# Rx for Leaky Outlets

by J.D. Ned Nisson

How important is it to seal electrical outlets against air leakage? Despite the tireless efforts of energy analysts and product manufacturers, nobody will ever come up with a truly valid answer to this question. One obstacle is that finding the "average" air leakage through electrical outlets is like trying to calculate the average size of rocks.

Research reports and published pie charts show that air leakage through outlets can account for 15% to 25% or more of the total air infiltration in a house. But common sense tells us that the amount of air that flows through electrical outlets must depend on the tightness of the exterior sheathing and siding, the wall insulation, and the number of unsealed wiring holes in the top and bottom plates of the wall.

So is it worthwhile to bother sealing electrical outlets against air leakage? In most cases, yes. Not because the effort will save enormous amounts of energy or qualify a builder for the "Tightest House in North America" award, but because it will reduce drafts, avoid moisture condensation problems in walls and attics, and reduce heating and cooling bills a little.

The five following techniques are so inexpensive and easy that they make sense even though we can't exactly quantify the benefits.

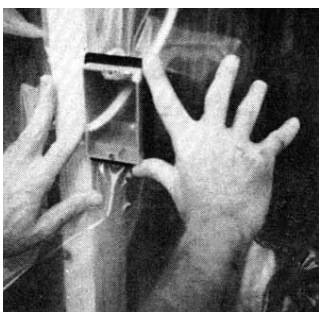


**Figure 1.** *R&S boxes provide a relatively easy and inexpensive seal. Romex wiring enters the box through a neoprene patch. A plastic snap-on ring seals the box to the poly, which is slit to allow access to the wiring.*

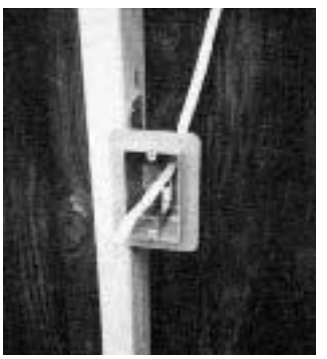
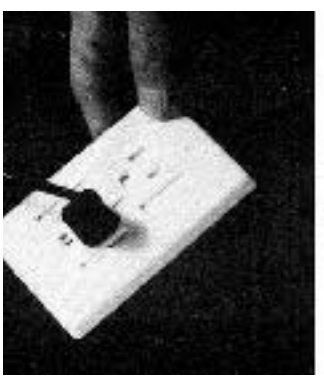


**Figure 2.** *Nu-Tek plastic boxes have a front flange designed for caulking or gasketing to the air barrier.*



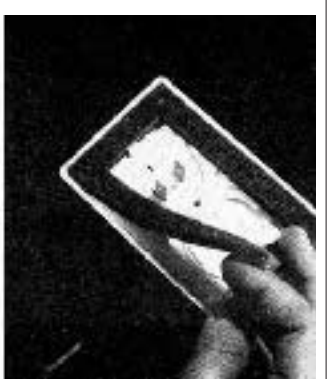


**Figure 3.** *The Carecover outlet cover has sliding plastic panels that seal the outlet when the plug is removed. A urethane gasket on back seals tightly to the wall.*

### Option 1: Airtight Electrical Boxes

Airtight plastic electrical boxes that can be sealed to the wall air barrier are now available from two companies. *R&S Vapour Seal* boxes (R&S Vapour Seal Systems, R.R. #2 Boyers Rd., Keswick, ON L4P 3E9, Canada) have a unique snap-on ring for sealing the box to a polyethylene air barrier (Figure 1). Installation is easy and the ring creates a tight seal between box and air barrier. *Nu-Tek* boxes (Nu-Tek Plastics, 4703 51st St., Delta, BC V4K 2W1, Canada) have a plastic flange which is either caulked to a polyethylene air barrier or gasketed to a drywall air barrier (Figure 2). Both brands have neoprene patches over the wiring holes to seal around Romex cable.

On the samples I tried, the patches were much more substantial on the R&S boxes than on the Nu-Tek boxes and formed a better seal around the wiring. I was told by Nu-Tek, however, that future versions of their product may have an improved patch material.

R&S and Nu-Tek wall boxes both cost about $2 (Canadian). Both companies also make an airtight ceiling box which is slightly more expensive.

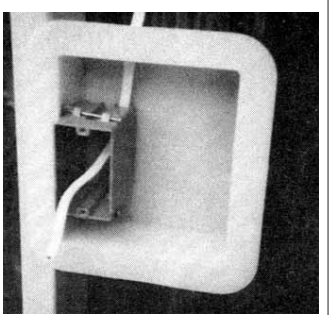


**Figure 4**. *The "poly-pan" is one of the earliest techniques for sealing outlets. Though effective, they cost more and take more time to install than airtight plastic boxes. A Lessco model is pictured.*

### Option 2: Airtight Cover Plates

One simple solution to electrical box air leakage is an airtight cover plate. The only such product I have seen is the *Carecover* (We Care, Inc., P.O. Box 873, Pierre, SD 57501; 605/224-5304). Originally developed as a safety device to prevent children from electrocuting themselves, the Carecover (Figure 3) has two independent spring-loaded sliding panels which seal the sockets of a standard duplex receptacle. An open-cell urethane foam gasket on the back side seals the cover plate to the wall.

One potential drawback to Carecovers is that they are not part of the wall and can be removed by the homeowner, in which case the airtight seal would obviously be lost.

### Option 3: Poly-pans

One of the earliest techniques for sealing electrical boxes was to use "poly-pans" — semirigid polyethylene boxes that form airtight enclosures around conventional electrical boxes. The newest and probably best is the *Lessco* box (Low Energy Systems Supply Company, 990 Mink Lane, Campbellsport, WI 53010; 414/533-8690).

The Lessco box (Figure 4) is much stronger than other poly-pans and its rigid front flange makes a good seal against the drywall. Available in only one size ($6\frac{1}{2}$ x $7\frac{1}{2}$ x $2\frac{7}{8}$ inches), a Lessco box can hold up to a three-gang outlet box.

### Option 4: Recessed Air Barrier

Another older method for reducing air leakage through electrical outlets was to install the boxes inside the air barrier. Some builders actually used surface-mounted wiring and boxes to avoid penetrations through the poly. A more practical approach is to position the air barrier toward the outside of the wall where it will not be penetrated by electrical boxes or wiring. There are two wall designs that allow this — a strapped wall and a double-stud wall.

In a strapped wall, a polyethylene air barrier is sandwiched between the

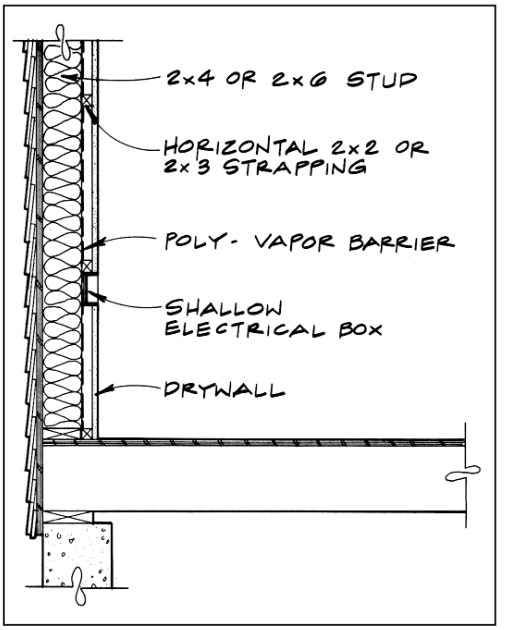



**Figure 5**. *In a strapped wall, the poly air barrier is installed between the studs and horizontal strapping, leaving a 1½-inch cavity for shallow electrical boxes.*

studs and horizontal 2x2-inch strapping, leaving a 1½-inch cavity in which to install shallow electrical boxes and wiring (Figure 5).

When using shallow boxes, keep in mind that the National Electrical Code (NEC) limits the number of conductors according to box volume. Boxes from different manufacturers vary slightly in length and width. Not all single-gang shallow boxes contain the minimum volume (10 cubic inches) for a grounded receptacle. Check manufacturer catalogs for actual volume and the allowable number of conductors for specific boxes. If multiple connections are needed in a single shallow box, it may be necessary to go to a 4-inch box with a mud plate cover. An alternative approach is to use 2x3 strapping, nailed on edge to provide a 2½-inch cavity for larger volume boxes.

Another code-related issue is wiring protection. Section 300-4(1) of the NEC states that wiring run through bored holes must be at least 1½ inches from the stud face. Although this provision is subject to interpretation, it should not apply to wiring that is fished through strapping cavities. The wiring will be close to the wall surface, but since it is not confined in a drilled hole it should not be subject to nail penetration.

Double-stud construction (a rarity nowadays) uses the same approach except the poly is installed between two stud walls, leaving a full 3½-inch cavity for installation of conventional boxes.

### Option 5: Exterior Air Barrier

This is actually a variation on the last option, in which the air barrier is moved all the way to the outer surface of the wall, leaving the entire wall cavity available for electrical components.

An exterior air barrier can be made using airtight sheathing or house wrap that is taped at the seams and sealed at the top and bottom plates of the wall. It can also be created using a skim coat of urethane foam in the stud cavities. While this technique seems very simple (just wrap the house with Tyvek or Typar, right?), it actually requires a good bit of care. Not only must the air barrier be sealed at all seams, but any wiring holes or other penetrations in the top and bottom plates must also be sealed to prevent leakage into the attic or basement. In the final analysis, this technique is likely to be the least effective.

### Which Technique Is Best?

If you are building either strapped walls or double-stud walls, then the best approach is Option 4 — the recessed air barrier. However, it's important to note that electrical box air leakage alone is not sufficient justification for going to a strapped wall or double-wall design.

In any other situation, the most practical and effective choice is probably Option 1 — airtight plastic boxes. They are easier and less expensive than "poly-pans" (Option 3), generally more effective than an exterior air barrier (Option 5) and more permanent than airtight cover plates (Option 2). The only problem with the new airtight boxes is that they are not yet widely available at electrical supply houses. Perhaps that will change if the idea catches on.

### What About Interior Partitions?

I still remember my amazement when a blower door contractor first demonstrated to me how much air actually leaks through electrical outlets in interior partitions. It is now well known that unless top plates are well sealed, interior partitions can provide an excellent pathway for air leakage into attics. In this case, however, the best method of control is to seal all penetrations and gaps around the top plates rather than at the electrical boxes. ■

*J.D. Ned Nisson is president of Energy Design Associates Inc., a New York City-based building systems consulting firm, and editor of Energy Design Update of Arlington, Mass., a monthly technical newsletter on energy-efficient building design and construction.*