MEASURE 4.4.1 Set the cooling coil discharge at the highest temperature that maintains satisfactory cooling.

RATINGS

New Facilities	Retrofit	O&M
		A

SUMMARY

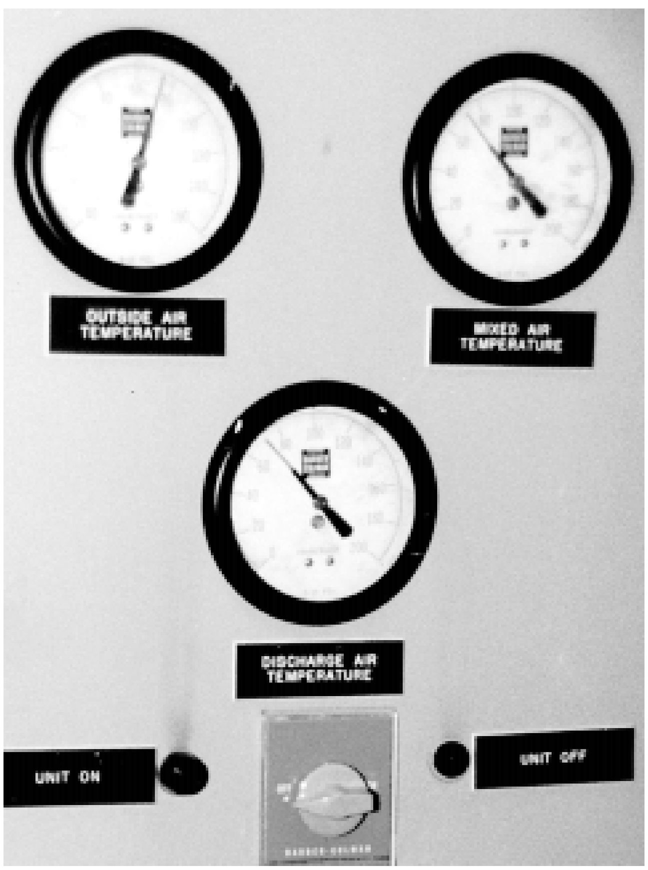
Save a lot of energy just by turning a screw.

SELECTION SCORECARD

Savings Potential	$ $ $
Rate of Return	% % % %
Reliability	✓ ✓
Ease of Initiation	☺ ☺ ☺

The amount of energy that is wasted by reheat depends on the cooling coil discharge temperature in the air handling unit. A lower chilled air temperature forces each terminal unit to expend more energy to re-warm the air to the appropriate supply temperature for the space. Therefore, the simple act of raising the chilled air temperature is a powerful energy conservation action. And, it is easy to accomplish. See Figure 1.

The optimum chilled air temperature changes continuously, unless the cooling load is constant. Don't expect the staff to keep resetting the chilled air manually as conditions change throughout the day. The best they can do manually is to reset the chilled air at intervals, perhaps on a seasonal basis. Subsidiary Measure 4.4.1.1 improves on this Measure with continuous automatic resetting of the chilled air temperature. Use manual adjustment as a stopgap method until you install automatic reset controls.



WESINC

Fig. 1 Chilled air temperature control Just by setting this knob the right way, you can save a large amount of energy in a reheat system.

Energy Saving

Let's calculate the energy saving at an individual terminal unit under typical conditions. Here are the conditions:

- the terminal unit delivers 1,000 CFM
- the space is cooled to 75°F
- the cooling coil maintains a supply air temperature of 55°F
- the air is dry enough so that all the cooling load is sensible
- the cooling load in the space is half its maximum, so that a supply air temperature of 65°F would suffice at this particular moment.

This table shows the effect of raising the chilled air temperature:

	Supply Air Temperature		
Energy Input, BTU/hr	**55°F**	**60°F**	**65°F**
cooling energy to space	10,800	10,800	10,800
cooling energy from coil	21,600	16,200	10,800
reheat energy	10,800	5,400	0
total input energy	32,400	21,600	10,800

This example shows how horribly wasteful reheat systems can be. At the original chilled air temperature of 55°F, the system consumes three times as much energy as is needed to cool the space. Experience with actual buildings confirms that reheat systems really are this wasteful.

Reheat systems are most wasteful at low loads. In fact, a reheat system consumes the most energy in absolute terms when the space load is zero, because the output of the cooling coil must be completely cancelled with reheat energy. In most climates, the cooling requirement is only a fraction of the design maximum

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load for much of the time. This fact keeps the reheat system in a very wasteful mode of operation.

How to Maximize the Chilled Air Temperature

Most reheat air handling systems have a chilled air thermostat that controls the cooling coil discharge temperature. You can reset this thermostat easily with a pocket screwdriver. If you have a centralized energy management system, you can achieve the same result by tapping on a keyboard.

Designers sometimes shave installation cost in hydronic reheat systems by omitting the control valve from the cooling coil. In such cases, the chilled air temperature is tied to the chilled water temperature. To raise the chilled air temperature independently, install a cooling coil valve that is controlled by a supply air thermostat. If you go to that expense, spend the additional money to install a reset controller, as recommended by subsidiary Measure 4.4.1.1.

Limitations Caused by Load Diversity

Your ability to raise the chilled air temperature may be seriously limited by diversity in the cooling loads of the different terminal units. The chilled air temperature can be set no higher than the temperature needed by the terminal unit having the largest cooling load.

A single space that has inadequate cooling can thwart your attempt to raise the chilled air temperature. The space may have an exceptionally high load, or the terminal unit serving the space may be undersized, or a control defect may limit the output of the terminal unit. As you raise the chilled air temperature, be aware of which spaces run out of cooling capacity first. Examine the cooling of these spaces to see if any of these situations exists. For example, if a space with high solar gain requires exceptionally low chilled air temperature, try shading the space. Or, replace the terminal unit with one having higher air flow capacity. (Of course, the former solution is more efficient.)

Load diversity depends on the way the building is zoned. For example, if a reheat system serves a zone with extensive glazing on both the east and west sides of the building, then the load remains high for most of the day. This illustrates a major reason to pay attention to zoning when laying out an air handling system. Seize this opportunity in new constructions and renovations, because changing zoning on a retrofit basis is expensive.

Effect on Humidity

Raising the supply air temperature setting causes the coil surface to be warmer, so the coil does not condense as much moisture out of the air. As a result, raising the chilled air temperature allows the humidity inside the building to rise, assuming that the air entering the coil is humid. The dew point of the supply air is always somewhat lower than the supply air temperature. For example, if the supply air temperature is 65°F, the dew point may be 60°F. The difference depends on the surface temperature of the cooling coil surface, the bypass ratio of the coil, and the percentage of outside air.

Problems with excess humidity may arise when the weather is mild and humid. They may also occur if a large amount of moisture is released within the space, for example, if there is a lot of decorative foliage. Basements are a special humidity problem, because contact with the earth keeps basement walls cool enough to condense moisture out of the air. Lower humidity may be needed to satisfy comfort standards in posh environments. Some manufacturing and storage applications require exceptionally dry air. In such situations, be cautious about reducing the chilled air temperature.

Humidity is not a problem during cold weather because cold outside air cannot carry much moisture, and air exchange keeps internal humidity tied to the external humidity. Humidity is not a problem during warmer weather if mechanical cooling is used, because operation of the cooling equipment dries the air.

Two factors keep humidity from becoming a problem in most locations, even during mild weather. One is that the outside air temperature swings widely during the day in most locations, so that conditions that create high internal humidity persist only for a few hours, usually not long enough for humidity to become objectionable. The normal operation of cooling equipment during part of the day dries out the spaces.

The other helpful factor is heat gain. In a building with typical levels of heat gain, the heat gain alone usually keeps humidity from becoming excessive. As an extreme example, consider a rainy day in New Orleans with the outside temperature at 65°F. If heat gain (from solar gain, lighting, etc.) provides a temperature rise of 8°F, the relative humidity inside the building can be no higher than 77%, even if the air handling system is turned off. If the cooling system operates at all, even without reheat, the relative humidity in the space will fall even lower.

Explain It and Keep Reminding!

This activity is easily forgotten. Therefore, document the procedure in a manner that keeps it in the eye of the plant operators. Install an effective placard at the discharge air thermostat that explains how to set it. See Reference Note 12, Placards, for details of effective placard design and installation.

ECONOMICS

SAVINGS POTENTIAL: *10 to 40 percent of cooling and reheat energy.*

COST: *Minimal.*

PAYBACK PERIOD: *Immediate.*

TRAPS & TRICKS

TRAINING AND DILIGENCE: *This Measure depends on the diligence and skill of the plant operators to keep the chilled water temperature as high as possible. The cooling load changes widely over the course of a day, so almost continuous attention is needed to achieve the maximum saving. Make sure that plant operators are trained and understand the importance of the adjustment. Put clear instructions in the plant operating manual. Install a placard at the thermostat that identifies it and explains its purpose. Schedule periodic checks of the procedure.*

CHOICE OF METHOD: *If you cannot be sure of maintaining effective staff performance, install an automatic chilled water reset controller, as described next. In fact, there are few instances where manual control is more than a stopgap approach.*

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