



## **ProTEC™ NATURAL HUMIDITY PROTECTION DESICCANT PANELS**

### **Introduction**

HumiTEC Corporation has a number of products that use all natural, volcanic Zeolite crystals to address moisture, vapor and energy problems. One of HumiTEC's products is called a **ProTEC™ Natural Humidity Protection** panel and offers homes and buildings a very special benefit.

**ProTEC™ Natural Humidity Protection** supplements A/C systems by helping to remove residual moisture so cooling systems can operate more efficiently. The results are safer and healthier air, better energy savings, less maintenance, and improved comfort.

More importantly, **ProTEC™ Natural Humidity Protection** can help prevent mold, mildew, airborne allergens, odors, and the growth of dust mites and some insect infestations by reducing residual excess moisture levels in the air. Zeolite crystals function on an ionic molecular level – *a natural way to adsorb unwanted moisture.*

### **How It Works**

**ProTEC™ Natural Humidity Protection** is a passive unit with minerals that have a high affinity to capture water vapor molecules. It is based on pore (angstrom) sizes. Water vapor molecules are typically 3.2 angstroms in size. HumiTEC's Zeolites have an angstrom size from 2.5 to 5.0, so it has the capability of being **very effective at capturing (adsorbing) water vapor.**

Natural Zeolites of the blend we use have a tremendous internal surface area (per unit of mass). A single gram of our Zeolite can have more than 500 square meters of surface area. Therefore, just one **ProTEC™ Natural Humidity Protection** panel can have OVER 2 MILLION SQUARE METERS of surface area (*that's over 24 Million Square Feet*)! This means the potential for both adsorption and ion exchanges are extremely high!

The natural Zeolites used in **ProTEC™ Natural Humidity Protection** panels also have a high affinity for polarized substances such as water vapor. Zeolites have negatively charged ions, while water vapor molecules are positively charged. Therefore, water vapor molecules are captured and held by the Zeolite minerals during this naturally occurring cationic (cat•i•on•ic) process. The water vapor molecules are held until given off by heating the minerals.

Thus, by reducing water vapor, it also reduces the environment for molds, mildews, and other allergens (and other associated problems). HumiTEC's panels have been created by mixing Zeolites so their affinities match the job they are designed to do.

## TECHNICAL INFORMATION

### The Process

There are distinct advantages of using Zeolite to assist in the control of moisture. Zeolites, as used in **ProTEC™ Natural Humidity Protection** panels, work on a continual basis to adsorb moisture vapors (humidity). Within any area, there is a continuing cycle of vaporization and condensation. There is a buildup of moisture each time an air conditioner cycles off. Some of this moisture vaporizes and becomes a gas, some stays as condensation. Because **ProTEC™ Natural Humidity Protection** is always “on”, it will help to keep areas drier.

As **ProTEC™ Natural Humidity Protection** adsorbs water vapor from the airspace, moisture is also given up by the products, by people and by materials in the room in an attempt to reach vapor pressure equilibrium. **ProTEC™ Natural Humidity Protection** adsorbs moisture more strongly than the materials, products and people (comparing their heats of adsorption/desorption) and will continue to dry out the airspace until it reaches equilibrium with the surrounding air. Some of the humidity will evaporate into gas, which **ProTEC™ Natural Humidity Protection** adsorbs before it can turn into a liquid. When the air conditioning system is in the cooling mode, it will dehumidify the airspace. So, there is a definite relationship between **ProTEC™ Natural Humidity Protection** and the HVAC system.

Sorption of water vapor by **ProTEC™ Natural Humidity Protection** always generates sensible heat equal to the latent heat of the water vapor taken up, plus an additional heat of sorption that varies between 5 and 25% of the latent heat of the water vapor. Both higher temperatures and increased moisture content increase the vapor pressure at the surface of **ProTEC™ Natural Humidity Protection** panels. When the surface vapor pressure exceeds that of the surrounding air the moisture leaves. The moisture, released by **ProTEC™ Natural Humidity Protection**, is picked up by the air conditioning system.

### Vapor Pressure

All desiccants work by vapor pressure differences. Moisture is transferred to the Zeolite because of a difference between the water vapor pressure at their surface and that of the surrounding air. When the vapor pressure at the surface of a **ProTEC™ Natural Humidity Protection** panel is lower than that of the surrounding air, it will attract moisture. When the surface vapor pressure is higher than that of the surrounding air, **ProTEC™ Natural Humidity Protection** will release moisture (which is a natural desorbing mechanism). As the moisture content of a **ProTEC™ Natural Humidity Protection** panel rises, so does the water vapor pressure at its surface. At some point the vapor pressure at the surface is the same as that of the air – the two are in equilibrium.

### How Do Molecules Of Liquid Become Molecules Of Gas?

Phase transitions (going from a liquid to a gas) represent structural and energetic changes in a substance that requires energy. Some of the moisture will evaporate into gas. The gas that is above the liquid is called its vapor and it creates the pressure called vapor pressure. Each molecule in the liquid has energy, but not the same amount. The energy is distributed according to the Maxwell-Boltzmann distribution. Some molecules have more energy than others. High-energy molecules sitting at the surface of the water start in motion because of their energy. Some

have enough energy to break away from the attractive forces of the molecules around it. When this molecule moves away from the liquid surface, it becomes a molecule of gas. As more and more molecules become gas, more vapor pressure is made.

As the temperature goes up, there are more and more molecules with the right combination of energy and direction to break free of the liquid's surface. When equal numbers of molecules evaporate and condense per unit of time, then equilibrium is established. The change in phase going from liquid to gas is called vaporization. The reverse process, going from gas to liquid is called condensation. Vaporization is endothermic, condensation exothermic.

### **Reaction Time of Adsorbers – How Fast Do They Work?**

The conditions present when *ProTEC™™ Natural Humidity Protection* panels are installed will determine the speed of the results. The amount of moisture vapor adsorbed depends upon many variables:

- 1) Length of exposure,
- 2) Quantity of product used,
- 3) Quantity of moisture in the airspace,
- 4) Quantity of vapors already adsorbed, and
- 5) Air temperature.

The Zeolites we use are natural adsorbers, not absorbers. Adsorbers are different than absorbers because they do not undergo any chemical or physical change as they collect vapors.

### **Desorbing and Regenerating ProTEC™™ Natural Humidity Protection Panels**

In climates where there is winter heat being used, the *ProTEC™™ Natural Humidity Protection* system will completely self-dry. Meaning, no maintenance is required. It regenerates itself. In climates where there is no winter heat in use, simply remove *ProTEC™™ Natural Humidity Protection* system once a year and place it in the sun for about six hours. Exposing *ProTEC™™ Natural Humidity Protection* panels to heat (kinetic energy) allows molecules to escape, desorbing and regenerating the Zeolite. Drying and cooling the panels will prepare it to become efficient again. Cooling off the Zeolite inside the *ProTEC™™ Natural Humidity Protection* panel happens each time the air conditioner is blowing cold air. Cooling the Zeolite crystals reduces its surface vapor pressure so that it more readily adsorbs moisture. The greater the difference between the air and Zeolite surface vapor pressures, the greater the ability of the Zeolite to adsorb moisture from the air at that moisture content level.

### **Moisture/Air Dynamics**

The term relative humidity refers to the percentage of water vapor in the air at a given temperature. When the temperature is high, air can contain a great deal of water in the form of vapor, but when the temperature drops the vapor condenses into water. In other words, temperature is closely linked to relative humidity. Because cooler air cannot hold as much vapor as warmer air, a rapid lowering of temperature can result in condensation, causing the airspace as well as absorbent materials to become damp. The sudden lowering of temperature happens each time the A/C cycles on – which means condensation can form – it is the nature of the system. This makes a passive desiccant such as *ProTEC™™ Natural Humidity Protection* the perfect companion to all HVAC systems.

Because of the desiccant adsorption/desorption characteristics, everything in the system is dynamic (changing temperature and amount of moisture) rather than at a steady state and nothing is isothermal. Within a week after installing **ProTEC™ Natural Humidity Protection**, the quality of the airspace will improve and compressor run clocks will indicate run-time savings, which converts to KWH savings and energy savings.

### **Solving The Moisture Problem Will Solve The Poor IAQ Problems**

Experts in indoor air quality have identified moisture and molds as a priority to be addressed for improving indoor air quality. For optimum IAQ, design conditions are a very important factor to consider when selecting an HVAC system. The building structure should be evaluated to determine how moisture impacts the space: Number of people and type of activity, vapor barriers, fixed openings and number of door openings, type of building materials, level of outside humidity, etc. For safer moisture levels, simply add **ProTEC™ Natural Humidity Protection**. A well-engineered HVAC system and **ProTEC™ Natural Humidity Protection** is the solution to today's IAQ moisture problems.

### **The Answer To Energy Efficiency And Better Indoor Air Quality**

Much has been written lately about the devastating effects of high humidity, mold and allergens in buildings and the role of the heating, ventilation and air conditioning systems. In the last two decades, ventilation levels decreased as buildings were made tighter. This has created moisture load problems that conventional A/C systems could not remove. Therefore, A/C companies have increased ventilation rates but this increase in ventilation actually increased mold and other moisture-related problems, making this one of the biggest concerns in indoor air quality today. Excess moisture loads cannot be removed by ventilation alone, which creates a crucial need for a better method of dehumidification. The answer lies in the distinct advantages of **ProTEC™ Natural Humidity Protection** panels.

### **How Air Conditioners Work**

Air conditioners are designed to do two things: remove moisture from the air and lower the temperature. As the air is cooled, it loses its ability to hold moisture, so relative humidity can actually increase. This is the “problem” that **ProTEC™ Natural Humidity Protection** helps to alleviate because it continually adsorbs water vapor.

Methods Currently Used To Reduce Moisture Levels In A/C Applications:

- Oversizing Air Conditioning Systems
- Undersizing Air Conditioning Systems
- Reducing Fan Speed
- Reheat Methods

**1. Oversizing** A/C units will result in units that actually run a relatively short period of time. The air is cooled very quickly – the thermostat senses this and turns the unit off. Unfortunately, there is little opportunity for the moisture in the air to come in contact with the coil long enough to condense it thoroughly. The return air is cold enough, but very humid, resulting in the development of pollutants, mold and allergic reactions.

**2. Undersizing** A/C units will run longer since they do not easily satisfy the thermostats. Longer run cycles allow the system to remove more moisture from the air, but the indoor temperature may rise several degrees during the late afternoon. More energy is also used.

**3. Reducing the indoor fan speed** causes the coil temperature to drop and also allows the air to remain in the coil longer. This does lower the dew point of the exit air but system efficiency is significantly reduced.

**4. Reheat methods** result in substantial increases in electrical consumption, especially electric strip reheat, which can triple the required energy input. Reheat methods heat the air after it passes through the cooling coil. This allows the removal of moisture without overcooling the air. When reheating is used, the cooling ability of the A/C system goes to waste. Electric reheat uses over twice the electricity to reheat the air as it took to cool it. (*Hot gas bypass uses a hot refrigerant to reheat the air and electric strip reheat uses resistance coils.*)

All of the current methods to curb excess moisture have a downside. ***ProTEC™ Natural Humidity Protection*** has none of the downsides of the other methods used to remove moisture. It is a totally safe and environmentally friendly way to help remove the water vapor. Because ***ProTEC™ Natural Humidity Protection*** works continuously to adsorb moisture and vapors, it keeps areas from becoming saturated.

It improves overall comfort and health, protects against moisture damage and mold growth, and improves indoor air quality (IAQ). It conserves energy, is easy to install, has no operating cost, no byproduct waste, and has a fast ROI.

### **Saving Energy**

High efficiency units are often being recommended today to save energy. These high efficiency units sometimes sacrifice latent (moisture removal) capacity in order to increase their nameplate SEER ratings. (SEER stands for Seasonal Energy Efficiency Ratio and is a measure of energy efficiency.) A way that manufacturers increase SEER is to raise the cooling coil temperature. Unfortunately, this means that the air blown through the coil does not reach a low dew point temperature, leaving an unacceptable amount of moisture in the building. Added capacity on the A/C to overcool the air is required in order to remove the moisture. The additional energy required to reheat the air to comfortable levels eliminates the intended benefit of the SEER rating.

Another common way many people try to save energy is to totally shut off the A/C system when occupants are not present. Turning off the system is a way to invite high relative humidity. Moisture migrates from areas of high humidity to areas of low humidity. Water vapor transfers through materials (even walls) as a liquid or as a vapor. It moves as a liquid by capillary action and as a vapor through diffusion. Diffusion is vapor moving through materials due to differences in vapor pressure. If there is a difference in vapor pressure between the inside and outside of materials, moisture is going to move toward the lower humidity level. Keep the interior of the building free of excess water vapor by turning up air conditioning systems instead of turning them off and use your ***ProTEC™ Natural Humidity Protection*** panel.

### **Naturally Better. . .**

The principle of ***ProTEC™ Natural Humidity Protection*** is very simple – air conditioning operates more efficiently when energy is not wasted on excess humidity removal. Thermostats can normally be adjusted to save even more energy. Our panels/filters contain 100% natural Zeolite minerals, which is our way of very effectively using Nature to solve indoor air quality and moisture problems.