



Dirt and dust can be brought into a home from an attic and/or crawl space. Researchers have proven that only 20 percent of the air that comes into a home comes from around windows and doors. Unfortunately, that means that 80 percent of the air comes in from attics, crawl spaces, and garages. And duct leakage can exacerbate it.



This illustration shows how supply duct leaks can bring in dust.

**W**e all have heard that duct leakage is bad for system performance and loss of energy. A Department of Energy (DOE) report states, "Most duct systems lose 25-40 percent of the energy." Meanwhile, the Environmental Protection Agency (EPA) stated "as much as 30 percent of energy is lost due to duct leakage." In a recent interview, Max Sherman from Lawrence Berkley Labs said, "It does not make sense to hook up a high-efficient heating and cooling system to a leaky, inefficient duct system."

Why do they all say this? Because it can cost the homeowner more money. However, controlling duct leakage is not just about reducing utility bills. It also is about improving the indoor air quality (IAQ) in the home.

### ONE EQUALS ... 30?

A heating-cooling duct system is supposed to be a closed loop. Every cfm of air that leaves the HVAC unit on the supply side of the box must come back on the return side. In truth, a contractor's job is relatively simple. You take air from the room, put it through a return grille, send it down through a duct, heat it, cool it, clean it, humidify and/or dehumidify it, then send it back down through a duct and bring it back to the structure.

Research has found that a 1-square-inch hole in ductwork has approximately the same impact as a 30-square-inch hole in the outside wall. This is due to the fact there is large pressure in the ducts caused by the fan. Return-side duct leaks suck air from wherever they are connected. When you have a supply-side duct leak it will depressurize the home and replacement air will come in from wherever it can.

Every cfm that leaves the home must come back in, and where it comes from can be a real IAQ problem.

Researchers have proven that only 20 percent of the air that comes into a home comes from around windows and doors — and when it comes to clean air, it is the cleanest we have. Unfortunately, that means 80 percent of the air comes in from attics, crawlspaces, and garages. Duct leakage can exacerbate it.

### BAD AREAS TO GET AIR

Let's look at some of the areas where bad air can get in a home.

**Fireplaces:** Here is an excellent area to make up lost air. Even though there may be a damper in the flue, a fireplace is never airtight. Fine particles get pulled down through the flue and are circulated around the home and can leave streaks on carpet or walls. In addition, many times you can smell the creosote, especially in summer when the fan ramps up to accommodate the air conditioning. The resulting staining sometimes is confused with candle burning, especially under doors or around supply registers on walls or ceilings.

**Gas appliance vents:** A naturally aspirated appliance relies on the draft created by the warm exhaust gases. If the negative pressure created by supply duct leaks to the outside overcomes it, you have unhealthy spillage or back drafting. A return duct leak in an enclosed combustion appliance zone can do the same.

**Garages:** Ten to 40 percent of a home's air infiltration first passes through an attached garage. From an IAQ standpoint, what do we keep in the garage? Well, pretty much everything we don't want to breathe. This includes gasoline, pesticides, solvents, and CO from fuel-burning appliances in the garage or car exhaust. Garages are usually a major source of VOCs in the indoor air.

**Attics:** These are a source of makeup air we definitely do not want to breathe. Insulation particles infiltrating into the home are a common cause of dust complaints. Other IAQ issues can be found in attics, too. For instance, rodents love to burrow into the

insulation. The big problem here is the feces and urine crystals, which are highly allergenic and can also carry the Hanta virus.

**Crawl spaces:** The crawl space is a great place to find types of bacteria or molds we don't want to breathe. Unfortunately, duct leakage can bring this air into the home. Crawl space air also routinely contains radon gas, high humidity, insulation particles, and pesticide chemicals.

There is also a duct leak that most contractors avoid. When the air comes out of the supply registers, it is actually blowing into the largest return plenum in the house, which is the house itself. Pressure imbalances in homes can also cause outside air to be drawn into the home.

### TEST FOR LEAKS

Types of duct leakage vary. Almost all duct systems leak, even a good-looking duct system. They must be sealed using a good fiber-reinforced duct sealant (mastic). In addition, the area between the boot and sheetrock or floor also leaks. This gap can pull air into the home through what is called the venturi effect. This air can contain dust, insulation particles, and humidity.

**Duct leakage, while it does cost the homeowner money, also significantly impacts the indoor quality of the air in the home.**

How do you tell if a home has duct leakage? There are various ways to test a system. A blower door and a smoke puffer will tell you instantly if you have any air coming in from outside the envelope. For exact measuring, use a Duct Air Tightness Tester. Another accurate way is to take an infiltrometer blower door in conjunction with an airflow capture hood. Inferring duct leakage by comparing supply vs. return air balancing measurements is unfortunately a very inaccurate technique, as the leakage we are trying to identify is often the same as the error band of the instruments.

**Bottom line is this:** Duct leakage, while it does cost the homeowner money, also significantly impacts the quality of the air in the home. If you want to claim to be an IAQ problem solver, you have to become a duct renovation expert, too. ■

#### ABOUT THE AUTHOR...

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