

DEVICE INFORMATION

Identification

Thermostats of this family may be easily identified by referring to the part number located on the carton and on the back and side of the device. Stamped on the back of the device is the date of manufacture (four digits, the first two representing the week of the year and the last two representing the year).

These thermostats are used for proportional control of pneumatically actuated valves, dampers and similar devices in heating, ventilating and air conditioning systems. See Performance table.

Pre-Installation

The thermostats are shipped with mounting screws and three 3/4-inch long copper tubes. Wall fittings must be ordered separately.

Before installation, make a visual inspection of the thermostat carton for obvious signs of damage.

Air Connections: Two plastic tubes reinforced with a coil spring are coded M & B. The M (Black) designates the supply main and the B (White) designates the controlled branch line.

Model TK-1601 has three plastic tubes. The additional tube A (White) designates the auxiliary (two-position) branch line.

INSTALLATION

Requirements

Locate the thermostat where it will be exposed to unrestricted circulation of air which represents the average temperature of the controlled space. Do not locate the thermostat near sources of heat or cold, such as lamps, motors, sunlight, or concealed ducts or pipes. Maximum safe ambient temperature is 150°F.

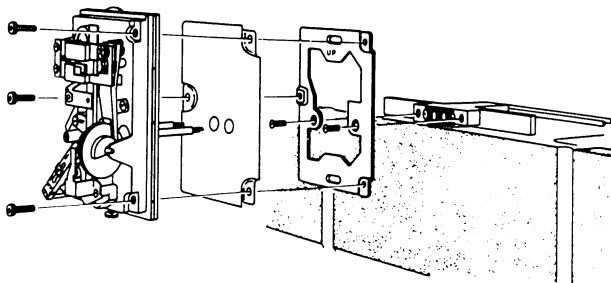
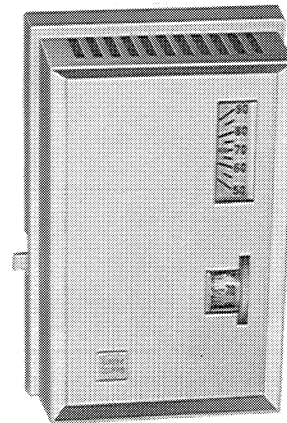


Figure 1. Mounting Thermostat to AT-507 Mortar Joint Fitting



The thermostat fitting is available for either flush or surface mounting. See Figures 1 and 3. The AT-506 and AT-508 (wall box fittings) are for surface mounting on all wall surfaces and flush mounting on plastered or stud walls. The AT-507 is for flush mounting in masonry walls. **Note:** No fitting is available for use for flush mounting in masonry walls when using the TK-1601, an electrical box is used for this application (Figure 2).

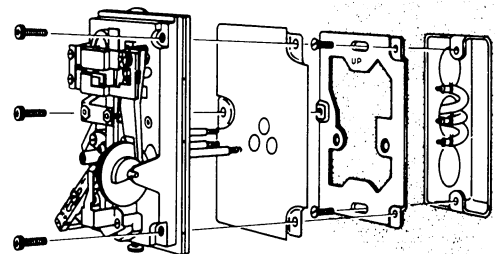


Figure 2. Mounting Thermostat to Electrical Box

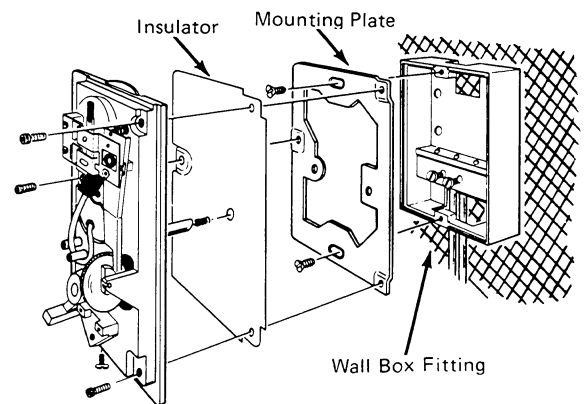


Figure 3. Mounting Thermostat to AT-506 or AT-508 Wall Box Fitting

PERFORMANCE

Part Number	Description and Action*	Dial Range (F)	Factory Setpoint Setting (F)	Throttling Range	Supply Air Pressure (psig)
TK-1001	Heating DA	55.85	75	Adjustable 2–10F°/10 psi Factory Set 4F°/10 psi	15 or 20
TK-1101	RA Cooling				
TK-1201	Heating-Cooling DA – 20 psig RA – 15 psig				15 – RA* 20 – DA*
TK-1301	Day-Night DA				15 – Day 20 – Night
TK-1601	Night – 20 psig Day – 15 psig				

*Direct acting: Increases output pressure on temperature rise
Reverse acting: Decreases output pressure on temperature rise

Air Consumption: .008 scim for sizing air compressor (exception: .024 for TK-1601).

Supply in Pressure: See Performance table.

Air Capacity: 16 scim for sizing air mains (exception: 32 for TK-1601).

Air Connection: 5/32 plastic tubing.

- If the thermostat tubing is too long for easy coiling in the wall box, it can be cut to length. Cut the tubing at a 45° angle, for ease in inserting the tubing into the “O” ring seal. Be sure that the coil spring is cut flush with the tubing.
- Remove and discard the short piece of tubing from the connector head of the wall box.
- Place the fiber board insulator over the tubes on the back of the thermostat.
- Insert the main (black) plastic tubing into the left hand hole in the connector head. Insert the branch line (white) tubing in the right hand hole in the connector. TK-1601 – Insert the auxiliary branch line (A White) in the center hole in the connector. Insert tubes at least 1/4-inch. Do not use any lubricant on the plastic tubing.
- Fasten the thermostat to the mounting plate with the three Allen mounting screws provided. Tighten the screws evenly.

To mount a thermostat on an electrical switch box. When installing a thermostat to an electrical switch box (Figure 2) in a masonry wall, proceed as follows:

- Attach the mounting plate to the switch box with the two flathead screws provided. Be sure the mounting plate is vertical.
- Place the fiber board insulator over the tubes on the back of the thermostat.
- Slightly rotate the tubes back and forth, and push firmly on to the fittings.
- Fasten the thermostat to the mounting plate with the Allen head screws provided and tighten evenly.

See Figure 5 for connection to field tubing.

Application of TK-1301 and TK-1601

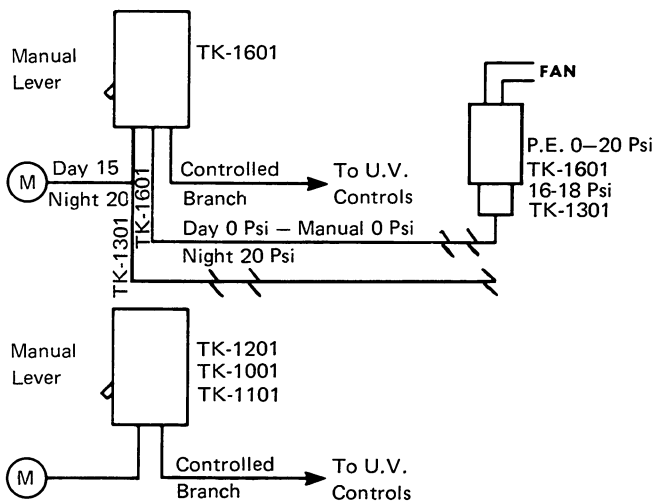


Figure 4

Procedure

To mount a thermostat on a AT-506 and AT-508 wall box fitting, refer to Figure 3:

- Remove and discard the cardboard cover plate on the wall box. (The cardboard cover protects the fitting while the wall is being plastered.)
- Fasten the mounting plate to the wall box with the two flat head screws provided. Make sure it is square with the wall before tightening the screws.

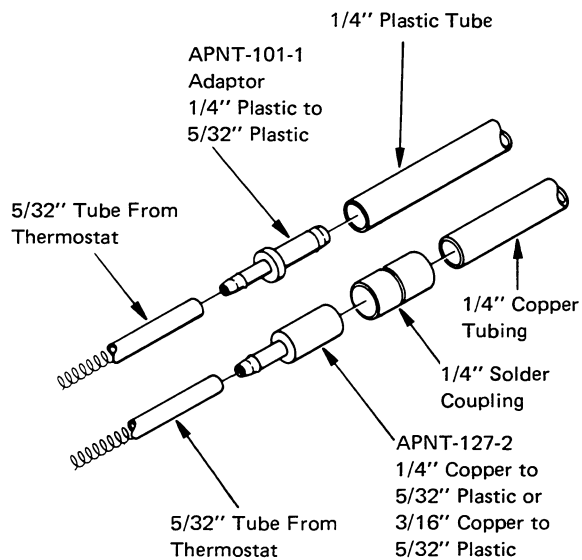


Figure 5

To mount a thermostat on a AT-507 mortar joint fitting (Figure 1) proceed as follows:

1. Remove the screws holding the protector block in place. Pry out and discard the protector block. Pull out and discard the short piece of plastic tubing inserted in the connector head.
2. Attach the thermostat mounting plate to the connector head with the two flathead screws provided. Be sure the mounting plate is vertical.
3. Measure 7/8-inch from the back of the thermostat and cut the tubing at a 45° angle to make the tubing slide into the connector head easily. Remove the coil spring from the tubing and discard.
4. Insert two 3/4-inch lengths of copper tubing, supplied with the thermostat into the plastic tubing to stiffen the plastic tubing so it can be installed easily.
5. Place the fiber board insulator over the tubes on the back of the thermostat.
6. Lubricate the outside of the two plastic tubes (this applies to the mortar joint fitting only) with water or glycerin. Be sure that none of the lubricant gets inside the tubing.
7. Insert the tubes into the connector head. Slightly rotate the tubes back and forth, and push firmly into the sockets at least 1/4-inch.
8. Fasten the thermostat to the mounting plate with Allen screws provided, and tighten evenly.

CHECKOUT

After installing the thermostat, verify proper operation as follows:

1. To check the nozzle and/or restriction, turn the setpoint dial to 85°F. If the thermostat is direct acting, the output pressure will drop. If the thermostat is

reverse acting, the output pressure will rise. Turn the setpoint dial to 55°. If the thermostat is direct acting, the output pressure should rise. If the thermostat is reverse acting, the output pressure will drop.

Note: The amount of rise or drop in the output pressure may vary depending on the ambient temperature in the test area. If output is always 0 psig, the restriction may be plugged. If output is always equal to supply or unable to decrease below 3 psig, the nozzle may be plugged.

2. To check for active thermal element, adjust the setpoint knob to obtain approximately 8 psig branch output. Slightly warm the element with your hand or breath. A direct acting thermostat will increase output pressure. A reverse acting thermostat will decrease output pressure. If the thermostat fails to function properly, refer to **REPAIR**.

RUN/ADJUST

Theory of Operation

These thermostats are piloted relay devices incorporating an internal pneumatic feedback principle which permits the use of low mass bimetal and minimum leak from the nozzle-restriction side of the circuit. This provides maximum sensitivity with minimum air consumption. Operation may be understood by referring to the schematic diagram in Figure 6.

The supply air pressure (1) is channeled from the main chamber through the restriction (2) into the nozzle (3).

The nozzle-restriction combination controls the pressure to the pilot diaphragm of the pneumatic relay. The bimetal positions the nozzle lever over the nozzle to regulate the pressure in the pilot chamber. The force exerted against the pilot diaphragm (4) actuates the relay part of the system.

The relay is operated by the pressure on the pilot diaphragm as follows:

An increase in pressure on the pilot chamber diaphragm (4) overcomes the preload force on the pilot diaphragm spring (5), the main valve plug spring (6) and the air pressure on the plug (7), to move the supply main valve plus off its seat. Supply air pressure then flows into the branch chamber (8). The resulting pressure change is transmitted to the feedback chamber (9), where it exerts a force on the feedback plunger (10), moving it up. The force is transmitted to the nozzle lever through the feedback levers (11 and 12) and spring (13) to balance the force exerted by the bimetal. This action provides a linear relationship between temperature at the bimetal and branch line pressure.

A reduction in pressure on the pilot diaphragm allows the diaphragm to move away from contact with the bleed valve seat (14). The bleed valve seat then moves off the main valve plug and allows air from the branch chamber to bleed through the bleed valve and out to atmosphere through exhaust port (15). This reduces the force in the feedback chamber until it is balanced by the reduced bimetal force.

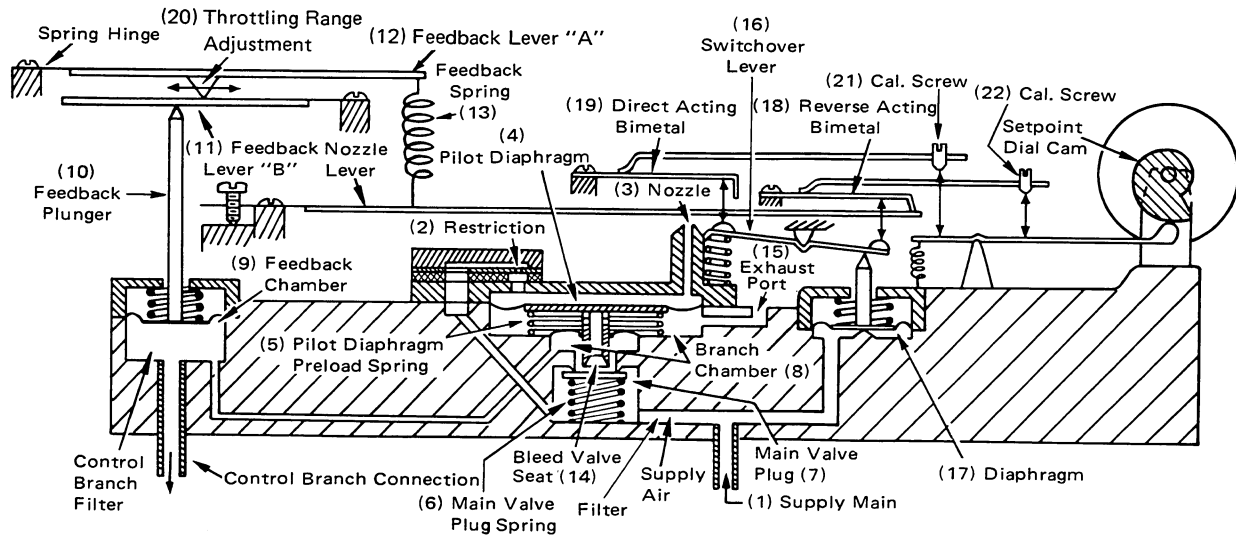


Figure 6

At that point the pilot chamber pressure is just adequate to cause the bleed valve to seat on the main valve plug and stop flow of air out of the branch.

Changeover: In the thermostat, two bimetals are mounted on the bimetal bracket. On TK-1201, one bimetal is direct acting and the other is reverse acting. On the TK-1301 and TK-1601, both are direct acting. The bimetal which is in control of the thermostat is determined by the position of the switchover lever (16). The position of the switchover lever is determined by a spring-loaded diaphragm (17), which is actuated by the supply main pressure. When the pressure is 15 psig, the piston is at the bottom of its stroke. At this position, the bimetal (18) rests on the nozzle lever and the bimetal (19) is raised off the nozzle lever by the change-over lever. When the main pressure is changed to 20 psig, the diaphragm overcomes the spring force and moves the piston to its upper limit, moving the over lever to allow the bimetal (19) to rest on the nozzle lever and lift the bimetal (18) off the nozzle lever.

Adjustments

Throttling Range: The throttling range is set at $4F^{\circ}$ per 10 psi control pressure change. It should be set at the lowest value which will allow the thermostat to control the system without cycling under normal load conditions. The most satisfactory setting will vary with the type of system being controlled.

If the throttling range of the thermostat as shipped is not satisfactory, proceed as follows:

1. Measure temperature at sensing element. This should be a stable temperature.
2. Rotate setpoint dial to this temperature.
3. With 15 psig supplied to thermostat, adjust calibration screw until 3 psig is read on branch test gauge.

4. Rotate the setpoint dial in a direction which raises the output until 13 psig is read on the branch gauge.
5. The difference between the setpoint dial readings in Step 2 and 4 is the throttling range of the thermostat.
6. If the throttling range in Step 5 is not that desired, move the throttling range slider (Figure 7) in the appropriate direction and repeat Steps 2 through 5 until the desired throttling range is obtained.

The calibration of the thermostat should be checked after the throttling range has been changed.

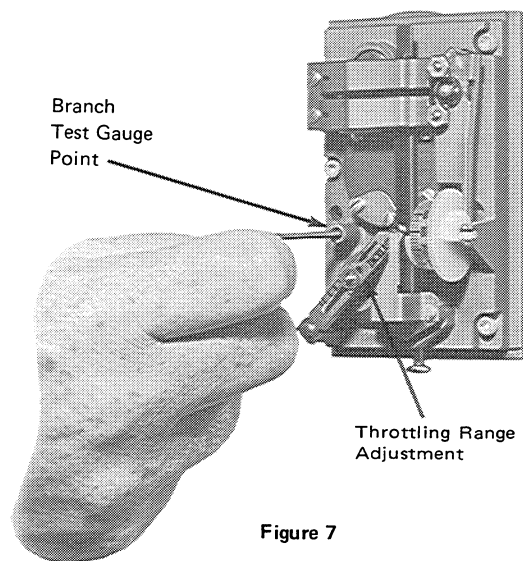


Figure 7

Calibration: As a nominal calibration, the branch line control pressure should be 8 psig when the setpoint is equal to the room temperature indicated by an accurate thermometer. On some applications, a value other than 8 psig will be required to get the desired control results. In this case, change the 8 psig designation used in the calibration procedure.

x
x

CAUTION

The thermal element of the room thermostat is very sensitive to temperature change. Do not affect its temperature by touching the bimetal or breathing on the thermostat. When calibrating the instrument, observe the room temperature frequently and reset the setpoint dial if required.

x
x
x

1. Remove the thermostat cover by loosening the cover screw.
2. Using a 5/64-inch Allen wrench, unscrew (counterclockwise rotation) the test point screw one full turn (Figure 7).
3. Attach the test gauge rubber seal to the boss, as shown. Using a rotary motion, push the gauge on as far as it will go (1/4-inch minimum). See Figure 8. The tubing will support the test gauge in a position where it will be easily read. The supply pressure to the thermostat should be 15 psig.
4. Adjust the setpoint dial to the room temperature as indicated on the test thermometer.
5. With a .048-inch six spline wrench, turn the calibration screw (Figure 9) clockwise if the controlled pressure is above 8 psig and counterclockwise if it is below 8 psig. Adjust the screw until the controlled pressure is 8 ± 1 psig.

Note: The hex nuts on the calibration screws are tension devices only. They should not be loosened to make an adjustment.

The TK-1001, and TK-1101 thermostats are now calibrated. Proceed to Step 4 below. Bimetal (18) on TK-1201, 1301 and 1601 is also calibrated. To calibrate bimetal (19) proceed as follows using a special tool AL-80 or a small screwdriver.

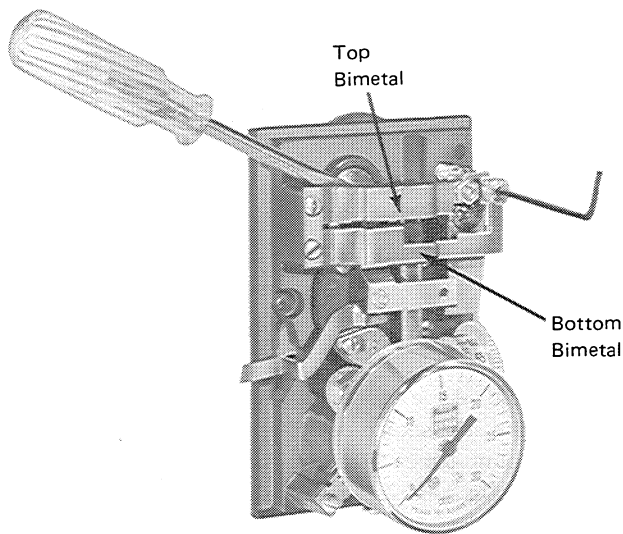


Figure 8

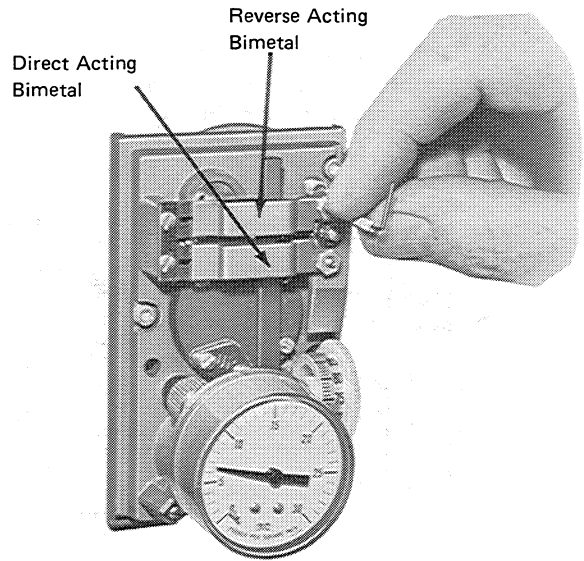


Figure 9

1. Insert the blade of the tool or screwdriver between the switchover plunger and the switchover lever shown in Figure 8. The top (18) bimetal should be approximately 1/32-inch off the lever and the bottom (19) bimetal should be in contact with the lever.
2. With a .048-inch six spline wrench, turn the calibration screw clockwise if the controlled pressure is above 8 psig and counterclockwise if the controlled pressure is below 8 psig. Adjust the screw until the pressure is ± 1 psi.
3. Manually switch the thermostat several times by removing and reinserting the AL-80 or screwdriver and observing the branch line pressure. If it varies beyond the limits, repeat the calibration.
4. Remove the test gauge.
5. Turn the test point screw clockwise to tighten.
6. Replace cover.

MAINTENANCE

The pneumatic thermostat requires no routine maintenance.

REPAIR

Field repair of pneumatic thermostats is not recommended. However, if the thermostat output pressure is 0 and it cannot be corrected by calibration, the restriction should be checked. Hold the restriction plate up to the light and check the .0075 hole. If the hole is blocked, the restriction plate must be replaced. The filter should be replaced at the same time. If the hole is not blocked, then the thermostat should be replaced.

