

CASE STUDY



INDIVIDUALLY CONTROLLED OPERATING ROOM CONDITIONS WILLIS KNIGHTON HEALTHCARE SHREVEPORT, LOUISIANA

BACKGROUND

The Willis Knighton Health Care System is a diversified health care provider serving Northern Louisiana. The system operates two major hospitals, an outpatient surgical center and many medical office buildings.

In 1993, system administrators began planning to rehabilitate the air handling systems for eight of the Shreveport hospital's operating rooms. Originally installed in 1964, the mechanical system was at the end of its useful life.

Purtle & Associates, an engineering consulting firm, was engaged to upgrade the systems to comply with current code requirements and to meet the guidelines of ASHRAE Standard 62-89.

Above: At the Willis Knighton hospital, a Munters MedAire system allows eight Surgeons to simultaneously set different OR's to the exact temperature and humidity needed for each procedure.

THE PROBLEMS

In the operating rooms, temperature and humidity control had become a problem. Complex, lengthy surgical procedures require low temperatures. Systems designed for temperatures of 72–75°F did not have the capacity to maintain 66-68°F in the operating rooms.

Such low temperatures are essential because Surgeons may operate for 10 to 14 hours of strenuous physical effort during orthopedic procedures, or an equal time while performing delicate neurosurgery or cardiac replacements. This effort occurs while the surgical staff is clothed in three layers of protective garments to guard against blood-borne pathogens. And humidity must be maintained below 70% rh in duct work to avoid the fungal growth which can be hazardous to patients with open wounds.

Consequently, Purtle & Associates chose a Munters MedAire System, which uses desiccant technology to control humidity at low temperatures.



DESIGN ISSUES

Ninety-five percent of the sensible heat and moisture loads on an OR are contained in the ventilation air. When the incoming air is cooled and dehumidified deeply, that air will absorb the heat and moisture loads generated in the operating rooms. Recognizing this, Jerry Ivey, the project engineer for Purtle & Associates, installed a MedAire system for the make-up air.

By using a desiccant system, the hospital took advantage of wasted steam. Sterilizers require the operation of both boilers even during summer. The excess steam was used for desiccant reactivation, eliminating incremental cost for operating the desiccant system.

Ivey considered cooling-based humidity control, but rejected that approach. The supply air dew point needed to be 42°F, so the existing OR chilled water system would have required replacement with a glycol system. That would have eliminated the current safety feature of having the main chilled water system back up the OR cooling system. While cooling technology could have been made to work by using return air and more air changes, that approach would have required adding, large duct work, which would have interrupted surgical revenue for the construction process.

Finally, the MedAire system provides very low humidity in the duct work. Low humidity allows compliance with ASHRAE Standard 62, which cautions against the hazards of fungal infection of duct work when relative humidity exceeds 70%.

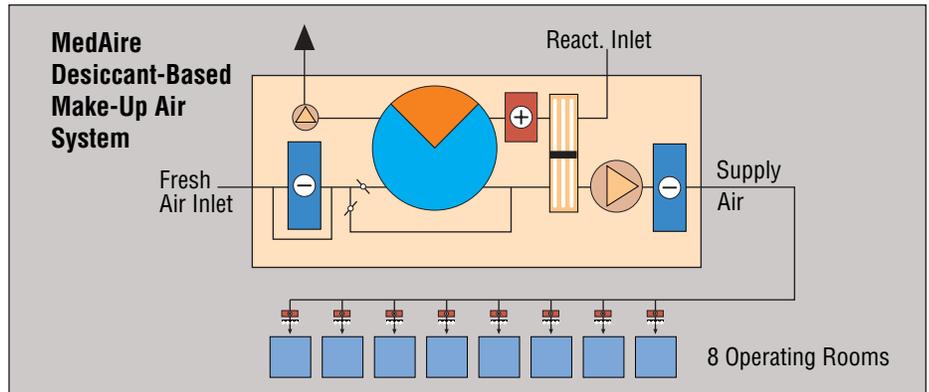


Figure 1.

THE MEDAIRE SOLUTION

The MedAire system (Figure 1) pre-cools and pre-dehumidifies 7700 cfm of make-up air. The air is “deep-dried” by a desiccant wheel, so it can be supplied to the operating rooms at a 42°F dew point. Then a heat pipe moves some of the dehumidification heat from the supply air to the reactivation air, where heat can be used productively. Finally, a chilled water coil cools the supply air to 52°F.

The MedAire system removes 366 lbs. of water vapor every hour from the OR’s, which allows the system to easily maintain the spaces at 45% rh, even though the room temperature is 68°F.

Humidity is controlled with a variable bypass around the desiccant wheel. As the outside air moisture level drops, air bypasses the wheel. This keeps humidity within 1% rh of set point regardless of changes in moisture loads. With no need to control humidity, the cooling coils control temperature very easily by varying the chilled water flow.

Individual reheat coils and separate steam humidifiers are provided for each OR, so that each surgeon sets the exact conditions for the current procedure. Also, the massive capacity of the MedAire system allows fast changes, so surgical staff and facilities are not idle while waiting for the system to stabilize at new conditions.

Figure 2. MedAire is installed at the make-up air inlet, avoiding construction interruptions to the HVAC system.

Because surgeons are confident that conditions will be quickly achieved and accurately maintained, they continue to refer their complex cases to Willis Knighton. In effect, the MedAire system provides a competitive advantage for the hospital.

BENEFITS

- **Enhances Revenue From Surgery**
By keeping Surgeons comfortable during long operations, the MedAire system helps the hospital retain revenue-producing procedures, and reduces the risk of errors caused by stressful working conditions.
- **Avoids Revenue Interruption**
By achieving complete control though treating only the make-up air, the MedAire system can be placed on older buildings without tearing apart the entire air distribution system, which would halt surgery for an extended period.
- **Dry, Safe Duct Work**
The desiccant wheel dries air so deeply that humidity stays well below the 70% threshold for fungal growth, minimizing the risk of infection from microorganisms produced in the air handling system.
- **Superb Control at Minimal Cost**
By using extra steam capacity for desiccant reactivation, the cost of removing massive amounts of excess moisture is very low. The MedAire system allows the hospital to make the most productive use of existing equipment.