inside out and place it over the piston. Smooth out all of the wrinkles and release any air trapped between the head of the piston and the diaphragm, then pull the flange up. The diaphragm will assume its shape, as illustrated in Figure 19.
4. On piston top valve actuators, place the piston straight within the new diaphragm and insert into the bell housing.
5. Replace the thermostat.
6. Replace all the screws and tighten equally.
7. Place the instrument in operation and check its action.

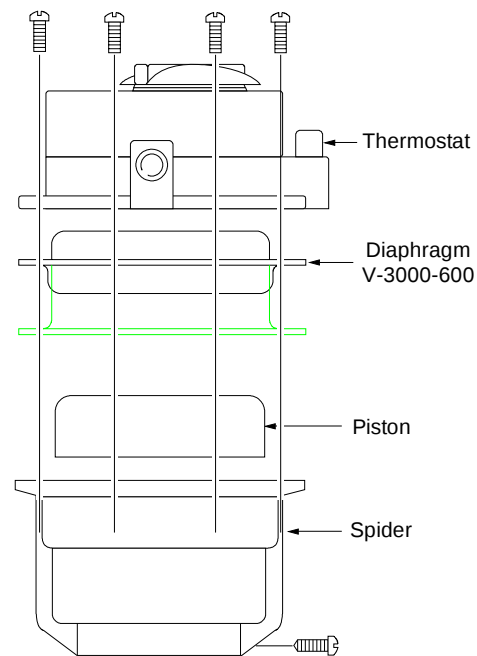


Figure 19: Diaphragm Installation for T-3111 and T-3311 Series

Specifications

Product		T-3100, T-3200, and T-3300 Series Controllers	
Models		See Table 1.	
Proportional Action		See Table 1.	
Maximum Supply Pressure		25 psig (172 kPa)	
Ambient Temperature Limits		-20 to +150°F (-29 to 66°C)	
Air Connections	Supply	T-3100 T-3111 T-3200 T-3311	Barbed Restrictor Tee for 1/4 inch O.D. Polyethylene Tubing
		T-3300	Straight Connector for 1/4 inch O.D. Polyethylene Tubing; 1/8 inch NPT Barbed Fitting for 5/32 or 1/4 inch O.D. Polytubing*
	Subordinate	All Models	1/8 inch NPT, Internal Thread
Element	Type	T-3111	Bulb with 42 inch (1067 mm) Capillary
		T-3111 and T-3200	8 ft (2438 mm) Averaging with 18 inch (457 mm) Capillary
		T-3100 T-3300 T-3311	Bulb with 42 inch (1067 mm) Capillary
	Range	T-3100 T-3200 T-3300 T-3311	60 to 150°F (16 to 66°C)
		T-3111	Bulb, 60 to 150°F (16 to 66°C) Averaging, 30 to 175°F (-1 to 80°C)
Dial	Span	All Models Except T-3200	20F° (11C°) Maximum
	Range		Factory Set at ± 7.5°F (± 4°C)
	Marking		“Cool-Warm,” Graduated in one degree “F” Increments
Sensitivity	Remote Bulb	T-3100 T-3111 T-3300 T-3311	2.5 psi/F° (31 kPa/C°)
		T-3111 T-3200	0.5 psi/F° (31 kPa/C°)
	Factory Setpoint	T-3100	75°F (24°C)
T-3200		56°F (13°C)	
T-3300		75°F (24°C)	

Continued on next page. . .

* The maximum length of 5/32 inch tubing is 15 feet. It is recommended that 1/4 inch tubing is used at all times to ensure proper switchover.

Specifications (Cont.)

Material	Body	All Models	Die Cast Aluminum
	Cover	All Models	Die Cast Zinc
	Yoke	T-3111 and T-3311	Die Cast Aluminum
	Diaphragm	T-3111 and T-3311	Molded Synthetic Rubber
Finish		Green Lacquer	
Accessories (Order Separately)		See Table 3.	

The performance specifications are nominal and conform to acceptable industry standards. For application at conditions beyond these specifications, consult the local Johnson Controls office. Johnson Controls, Inc. shall not be liable for damages resulting from misapplication or misuse of its products.

European Single Point of Contact:

JOHNSON CONTROLS
WESTENDHOF 3
45143 ESSEN
GERMANY

NA/SA Single Point of Contact:

JOHNSON CONTROLS
507 E MICHIGAN ST
MILWAUKEE WI 53202
USA

APAC Single Point of Contact:

JOHNSON CONTROLS
C/O CONTROLS PRODUCT
MANAGEMENT
NO. 22 BLOCK D NEW DISTRICT
WUXI JIANGSU PROVINCE 214142
CHINA



Controls Group
507 E. Michigan Street
P.O. Box 423
Milwaukee, WI 53201

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