

Duct Sealing

Properly sealing ductwork results in several benefits. It improves comfort by increasing the rate at which air is delivered to a space; it can prevent safety problems caused by carbon monoxide gas leaking from water and space-heating equipment; and it improves indoor air quality by reducing the infiltration of dust, humidity, and outdoor fumes and odors. It also saves energy. The most cost-effective time to seal ducts is when an HVAC system is first installed in new construction, because the ducts are easily accessed. However, ductwork can also be sealed in existing buildings.

Duct sealing may be justified on the basis of its non-energy benefits; however, its cost-effectiveness based on energy savings alone is unclear. Research from Lawrence Berkeley National Laboratory shows that 10 to 20 percent of the air from an HVAC supply fan is wasted through leaks in commercial buildings. At 15 percent leakage, buildings must use 25 to 35 percent more fan power to distribute air than if there were no leakage. Stopping this leakage could create significant dollar savings in certain climates. However, the cost of sealing ducts in commercial buildings, particularly in existing ones, is not well established and depends on many factors.

WHAT ARE THE OPTIONS?

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Tapes and mastic. Metal-reinforced tapes and mastic approved by Underwriters Laboratories are the preferred, conventional choice for sealing ducts. Mastic is rubbery, fiber-reinforced goo that is applied with a brush. Large holes are generally patched with sheet metal and then sealed with mastic. Ducts are still often sealed with standard duct tape, but, despite its name, duct tape is a poor material for that purpose.

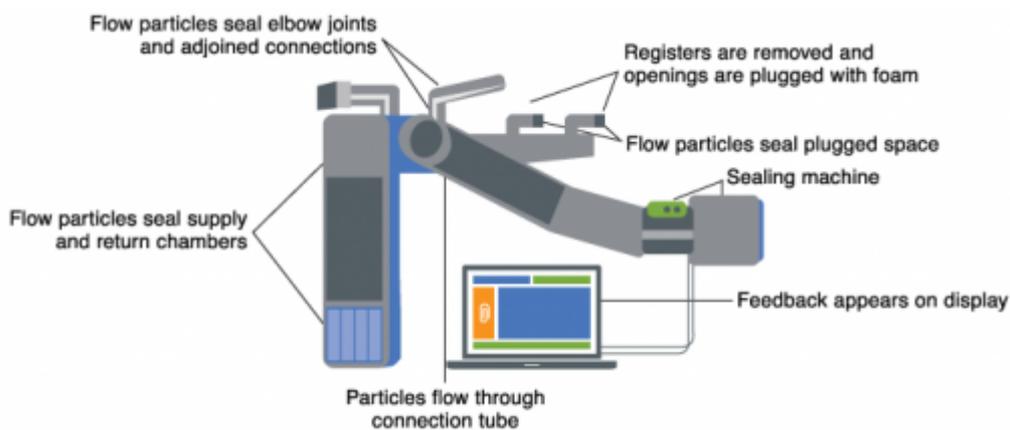
Aerosol sealants. A technology sold under the trade name AeroSeal by Carrier Corp. has the potential to dramatically mitigate leaks and the problems they cause. It works by blowing sticky particles into ducts. The particles attach themselves to the edges of leaks and effectively seal them. Sold as part of a franchised service that includes diagnostics,

repair, safety testing, sealing, and reporting, AeroSeal is the only technology on the market that can seal leaks in ducts made inaccessible by walls and insulation.

How AeroSeal works. When the computerized AeroSeal process begins, all supply registers are removed and foam plugs are installed in their place. An access hole is cut into the supply- or return-air plenum and a temporary collar is attached. The air-conditioning coil, fan, and furnace are temporarily blocked with a foam plug so that sealant particles produced by the machine will not find their way into the equipment. The AeroSeal injection machine is then connected to the duct system using a long, flexible plastic tube (see **Figure 1**). Larger commercial buildings will likely require the simultaneous use of multiple AeroSeal injection machines to effectively seal the ducts.

Figure 1: Duct connection from plenum to AeroSeal machine

An inflatable plastic tube is installed from the AeroSeal machine to the collar at the new plenum opening.



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The AeroSeal software allows the technician to accurately measure duct system leakage. A fan blows small, dry adhesive particles into the temporarily blocked duct system, depositing these particles directly onto the edges of holes to create seals. Because all primary registers and the furnace are blocked, the suspended adhesive particles forced into the ducts have only one place to go. As the airstream exits the duct through leaks, the adhesive particles stick to the edge of the leak and build a seal up to five-eighths of an inch wide without leaving excess deposits on interior duct surfaces. The AeroSeal software allows the technician and the customer to view the sealing process in real time. In addition, while the sealing process is under way, the technician will manually seal leaks found at register boots (the connections from the duct to the register), at return platforms, and in

HVAC equipment. Once the aerosol sealing is complete, the technician measures the duct system leakage using the AeroSeal machine. The computer measures duct leakage amounts before and after sealing and shows the improvement in overall system capacity.

To complete the AeroSeal process, the technician removes all register and equipment plugs from the system, patches the injection hole, and replaces the room registers so that everything is returned to its original state.

In 2014, the Western Cooling Efficiency Center published the report [Speed Program Demonstration For Sealing Duct Leaks Using AeroSeal](#), (PDF) which reviewed the sealing process of University of California, Davis art building. The report found total energy savings at 19 percent, with electric savings of 42,085 kilowatt-hours per year and 3,651 therms per year in heating. The sealing process cost \$78,175, and expected savings per year was \$5,653, which leads to a simple payback period of 14 years. The study notes that actual savings should be higher than modeled savings due to reduced infiltration after rebalancing and additional exhaust fan power savings of an estimated 10 to 15 percent. Over time, feedback for actual savings will accumulate.

HOW TO MAKE THE BEST CHOICE

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Calculate the cost-effectiveness of duct sealing. Potential energy savings that result from reducing duct leakage vary widely with climate, utility rates, occupancy patterns, and HVAC equipment type and vintage. For small commercial buildings, savings are also influenced by whether ducts are located above or below an insulated ceiling. For large commercial buildings, costs are influenced by many other variables, including whether ceiling plenums or ducts are used for returns, how many variable-air-volume boxes are used, and how high the boxes are from the ground. One estimate of the cost for the AeroSeal process averaged across both large and small commercial buildings gives \$0.40 per square foot; however, this will vary widely for the reasons listed above. As AeroSeal franchisees gain experience and recoup their initial investments, the price is likely to fall, which will probably shorten the payback period. Payback will also be quicker where utility rates are high or the local climate requires large heating or cooling loads. Insulating ducts in unconditioned spaces is usually cost-effective and can add to energy savings.

The following online calculator can be used as a screening tool to perform a rough

calculation of the payback period for using aerosol-based duct sealing. The calculation assumes a leakage rate of 25 percent before treatment and 5 percent afterwards. To use the calculator, fill in the required input data for a particular region and click the Calculate button.

Aerosol Duct Sealing Calculator Screening Tool

Consider Aero seal for otherwise intractable problems. In 17 houses in Florida, a crew of utility technicians took 60 percent less time to seal leaks than the researchers estimated would have been required for conventional leak-sealing methods. One contractor found that his employees fruitlessly spent more than 250 hours trying to repair a single faulty residential HVAC system using conventional methods. With Aero seal, they identified the system's problems—one of which was a leaky return air duct hidden behind a wall—and fixed them in less than a day.

Consider the overall duct-sealing package. Aero seal franchises compete with other duct-sealing and diagnosing contractors, whose services vary widely in sophistication and effectiveness. These competitors offer less-expensive (but also less-effective) sealing treatments. Anyone considering the use of Aero seal should weigh its additional benefits over conventional sealing techniques. These benefits include the ability to seal leaks that can't otherwise be reached, safety testing, and the production of detailed performance reports.

WHAT'S ON THE HORIZON?

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As Aero seal franchisees gain experience and recoup their initial investments, their prices are likely to fall, which should shorten payback periods. Quicker paybacks can also be achieved where there is an increasing cost of energy.

Cost-effectiveness of duct sealing will become easier and more convenient to assess as mainstream building energy simulation programs like EnergyPlus and DOE 2.2 begin to provide more accurate and in-depth modeling of duct leaks.

WHO ARE THE MANUFACTURERS?

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- **Aeroseal Inc.** is the only manufacturer of aerosol duct-sealing technology.
- **The Energy Conservatory** manufactures leak-testing equipment for ducts.

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