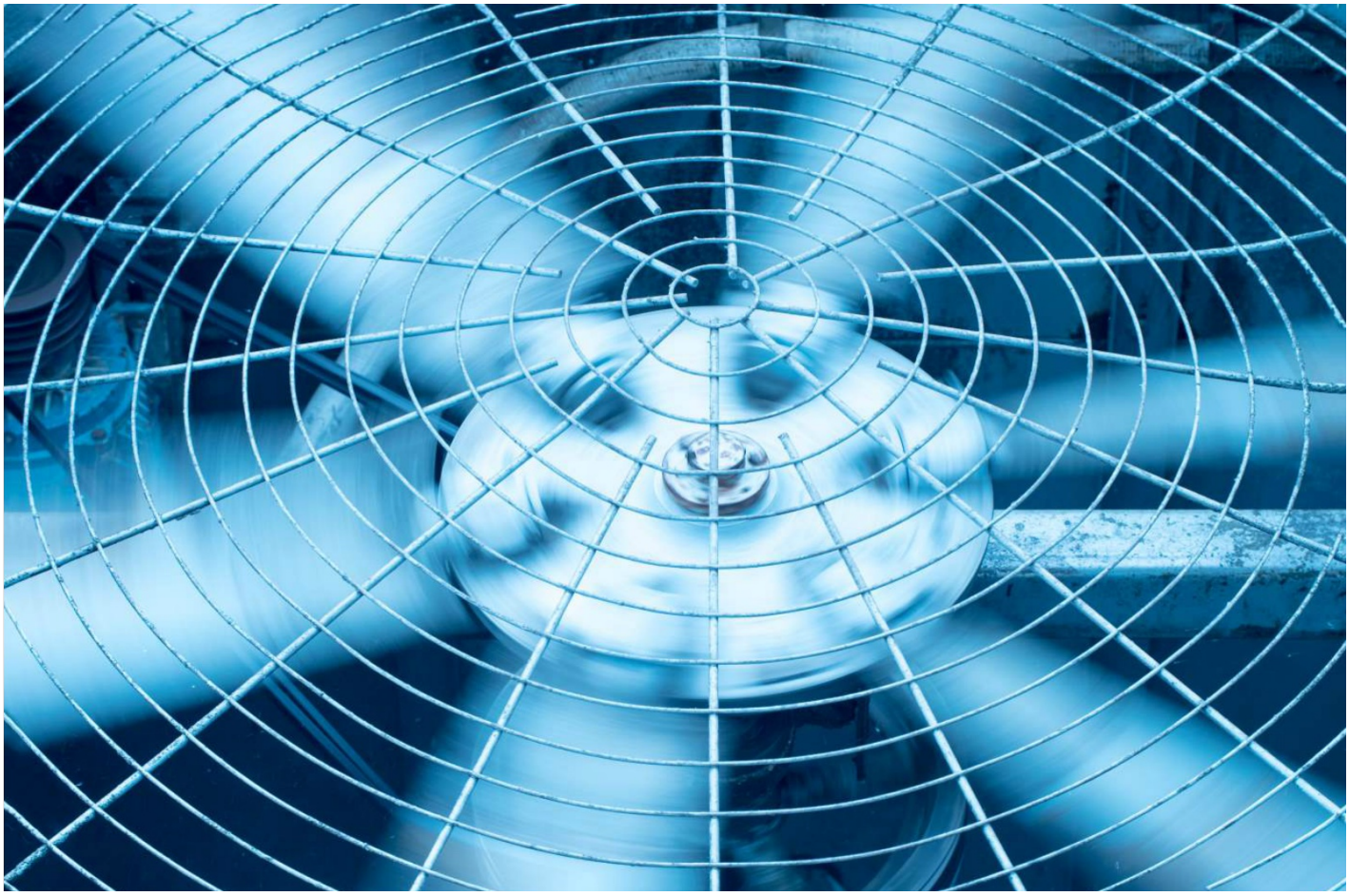
Sealing Heating And Air Conditioning Leaks From The Inside Out

Lawrence Berkeley Natl Lab



Aeroseal, now a division of Carrier Corp., revolutionized the process of searching for, and sealing, hidden leaks in heating and air ducts.

Move over duct tape, a new competitor on the market is getting the job done faster and with more energy savings.

Long thought to be the right solution for stopping leaks around hot or cold air ducts, fabric-backed duct tape fails to seal leaks in ducts and pipes, according to Lawrence Berkeley National Laboratory in Berkeley, Calif.

Instead, Aeroseal duct-sealing technology, invented and developed by the Energy Performance of Buildings Group at Lawrence Berkeley National Laboratory, is making waves for its ability to seal more leakage because of its unconventional method of getting at inaccessible leaks.

> *Each year about $5 billion of energy escapes into thin air due to leaky ducts in American homes.*

The new technology stops the leaks from the inside of the ducts by coating the leaks with tiny sealant particles. The discovery can benefit virtually anyone with a heating and cooling system by offering increased energy savings and

comfort.

Mark Modera, Ph.D., inventor and principal investigator for the research group that developed the technology, is also the principal engineer with Carrier Aeroseal. He points out why it's challenging to maintain a comfortable environment if there are duct leaks.

"You won't have the same degree of comfort in a two-story home that you're trying to cool in summer when you have duct leaks," he explains. "But the Carrier Aeroseal technology allows more air and cooling upstairs and ultimately provides more comfort."

Addressing Energy Costs

Viviana Wolinsky, licensing manager at Berkeley Lab says, "Even in the very early stages of the development, we could see that the duct-sealing technology had far-reaching benefits for everyone interested in decreasing energy costs."

Wolinsky points out that no one wants to pay more for their energy bills than they have to, but when leaky ducts mean you're paying to heat or cool the air outside your home or office, it's doubly frustrating.

"The prospect of being able to make homes and commercial buildings more energy efficient by sealing ducts from the inside, and at the same time making interior environments more comfortable, was exciting from a technology standpoint," she says.

Idea Comes to Life

The first concept for the technology came to Modera in 1987 when it was apparent that the current methods for sealing leaks weren't effective.

"It's difficult, often impossible, to seal duct leaks from the outside when the ducts are in inaccessible locations," says Modera. "When exploring technologies to seal leaks from the inside, I found that sealing leaks in straight pipes is one thing, but too often there are bends and junctions in the ducts and that's where the problem lies."

Modera used his skills as a research scientist to gain information about duct sealing. When he saw a newspaper advertisement touting a company's ability to seal duct leaks, he set up a duct system and invited the company to take a look at it.

"I discovered their method didn't seal the system I showed them," he recalls. "That's when I decided that maybe I could design a technology that would seal ducts from the inside."

Invention Driven by Marketplace Needs

In 1990, the original funding came as part of a multi-year, multi-million dollar Department of Energy (DOE)-sponsored Cooperative Research & Development Agreement between Berkeley Lab and the California Institute for Energy and the Environment, $50,000 of which was for developing duct technology. Subsequent funding of more than $1 million was provided by the Environmental Protection Agency, DOE and the Electric Power Research Institute.

For three years, Modera and a graduate student worked on developing the technology, and in 1993, Modera says, "We figured it out."

Modera explains how the technology works using the analogy of a car driven at high speeds.

“If a car is driven at 90 miles per hour in the city, it will skid out and crash going around the first sharp turn. Similarly, our technology works by using airborne adhesive particles injected into the ducts so that, when they speed up trying to go through a leak, they ‘pile up’ or ‘crash’ into the sides of the leak and seal it.”

Carrier Seals the Deal

In 1997, the technology was licensed for use in the residential market as well as for small commercial buildings. The logical next step was to create a business so the technology could reach customers who needed it. By 1997, Dr. Modera began spending about half of his time in the lab so that he could devote enough time to starting the company.

The marketing of Aeroseal, which is the name of the company as well as the product, was initially done through franchises primarily sold to heating and cooling dealers.

In 2001, the business was sold to Carrier Corp., which in turn created the subsidiary, Carrier Aeroseal. Two years later the company obtained a license from Lawrence Berkeley National Laboratory for improved nozzles and was able to offer the same product and service to the non-residential market.

Hospital Sees Benefits from Duct Sealing

When Cleveland’s MetroHealth Medical Center hired Karpinski Engineering as a consultant to improve the heating, ventilation and air conditioning systems in its Central Sterilization Department, the firm specified that the Carrier Aeroseal method of duct sealing should be utilized for a portion of existing ductwork on the project.

A previous balance report had shown significant leakage in the hospital’s ductwork in this part of the facility.

“We felt that the Carrier Aeroseal technology would be ideal for this project,” says Nathan Anderson, a project engineer with Karpinski. “The hospital has an exhaust fan on the roof and ductwork that was originally installed in the 1970s. When originally constructed, this ductwork was enclosed in a shaft and after the leakage was revealed, the duct was inaccessible for sealing.”

The first steps involved Modera taking measurements and sealing off the existing exhaust grills, and a sealant was injected from the inside of the ducts.

The technology can block off existing exhaust openings that range from a quarter inch to a half inch in size. The time varies from a few hours to a few days depending on the characteristics of individual heating and cooling systems.

“With Carrier Aeroseal, it’s a computerized, high-tech process,” says Anderson. “Once the openings were blocked off, sealing ducts from the inside took just about 30 minutes.”

The “after sealing” report at the time the project was completed in April 2006, showed about 85 percent of the leakage had been plugged — 1,570 cubic feet per minute (cfm) leakage prior to sealing, 230 cfm leakage after sealing.

“By specifying Carrier Aeroseal, we accomplished our goal, which was to improve the exhaust airflow rates,” says Anderson. “If we had not sealed off the ducts from the inside, there would have been significant demolition work involved to accomplish sealing from the outside because of the inaccessibility to the ductwork.”

Meeting the goals of the hospital was paramount for the engineering firm.

“By using this new technology, which has a 10-year warranty, we saved the hospital time and money,” says Anderson.

The engineering firm is so satisfied with the technology, it has specified Carrier Aeroseal to seal 21 ducts in another significant Cleveland building.

“The technology is simple, easy and relevant to today’s world,” says Wolinsky. “Customers realize a demonstrable payback. When they see how much air is escaping in the before-test when compared to after the ducts are sealed, it’s a powerful visual.”

Between 2003 and 2006 Carrier Aeroseal sealed 20 large buildings ranging from offices to hospitals. The company intends to focus on promoting the technology via a larger launch into commercial markets during 2007 and 2008.

“The driving forces are energy savings and building/system performance improvement,” Modera points out. “During the past four years of accelerated testing, the technology has never failed.”

This story was originally published in 2007.

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