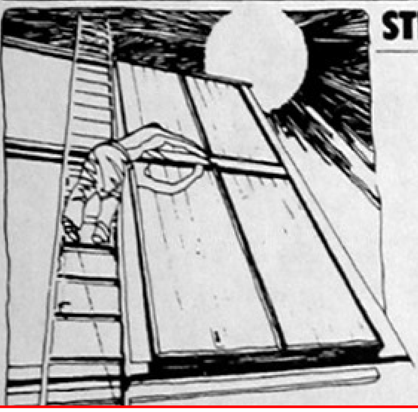


Radiant Barriers

They cut cooling bills and help a little on heating, too.

Radiant barriers are highly cost-effective in hot climates because they sharply reduce cooling loads. They work as if by magic, but the magic is based soundly on principles of physics.

How they work

In summer, heat travels through attics primarily as *radiant* energy, rather than by *conduction* or *convection*. It works like this. The sun heats up the roof surface—as high as 190°F on a black roof or 160°F on a white roof. The heat conducts through to the underside of the sheathing, and from there radiates down to the top of the ceiling insulation. From there, it conducts its way down to the room below.

In this scenario, the top of ceiling insulation actually gets hotter than the air in the attic! That's because the ceiling insulation "sees" the hot underside of the roof sheathing and receives its radiant heat. Place a radiant barrier between the roof sheathing and the ceiling insulation and you break the chain. The heat can no longer radiate down through the attic, but is stopped dead in its tracks. A clean, shiny radiant barrier reflects 97 percent of the radiant heat back up to the roof sheathing, where it came from. The heat is lost back to the outside air.

With the radiant barrier, the ceiling insulation stays cooler, and the attic air (which is heated convectively by the ceiling insulation) stays cooler. Most importantly, the house stays cooler.

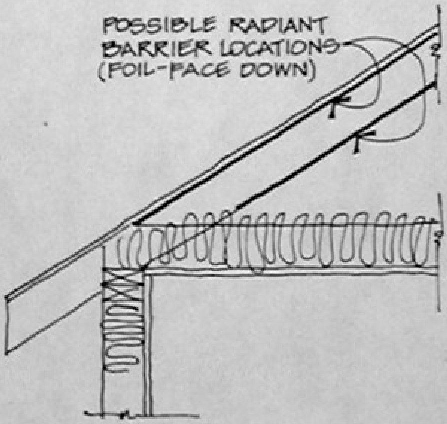
There's one twist. It doesn't matter which way the radiant barrier faces—up or down. This is due to a principle of physics that says a shiny surface will neither absorb nor emit heat very well. Facing up, the shiny surface will not absorb heat from the roof. Facing down, it will not emit heat to the insulation below. In either case, it blocks the radiant transfer. The heat is effectively reflected back to the hot roof.

Steve Bliss is managing editor of Progressive Builder *and building editor of* Solar Age.

If this seems confusing, hold your hand (carefully) an inch below a hot iron. You won't feel much heat because the shiny metal is poor emitter. Now hold it (very briefly) near an electric heater coil, which is a good emitter. It's hot! One more point: A radiant barrier must be metallic and shiny. White won't do. A white surface reflects visible light well, but it absorbs and emits radiant heat as well as a black surface.

How to do it

The Florida Solar Energy Center (FSEC) has experimented with many configurations.



A radiant barrier works best as part of the roof, and to work at all it must face an airspace. Since dust buildup can cut the barrier's performance, it's best if it faces downward.

The one they like best, says FSEC's Philip Fairey, has the foil face-down under the roof sheathing. Facing the foil down, he says, discourages the buildup of dust, which impairs the material's ability to reflect heat.

The general procedure is to staple the foil to rafters, draping it from rafter to rafter. The foil can go either above or below the rafters. In either case, a tight fit isn't required, since radiant transfer is not affected by air movement. It is critical, however, that a radiant barrier face an airspace. Some designers recommend venting the airspaces above the radiant barrier to reduce heat transfer by convection. FSEC has not yet tested this, but researchers there