

Kevin Kelly's Letter to the Editor at **Home Energy** Regarding Humidity Includes Humidity Reference Table

OTHER FACTORS

I agree with your statement “the easiest-to-use thermostat is worthless in the hands of someone who doesn’t care to use it to save energy.” In addition, the easiest-to use thermostats also require an operator with the smarts to program them and an operator with visual acuity and decent illumination to calibrate them--So much for a thermostat programmer job description.

I submit the attached Humidity Table to indicate that in cold weather heating climates using zoned heating (with or without programmable thermostats) or manually lowering the temperature in a building or a section of a building can cause water activity, condensation and subsequent mold development in the coolest areas of the building. “Contrary to popular belief, surface condensation is not necessary for fungal defacement. Water activity above a threshold value suffices for mold growth” [1]. When relative humidity is high, temperature fluctuations may cause water activity, condensation or mold growth. God forbid that an over zealous energy saving thermostat programmer does not set a large enough temperature differential to causes water activity. Water activity and condensation occur because air is holding all the water vapor it can in these cooler areas of the building where the temperature has been lowered.

This water activity is a significant problem in America where mold and asthma are major public health issues. The question arises as to the potential cost benefit ratio of energy savings vs. medical costs using programmable thermostats. Water activity also raises the point about the value of these thermostats for heating vs. cooling purposes.

Energy Star certification to endorse programmable thermostats for heating energy savings may be dubious at best. But in any case, review for certification of thermostats should consider the whole story, including heating, cooling, socio-economic and public health factors.

On the other hand, as a public health issue and in light of the possibility of mold developing in cool areas of buildings, there could be an argument made for having zoned heating with thermostats in various areas of a building synchronized at the same temperature to ensure minimizing temperature differences while decreasing the possibility of water activity. When I consider the use of programmable thermostats in cold climates I think, Mold? – Of course!

1. Hens, H.L.S.C.P.D. *Mold in Dwellings --A Building Physics Related Approach*. in *9th International Conference on Indoor Quality and Climate*. 2002. Monterey, CA

Humidity Table

Pounds of water per 100 pounds of dry air at different temperatures and relative humidities.
 100 pounds of dry air equals 1,333 cubic feet of dry air at 70° F. This is equal to the amount of air in a room 11 feet wide, 15 feet long, and 8 feet high.

AIR TEMPERATURE In Degrees F	RELATIVE HUMIDITY PERCENT							WALL OR WINDOW TEMP
	100%	80%	60%	50%	40%	30%	20%	
160° F	22.90			15.00				
150° F	22.00			11.00				
140° F	15.00			7.50				65° F
130° F	11.00			5.50				60° F
100° F	4.30	3.50	2.60	2.20	1.70	1.20	0.87	55° F
90° F	4.10	2.50	1.90	1.60	1.20	0.93	0.62	45° F
80° F	2.20	1.60	1.40	1.20	0.90	0.68	0.45	Note:
70° F	1.60	1.30	1.00	0.83	0.65	0.48	0.32	Lines
60° F	1.05	0.86	0.65	0.54	0.42	0.32	0.21	indicate
50° F	0.78	0.62	0.47	0.39	0.31	0.23	0.15	Dew point
40° F	0.53	0.42	0.33	0.27	0.21	0.16	0.11	on cool
30° F	0.35	0.28	0.22	0.18	0.14	0.10	0.07	surfaces
20° F	0.24	0.19	0.15	0.12	0.09	0.07	0.05	at these
10° F	0.17	0.13	0.10	0.08	0.07	0.05	0.03	temperatures.
0° F	0.11	0.09	0.07	0.06	0.04	0.03	0.02	

Using The Chart

The lines indicate the Dew Point, the temperature at which water condenses. For example, moisture appears on the wall or window whose temperature is 55° F when the adjacent living area has a 70° F air temperature and 50% relative humidity (RH).

Humidity Note:

One shower adds one pound of moisture to the air.

This is enough to make foggy even very dry air below 65° F air that was 31% RH (which is average for a house), and even 80° F air at 50% RH, typical say of a bathroom.

Hot Air Is Thirsty Air:

Example: Cold air holds less moisture (absolute humidity) than warm air. Although its relative humidity may be high, it will pick up much more vapor when warmed and still be at the same or lower relative humidity.

At 70° F, a building with a relative humidity (RH) of:

- 30% will cause condensation to form on surfaces at 38°F.
- 40% will cause condensation to form on surfaces at 43°F.
- 50% will cause condensation to form on surfaces at 53°F.*

*This temperature may be found in below grade areas in buildings in climate zones 5, 6 and 7.