

Facilitator — June/July 2013



Water World

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Solving humidity and moisture issues in restaurants

Of the unexpected issues restaurant facility managers tackle, one of the most difficult tends to be moisture problems.

By the time a facility manager has been called, restaurant management has identified a musty odor or signs of water air quality and comfort issues or, in many cases, guest complaints.

In the South, moisture issues naturally follow the more humid climate. However, less humid climates are not shield driest climates, which means this problem is inevitable.

The challenge: In most cases, the problem does not result from a single source. Resolving a serious humidity or moisture problem can take several weeks or even months.

The most important thing to remember about water intrusion: Water always changes its behavior, and its form—condensation, capillary suction, gravitational flow, vapor diffusion and mass flow of moist air all happen at the same time.

Common Culprits

When addressing humidity, comfort and air-quality issues, consider these common causes:

Is the building out of balance? Check for signs of negative air pressure in the building. If present, schedule to have a professional

Are the HVAC systems—rooftop units, exhaust and make-up air units— functioning properly?

Are the intake filters clean? They can contribute to moisture problems and affect air balance. Other common issues that can contribute to moisture problems include:

- Fresh air dampers: Rooftop units require fresh air, either from an economizer or a motorized or manual fresh air damper.
- Incorrect belts and pulley adjustment: An incorrect or loose belt and pulley affects airflow and increases the likelihood of moisture intrusion.
- Dirty filters: They impact airflow.
- Off-balance rooftop units: If the unit is not level, condensate will not flow properly and may overflow into the ductwork.
- Holes or loose connections in exposed ductwork: These are common causes for water intrusion.
- Thermostats: Verify thermostats have the fan “on” during business hours to maintain building balance.
- Refrigerant charge: Have a service contractor verify the proper refrigerant charge. A properly functioning HVAC unit will have a clean cooling coil.
- Adjust rooftop unit airflow to remove more moisture: A service provider can reduce airflow by up to 20 percent to reduce space humidity.

Are the HVAC units oversized for the space?

Have a load calculation performed by a qualified service provider to verify the correct sizing and look for more obvious signs of moisture intrusion on a small curb.

Is the return duct undersized for the unit?

This is a commonly overlooked problem. Manufacturer guidelines suggest that return ducts be equal to the size of the supply duct. If the return duct does not have enough return ductwork, you are potentially starving the unit for air, which increases the static pressure in the ductwork from any crack and crevice. This can lead to wicking water through the opening when it rains. Undersized return ductwork is a common cause of moisture intrusion.

Inspection Steps

Begin by looking inside for signs and causes of water intrusion. Inspect for roof or window leaks or rotted walls. Have a professional determine what caused the damage and remove the leak source.

Next, take a detailed visual walk around the building's exterior. Verify water will drain away and not toward the building. Moisture intrusion is common in landscape areas where excess soil and mulch have been piled over time, preventing water from draining away. A professional can resolve this problem.

Remember a big problem most likely has several sources. Look for exterior signs of window leaks (e.g., rotted window finishes, framing and structure. Address any issue found. Check for water leaks through loose and damaged siding, bring water and/or humidity from outside.

All damaged areas contributing to the moisture problem, as well as the underlying cause of the issue, must be resolved.

After checking the building envelope, look for water and moisture damage inside the building. In many cases, it coincides with what you have found outside.

- Carpet water damage is a telltale sign of water intrusion.
- Inspect wall and ceiling finishes for signs of water intrusion. Connect this information with what you've found outside and find out if water is entering at the base or higher.

Take a look in the attic for more possible hidden issues:

- Signs of unresolved roof leaks: Some leaks are not found easily. Wet or damaged roof decking and trusses point to after a rainstorm.
- Damaged dishwasher exhaust ductwork: A major cause of humidity issues—it continually adds water vapor into the ductwork and upgrade as required to meet local code.
- Damaged HVAC ductwork or ductwork insulation: Crushed or broken ductwork, or metal ductwork with faulty insulation.
- Ductwork connections at registers: Verify ductwork is connected properly to registers and all supply grilles have insulation.
- Refrigeration line sweating: Refrigerant lines for walk-in coolers/ freezers will sweat if not insulated properly; replace.
- Verify ductwork sizing: Ask your service provider to verify that the supply/return ductwork is sized correctly.
- Look for leaks in plumbing and condensate lines: There could be an unseen slow leak.

Now that you have a better picture, begin addressing the situation. There might be an immediate need for the following:

- Professional testing: If high humidity persists, seek professional testing of humidity and moisture levels in the walls. It may be necessary to place sensors in the walls.
- Dehumidification: The same professional should offer temporary dehumidification services. They can place equipment to take daily readings. This monitoring may be needed for days or even weeks during the repair process to maintain a relative humidity control devices may be required permanently.
- Contact equipment manufacturer representatives: HVAC manufacturers are a great resource. They offer engineering solutions to the toughest problems.

The Manufacturer's and Building Servicer's Perspective

Water does funny things! The first considerations when assisting with humidity issues are: Was it designed and installed correctly?

The Design Perspective

Restaurants are one of the most complicated buildings to design. A 5,000- to 8,000-square-foot, casual dining restaurant is up to 10 times more air of a typical retail space. Dealing with this drastic amount of outside air complicates a traditional rooftop HVAC system.

In many climates, most package units are capable of processing only 15 to 25 percent outside air. In an extremely hot climate, managing the 80 percent of outside air introduced into the building requires a dedicated outdoor air system (DOAS), which is more comfortable. This requires cooling air to between 52 and 58 degrees or below the desired dew point temperature—moisture—the byproduct is condensate that drains from the evaporator. Many times the air must be reheated so that it is comfortable.

DOAS offers advantages in a DX rooftop design.

A dedicated outdoor air unit handles all or the majority of the outside air load (heating and cooling). Outside air load is properly managed, the rest of the system can be sized based on the lights, people and envelope loads. This design is more efficient.

Hot gas reheat takes "free heat" from the condenser.

This helps keep the space comfortable and allows the rooftop unit to reduce humidity. What about traditional restaurant make-up air? Outside air in a hot and humid climate might have a design of 91 dry bulb/79 wet bulb or higher. Air with a comfortable space condition of 75 dry bulb and 50 percent relative humidity, the air has 64 grains of moisture. So the air has a lot of moisture.

If you look at 1,000 CFM of untreated outside air, it can carry 5 gallons more moisture vapor than the indoor space. A HVAC system.

How much air does your make-up air unit provide? Do the math to find out how much extra water vapor is in your building.

Vapor travels from a warmer to a colder surface and can travel through solid materials such as walls. This is why you feel humidity in a building. In a restaurant, a dining room typically is maintained at a cooler space temperature than the kitchen space. Is the air introduced into the kitchen untreated? The vapor pressure pushes the vapor-laden air from the kitchen to the dining room.

So how do you remove the moisture? Use mechanical cooling.

New Construction

- 1) Ask your engineer to design an HVAC system that provides latent moisture removal at the source (prior to the air and dedicated outdoor air systems. Treating the outside air at the source (heat, cool or dehumidify) is the best way to
- 2) Use hot-gas reheat in humid and seasonally humid climates. These units provide mechanical cooling to remove space.
- 3) Properly size replacement HVAC units. Bigger does not equal better. The key to moisture removal is compressor ru

Was the equipment installed correctly? Properly installed units help solve the moisture dilemma. Units should be includes following the roof curb flashing detail, making sure the unit sits level, installing the provided gasket to seal t does not run back into the unit. These details prevent water intrusion and allow the unit to remove the condensate.

Is the HVAC equipment being maintained properly? Are filters being changed regularly on the rooftop units? Are eq been performed? Are the belts worn and loose? Without proper maintenance, equipment cannot perform to manuf however, it should be the first question the facility manager asks. Invest in a site visit to verify if the service provider i: as the humidity source.

HVAC equipment manufacturers can help with humidity issues once you have addressed all other possible causes : may consider replacing or upgrading your existing equipment:

- 1) Install an adiabatic proportional regulator to create a load and drive compressor runtime. Compressor runtime equa
- 2) Consider stand-alone dehumidifiers that can be hard ducted in parallel with the current HVAC unit. It also is import
- 3) Use hot gas reheat in humid and seasonal humid climates.
- 4) Properly size HVAC replacement units for replacement projects. With new lighting technology, space heat gain is lc
- 5) Consider UV lights. Adding ultraviolet light technology inside a rooftop unit can assist with killing bacteria and re space. As a cautionary note, a UV light can dry out the inside of a standard rooftop unit and cause long-term damage

Remember that restaurant moisture problems are complex and require a systematic approach. Treat the disease ai hesitate to ask for help if you need it.