MEASURE 4.3.4.2 Install deadband thermostats.

RATINGS

New Facilities	Retrofit	O&M
A	B	

SUMMARY

Inexpensive. Usually easy to install. Different types provide different control characteristics.

SELECTION SCORECARD

Savings Potential	$ $	$		
Rate of Return, New Facilities	% %	%	%	
Rate of Return, Retrofit	% %	%		
Reliability	✓ ✓	✓		
Ease of Retrofit	☺ ☺	☺		

Often the easiest way to achieve temperature deadband is to install a deadband thermostat. The purpose of a deadband thermostat is to insert a range of temperature between heating and cooling in which no conditioning occurs. In retrofit applications, a deadband thermostat is used to replace a single thermostat that controls both heating and cooling sequentially. Deadband thermostats are available for pneumatic, electric, and electronic control systems.

Deadband thermostats correct most of the causes of energy waste listed in Measure 4.3.4. Most deadband thermostats do not save fan energy, but some models are available with a fan switch and connections that allow the thermostat to turn off the fan when there is no heating or cooling.

Types of Deadband Thermostats

A deadband thermostat is essentially two independent thermostats in one housing. One thermostat controls heating and the other controls cooling. There are several different versions of dual-element thermostats. The differences between them are important, as follows.

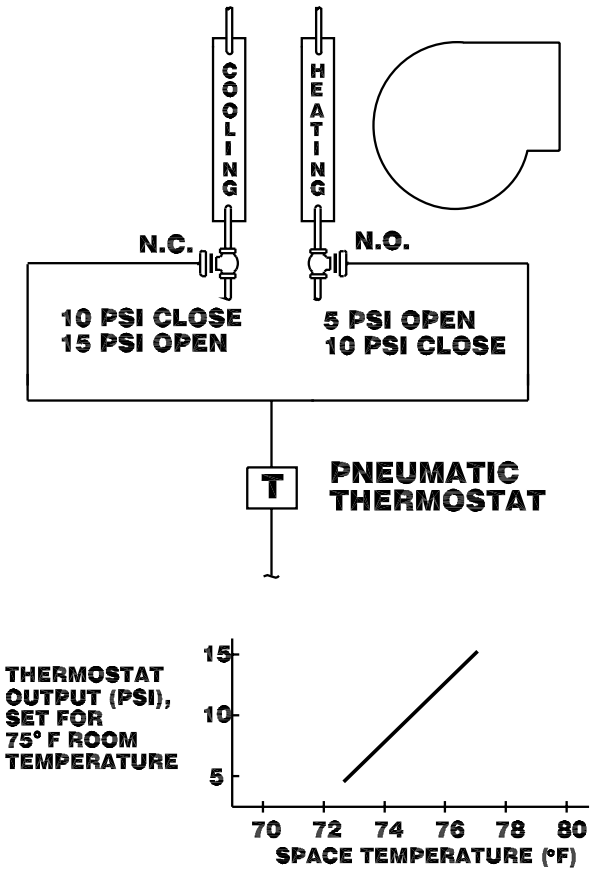

Fig. 1 Typical pneumatic temperature control The graph shows the strength of the output signal as the space temperature changes.

■ Fixed-Deadband, Dual Output Signal

The most common type of deadband has a single temperature setting. The occupant cannot control the deadband interval.

The thermostat produces two separate control signals, one for the heating equipment and one for the cooling equipment. Some deadband thermostats allow you to adjust the sensitivity of each element individually. This is important if the heating and cooling equipment have different control characteristics. Also, some models allow one element to be connected direct-acting, while the other element is connected reverse-acting. ("Direct-acting" means that the output signal rises as the temperature rises. "Reverse-acting" means the opposite.)

Most deadband thermostats allow the staff to adjust the deadband interval by removing the thermostat cover. Get this important feature.

Figures 1 and 2 show how a deadband thermostat works. Figure 1 is the same type of system used as an example in Measure 4.3.4.1, without deadband. The graph in Figure 1 shows how the pressure output signal of the thermostat changes with space temperature, when the thermostat is set for a space temperature of 75°F.

Figure 2 shows how the control behavior changes when installing a deadband thermostat. One element in the deadband thermostat controls the heating valve, and the other controls the cooling valve. The graph in Figure 2 shows the pneumatic pressure output from the two elements when the thermostat is set to maintain a space temperature of 75°F. The graph shows that both valves are closed between 73°F and 77°F.

Electric and electronic (digital) deadband thermostats operate in a similar manner, except that they

respond to electrical input signals rather than to air pressure.

■ Fixed-Deadband, Single Output Signal (Hesitation Thermostat)

A "hesitation" thermostat is a variation of a deadband thermostat that has a single output signal. The name derives from the fact that there is a plateau, or hesitation, in the output signal within the deadband temperature range. Figure 3 shows how a hesitation thermostat works in our example system.

In many applications, you can use either a conventional deadband thermostat or a hesitation thermostat. Hesitation thermostats do not have the control signal flexibility of the dual-output type. For example, use them where heating and cooling are both provided by hydronic coils having similar control valve characteristics.

■ Separately Adjustable Heating and Cooling Temperatures

Some thermostats have separate temperature settings for heating and cooling. The heating and cooling settings are interlocked so that the heating temperature is always lower than the cooling temperature. These are not true deadband thermostats, because there is no way to maintain a fixed deadband when either temperature setting is changed.

The amount of deadband is under the control of the occupants. The advantage of this type is that it gives occupants more explicit control of heating and cooling temperatures. The disadvantage is that occupants may not exploit the energy saving potential of the thermostat. Consider using this type in environments where occupants are permanently assigned to spaces, especially where a single responsible individual controls the thermostat.

How to Set the Deadband

Set the deadband as high as the thermostat allows. Reduce the deadband incrementally if there are legitimate comfort complaints. Expect the maximum acceptable deadband to differ between spaces, especially between interior and perimeter spaces.

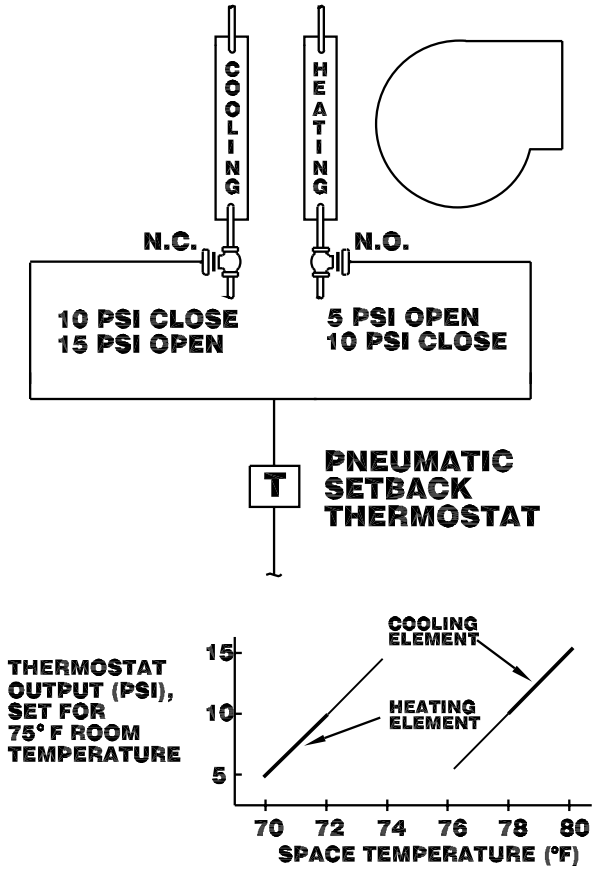

Fig. 2 Dual-output deadband thermostat This is the most common type of deadband thermostat. It has two separate sensing elements, each with its own output characteristics and adjustments. The cooling element controls only the cooling coil, and the heating element controls only the heating coil.

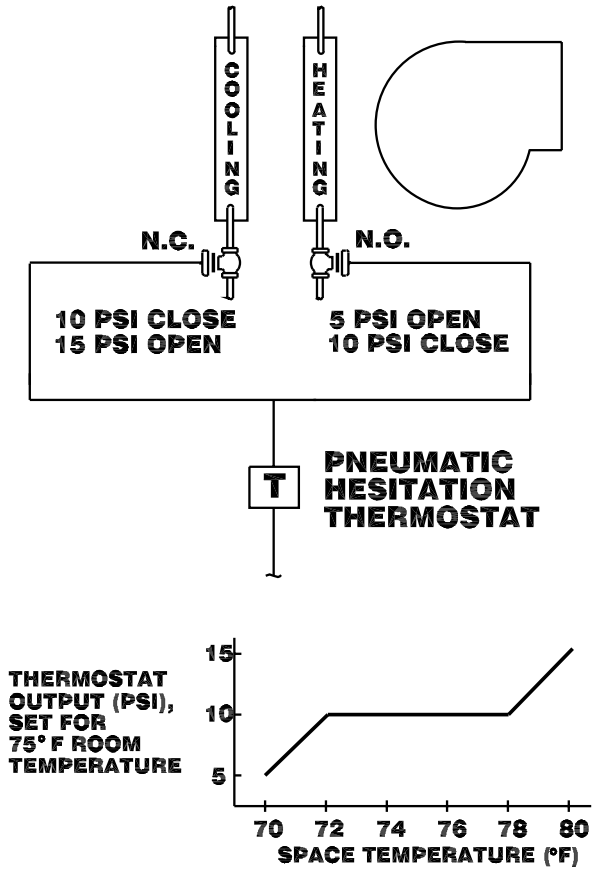

Fig. 3 Single-output (hesitation) deadband thermostat This variation has a single output that goes to both coils. It is less versatile than the dual-output type.

Install Thermostat Placards

This Measure depends on occupants to set the space thermostats efficiently. Therefore, an effective instruction placard is an integral part of each thermostat installation. See Measure 4.3.1 for details.

ECONOMICS

SAVINGS POTENTIAL: *1 to 10 percent of conditioning cost. The higher percentages occur in milder climates, where the overall energy consumption is lower.*

COST: *Deadband thermostats cost less than $100. In retrofit applications, they can replace the original thermostat in an hour or two.*

PAYBACK PERIOD: *Less than one year, to several years.*

TRAPS & TRICKS

SELECTING THE THERMOSTATS: *For most applications, select true deadband thermostats, the kind that have a fixed deadband setting that can be changed only by the maintenance staff. Select units that make it easy for occupants to set the space temperature.*

EXPLAIN THEM: *To forestall vandalism and comfort complaints, install instruction placards that tell occupants how the thermostats control the space temperature. See Measure 4.3.1.*

STAFF TRAINING: *The energy saving is determined by the person with the small screwdriver who sets the deadband in each thermostat. Make sure that the staff are trained to set the maximum acceptable deadband. Put clear instructions in the plant operating manual.*