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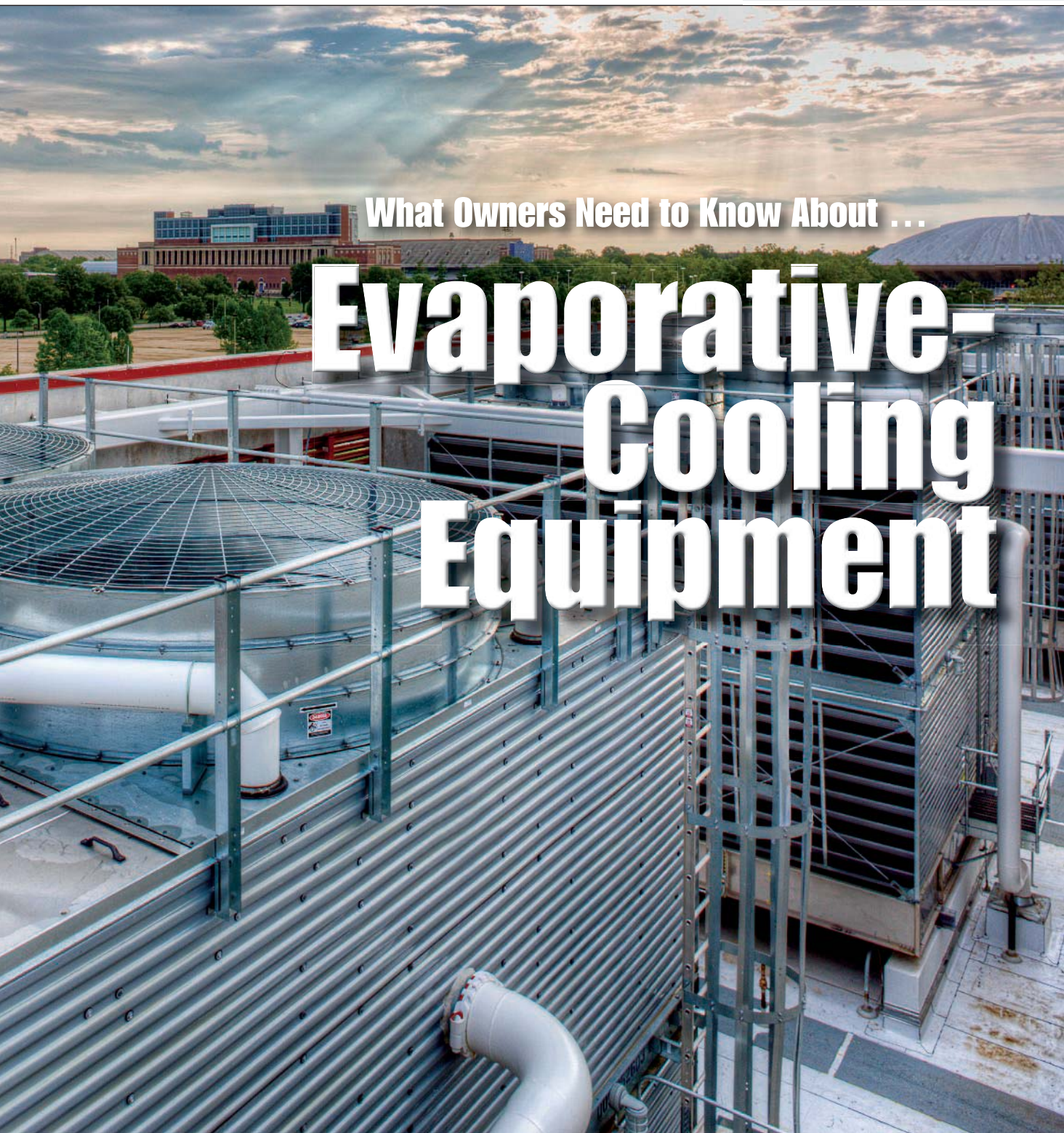
Association Solutions: Rethinking Air-System Performance and Efficiency

Combining Dedicated Outdoor-Air Systems and Variable Refrigerant Flow, Part 2

Air Filtration for Mold Management



What Owners Need to Know About . . .

Evaporative-Cooling Equipment

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Rethinking Air System Performance and Efficiency

Engineers need to update their office specifications to embrace modern, high performance attributes, especially with VAV systems.

Just as today's cars are designed and built much differently than cars from the 1970s, so too are air-delivery systems in commercial buildings. Sadly, 70s-style air systems that look and behave like the gas guzzlers of the past are still being designed and built today.

This article documents how today's high-performance air systems (HPAS) make use of more efficient application engineering, equipment, and control logic. According to a committee within AMCA International—consisting of AMCA member companies and non-members—have defined HPAS as follows:

- Apply modern design approaches with leading-edge products and technology to optimize energy efficiency, comfort, and indoor air quality.
- Integrate the strategies of right-sizing, free-cooling using outside air, and small thermally similar control zones and minimize static pressure, system leakage, and system effects.
- Technologies include high-efficiency fans with variable-speed capacity controls, low-leakage outside-air economizers, low-leakage ducts and fittings, low-pressure-drop components (filters, coils, ducts and diffusers), diagnostic monitoring, and digital controls.

High performance air systems are not a product—they're not purchased off the shelf as a complete package. HPAS are a result of industry professionals thinking differently about air systems in new construction and substantial renovations to deliver better comfort, lower energy use, and competitive installed cost.

The Devil Is in the Details.

In practical terms, HPAS follow the design guidelines listed below. Actually, this list is truncated so we can fit it all into this short article. To really understand how these guidelines combine to deliver a better system without driving construction costs over tight budgets, please visit the AMCA Website at *www.amca.org/feg/hpas.aspx*.

These guidelines are in accord with ASHRAE's "Advanced Energy Design Guide for Small to Medium Office Buildings: Achieving 50 % Energy Savings Toward a Net Zero Energy Building."

Select the Lowest-HP Fan and Vary the Speed

Every HPAS varies fan speed with a change in load—even single-zone systems. Selecting the right fan, minimizing power at design conditions, and maximizing savings at part-load depends on how you control and how you apply the fan.

Eliminate the Need for Reheat

Modern VAV systems do not reheat cooled air. In the winter, ventilation air is delivered to zones at temperatures needed to serve zones calling for cooling. Heating in perimeter zones is limited to times when primary airflow is based only on ventilation demand. This requires careful zoning, added perimeter insulation, heat recovery from warm ceiling plenum air, and demand-based ventilation control.

Small Zones improve Comfort and Reduce Overcooling/Overheating

Try to provide a VAV zone and a thermostat for each occupant. This can be done cost-effectively with diffusers that incorporate temperature-control dampers.

For Lowest Pressure Drop in VAV System—Use Low Supply-Air Temperatures and Temperature Reset

Large components, smooth transitions, unobstructed fan inlets, and fully developed fan discharges matter. Ducts can be smaller if design supply temperatures are lower. This approach, coupled with supply-temperature reset, saves enough on ductwork to fund many other attributes of HPAS without driving installed costs too high.

Minimize Ventilation, Exhaust, and Makeup Air

Ventilation must be controlled to match occupancy down to some minimum level associated with unoccupied space. In VAV systems, the outside air delivered to each zone has to be compared to the need, and controlled accordingly.

Specify Controls for Low-Energy VAV

Lowering design cooling temperatures saves a bundle on ductwork. To minimize the energy penalty of this approach, raise the temperature at part load. Control fans from a pressure sensor placed near the end of the longest

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run. The closer to the end this sensor is placed, the more efficient the fan selection and operation can be.

Tune the System by Re-engineering for What "is" Post installation

Design tools available to the air-system designer are coarse. System effects in ductwork, and installation adjustments cannot be estimated properly Re-engage with the project during test and balance—uncover the system challenges that compromise performance. Change some things—make it right.

Monitor Performance and Alert Operators of Faults

Once you have the system tuned and operating as you intend, monitor performance. It costs very little to track airflow and pressure at critical points in a system. Track power consumed by the fan, comparing power draw (kw) and power use (kwh) to cooling and heating demand, and to average peak and minimum flow rates. Expose actual performance over time to someone who is intimate with the design expectations. When performance degrades, find the problem, and see that it is corrected. This is easier than you think, but that's the point. You have to think about and implement this capability into your design.

- You need the means to record and convey history of operations, conditions, and efficiencies.
- You need the means to document preventive maintenance.

The designer must never forget that the primary purpose of HVAC is comfort for building occupants. Fortunately, comfort and saving energy go hand in hand with high performance air systems.

These design guidelines for HPAS are just an overview. For more information about high performance air systems, visit *www.amca.org/feg/hpas.aspx*.

For a longer version of this article, go to *bit.ly/AMCA_HPAS*.

References

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