

Engineer's HVAC Retrofit Design Cuts Costs in Printing Plant's Quest For Employee IAQ.

Modifying existing rooftop units saves equipment costs; USING FABRIC DUCTWORK FOR SPOT COOLING SAVES OVER \$150,000 IN LABOR, MATERIALS.

Saratoga Springs, NY—Mechanical engineer, Fil Fina, PE, believes there are hundreds of industrial plants across the country with the same employee indoor air quality (IAQ) challenges that printing giant, **Quad/Graphics**, faced at its catalog printing plant in Saratoga Springs, NY.

Hot summer interior temperatures could be uncomfortable. High-speed, offset printing presses, gas-fired dryers with accompanying fume incinerators, and other equipment inherent in the magazine and catalog printing business also added to the summertime heat. Air conditioning even a portion of the one million square feet at the Saratoga Springs complex would have been cost prohibitive with the tons of metal ductwork needed plus costly energy consumption.

Even though Quad/Graphics surpassed Occupational Safety & Health Administration (OSHA) standards, management had a quest for superior IAQ. "I think a lot of industrial plants are in the situation where they want to improve employee IAQ, but there's just no way to do it cost effectively," said Fina, a semi-retired, Saratoga Springs-based engineer who had previously provided Quad/Graphics with a variety of consulting services.

Total plant air conditioning and metal duct installation were cost prohibitive, so Fina employed the cost alternative of fabric ductwork and a past successful technique used in other Quad/Graphics' other plants—spot cooling. The combination is now saving significant operating costs versus total plant air conditioning, according to management.

Fina's spot cooling air distribution layout of five 200-foot-long lengths of fabric duct efficiently spot cool only worker stations at offset printing machines. Depending on outdoor humidity and temperatures, spot cooling the worker stations provides temperatures 10 to 15°F cooler than outdoor temperatures. The 28-inch-diameter Comfort-Throw Sedona fabric ducts manufactured by DuctSox, Dubuque, IA, have from one to three factory-engineered linear diffusers between the 4 and 6 o'clock positions appearing only at points near worker stations. Using fabric duct versus metal saved the project over \$150,000 in labor and materials, Fina estimated.

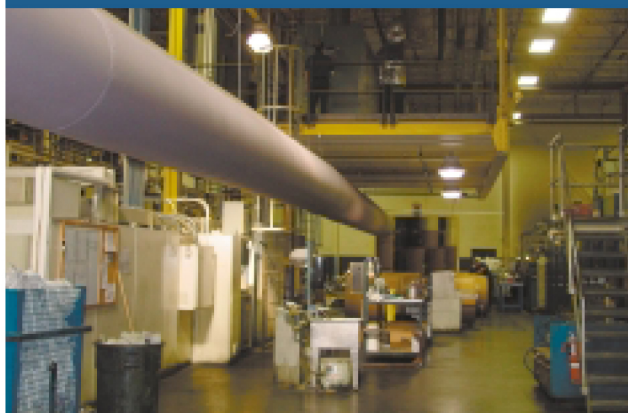
"Because we used fabric duct instead of metal, the retrofit cost was approximately cut in half," said Fina. "Once other engineers realize fabric duct's value in a project such as this, I think you'll be seeing a lot of other industrial plants adding these types of cooling and IAQ benefits for employees."

Another advantage fabric has over metal duct is airflow. The printing process needs gentle airflow that doesn't stir up typical manufacturing dust or disturb paper proofs. Fabric duct's linear slot diffusers provide the airflow needed for employee spot cooling without the need for extensive sheet metal linear diffusers.

The easy removal of fabric duct makes printing equipment very accessible for repair and maintenance. To move heavy-duty lifts past the 10-foot-high duct for printing equipment repair, a section needs only to be unzipped and slid back on its H-track suspension system. If necessary, the H-track itself can be moved with equal ease. **"Anytime you can remove 50 or 60 feet of ductwork in a matter of minutes to gain service accessibility, that's a real advantage and in fact a necessity,"** said Fina. "There's no piece of industrial machinery made yet that doesn't need maintenance. If ductwork interferes with the maintenance of that equipment, then that's unacceptable."

G. Thomas Hutchins, PE, of Queensbury, NY detailed design of the system. Their design also saved air conditioning equipment capital costs as well as long term operating expenses by tapping into the facility's existing chilled process water loop that's used to for cooling the printing equipment. The chilled water feeds five York International Inc., York, PA, coils. Installed by the project's sheet metal contractor, Monahan Metals, Glens Falls, NY, the coils are in each of the five metal supply duct transitions between the make-up air units and their respective run of fabric duct. The system's ample 1,200 tons of capacity is produced in off-peak hours by two existing water-cooled 300-ton York chillers and supplemented at peak loads by two existing 300-ton Trane, Tyler, TX, air-cooled chillers. The facility also uses an underground fire protection water storage tank to provide more than 3,000 ton hours of chilled water storage capacity.

Besides summer operation, Fina also addressed winter IAQ concerns. Because production floor machinery is capable of producing excess heat on most winter days, cooling is still needed. Fina chose a different



type of DuctSox, the Low-Throw Sedona model, which was custom manufactured with a porosity that allows all of the air to flow through the fabric within Fina's airflow velocity requirements of 15 ft./second. The winter DuctSox, which use the same H-track cable suspension system as the summer DuctSox, distribute 100-percent outside air that's tempered to 55°F to 65°F. The even and gentle air dispersion through the material allows the building's air to stratify, with the cooler fresh air near the floor and hot stale air at the ceiling where it is exhausted from the space.

The system introduces 100-percent outside air into the building for comfort ventilation and to replace the air used by the printing equipment. To balance the building pressure according to the number of presses and incinerator exhaust fans, Fina had the building's three existing Greenheck, Schofield, WI, roof-mounted propeller exhaust fans retrofitted with Square D, Palatine, IL, variable speed drives. The Invensys Building Systems, Inc., Loves Park, IL, Network 8000 building automation system monitors and controls the entire ventilation system.

Using different DuctSox models for summer and winter operation affords Quad/Graphics the unique opportunity of cleaning its make-up air distribution system every six months without disrupting production. In just a few hours, Emery with a small crew can easily switch out the 1,000 linear feet of duct systems according to season and commercially launder the disassembled system.

The challenging part of engineering seasonal air distribution systems with two entirely different modes of dispersion (linear vents in the summer and flow through fabric in the winter) was velocity in the duct system. Assisted by Hutchins, Fina and DuctSox engineers designed the wintertime flow through fabric to match the 20,000 cfm flow of the summertime linear vent models.

Because existing and potential Quad/Graphics clients visit the plant daily, aesthetics in the HVAC retrofit was an important factor. Quad/Graphics opted for DuctSox's Sedona fabric for technical and aesthetic reasons. Besides the economical benefits of fabric duct and spot cooling, Fina saved Quad/Graphics additional equipment costs with a modification design of existing Sterling Gas Products, Westfield, MA, rooftop make-up air units versus purchasing new units with direct-fired gas heat. The modification, which was performed by service contractor, Stants Combustion Associates Inc., Albany, NY, consisted of new direct gas-fired burners, gas trains, and burner controls for tempering outside air in winter.

The Quad/Graphics HVAC retrofit design was hugely successful. **"Quad/Graphics reached its goal of increasing year-round employee comfort by implementing a cost effective solution that retains machinery serviceability and plant aesthetics,"** added Fina. ■

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