

# Relative Humidity & A Few Ways to Reduce It

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*“Make daily deposits to your box of knowledge, soon it will have many reference cards.”--Randal S. Ripley*

### **Does a hot air system remove the moisture from the air circulating through it?**

If this question means that it reduces the actual moisture content in the air as it passes over the heat exchanger, the answer is “no”.

When an air sample is heated, the amount of moisture in the air sample remains the same. This is referred to as the **absolute humidity** and is measured in grains per pound of air or as grains per some unit volume. It takes 7,000 grains of moisture to make 1 pound of water.

When water vapor is heated, what do we get? You guessed it, water vapor. There is no change of water quantity; therefore the amount of water vapor in the air sample entering the heat exchanger will be the same amount in the supply air to the conditioned space.

You may wonder if what I am saying is true, why is there an increase in static electricity shocks, cracking furniture, dry skin and nosebleeds, all sign of low humidity levels during the heating season?

The answer for this is that while the absolute humidity doesn't change, the relative humidity does.

**Relative Humidity** is defined as the ratio of water-vapor pressure—amount currently in the air to the saturation-vapor pressure—the amount the air can hold—at a given air temperature. What?

If you were holding a sponge that was completely saturated with water, meaning if you added one more drop of water it would drip from the bottom of the sponge, it can be said the sponge is now holding the maximum amount of water that it can and its relative humidity is 100%.

Now say the sponge just suddenly doubled in size. The size of the sponge, its ability to hold water and the relative humidity have changed but the amount of water in the sponge is the same.

When you doubled the size of the sponge, you are also doubling the amount of water it can hold. Since you didn't add anymore water, the relative humidity is now only 50%.

When air is heat it expands and increases its ability to hold moisture. This causes the relative humidity to drop.

The reason our skin, nose and eyes, furniture, etc, dry out under low humidity conditions is because the human body or anything else that contains moisture will release this moisture at a higher rate as the relative humidity goes lower.

The reason we use humidifiers is not to replace moisture that is supposedly removed from the air by the furnace, but to add moisture to raise the relative humidity of the conditioned space.

So now you know that when air is heated its ability to hold moisture increases, well the opposite is also true, as air is cooled its ability to hold moisture decreases.

When you set a glass of ice water on the counter on a hot day it will get wet on the outside of the glass, right? Where is that water coming from? It certainly isn't coming from inside the glass.

The water vapor (humidity) in the air is coming in contact with the glass and being cooled to its dew point, causing the water to condense from a vapor to a liquid.

**Can a system with a variable speed motor dehumidify better than a multi-speed motor?**

An air conditioning system does some dehumidifying as a byproduct of the cooling process but is not designed to control humidity below 50% on a continual basis.

Today's high efficiency systems struggle to control humidity and provide energy efficiency at the same time.

The larger evaporator coils in these higher efficiency systems have more evaporative space and the industry still uses the 400 CFM per ton rule, which can cause higher coil temperatures and less ability to remove moisture.

The upside of these larger coils is they also can remove more humidity from the air than the smaller 10 SEER coils when airflow is reduced making the coil colder.

The **Goodman** variable speed unit has the ability for the motor to ramp up to 50% of the required airflow for 30 seconds; it will then ramp up to 82% of the required airflow for 7 1/2 minutes and finally go to 100% of the airflow for the remainder of the cycle.

By reducing the airflow over the coil, the coil temperature will go further below the **dew point** (the temperature that water vapor will condense to liquid if cooled any further) removing more humidity from the air than the normal operating cycle.

Most of the variable speed units on the market today have some form of super dehumidification.

### **Why is a TEV (thermal expansion valve) better for humidity removal than a fixed bore (piston) metering device?**

When a unit doesn't have capacity control such as a fixed bore metering device, most humidity control issues occur at part load (lower dry bulb temperatures but still having high humidity) conditions.

Because we use dry bulb thermostats to control the equipment, run times will be shorter on part load cycles which will also reduce humidity removal.

Oversized equipment will make part load conditions even worse for the occupant because it will bring the space to its set dry bulb temperature. Short run times only

remove sensible heat (heat added or removed to raise or lower temperature) but does nothing about removing the latent heat (heat added or removed to change the state such as ice to water, water to vapor, or vice versa) in the water vapor. In a nutshell, less run time equals less humidity removal.

Changing the metering device to a thermal expansion valve will give maximum evaporator capacity at part load conditions because it utilizes more coil surface for moisture control.

**Combination Temperature and humidistat's controls** can be used to help control humidity in cases of high humidity low load days.

These controls when they sense humidity outside the set parameters will change the system airflow speed from high (the normal A/C speed) to a lower speed (multi-speed motor required) to remove more humidity. They will cool to 3 degrees below set point if needed and then shut off. If the relative humidity is still high the unit will cycle again.

**Proper sizing of the unit is the most important thing a contractor can do. In hot, humid weather a properly sized unit will have longer run cycles, removing more humidity from the air.**

### **In case you're interested:**

Most experts agree that a range of 30-60 percent relative humidity is the safest and healthiest for keeping occupants from feeling the air is too dry or humid.

Humidity in basements should be regulated to 60 percent or less to prevent microbial growth.

Next month I will tell you the story of the human furnace. An understanding of how the body controls its temperature is necessary if you want to properly design, install, adjust and service equipment that aids the human body in its quest for personal comfort.

Join the email club is easy, just send me an email [randal@totalairsupply.com](mailto:randal@totalairsupply.com) and you will be added to the list.

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