MegaControls

Why Are Heat Anticipators (Accelerators) Used in Bimetal Thermostats?

A bimetal sensing element consists of 2 dissimilar metals which expand and contract at different rates in response to changes in room temperature. The bimetal is calibrated such that the amount of deflection is directly proportional to the change in room temperature. As the bimetal deflects, it exerts a force on a mechanical contact that actuates the closing of the switch contact to allow the flow of electric current to the controlled device.

Owing to its inherent thermo characteristics, bimetal thermostat has relatively high temperature differentials, typically 3 K in room sensing for HVAC applications. These differentials are called mechanical temperature differentials.

However, operating temperature differential of 1 K is more acceptable to room occupants in the HVAC industry. To compensate for the relatively high mechanical temperature differential, heat anticipation is used. Heat anticipation is based on supplying a small amount of heat input to the sensing element and causing the thermostat to open or close slightly before the room temperature reaches the set point. It “anticipates” the thermal lag from the mechanical parts and adds a small amount of heat to open or close the switch contacts before temperature overshoot or undershoot occurs.

Heat anticipators are electrical resistors with appropriate values installed in close proximity to the bimetal element. When energized, they will generate enough heat to accelerate the changeover action of the bimetal to reduce the temperature swings. In practice, when the ambient temperature changes 1 K (this is called the operating temperature differential), the bimetal will change action with its contacts switched from open to close or from close to open.

Because of the heat generated inside the thermostat enclosure, the bimetal temperature always changes faster than the ambient temperature, leading to a fixed temperature relationship between the two. The heat generated by the anticipators must be calculated in such a way that this fixed temperature relationship is maintained.

In cooling application, the anticipator is only energized when the air conditioning unit stops supplying cooling to the room. In heating application, the anticipator is only energized when heating is supplied to the room.

Another factor in the accuracy of bimetal thermostats is cycle rate. It has been calculated both experimentally and theoretically that the higher the cycle rates, the less temperature swings the thermostat has. An optimal goal for a bimetal thermostat cycle rate is 6 cycles per hour.