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Free-Cooling Chillers, Rear-Door Coolers Yield Flexibility, Savings for Data Center

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Facility able to handle wide array of server densities

Looking to expand a thriving colocation data-center business, LightBound LLC, an Indianapolis-based provider of business-technology services, including managed servers, data backup, disaster recovery, and cloud computing, set out to create a 47,000-sq-ft data center to handle server densities from 1 kw to 35 kw per rack with a uniform but flexible cooling solution.

The initial design utilized evaporative cooling towers on the roof and water-cooled chillers supplying chilled water at 55°F on the first floor. One 24-in.-wide "in-row" cooler between every other server rack and a hot/cold-aisle containment system were proposed. This design, however, failed to address the need for server-layout flexibility and placed a significant premium on floor space. Available server-rack space was reduced by almost 50 percent because of the in-row coolers' cabinet footprint.

Indianapolis-based DEEM was engaged by LightBound to review the initial design. To maximize usable floor space, reduce power costs, and capitalize on Indianapolis' cooler seasonal temperatures, DEEM proposed a unique cooling solution for the data center.



Air-cooled free-cooling chillers atop the LightBound facility.

The first phase of the project involved the installation of three Motivaire air-cooled free-cooling chillers in an N+1 configuration on the roof and 57 Motivaire Chilled Door high-density rack-

cooling units on the rear of the server racks in the data center. This design almost doubled the available rack space on the first floor and significantly reduced the size of the mechanical room. Most importantly, it created a highly efficient and flexible data center.

The 350-ton free-cooling chillers supply 64°F glycol to the data center year-round, with 76°F glycol returning to the chillers for the highest possible efficiency. Each chiller offers maximum air-cooled efficiency during summer while providing partial or 100-percent free cooling during seasonal cool temperatures.

By elevating chilled-glycol temperature and, thus, increasing available free-cooling hours, the DEEM design always provides 100-percent sensible cooling at the racks and allows the free-cooling chillers to provide a weighted average energy-efficiency ratio of 62.1. This saves over 40 percent in recurring power costs compared with the original design while creating more free space in the building. The data center's overall risk factor and maintenance costs were reduced through elimination of cooling towers and their dependence on treated city makeup water.

Inside of the data center, the Chilled Door units provide server-rack cooling that automatically adjusts to match the changing heat load of clients' servers. Each Chilled Door has an integrated programmable logic controller (PLC) that actively controls five 75-w electronically commutated (EC) fan motors and a modulating chilled-water control valve. This allows the Chilled Door units to adjust their cooling capacity, while 64°F entering glycol guarantees 100-percent sensible cooling for any rack density.



Chilled Door high-density rack-cooling units.

The Chilled Door solution allows flexibility for future growth and infinitely variable cooling capacity. EC-fan power ranges from under 5 w at minimum heat loads to a maximum of 350 w per door with 40-kw rack density loading.

By simply replacing the standard rack rear doors, the Chilled Door units occupy minimal floor

space. They are connected to the underfloor chilled-water supply and return headers via two 1-in. flexible hydraulic hoses.

The Chilled Door units remove the entire server heat load at its source and deliver conditioned air back to the data center at the design room temperature of 75°F with a heat-neutral effect on the room. This eliminates the need for hot or cold containment aisles and computer-room air-conditioning units.

Mapped data points from the Chilled Door PLCs allow LightBound to monitor each rack in real time, giving important live feedback to the front-end control system and enabling the optimization of overall system efficiency. LightBound is able to cater to each client's individual needs with "active" cooling and rack-level control while maintaining overall data-center temperature control at the lowest operating cost.

With 17 MW of available power in its new high-efficiency data center, LightBound can offer its services to a broader range of clients while maximizing its own capital investment.

"We're excited to be able to offer both high- and low-density clients a way to safely and efficiently store their critical data," Jack Carr, president of LightBound, said. "We truly believe we have positioned this data center as a leader in its class."

Information and photographs courtesy of Motivair Corp.

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