WHITE PAPER

HUMIDIFICATION FOR HIGH PERCENTAGE OUTDOOR AIR

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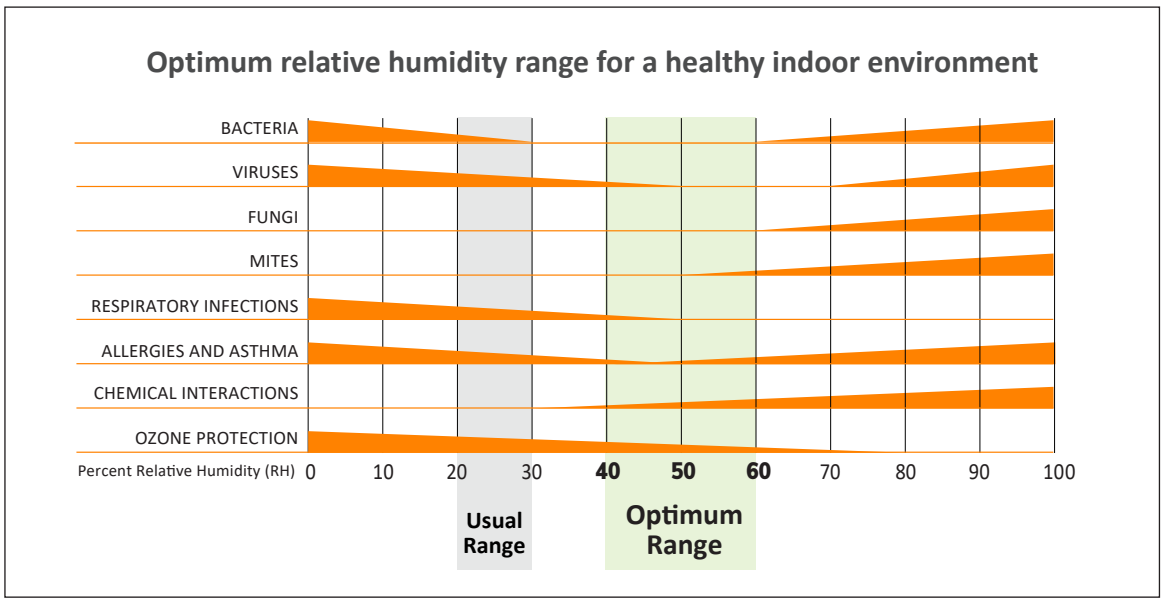
HIGH OUTDOOR AIR SYSTEMS (HOAS)

Many building operators and managers are optimizing their HVAC systems to significantly increase outdoor air intake for healthier indoor air quality. In fact, many jurisdictions are mandating 100% outside air as a result of the recent COVID-19 pandemic.

Taking in more outdoor air reduces the spread of illness and increases occupant comfort, but it is important to keep in mind that it also affects building systems.

When the HVAC system of a building is adjusted to bring in more outdoor air, the requirements change, so humidification strategies should be reviewed and realigned for optimization of indoor air quality and energy efficiency. This is especially true with indoor relative humidity playing a significant role in supporting human health, productivity and process.



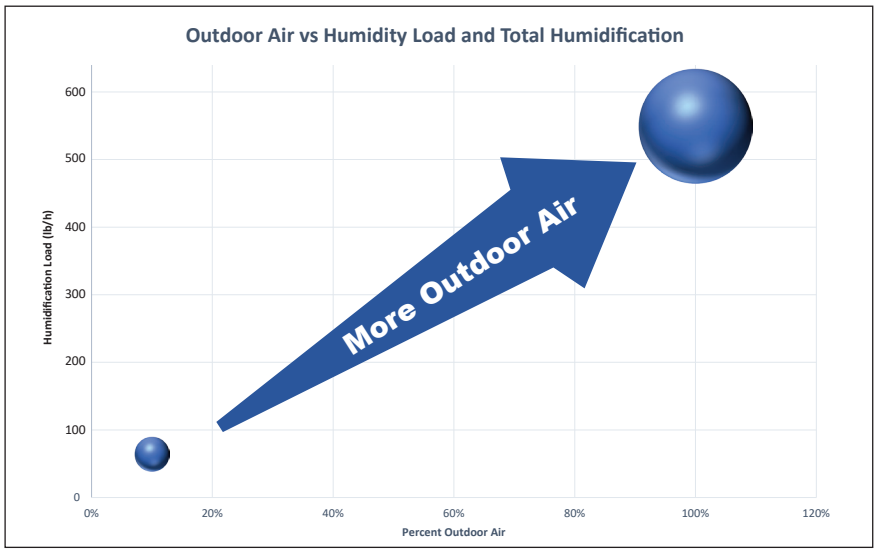
1. A key study done in 1986 showed that the indoor relative humidity (RH) level, or the amount of water vapor present in air, should be kept between 40 and 60% RH to reduce the transmission of viruses. Many studies have been done since that also support this guidance.

MORE OUTDOOR AIR REQUIRES MORE HUMIDIFICATION

Humidification loads are primarily driven by the amount of outdoor air being brought into a building. In general, more outdoor air means an increased need for humidification.

Now, with buildings bringing in an even higher percentage of outdoor air, there will be even larger humidification loads, particularly in the cold winter months. To maintain a 40% relative humidity level for occupant health and comfort, more water will need to be added to the air of a building than before.

For example, a building that normally runs on 10% outside air that switches to 100% outside air would need humidifiers that are almost ten times larger in order to add up to ten times as much moisture over the entire year. Simply opening a window will not work to increase indoor humidity levels during the heating season in most regions.



2. More water and energy are needed to humidify when the percentage of outdoor air is increased

It is crucial to have the correct humidification system in place to handle this increase in load for any building that is using high outdoor air percentages. Below are some factors to take into consideration when adding to the humidification capacity of a building.

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HUMIDIFICATION OPTIONS

TWO MAIN METHODS OF HUMIDIFICATION

ISOTHERMAL (STEAM) HUMIDIFIERS: work by boiling water inside the humidifier tank and distributing it into the ductwork through a steam manifold or directly into the space.

ADIABATIC (EVAPORATIVE) HUMIDIFIERS: use the heat in the air to evaporate water into the ductwork or directly into the space.

COMPARE HUMIDIFIERS FOR HOAS

Adiabatic Humidifiers

Many buildings use adiabatic, or evaporative, systems to add humidity to the building. When there is excess heat in the air these humidifiers can be very energy efficient because there is no need to add energy to the system; they use the heat in the air to evaporate water into the building air management system.

However, in high percentage outdoor air systems, the air at the humidifier must be warm enough to evaporate all the water needed. In cold climates, the humidification load increases significantly due to the 100% outside air requirement and the system must preheat the additional incoming air, potentially to 104 °F or above.

Most existing building heating systems are not designed to do this, especially when those systems were originally designed for lower outdoor air requirements. This could mean adding both heating capacity and additional adiabatic humidification capacity to meet the increased humidification need.

An existing adiabatic humidifier, while well suited to hot arid climates or for systems with the option of a lot of air recirculation, may not be the most energy efficient option in most climates. It may not even

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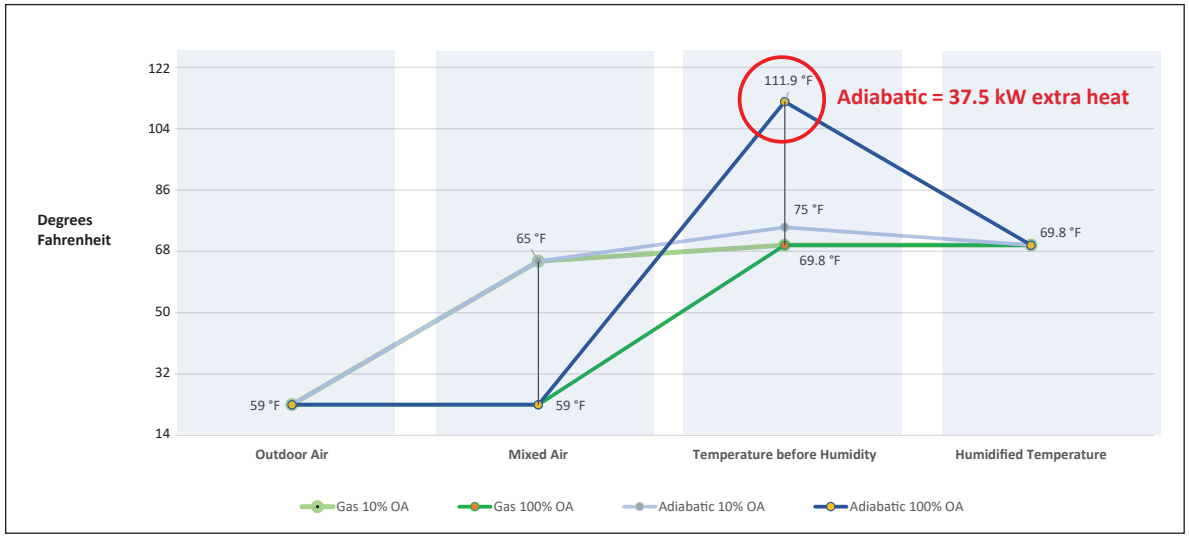
be a feasible solution for a high percentage outdoor air system in a cold climate. Another challenge for adiabatic humidifiers is the non-uniformity of temperatures across an air handling unit with a large heating requirement, meaning that evaporation will not be evenly distributed in the incoming air, making wetting downstream possible.



3. Comparing temperatures required in duct for different humidification systems at 5,886 cfm/hr

Isothermal Humidifiers

The most common way to humidify a building is to add steam to the air from an isothermal humidifier, more commonly known as a steam humidifier. Isothermal humidifiers work by boiling water inside the humidifier tank and distributing it into the ductwork through a steam manifold or directly into the space.

Of course, isothermal humidifiers add energy to the system, but in HOAS, adiabatic humidifiers would need energy added to the air as well. Which is more efficient and effective? And what fuel should be used to boil the water?

On the question of fuel, electricity and natural gas are the most common options. For larger humidification systems, natural gas (or propane) is almost always more economical than electricity due to the significantly lower cost of natural gas, which is roughly one third the cost of electricity. “Larger humidification systems” mean a system with a capacity of 44 kg per hour or higher in most situations.

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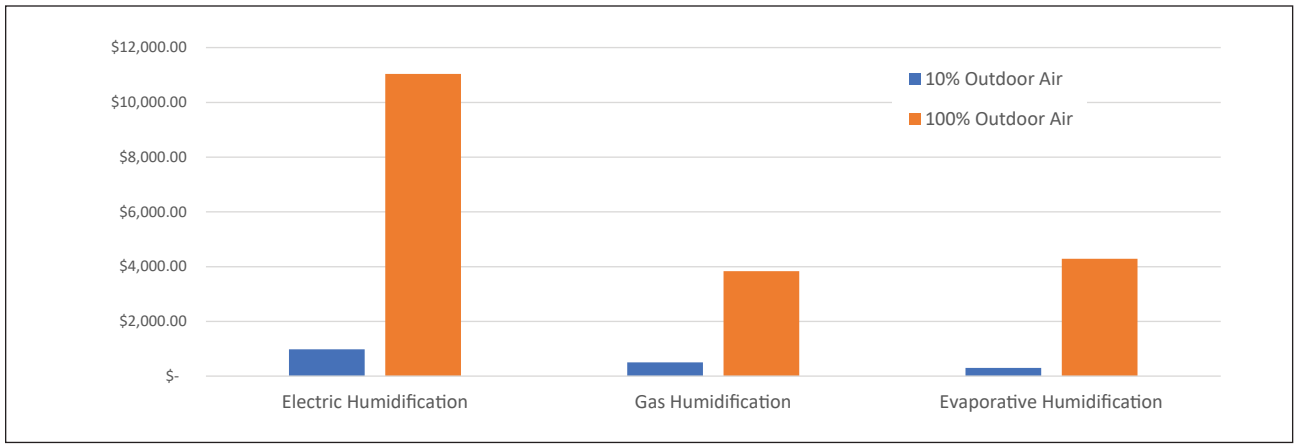

4. Comparing costs of humidification types by outdoor air requirements at 5,886 cfm/hr for one year

Some gas humidifiers, such as the DriSteem GTS® humidifier LX series, operate at greater than 90% efficiency, meaning it uses nearly every Joule of energy available in the gas. For comparison, an adiabatic humidifier will draw energy from the air, which is often heated by a natural gas boiler with system efficiencies between 70% and 85%.

The GTS LX series humidifies the air in a high percentage outdoor air system using less natural gas than the pre-heating source needed for an adiabatic system. Additionally, the building's existing heating system would not need to be upgraded to meet the increased pre-heat demands of an adiabatic system.

Installing a new gas humidifier like the GTS LX is likely less expensive than installing more capacity to a building's heating system and adding adiabatic humidification. The GTS LX humidifier also allows for polypropylene (PP) or polyvinyl chloride (PVC) venting to make installation even easier for up front savings and continued energy savings.

Adding more outside air also increases water consumption and extends operating hours, which in turn increase maintenance requirements. Comparatively, the GTS LX humidifier requires less costly maintenance than an adiabatic system. In addition, gas humidifiers offer indirect savings by reducing water usage as well as the wastewater costs associated with higher demand/increased capacity.

5. DriSteem gas-fired humidifier

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Utilizing a gas-fired steam humidification system like the GTS LX instead of an adiabatic system has numerous additional benefits. Gas humidifiers reduce peak load energy concerns and associated costs so the boiler system size can be maintained or reduced even as the percent of outside air used increases. Gas systems are able to provide humidification instantly to maintain the required setpoint, while wetted media type adiabatic systems require hygienic drying cycles where humidification may be temporarily unavailable. Adiabatic systems also may be slow to come back on line or unable to maintain the required setpoint.

Where an adiabatic wetted media system may struggle to maintain precise humidity control in a high percentage outdoor air system, the GTS LX humidifier reacts quickly to changes in demand, and can produce as low as 5% of its rated capacity, meaning it will always maintain the required humidity even with quick weather changes. The GTS LX humidifier does this with ultra-low NOx emissions, making it the most environmentally friendly option. To maximize energy savings, ensure that high-efficiency insulated tubes are used to distribute the steam – saving up to 85% of the condensate production.

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HUMIDIFICATION REVIEW

If a building currently does not have a humidification system, it is time to add one to avoid dry indoor conditions due to increasing percentages of cold outside air being incorporated into the air management system. If a humidification system exists, a review will be needed to ensure it is properly sized, operating correctly, and energy efficient for the building.

In most climates, utilizing a gas-fired steam humidification system will deliver the most economical and precise means of maintaining a healthy indoor relative humidity range of 40-60%. Look into a high-efficiency gas fired humidifier (such as the DriSteem GTS® humidifier LX series) in your HOAS system for lower upfront and operational costs.

Reviewing the capabilities and performance of your humidification system when outside air percentages change is critical. Your indoor air quality and the health of building occupants depends on it. Reach out to your local DriSteem representative today for a review.

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Continuous product improvement is a policy of DriSteem; therefore, product features and specifications are subject to change without notice.

EXPECT QUALITY FROM THE INDUSTRY LEADER

Since 1965, DriSteem has been leading the industry with creative and reliable humidification solutions. DriSteem leads the industry with a Two-year Limited Warranty and optional extended warranty.

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