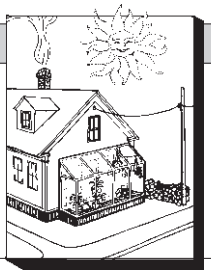

Reflecting on Radiant Barriers

by Chuck Silver

Radiant barriers have received a great deal of attention in the past two years, some good, some bad. To their credit, radiant barriers significantly reduce cooling loads in both new and existing houses. However, the performance claims, installation recommendations, and sales tactics of some manufacturers have been questioned.

Quite a battle has been brewing between Energy Design Update, the leading newsletter on energy-efficient building technology, and the National Energy Specialists Association (NESA), a trade association representing the radiant barrier industry. I'll try to sort through some of the controversy and provide useful information of when, where, and how to use radiant barriers.

What is a Radiant Barrier?

A radiant barrier is a layer of shiny foil installed next to an air space to reduce the radiant flow of heat—whether the aim be heat gain or loss. The radiant barrier may be a thin reinforced foil (reflective on one or both sides), or a reflective surface on a rigid boardstock, such as cardboard or rigid insulation. It is installed so that the reflective surface abuts n air space. Radiant barriers are usually used in unheated attics, but may also be used in wall systems. Some radiant barriers are perforated and some are not; which type you should use depends on the application, as described below. (I won't be discussing radiant insulation "batts"—multiple layers of foil between layers of "bubble pack" that are used in place of conventional batt insulation.)

Installation

How and where to install radiant barriers is a hot topic today. There is strong disagreement as to where the barrier should go in an unheated attic. NESA recommends placement on top of the floor insulation in the attic (see Figure 1) in its training manual *Radiant Barrier Aspects and Applications* (see "Training Manual A Loser"). Eagle Shield, Inc. also recommends this placement, as will DuPont with its upcoming Tyvek radiant barrier.

On the other hand, the Florida Solar Energy Center (FSEC), which has been carrying out research on radiant barriers for years, recommends against installing directly over insulation in an unheated attic. They give two reasons: (1) Dust will accumulate on it and decrease its effectiveness; and (2) Moisture could collect on the underside of the radiant barrier, which could lead to rotting of the joists. Instead, they recommend either draping the radiant barrier over the tops of rafters before installing sheathing so that it hangs down a couple of inches, stapling it to the underside of the rafters (see Figure 1), or attaching it to the decking prior to its installation. It's important to note that in all three

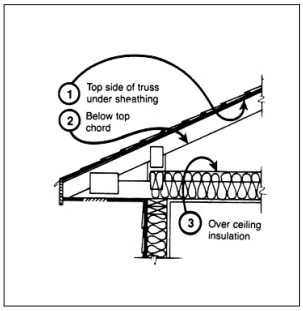

Figure 1. *Typical attic section with three possible locations for a radiant barrier.*

methods, the radiant side (foil side) faces downward.

Recent research at the Oak Ridge National Laboratory has shown that there was better energy performance with the radiant barrier on top of the floor insulation then when it is attached to the rafters. But Ken Wilkes of Oak Ridge agrees that the issues of dust accumulation and moisture condensation with the attic floor installation are still big questions. Work at the lab has shown a somewhat reduced performance with heavy dust accumulation, but not as big a reduction as would be expected.

In the Tennessee climate, they did observe some moisture condensation on the bottom side of perforated radiant barriers on cold nights, but this disappeared the following day. In a few situations with high humidity and cold weather, the condensation did not evaporate s quickly. Nonetheless, Wilkes feels that in their climate, moisture condensation is not a major concern.

DuPont, which may have its new radiant barrier on the market as early as February or March of this year, considers moisture condensation "a very big issue." David West with DuPont said that the preliminary testing of Tyvek Radiant Barrier (made by depositing a very thin metal film on Tyvek Housewrap) showed it to have a moisture vapor transmission of 750 to 1000 grams/m2/day (metric perms). This is actually higher than the permeability of their air barrier! IN fact, West claimed the new DuPont product is five times as permeable as the standard perforated foil products.

While research is continuing on this question, we are unlikely to have a definitive answer any time soon. Dust accumulation and moisture condensation are long-term problems that might not be fully known for a decade or more. Therefore, as with vapor barriers, I opt for a conservative approach: At least in cold or very humid climates I'd follow FSEC's recommendations and install an attic radiant barrier on the rafters, using the type that is permeable to water vapor. When installed directly over the insulation in the attic floor, a permeable radiant barrier is an absolute must.

With wall installations, a radiant barrier must face an air space to be effective. Because most wall systems do not include an air space, one must be created, usually with furring strips. The radiant barrier can be installed either on the outside or inside of the structural wall. In very warm climates, placement on the outside, with the air space vented, will maximize cooling performance. But you need to be careful about moisture problems. Only use a permeable radiant barrier, and install a good vapor barrier on the inside of the wall cavity. Because of moisture-damming concerns, some experts shy away from putting even a perforated radiant barrier on the outside of a studwall. The high permeability of DuPont's new product may eliminate this concern.

In cold climates it makes more sense to put the radiant barrier on the inside where it can double as a vapor barrier. Use a non-permeable radiant barrier or foil-faced rigid insulation and tape the joints. To provide an air space, install 1x or 2x furring strips on the inside of the foil and then drywall. The beauty of this technique is that the radiant barrier serves as the vapor barrier, and the air space provides a wiring chase so penetrations through the barrier will be minimized.

I would like to be able to use a radiant barrier above the insulation in cathedral ceilings—for example, the foil-clad cardboard panels that Parsec

Parsec Retroflect Panels are pressure laminated panels covered with a radiant barrier material on both sides, and are designed to be used where hot and humid weather conditions exist over long periods of time.

sells (see photo). But so far I would be reluctant to do that for fear of condensation. If this is eliminated as a concern or if an adequately permeable rigid baffle could be produced, it would be a great way to obtain an air channel above the fiberglass while reducing summertime heat gain.

Energy Savings

According to FSEC, a radiant barrier installed as they recommend, in an unheated attic, will save 10 to 15 percent on cooling costs in areas with a significant cooling load. This amounts to 5 to 7 percent annual electricity savings. The July 1988 issue of Energy Design Update presented somewhat higher savings estimates: "Radiant barriers could reduce total cooling energy consumption by as much as 25 percent."

Some other estimates are far higher. The NESA training manual (see sidebar for review), while not firmly stating that savings over 30 percent will be achieved, alludes to savings of up to 70 percent throughout the book. According to recent issues of *Energy Design Update*, Eagle Shield, the largest distributor of radiant barriers, and its "independent sales associates" have often misrepresented claims of energy savings. An ad for Eagle Shield in Progressive Builder Magazine claimed savings on utility bills "as much as 45 percent."

Performance claims are hard to verify because despite all the research on radiant barriers, we still don't have a clear picture of how they work. There is very little data on performance in the field. Hopefully that will soon change. The Florida Solar Energy Center, Oak Ridge National Laboratory, the Tennessee Valley Authority, the University of Texas, and other groups are actively involved n radiant barrier research.

Energy Shield, Inc. to its credit, has provided more than $1 million in funding to the NAHB National Research Center for energy savings research for radiant barriers. The 18-month study, to begin in December 1988, will include installation and comprehensive energy monitoring of radiant barriers in 500 homes in eight regions of the U.S. The radiant barriers will be installed, as Eagle Shield recommends, in unheated attics directly over the floor insulation. When final results from the study are published in 1990, they should go a long way toward answering the energy performance questions about this particular radiant barrier application. Unfortunately, the study will not address other radiant barrier installation options (such as attachment to rafters, as FSEC recommends), and it will not address possible dust accumulation and moisture problems with the attic floor installation. ■

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Training Manual A Loser

Radiant Barrier Aspects and Applications written by Michael Cooper and published by the National Energy Specialists Association, is very disappointing. I had hoped to find useful details relating to the installation of radiant barriers. Instead, out of 250 pages total, I found only eight that dealt with installation! The illustrations are not geared toward practical how-to information. Most of the rest of the book is opinion on energy policies and novel theories on heat transfer and energy economics. Energy Design Update calls the book "embarrassing" and I have to agree.

The National Energy Specialists Association and its dedicated staff should be able to do a whole lot better. NESA has a value role to play in the radiant barrier industry. Their literature, especially a "training manual" on radiant barriers, should live up to their reputation. Literature like this makes it easy to understand why the radiant barrier industry has not gotten the respect it deserves.—*A. W.*