

**Caution:** DO NOT KINK CAPILLARY

## General Information

The dual bulb thermostat has a liquid filled thermal element with one bulb to sense representative outdoor air temperatures and the other bulb for installation in the supply media (usually hot water or warm air). The combined effects of the two bulbs varies the supply temperature in accordance with the outdoor temperature. The supply temperature is raised as the outdoor temperature drops and conversely the supply temperature is lowered as the outdoor temperature rises.

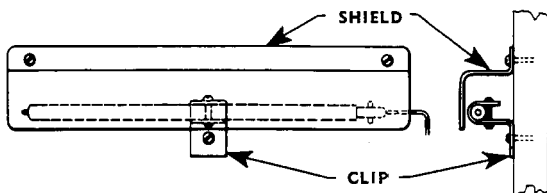
**Switch Action:** Single-pole, double-throw with proportional solenoid.

**Electrical Rating:** For 24 volt, 60 cps control circuit — Contact rating 1.0 amps, at 24 volts.

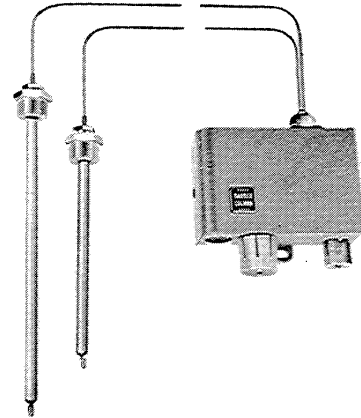
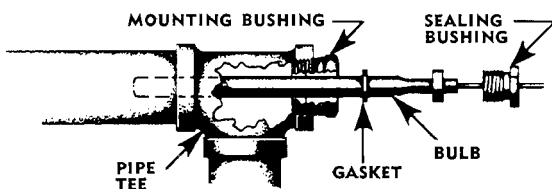
**Installation and Mounting:** Mount the thermostat on a wall or flat vertical surface free from excessive vibration. Case must be vertical with solenoid pointing down. Locate the instrument so that both the outdoor and indoor bulbs can be installed in their proper places: the outdoor bulb in the outdoor air and the indoor bulb in the supply line or duct. Avoid locations where radiant heat will affect the capillary tubing.

### Bulb Mounting:

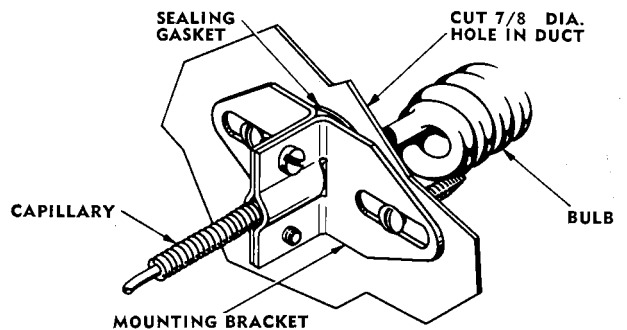
**Outdoor Wall Mounting,** A clip and shield are furnished with the instrument for mounting the bulb to the outside wall or surface (see cut). After mounting the bulb with the clip, place the shield directly over the bulb and fasten the shield to the mounting surface.



**Liquid Line Mounting,** The bulb is furnished with a mounting bushing threaded for use with standard 3/4-inch pipe. Before inserting the bulb, back off the sealing bushing (see cut) within the mounting bushing. Insert bulb and thread-in mounting bushing. Tighten mounting bushings and then tighten sealing bushing.

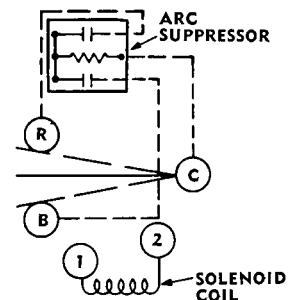


**Air Duct Mounting,** Mounting flange is provided so bulb may be installed on a duct wall. Cut 7/8-inch hole in duct, slip gasket over capillary between bracket and bulb, then fasten bracket to duct work with sheet metal screws provided.



**Wiring:** Large, coded screw type terminals are provided for all electrical connections. Make all connections in accordance with the job wiring diagram and in compliance with National and Local Electrical codes.

**Terminal Coding:** "C" is common of single-pole, double-throw switch. "R" closes on a decrease in either control temperature or outdoor temperature. "B" closes on an increase in either the control temperature or outdoor temperature. "2" is connected to ground either directly or by a jumper to "C" (see job wiring diagram) and "1" is connected to the potentiometer wiper arm of the actuator.



## Adjustment:

**Throttling Range,** Throttling range is the temperature change required at the sensing bulb to run the controlled actuator from one end of its stroke to the other. The throttling range is adjustable by moving the plastic slider on the tongue to the right (decreases throttling range) or to the left (increases throttling range). The throttling range adjustment should be set to the lowest value possible without causing instability or "hunting" of the actuator. If the actuator continuously runs and reverses direction of rotation frequently, the throttling range setting is too low and should be increased until stable operation results. As the control is quite sensitive stable operation does not necessarily mean the actuator should not often run. However, the actuator should not reverse direction frequently at set point or continuously run back and forth over a fairly large portion of its stroke. This is instability or "hunting" of the control.

The graduations on the adjustment slider together with the color of the indicating tab will give an approximate indication of the effective throttling range at a given slider setting. On a low span control with the slider marked 1, 2 and 3, the Tongue is not color coded and the throttling range is adjustable from 4 to 12 F°. On a high span control, with the slider marked 1, 3 and 5, the lower indicating tab on the tongue is color coded and the throttling range is adjustable from 5 to 25 F°. With the slider set at "1" (minimum) the throttling range will be 4 F° on a low span control or 5 F° on a high span control. At a slider setting of "2" the throttling range is twice the minimum and at "3" it is three times the minimum. For instance, a slider setting of "2" will result in an 8 F° throttling range (2 x 4 F°) on a low span control.

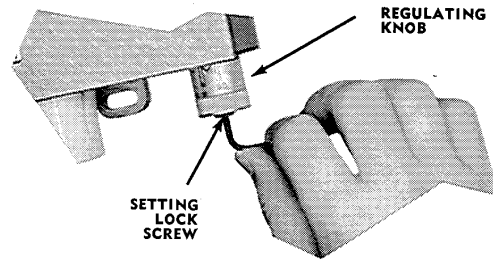
Whenever the throttling range slider has been changed the control must be recalibrated as described under "Calibration."

**Armature:** Should it become necessary to check the operation of the Solenoid Armature, proceed as follows:

1. Disconnect all field wiring, remove Wire Barrier and adjust Regulating Knobs until the Tongue "floats" between the two contacts.
2. Apply 24 Volts to Terminals "1" and "2" and check that the shoulder on the Armature is not more than 3/64" above extreme top of Solenoid Assembly.
3. To raise or lower the Armature, insert a thin blade screwdriver into opening in bottom of Solenoid Assembly. This will engage the slot in the bottom of the Armature and permit it to be turned either to the right or the left. Note that at least two threads must be engaged between the Spring and the Armature.
4. Replace Wire Barrier, Field Wiring and Case Cover.

**Differential:** The differential is factory set at approximately 1/2 F°, and should not, under normal conditions be altered. The contact gap is preset at .003 and this dimension may be checked with a feeler gauge. The white nylon screw in the lower contact bar may be rotated to adjust the gap only if necessary.

**Dial Setting:** Set the thermostat by turning the regulating knob, at the bottom of the case, to the desired temperature. The thermostat setting can be locked by tightening the recessed allen socket lock screw in the bottom of the dial screw (see photo).



The ratio of change in outdoor temperature to change in water temperature is stamped on the nameplate. A 1 to 1 ratio means that the water temperature is increased 1 F° for each degree decrease in outdoor temperature, 1 to 1-1/2 ratio increases water temperature 1-1/2 F° for each degree decrease in outdoor temperature.etc.

To adjust after installation it is necessary to know the approximate supply temperature for which the system was designed. Knowing this, dial setting can be determined from table below.

**Example A:** A dual bulb instrument with ratio 1-1/2 to 1 is installed in system which has a design supply temperature of 125°F at outdoor temperature of -10°F. From the chart it can be seen that a 1-1/2 to 1 ratio will control supply temperature at 123°F when outdoor temperature is -10°F with dial set at 70°F. Set dial at 72°F.

**Example B:** A thermostat with 1 to 1-1/2 ratio is installed in a system designed for 200°F supply temperature at 0°F outdoor temperature. Note from chart that dial should be set between 90°F and 100°F to provide 200°F supply temperature at 0°F outdoors. Note: If it is determined, after system is in operation, that supply temperatures are too high, lower dial setting. If temperatures are too low, raise dial setting.

**Calibration:** To calibrate the TP dual bulb thermostat, proceed as follows:

1. With power on the thermostat and actuator, place both bulbs in 70°F ambient temperature and allow to stabilize for approximately 10 minutes. Remove case cover.
2. Pry off Wire Barrier, then turn regulating knob until tongue "floats" with actuator at minimum heat position.
3. Disconnect the wire jumper from the printed circuit board by pulling straight out. Do not disconnect the end attached to the tongue assembly. Now, set regulating knob at 70°F.
4. Turn calibrating screw until tongue again "floats" between the two contacts. Turning the calibrating screw to the right (CW) raises set point temperature, while turning the Screw to the left (CCW) lowers set point temperature.
5. Re-install wire jumper onto the printed circuit board. Replace wire barrier and case cover. Now, adjust regulating knob to desired control point setting and return both bulbs to their respective locations.

**Replacement Parts:** When ordering replacement parts, use the name of the item along with the number of the thermostat for which the part is required. For example: One solenoid spring for a TP 231-0-0-1 bulb thermostat. Note that the thermal element part number is stamped on the inside case cover and may be ordered by this number alone.

Outdoor Design Temperature	Ratio	Change in Control Temperature (°F) for Different Ratios as Outdoors Temperature Drops from 70°F to Design Temperature						
		Dial Set at 60F	Dial Set at 70F	Dial Set at 80F	Dial Set at 90F	Dial Set at 100F	Dial Set at 110F	Dial Set at 120F
-30°F	1 to 1-1/2	—	70 to 220	80 to 230	90 to 240	100 to 250	110 to 260	120 to 270
	1 to 1	60 to 160	70 to 170	80 to 180	90 to 190	100 to 200	110 to 210	120 to 220
	1-1/2 to 1	60 to 127	70 to 137	80 to 147	90 to 157	100 to 167	—	—
-20°F	1 to 1-1/2	—	70 to 205	80 to 215	90 to 225	100 to 235	110 to 245	120 to 255
	1 to 1	60 to 150	70 to 160	80 to 170	90 to 180	100 to 190	110 to 200	120 to 210
	1-1/2 to 1	60 to 120	70 to 130	80 to 140	90 to 150	100 to 160	—	—
-10°F	1 to 1-1/2	—	70 to 190	80 to 200	90 to 210	100 to 220	110 to 230	120 to 240
	1 to 1	60 to 140	70 to 150	80 to 160	90 to 170	100 to 180	110 to 190	120 to 200
	1-1/2 to 1	60 to 113	70 to 123	80 to 133	90 to 143	100 to 153	—	—
0°F	1 to 1-1/2	—	70 to 175	80 to 185	90 to 195	100 to 205	110 to 215	120 to 225
	1 to 1	60 to 130	70 to 140	80 to 150	90 to 160	100 to 170	110 to 180	120 to 190
	1-1/2 to 1	60 to 107	70 to 117	80 to 127	90 to 137	100 to 147	—	—
+ 10°F	1 to 1-1/2	—	70 to 160	80 to 170	90 to 180	100 to 190	110 to 200	120 to 210
	1 to 1	60 to 120	70 to 130	80 to 140	90 to 150	100 to 160	110 to 170	120 to 180
	1-1/2 to 1	60 to 100	70 to 110	80 to 120	90 to 130	100 to 140	—	—
+ 20°F	1 to 1-1/2	—	70 to 145	80 to 155	90 to 165	100 to 175	110 to 185	120 to 195
	1 to 1	60 to 110	70 to 120	80 to 130	90 to 140	100 to 150	110 to 160	120 to 170
	1-1/2 to 1	60 to 93	70 to 103	80 to 113	90 to 123	100 to 133	—	—
+ 30°F	1 to 1-1/2	—	70 to 130	80 to 140	90 to 150	100 to 160	110 to 170	120 to 180
	1 to 1	60 to 100	70 to 110	80 to 120	90 to 130	100 to 140	110 to 150	120 to 160
	1-1/2 to 1	60 to 87	70 to 97	80 to 107	90 to 117	100 to 127	—	—

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F-11402-4

**TAC**  
1354 Clifford Avenue  
P.O. Box 2940  
Loves Park, IL 61132-2940  
[www.tac.com](http://www.tac.com)

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