



Improving Air Handler Reliability

Replacing the heart of an air handling system with better fan and control technology saved a healthcare facility more than \$103,469 per year. Just as importantly, it permanently resolved nagging reliability challenges. Carolinas Medical Center (CMC) in Charlotte, North Carolina, is the flagship hospital of Carolinas Healthcare System, one of the nation's largest healthcare organizations.

Its day-surgery facility on Blythe Boulevard is a key element in the Center's operations. The building is owned by CMC with property management by Lincoln Harris, a major property owner and manager in the Carolinas. The building was served by two penthouse air handlers, each equipped with two vaneaxial fans, one each on the supply and return air sides.

Air Handler Supplies VAV System

The two air handlers feed a network of variable air volume (VAV) boxes in the building. The building is connected to other facilities on the medical campus by a network of walkways and tunnels. The system design, with primary air handlers having one or two fans, was a common approach in earlier decades. Here, the air handlers were each designed to deliver 74,500 cfm of highly filtered 55 °F air through the building's ductwork, and room temperatures were regulated with the VAV boxes.

AT A GLANCE

- Hospital needed to replace two vaneaxial fan systems in the penthouse air handlers to improve reliability and energy efficiency
- Replaced the existing fans with a new FANWALL® array for both supply and return airstreams
- New fan system was comprised of two 15-fan FANWALL arrays for supply and two 12-fan FANWALL arrays for the return system
- FANWALL system saved the hospital 1,480,240 kWh in year one, resulting in \$103,469 in energy cost savings
- Sound level in the mechanical equipment room was reduced 15 dBA

Transformation to New Technologies

In this facility, the original air handler fans had led to problems. On several occasions, one of the fans had failed. The result had been building discomfort for several days while the fan was repaired.

For a healthcare facility, this was unacceptable.

Medical Center Needed a Change

Another problem was the high electric energy expense resulting from fan system inefficiency, and the fact that all of the fans were required to operate even during periods of light building use and moderate outdoor temperatures. CMC looked to Lincoln Harris for resolution to both the reliability and operating cost issues.

CMC and Lincoln Harris had a long-term relationship with Thermal Resource Sales (TRS) in

both its Kernersville and Charlotte locations in North Carolina. They approached that firm looking for a solution. TRS is a manufacturer's representative, and also has an engineering staff experienced in HVAC problem-solving. Danny Hall from TRS was closely involved with this project from the beginning.

Fan Failure Caused Major Problems

According to Hall, "We realized that the single vaneaxial supply and return fans had been causing CMC grief, and when the fans went down, it wasn't a one day fix. This created scheduling problems for them. In fact, some surgical procedures had to be rescheduled because of building climate conditions."

Hall explains that the existing system provided 124,000 cfm to the system, barely enough at peak load conditions. "And because there was only one supply fan in each penthouse, it couldn't be shut down during light load conditions, so much of the time it operated at part-load, where fans like this are quite inefficient."

Example of an old vaneaxial fan with a motor that is difficult to service. These fans often require lengthy sound attenuators to reduce fan sound.





Crane and rigging personnel installing the supply 3 x 5 FANWALL array in one of the penthouses. Cubes can be configured to fit virtually any air size tunnel and typically take up half the installation space required for vaneaxial fans and require no sound attenuation devices.

Transforming How They Move Air

TRS developed a proposed design to replace the vaneaxial fans using four arrays of FANWALL TECHNOLOGY® modular fan cubes, together with System Optimization Controls (SOC) for the arrays. The modular fan units and controls are products of Governair, a custom air handling brand specializing in designing equipment for demanding applications. The CMC facility certainly fit that description.

System Optimization Controls allow the varying of the speed of the fans and turn off fans when not needed, which leaves the remaining fans operating near their peak efficiencies. Tremendous energy savings can typically result from operating this way. Each of the motors has its own variable frequency drive, so if one fan were to become disabled, the remaining fans can speed up to overcome the loss in airflow.

“ All in all, we could not be happier with our decision to have installed a FANWALL® system into our critical air handling units. ”

— Dan Maples, Chief Engineer



1,480,240 kWh
Energy Savings
in Year One

Fit in Existing Air Handler

The FANWALL units are designed to be installed in a wide variety of configurations. In the CMC building, the design called for two sets of 15 cubes in a five-wide, three-high configuration within the existing penthouse air handlers on the supply airside, and two sets of 12 cubes which would be four-wide and three-high on the return airside.

Individual cubes on the supply side are 34" wide by 38" high, so getting them into a tight work area is seldom a problem. According to Hall, a crane lift to the rooftop was used for speed and ease of fan and sheet metal removal. Normally the cubes are brought in through a standard doorway.

The installation work took place in January and February, at a time of year when it was practical to take the old fans out of service one at a time. The contractor took out one set of fans first, keeping the other fans operating. But the old fans were held on site in the event one of the other vaneaxial fans went down and repair crews had to scavenge parts to bring it back on line.

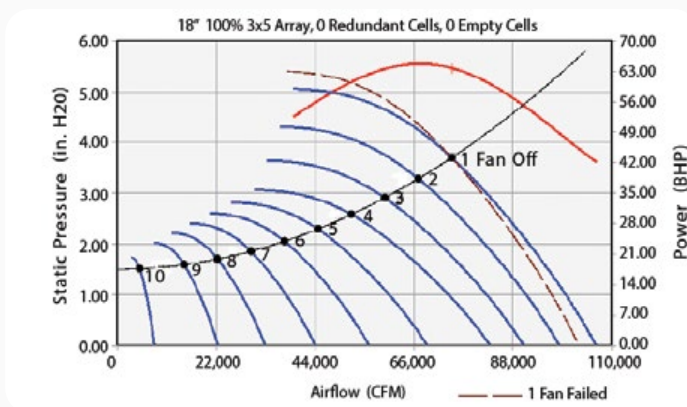
Energy Savings Realized

The unit was commissioned in April and after a year of monitoring energy use, the FANWALL system saved the hospital 1,480,240 kWh in year one or \$103,469 at \$0.0699/ kWh.

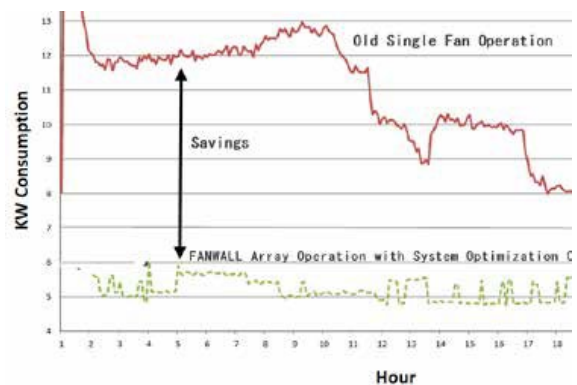
Optimized Fan Control

No changes were necessary in the coil or filter sections of the handlers. Each supply air FANWALL array produces 74,500 cfm and the return air array produces 67,650 cfm. The System Optimization Controls automatically monitor and implement the most efficient mode of operation to meet airflow requirements. The motor speed can be varied along with the number of enabled fans and motors at any given point in the operating range. In this way the optimum number of fans is operating at the optimum speed for all load requirements.

In order to allow efficient shutting down of an individual fan cube, they are fitted with FANWALL Backdraft Dampers (FBD) shown on the next page. These prevent backflow of air through the idled cube while the other cubes run. The FBD model also has a revolutionary blade profile that laminarizes incoming air and actually improves flow characteristics.



The supply FANWALL fan curve showing the number of fans operating as the airflow demand reduces. The SOC keeps the fans operating at their peak efficiencies as the system unloads, resulting in energy savings.



Upgrading old fans with FANWALL arrays with SOC can offer significant energy savings. The hospital realized a 1,480,240 kWh savings in Year One.

15 dBA Sound Reduction Measured in the Equipment Room

Quick Installation Possible

Hall likes the fact the FANWALL units are factory-built and can quickly be assembled into arrays and connected to power and system controls. He notes, “We had a narrow slot of time to install the units and get them operating, but we were able to achieve that easily.”

McKenney's, Inc., the mechanical contractor, was experienced using FANWALL TECHNOLOGY products, and worked closely with Hall from TRS and with Governair factory personnel in planning the changeover and putting the system on line as fast as possible.

Wes Dunaway, McKenney's Senior Project Manager, Healthcare division, commented,

“The design and construction team, of which TRS was an integral part, was able to achieve system performance goals, identify dimensional constraints and mitigate installation risks—minimizing impact of down time to the existing facility and controlling cost.”

One of the challenges in this changeover was maintaining correct building pressurization in the facility while running with a fan out of service. Hall says, “Once the new fan arrays were in place, this was easily achieved.”

Oustanding Reliability

The redundancy provided by the multiple fan units has meant that the system is totally reliable. The FANWALL units have high reliability, but even if a unit is lost, the System Optimization Controls rebalance the system and take up the slack with the remaining cubes.




What's more, because the units can be modulated or taken offline to match building air demand, considerable energy is saved. Between the improved efficiency of FANWALL TECHNOLOGY units and the System Optimization Controls, savings of \$103,469 have been achieved the first year according to documentation from the power supplier, Duke Energy.

And finally, they were able to increase the airflow capacity of the system—from 124,000 to 149,000 cfm—within the same space as the previous fan system in the air handlers.

Noticeably Quieter

Finally, the FANWALL units are considerably quieter than the vaneaxial fans previously used. A measured reduction of 15 dBA in the mechanical room was achieved. Even in other parts of the building, Hall says, many employees have commented on how much quieter the system is today. CMC was comfortable with the FANWALL TECHNOLOGY solution because they had seen its effectiveness and flexibility in another building application.



“There are so many benefits that Governair and the FANWALL system bring to our operation. Obviously, they have saved Carolinas Healthcare System a lot of energy dollars. In addition to the savings, however, it’s amazing how quiet our fans are.

The redundancy that we now have is an incredibly important factor as well, because we no longer have to worry about an unexpected failure causing the loss of services. All-in-all, we could not be happier with our decision to have installed FANWALL systems into our critical air handling units.”

— Dan Maples, Chief Engineer, Lincoln Harris



Governair is a brand of Nortek Air Solutions, LLC, a leader in innovative custom and engineered HVAC solutions for commercial, industrial and critical environments. Products are protected by patents, see www.nortekair.com/patents for more information. Governair, Coplanar Silencer, FANWALL and FANWALL TECHNOLOGY are trademarks of Nortek Air Solutions, LLC.