

# EFFICIENTLY MANAGE A BUILDING'S TEMPERATURE AND HUMIDITY LEVELS

DEHUMIDIFICATION CAPABILITIES OF MODEL L™ ROOFTOP UNITS



# **/** TABLE OF CONTENTS

## **01**

Efficiently Manage a Building's Temperature and Humidity Levels

## **02**

Increased Passive Dehumidification  
Enhanced Dehumidification Mode

## **03**

Humiditrol®+ Operation and Benefits

## **04**

Humiditrol®+ Versus Humiditrol (On/Off Reheat Systems)

## **05**

Increased Reliability  
A Modern Response to a Modern Problem



# THE NEW MODEL L™ ROOFTOP UNIT SERIES WITH ADVANCED DEHUMIDIFICATION TECHNOLOGIES.

The combination of temperature and humidity control are critically important to the comfort and indoor air quality of a building or space.

Occupant comfort and building health are directly tied to the HVAC's ability to control both the temperature and humidity of the building. ASHRAE recommends maintaining relative humidity levels of buildings between 40-60% to protect against the spread of mold and mildew, which can help control potential health and liability issues.

Model L's ultra-high efficiency rooftop cooling platform featuring variable-speed compressor technology and optional modulating hot-gas reheat can efficiently manage a building's temperature and humidity levels, while delivering premium comfort across a wider range of applications and operating conditions.

## / INCREASED PASSIVE DEHUMIDIFICATION

Passive dehumidification refers to the dehumidification of air that occurs during normal cooling operation when there is not a dehumidification demand present. One of the many benefits of a variable-speed compressor is its ability to provide more passive dehumidification than a traditional on/off compressor system during part load cooling demands. Typically, during part load cooling demands, rooftop units with on/off compressors will only need to operate the compressors for the minimum compressor runtimes in order to satisfy the cooling demand. This rapid, on/off compressor cycling results in most of the moisture that was removed from the air onto the coil being evaporated back into the air stream.

The effect of re-evaporating moisture back into the air is known as latent degradation. These short cycles, common with on/off systems, can cause a building's humidity levels to rise out of control. The Model L variable-speed cooling platform will modulate its capacity down to match those lesser cooling loads, which will greatly increase the unit's runtime, efficiency and moisture removal during part load operating conditions. While some might equate longer runtimes to higher energy usage, with inverter-driven, variable-speed compressors that is not the case. In general, air conditioners are most efficient when they can operate continuously because of the increased latent capacity that is generated when the evaporator coil is fully loaded. During startup, air conditioners are less efficient compared to their steady state operation. This is due to the extra energy required to start the compressors and the time it takes for the indoor coil to become cold enough to start condensing moisture from the air onto the coil. By operating at lower speeds for longer periods of time, variable-speed systems provide more dehumidification and offer better temperature control than traditional on/off compressor systems.

## / ENHANCED DEHUMIDIFICATION MODE

Along with the normal heating, cooling and ventilation modes available with any rooftop unit, Model L units are enabled with an additional enhanced dehumidification (EDH) mode, which is designed to operate the cooling system to provide additional dehumidification (latent capacity) when there are both a cooling and dehumidification demand present. EDH can be enabled

during the unit's setup and commissioning or any time thereafter via the CORE™ mobile app. When operating in the EDH mode, the CORE™ Unit Controller modulates the compressor(s), indoor blower and outdoor fan(s) with full variability to more accurately and efficiently match the humidity load in the space, while also providing sensible cooling.

While in EDH mode, the compressor(s) modulate to maintain a lower discharge air temperature, which increases the latent capacity of the system, while the indoor blower speed modulates based on the space temperature to match the cooling load. EDH mode on Model L units increases the overall system efficiency to lower operating costs by operating the cooling system to simultaneously address the cooling and dehumidification demands. By addressing both demands at once, the unit may be able to avoid unnecessary switching back and forth between normal cooling operation and reheat. In certain applications and climate zones, EDH mode can potentially provide enough latent capacity and dehumidification to remove the need for a factory-installed hot-gas reheat system.

During verification testing in the calorimeter room at our Product Development and Research facility in Carrollton, TX, we tested a Model L 4-ton unit in normal cooling mode and in EDH mode under the same operating conditions. This was done in order to create a side-by-side comparison to showcase the increased latent capacity of a unit operating in EDH mode.

| MODEL L 4-TON UNIT               |         |        |            |
|----------------------------------|---------|--------|------------|
|                                  | COOLING | EDH    | % INCREASE |
| AMBIENT TEMPERATURE (°F)         | 82      | 82     |            |
| ENTERING DRY BULB (°F)           | 80      | 80     |            |
| ENTERING WET BULB (°F)           | 67      | 67     |            |
| LEAVING DRY BULB (°F)            | 55      | 51     |            |
| LEAVING WET BULB (°F)            | 53      | 49     |            |
| INDOOR AIRFLOW (CFM)             | 800     | 800    |            |
| GROSS SENSIBLE CAPACITY (BTU/HR) | 21,919  | 25,853 | 18%        |
| GROSS LATENT CAPACITY (BTU/HR)   | 11,264  | 16,503 | <b>47%</b> |
| S/T RATIO                        | 0.64    | 0.61   |            |

The test results showed a 47% increase in latent capacity while operating in EDH mode. Enabling the EDH mode efficiently increases the dehumidification capabilities of the Model L rooftop unit, which results in more advanced temperature and humidity control.

## HUMIDITROL® + OPERATION AND BENEFITS

Humiditrol + is a modulating hot-gas reheat dehumidification system that can vary the sensible and latent capacity of the Model L rooftop unit to better match the dehumidification demand of the space. The Humiditrol + system is comprised of a reheat coil and an on-off reheat valve that work with the lead inverter-driven, variable-capacity compressor, variable-speed indoor blower and variable-speed outdoor fan(s) to optimize moisture removal and maintain a neutral discharge air temperature. Each component of the system is independently controlled by the CORE unit controller to optimize moisture removal without wasting energy.

During Humiditrol + operation, the CORE unit controller modulates the variable-speed compressor based on the dehumidification demand of the space. The greater the dehumidification demand, the faster the inverter will drive the compressor to increase the latent capacity and remove more moisture from the air. The indoor blower speed will modulate between minimum and maximum cooling speeds to optimize the evaporator coil temperature for maximum moisture removal. Model L's full-face, row split intertwined evaporator coil and saturated suction temperature sensor allows the CORE unit controller to slow down the indoor blower speed to reduce energy consumption, without freezing the indoor coil. The CORE unit controller modulates the speed of the outdoor fans to maintain a neutral discharge air temperature. The modulating outdoor fan(s) play a critical part in delivering neutral discharge air temperatures and preventing the unit from overcooling the space.

The Model L Humiditrol + dehumidification system will automatically modulate the unit's variable-speed components to efficiently deliver neutral, dehumidified air to the space for year-round comfort, better indoor air quality and optimal building health under a wider range of indoor and outdoor operating conditions.



## HUMIDITROL®+ VERSUS HUMIDITROL (ON/OFF REHEAT SYSTEMS)

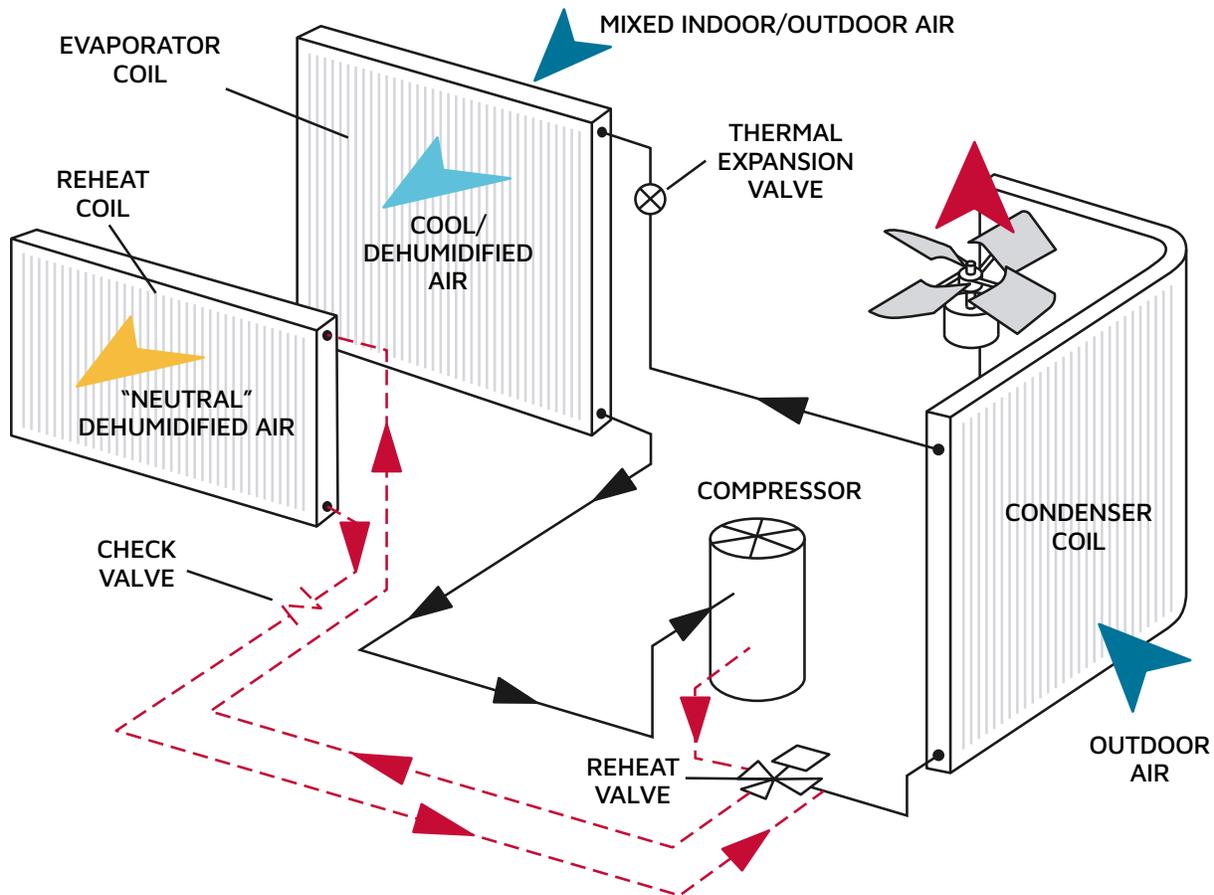
At first glance, Humiditrol + and Humiditrol might not seem all that different. They are both hot-gas reheat systems that work by utilizing a valve to route the refrigerant (hot-gas state) that is discharged from the compressor to the reheat coil—located downstream of the evaporator coil—where hot-gas proceeds to “reheat” the cold air coming off the evaporator coil before it is discharged into the space. Hot-gas reheat systems have been used by the HVAC industry since the early 2000’s as a way for the system to control humidity independent of temperature in the space.

So, what’s the difference between the two?

Humiditrol + delivers a variable amount of sensible and latent capacity based on the demand, whereas

the amount of latent and sensible capacity delivered by a Humiditrol or on/off dehumidification system is completely dependent upon the outside air temperature, indoor airflow and the entering mixed air conditions. Depending on the unit’s operating conditions, on-off reheat systems can deliver too much cooling during /eheat operation, which can cause overcooling to a point where the unit must switch from dehumidification mode to heating mode in response to the overcooling that has occurred. Switching back and forth between heating and dehumidification results in uncomfortable temperature swings, increased operating costs and unnecessary component cycling. By utilizing the CORE unit controller’s patented control algorithms and Model L’s variable-speed components, the Humiditrol + dehumidification system efficiently dehumidifies the air without overcooling, resulting in reduced operating costs, increased occupant comfort and better indoor air quality.

### TYPICAL HOT-GAS REHEAT DEHUMIDIFICATION SYSTEM





## / INCREASED RELIABILITY

The inverter-driven, variable-speed compressor in Model L rooftop units features a “soft-start” functionality that greatly reduces the inrush current associated with turning on a fixed-speed or digital scroll compressor. Each time the inverter-driven compressor is turned on, the CORE unit controller will ramp up the speed of the compressor from the minimum frequency to the desired operating speed in increments as little as 1%. This feature can help reduce the building’s overall peak load demand. The soft start also reduces the harshness of starting the compressor, which will help increase the reliability of the variable-speed compressor and reduce maintenance costs over the life of the unit. In multiple compressor systems, the lead variable-speed compressor also decreases the cycling of the fixed-speed compressors in the system by modulating to maintain the target discharge air temperature. The ability to control the inverter speed in 1% increments allows for tighter control of discharge air temperature and total capacity of the system for improved comfort and reliability.

## / A MODERN RESPONSE TO A MODERN PROBLEM

In response to COVID-19, many HVAC experts, including the ASHRAE Epidemic Task Force, have recommended that buildings increase outdoor air ventilation rates as high as possible to increase fresh air in the space. However, not all HVAC systems can handle the higher sensible and latent loads introduced from the increased ventilation rates. Commercial buildings, restaurants and classrooms that were once operating at full capacity are now faced with unpredictable loads and new hours of operation. Now, more than ever, we need our HVAC systems to be able to adapt to the changing loads in the space and the increase in fresh air requirements. Model L’s variable-speed cooling platform and advanced dehumidification technologies are engineered to adapt and deliver energy-efficient, HVAC solutions to meet the ever-changing HVAC demands of your building.

**Contact your Lennox Sales Representative to learn more about what Model L rooftop units can do for you. /**



Since 1895, Lennox Commercial has been creating reliable, innovative heating and cooling systems that help businesses reduce operating costs while maintaining comfort.

Over a century later, we continue to build on this foundation, finding new ways to help meet today's business challenges. With a wide range of ENERGY STAR® certified products that lower costs through reduced energy demand, Lennox is a single source for efficient, reliable HVAC solutions that professionals continue to depend on—year in and year out.

**[WWW.LENNOXCOMMERCIAL.COM](http://WWW.LENNOXCOMMERCIAL.COM)**