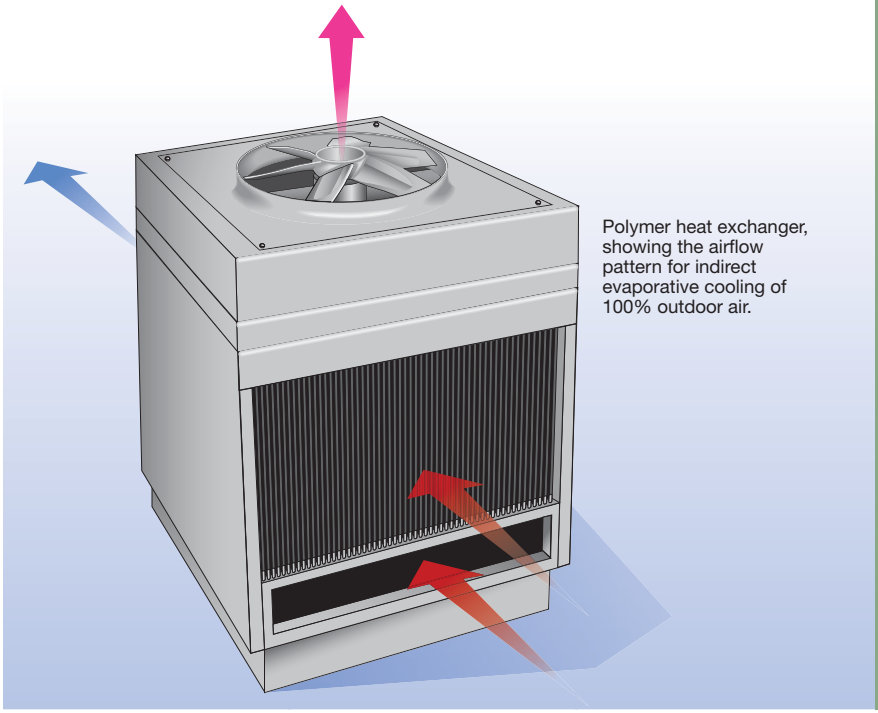
Indirect evaporative cooling uses outdoor air to reduce cooling costs for surgical suites

Indirect (dry) evaporative cooling helps provide substantial amounts of outdoor air to meet ASHRAE Standard 62 requirements, while keeping energy costs conservative. Here in the wine country north of San Francisco, a high-efficiency, air-to-air heat exchanger is using indirect evaporative cooling to introduce 100% outdoor air with less refrigeration consumption for the hospital surgery suites than a recirculation system introducing 30% outdoor air.

Indirect (dry) evaporative cooling results in a 31% reduction in cooling load tonnage, while providing the surgery suites with a ventilation rate of 70 cfm per person—more outdoor air than the 30 cfm per person called for in ASHRAE Standard 62.

A 1991 study by Dr. Nardell, M.D. (of the Massachusetts Department of Public Health, Center for Disease Control), titled "Airborne Infection: Theoretical Limits of Protection Achievable by Building Ventilation," shows that cross-infection may be reduced by more than 50% with an increase from 30 cfm to 100 cfm of outdoor air per person. As the saying goes, "The solution to pollution is dilution."



Polymer heat exchanger, showing the airflow pattern for indirect evaporative cooling of 100% outdoor air.

CASE STUDY:
Sutter Warrack Hospital

BENEFITS

- 100% outdoor air
- Low maintenance heat exchanger
- Reduced cooling energy costs
- Improved IAQ
- Meets ASHRAE Standard 62

Munters

The Hospital

Sutter Warrack Hospital in Santa Rosa, originally constructed in 1960, is a 79-bed, 65,000-square-foot, acute care facility with four operating rooms.

The surgery HVAC system remodeling work was designed and installed by H&C Metal Products of Santa Rosa. The company has been a pioneer in the development of indirect evaporative cooling systems for the HVAC industry, with more than 100 installations dating back to 1980.

The Munters surgery air-handling unit employs a new polymer, air-to-air heat exchanger. Using scavenger rooftop air to dry-cool the supply air, the approach to ambient wetbulb temperatures is in the range of 70% to 80%.

The air-handling unit employs a blow-through design which, with a 75% efficient indirect evaporative cooler, will eliminate 2° of the 3°F fan heat normally added to the system's refrigeration load. The static pressure penalty of the heat exchanger ranges from 0.5 to 0.6 in. wg at design flow, so EER values are typically over 20.

Rooftop units are available in many shapes and sizes, for applications ranging from residential to heavy commercial-industrial. This makeup air unit was placed on top of Sutter Warrack Hospital in Santa Rosa, California.

Survival, Maintenance

One reason for selecting a plastic heat exchanger for indirect evaporative cooling is its ability to survive and minimize maintenance costs in a hard water application.

The polymer tubes are elliptically shaped to flex slightly at startup and shutdown of the fan systems, to shed any wet-side hardness buildup into the unit sump. The heat exchanger meets the UL 90V-0 Fire and Smoke standards.

The energy impact of indirect evaporative cooling is obvious in arid climates such as California. Buildings like hospitals, schools, and prisons, which require a high outdoor air rate to meet the ASHRAE Standard 62 criteria, may be designed for 100% outdoor air, with a reduction in peak cooling demand tonnage. VAV systems connected to outdoor air/return air/exhaust air economy-cycle dampers have created a great deal of ventilation rate uncertainty as supply air fans throttle down during cooler weather.

Improved IAQ, Too

With indirect evaporative cooling, the designer may decouple the VAV system from an air-side economizer, improve indoor air quality, and reduce cooling energy costs in the arid, western regions of the United States.

Many consulting engineers were beginning to think that VAV and IAQ were mutually exclusive. However, with dry evaporative cooling, we may once again employ this energy-efficient design strategy with renewed assurances that minimum outdoor air requirements are met or exceeded.

For VAV systems, verification of outdoor air in the occupied area becomes as simple as putting an air-capture hood up to any ceiling diffuser in any zone, and adjusting the VAV terminal minimum-flow setpoint to meet the ASHRAE Standard 62 cfm per-person requirements.

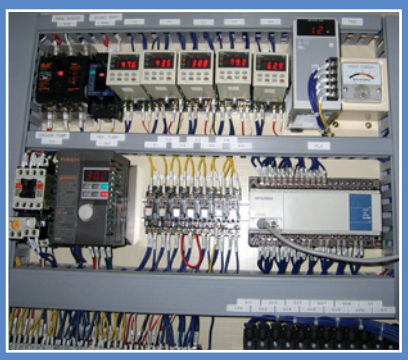
Certain zones may require reheat during winter weather, based on location within the building or space occupancy.

System Specs

Sutter Warrack Hospital system is a 5,000 cfm, constant volume supply air unit with a required delivery temperature of 52°F off the direct-expansion (DX) refrigeration coils.

The refrigeration system is sized to produce 14 tons of cooling on a summer design day of 99°F drybulb and 69°F wetbulb. The outdoor air is indirect evaporatively cooled, from 102°F drybulb (after fan heat) and 70°F wetbulb, down to 77.25°F drybulb and 61.5°F wetbulb entering the refrigeration coil.

A hot water heating coil provides 196,000 BTU of heating in winter months.



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