# Listening for air leaks

## How to spot infiltration with your ears

Simple acoustical tools and background noise can stem heat and A/C losses

By PAUL BOLON

Thirty to 50 percent of a typical home's heat literally leaks away—expensively heated air escapes through tiny cracks and crevices, and cold air seeps in. Most of us have taken caulking gun and weatherstripping in hand to perform the tedious chore of trying to stem those leaks. But tiny pinholes and cracks are difficult to spot, and sometimes they can't be seen at all.

Even skilled professionals often believe that they can see most air leaks. But obscured joints, such as a soleplate overlapped by siding, can't be inspected by eye. And even if a hole is found and caulked, there hasn't been a way to check whether the leak has been completely closed. But now there's a new method, based on acoustics, to locate those leaks and make sure they're sealed.

David Keast, an engineer in Cambridge, Mass., investigated acoustical leak detection, working under a contract with Brookhaven National Laboratory. He came up with this surprising result: Most leaks can be pinpointed with the use of simple, everyday equipment.

To see how practical the method is—or whether it works at all—I armed myself with a variety of detection equipment and did my own testing. My results confirmed Keast's: Acoustical leak detection does effectively locate significant leaks, and most homeowners can perform this simple procedure themselves.

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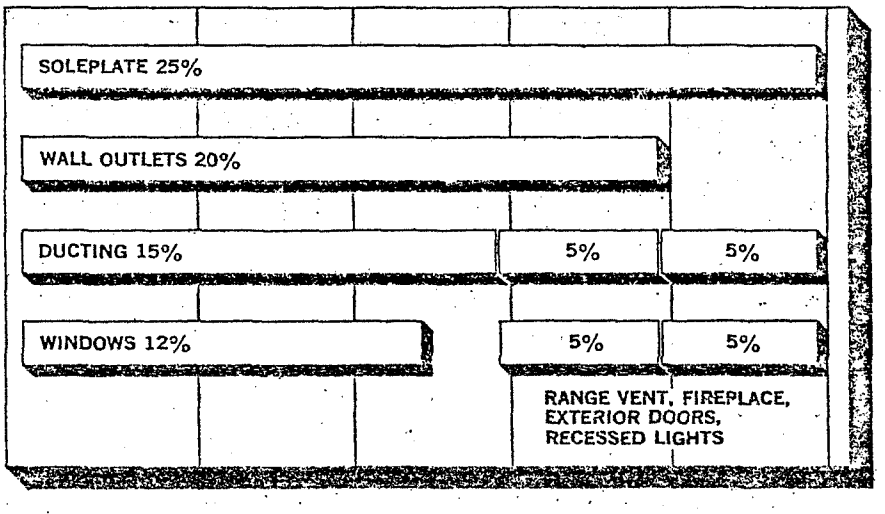
**Detecting air leaks** with a microphone and headset is done with a loud source of sound inside. Even small holes transmit about twice as much sound as the wall itself. Graph below gives locations of heat and A/C losses by infiltration. Five to 20 percent of A/C output is lost via leaks. Piling on insulation will not affect leaking.



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**Checking for air leaks** can be done with hollow-tube earphones (inset). When using simple tools like this, it's best to pick a day when it's quiet outside.

Acoustical leak detection relies on a simple physical phenomenon. An uninterrupted path of air, even a very small one, will carry sound through a wall with a volume twice as great as that which the wall itself transmits. To apply this principle to locating air infiltration, you need only a source of sound—noise, really—and a listening tool precise enough to detect point sources of sound. Leaks can be detected by moving a listening tool such as a mechanic's stethoscope along a joint where a leak is likely—around doors, windows, and soleplates, for example—and noting where the sound is louder. Where there is no leak, you hear only sound that the wall is transmitting. Near a hole, however, the sound increases perceptibly.

You place your sound source inside the house or building on the same floor that you are going to check. Good noise sources include vacuum cleaners, dishwashers, washing machines, or, possibly, records or tapes on a stereo or hi-fi system. The sound need only be fairly steady in volume, and broad band—that is, with many different pitches mixed in. Most musical recordings have too much variation in volume to be useful. Perhaps the easiest way to make use of an appliance for sound is to record it on tape, then play the tape on a stereo system at increased volume.

A number of simple tools qualify as good listening devices: a mechanic's stethoscope; a microphone coupled with a headset; a small, thick-wall rubber hose; a hollow-tube headset of the kind airlines supply for listening to music; or a sound meter.

Keast's testing included all of the devices a homeowner might resort to—as well as a battery-powered microphone and earphone headset that is no longer on the market. I used several sound meters and airline-type, hollow-tube earphones in my tests. I played a tape on small stereo speakers for my source of sound. With all doors and windows shut, I first examined the house with just the earphones, chalk-marking places that were noticeably louder. Then I checked my work with a sensitive sound meter.

Using the earphones, it wasn't difficult to distinguish the louder volume resulting from a medium-to-large leak, and the sound meter verified the location of the leaks I heard. After caulking the holes, the sound diminished, confirming the presence of the original leak.

I found acoustical detecting especially effective in locating leaks at soleplates and around doors. (Incidentally, soleplates should be checked once with the sound source on the first floor and again with it in the basement.) Testing was easier with a good sound meter, since it gave a verifiable reading on its scale. Unfortunately, the less expensive sound meters I tested, costing about $50, have scales that begin at 60 or 70 decibels—not sensitive enough to work conveniently.

The only drawback I found in using the simpler listening device was that my ears got tired after a while. Rest periods between listening intervals helped quite a bit. It also helped to use a headphone set to isolate myself from background noise.

Sound along outside walls is louder where solid surfaces meet inside, as at corners and at floor and ceiling levels. It sounds a third louder at floor level than on the wall above, and about two thirds louder at corners. But since it is the relative volume along each single joint that is compared, this absolute difference poses no problem.

Keast originally thought that home centers or lumberyards might rent battery-powered microphones and headsets to stimulate sales of caulking and weatherstripping. But the idea hasn't caught on, and the nifty battery-powered equipment isn't available now. So we're left with the simpler tools.

One final note: Acoustical leak detection does not spot long and complex leakage paths through walls. For this reason, the method is far less useful on houses already tightly sealed. And it won't tell you whether you have insulation in your stud spaces—or how much.