CASE STUDY

DATA CENTER
Involta, Northpointe

Involta's HVAC design team's ongoing innovations with air dispersion, VFDs, air distribution configuration reaps an impressive 1.3 PUE.

HVAC System Design Helps Data Center Facility Efficiency Rank in Industry's Top Five Percent

Freeport, Pa.—There are dozens of data center cooling methods, however multi-tenant, co-location data center operator Involta LLC believes its HVAC design team has developed one of the industry's most efficient concepts.

Involta Northpointe, a recently-opened, 40,000 sqft data center in the Northpointe Industrial Park, Freeport Pa., is already recording an impressive 1.3 power usage effectiveness (PUE), which places it in the top five percent of efficient multi-tenant data centers nationwide. The performance statistics haven't gone unnoticed. Involta recently signed one of the nation's top healthcare providers, University of Pittsburgh Medical Center (UPMC), as Northpointe's anchor tenant.

Uptime Institute, the industry benchmark for certifying data centers for design, construction, management and operations, issued Northpointe a Tier III Certification, which includes HVAC capabilities of cooling 725-kW/hr of critical heat load even during a power interruption.

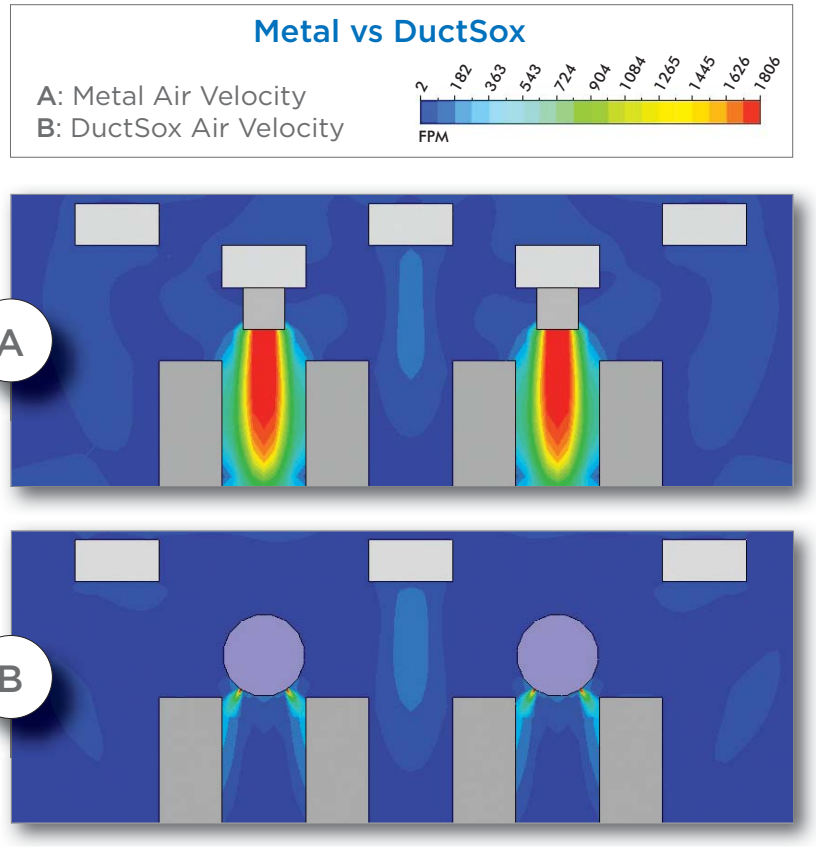
Involta has continually strived for higher efficiencies. For example, Northpointe's HVAC design is 52-percent more efficient, and uses half the energy of Involta's first co-location opened in 2008.

The statistical performance leading up to Northpointe's prototype didn't occur overnight however, but is due rather to a series of progressive HVAC design modifications Involta's design team have made constructing and retrofitting its 12 other co-locations in Arizona, Pennsylvania, Ohio, Minnesota, Iowa and Idaho comprising 300,000 sqft. Innovations include developing data center-specific air dispersion, variable frequency drives (VFD) on cooling systems, and supply/ return air plenum designs.

The Involta team includes in-house designers Chief Security Officer, Jeff Thorsteinson, and Director

of Data Center operations, Lucas Mistelske. The team also includes outsourced consultants, architects and engineers: Jason Lindquist, P.E., associate at consulting engineering firm Erikson Ellison & Associates (EEA), New Brighton, Minn.; and Scott Friauf, president of general contractor Rinderknecht & Associates, Cedar Rapids; and fabric air dispersion manufacturer, DuctSox Corp., Dubuque, Iowa.

Northpointe features a common industry methodology of computer room air conditioners (CRAC) that supply displacement ductwork runs centered above electronics rack cold aisles. However, that's where the similarities stop.



"The data center industry has come to realize that strategic air dispersion, not more cooling volume is the secret to effective rack cooling, facility efficiency and minimal equipment failures," said Thorsteinson.

Traditional metal ductwork in earlier Involta locations, whether recessed in ceilings or exposed over cold aisles, fell short of delivering efficient and effective cooling even though there was sufficient CRAC capacity and room temperatures as recommended by American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) Standard 90.4, "Energy Standard for Data Centers" and TC9.9, "Data Center Power Equipment Thermal Guideline and Best Practices."

The main shortcoming was metal duct's inherent high velocities resulting in turbulences that prevented electronic equipment fans to draw cooling into the racks. The high velocities of 800 feet/min. (FPM) and beyond also caused inefficient return air strategies.

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Consequently, Involta collaborated with fabric duct manufacturer, DuctSox to develop DataSox, an air dispersion duct that's specifically aimed at solving air distribution challenges unique to data centers.

The design solved velocity, volume and turbulant air dispersion issues. At Northpointe, DataSox are positioned over the cold aisles in double 36-inch-diameter, 36-foot long runs. A majority of air is distributed through the fabric porosity consisting of micro perforations located on the bottom half of the round, static-free fabric. There are also field-adjustable, directional nozzles running linearly down both sides at 5:30 and 6:30 o'clock locations that allow higher concentrations for hot spots. Lindquist also specified dampers for duct take-offs in the event a duct run is uninstalled for commercial laundering, reconfiguration or adjustments. Generally, data center-specific fabric air dispersion is factory-designed for a particular project's specifications. In the field however, the nozzles can be throttled and redirected to eliminate any damper balancing commonly required in conventional metal ductwork projects. "This unique approach that the Involta team innovated in its recent data centers is very impressive, and according to our tests, has outperformed a lot of other HVAC concepts we've looked at," said Lindquist, who has designed more than 12 data center mechanical systems.

Energy-Saving Stats

The CRACs discharge 64°F air and the racks generally draw in 64°F to 67°F air. Return air temperatures to the CRACs' return plenum ranges from 82°F to 95°F.

Cold aisle temperature uniformity in conventionally-designed data centers can surpass a 10-degree (Fahrenheit) differential in conventional data center air distribution designs. However, Northpointe's design records very slim cold aisle differentials of only two degrees from the top to bottom.

A precursor to this design, Involta's Marion, Iowa-based co-location, was retrofitted from metal duct/ conventional air handlers to data center-specific DataSox and CRACs with VFDs and other enhancements. The HVAC retrofit reduced energy usage by 80,000-kW/hr. monthly.

Northpointe's mechanical room configuration innovatively splits the data center into 200-rack and 180-rack halls. In the centrally-located mechanical room, each bank of ten 24-ton DA085 upflow CRACs by Vertiv, is positioned along the wall of the room it supplies. For example, the 200-rack room is anchored by 10 CRACs supplying approximately 13,000-total CFMs controlled by VFDs. Each CRAC offers redundant refrigerant circuits and fans. The CRACs' two-stage scroll compressors switch to free cooling when outdoor ambient temperatures drop to 54°F or less. The CRACs reject heat to rooftop high-efficiency micro-channel condensers.

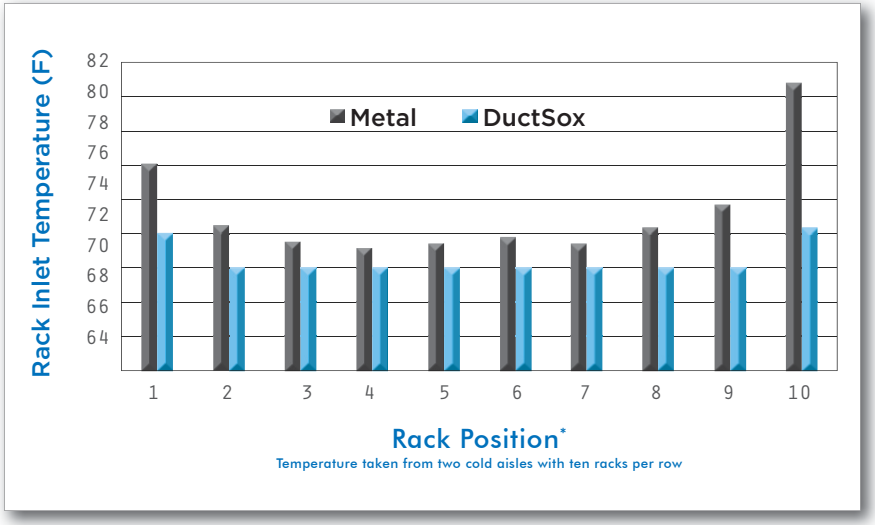
The VFDs operate the CRACs at 20 to 40-percent capacity; however the i-Vu building automation system (BAS) by Carrier Corp., Syracuse, N.Y., can call for more in high humidity situations. "Running at these lower fan speeds, obviously saves us a lot of energy," said Thorsteinson.

Rinderknecht's energy-efficient building envelope consists of a structural steel and metal stud-framed frontend construction for offices, storage and other non-data rooms supplied HVAC by Voyager Series rooftop systems by Carrier. The data halls are constructed of tornado-proof, 12-inch-thick, pre-cast concrete cores. Roof R-value insulation averages approximately R-36 and far surpasses ASHRAE 90.1 building energy code standards and adds to the facility's total energy savings.

Rinderknecht also designed a supply plenum and separate return air plenum that connect to each data hall's bank of CRACs. The return air collection of taking rising warm air and delivering it to a plenum arrangement the CRACs share is an innovation Rinderknecht designed.

Uptime Institute Certification

The HVAC section of Uptime certification wasn't easy. Uptime Institute certifiers had never before seen such a plenum arrangement and air delivery system. Therefore, they required unusual data from EEA, such as calculations on the mechanical spine pressurization, or unprecedented worst case scenarios of extreme pressurization, airflow and



temperature events. "They were initially quite skeptical of our HVAC approach and required test data that was well beyond typical certification requirements, but ultimately we proved the energy efficiency, airflow uniformity and performance claims," said Thorsteinson.

Rinderknecht was also proactive in helping Involta obtain utility rebates for LED lighting, lighting controls, BAS controls, uninterrupted power supplies (UPS), static transfer switches, direct current circuits, Energy Star-rated transformers and a host of other gear.

Besides Uptime Institute certification and energy efficiency, potential customers are wowed by the visual impact the unique air dispersion makes when touring an Involta facility. "Their (Datasox) unique appearance always prompts questions, which is always a good thing," said Thorsteinson. "Afterward they typically view them as innovative and smart."

For more information about how fabric air dispersion can improve the energy efficiency of your data center go to ***info.ductsox.com/data/download***

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