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RADIANT BARRIER ATTIC FACT SHEET

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Appendix

Test Results

Most tests of radiant barriers have measured the reduction in heat flow through the ceiling caused by adding a radiant barrier. The test results are usually expressed in terms of a percentage ceiling heat flow reduction. Table A1 gives a summary of measured ceiling heat flow reductions for summer conditions when radiant barriers were added in various locations to existing R-19 conventional insulation. Table A2 gives a summary for winter conditions. Table A1 shows that, while there are some variations in the summer data, there is also a good amount of consistency. For winter conditions, there are wider variations in the data and less consistency, but the percentage reductions for winter are less than for summer. Tests by the Tennessee Valley Authority and the Mineral Insulation Manufacturers Association show that increasing the insulation level from R-19 to R-30 instead of installing a radiant barrier reduces the ceiling heat flow by 27 to 33 percent. **REMEMBER THAT THE NUMBERS GIVEN IN THE TABLES ARE PERCENTAGE REDUCTIONS FOR THE HEAT FLOW THROUGH THE CEILING; THEY ARE NOT PERCENTAGE REDUCTIONS FOR TOTAL ENERGY USED BY THE AIR-CONDITIONING OR HEATING EQUIPMENT.**

Energy Savings Worksheet

If you want a more accurate estimate of your energy savings than the ones given in Tables 3-6, you may use the Worksheet given in this Appendix. Step-by-step instructions are as follows:

1. Examine air-conditioning unit, determine SEER (for a key to abbreviations, see page 24). Divide SEER by 3.413 to obtain efficiency or COP and enter result in Box A. Typical efficiencies are given in Table X. If SEER is unknown, enter 2.3 in Box A.

2. Examine heating equipment. Determine whether it is a gas furnace, oil furnace, heat pump, electric furnace, or electric baseboard heating. Determine efficiency, and enter in Box B. Typical efficiencies are given in Table X. If efficiency is unknown, enter 0.65 in Box B.

3. Obtain cost of electricity, either by examining your electric bills or by contacting your utility. Multiply the cost in cents per kilowatt-hour by 2.93 and enter result in Box C.

4. Obtain cost of heating fuel, either by examining your fuel bills or by contacting your utility.
   If you heat with gas, multiply the cost in dollars per CCF (or therm) by 10 and enter result in Box D.
   If you heat with oil, multiply the cost in dollars per gallon by 7.15 and enter result in Box D.
   If you heat with electricity (including a heat pump), multiply the cost in cents per kilowatt-hour by 2.93 and enter result in Box D.

5. Divide the value in Box C by the value in Box A and enter result in Box E.

6. Divide the value in Box D by the value in Box B and enter result in Box F.

7. Inspect your attic to determine the type and level of conventional attic insulation, the area of the ceiling, and whether or not the cooling ducts run through the attic.

   The level of insulation may be estimated with the following chart for insulation thickness (in inches) as a function of insulation type and level:

Type of Insulation	R-11	R-19	R-30	R-38
Fiberglass batts	3.5"	6.25"	9.75"	12.5"
Loose-fill fiberglass	4.75"	8.25"	12.75"	16"
Loose-fill cellulose	3.75"	6.50"	10.50"	13"

   The area of the ceiling is determined by estimating the length and width (in feet) of the ceiling and multiplying these two values together. Enter this value in Box 1.

8. a. **If you plan to install a radiant barrier (RB)**
   Go to Table Y1. Locate a city that is near your location and then read off the value for that city for the level of insulation in your attic. Then multiply this value by one of the following factors depending upon the type of radiant barrier you plan to install, and enter the result in Box 2:

Radiant Barrier Description	Configuration Factor
For low range of values for dusty attic floor RB	0.16
For high range of values for dusty attic floor RB	0.65
For RB attached to rafter bottoms, and with no ducts in attic	0.78

For RB attached to rafter bottoms, and with ducts in attic,	
- and with R-11 conventional attic insulation	0.98
- or with R-19 conventional attic insulation	1.07
- or with R-30 conventional attic insulation	1.15
- or with R-38 conventional attic insulation	1.22
For RB draped over tops of rafters or attached to roof deck,	
- and with no ducts in attic	0.68
For RB draped over tops of rafters or attached to roof deck, and with ducts in attic,	
- and with R-11 conventional attic insulation	0.86
- or with R-19 conventional attic insulation	0.93
- or with R-30 conventional attic insulation	1.01
- or with R-38 conventional attic insulation	1.07

b. **If you plan to install more insulation.**
Go to Table Y3. Locate a city near your location and read off the value for that city and for the initial and final levels of attic insulation. Note that values in the table may be added in steps. For example, if you start with R-11 insulation and want to go to the R-38 level, add the values for going from R-11 to R-19, for R-19 to R-30, and for R-30 to R-38. Enter the value in Box 2.

9. a. **If you plan to install a radiant barrier.**
Go to Table Y2. Locate the same city that you used for Step 8a and read off the value for that city for the level of insulation in your attic. Then multiply this value by one of the following factors depending upon the type of radiant barrier you plan to install, and enter the result in Box 3:

RAdiant Barrier Description	Configuration Factor
For low range of values for dusty attic floor RB	0.24
For high range of values for dusty attic floor RB	0.61
For RB attached to rafter bottoms	0.88
For RB draped over tops of rafters or attached to roof deck	0.82

b. **If you plan to install more insulation.**
Go to Table Y4. Locate the same city that you used for Step 8b and read off the value for that city and for the initial and final levels of attic insulation. Note that values in the table may be added in steps. For example, if you start with R-11 insulation and want to go to the R-38 level, add the values for going from R-11 to R-19, for R-19 to R-30, and for R-30 to R-38. Enter the value in Box 3.

10. Multiply the values in Boxes 1, 2, and E together, and divide the result by 1,000,000. Enter the result in Box 4.

11. Multiply the values in Boxes 1, 3, and F together, and divide the result by 1,000,000. Enter the result in Box 5.

12. Add the values in Boxes 4 and 5 together, and enter the result in Box 6. This is the expected savings per year due to adding a radiant barrier or additional attic insulation.

13. a. **If you plan to install a radiant barrier**
Determine the estimated cost for installing a radiant barrier in your home. This may be from a quote, or you may estimate the cost by using the values in Table 1 along with your estimate of the ceiling area. Note that for radiant barriers installed on the rafters or on the roof deck, you will have to estimate the area of the roof and the areas of the gable ends. Enter the estimated cost in Box 7.

    b. **If you plan to install additional attic insulation.**
Determine the estimated cost for installing more insulation in your home. This may be from a quote, or you may estimate the cost by using the values in Table 2 along with your estimate of the ceiling area. Enter the estimated cost in Box 7.

14. Go to Table Z. Locate the census region where you live and read off the value for electricity. Enter this value in Box 8.

15. Go to Table Z. Locate the census region where you live and read off the value for either electricity, oil, or natural gas, depending upon your heating fuel type. Enter this value in Box 9.

16. Multiply the value in Box 4 by the value in Box 8. Enter the result in Box 10.

17. Multiply the value in Box 5 by the value in Box 9. Enter the result in Box 11.

18. Add the value in Box 10 to the value in Box 11 and enter the result in Box 12.

19. Compare the value in Box 12 with the value in Box 7. If the value in Box 12 is greater than or equal to the value in Box 7, then the radiant barrier or additional insulation is an economical investment. If the value in Box 12 is less than the value in Box 7, then the radiant barrier or additional insulation is not an economical investment.

20. A simple payback period may also be determined by dividing the value in Box 7 by the value in Box 6. The result will be the number of years that it takes for the energy savings with the radiant barrier or additional insulation to pay back its initial cost. Note that this procedure is not applicable to the radiant barrier on the attic floor, because the energy savings changes from year to year.

Note: If you are planning to install a radiant barrier on the attic floor on top of the existing attic insulation, you should go through the worksheet twice, using

	the two factors that are given in Steps 8a and 9a to obtain an estimate of the expected range of energy savings.

Example of Use of Worksheet

I live in Orlando, Florida in a one-level 1800 square foot house. I have a heat pump system that has medium efficiency. My electricity costs 8 cents per kilowatt hour. I have 3.5 inches of fiberglass batt insulation (R-11) in my attic and the air-conditioning ducts are in the attic. A contractor has quoted a price for a radiant barrier installed on the bottoms of my rafters and on the gable ends for $400. Would this be a good investment?

Following the steps outlined in the instructions, the worksheet is filled out. The total present value of energy savings given in Box 12 is $533.14. This value exceeds the quoted cost of the radiant barrier of $400, and thus this would be a good investment.

EXAMPLE

ENERGY SAVINGS ESTIMATE FOR RADIANT BARRIERS OR ATTIC INSULATION WORKSHEET

COST OF ENERGY FOR HEATING AND COOLING

Code: (A)	(B)	(C)	(D)	(E)	(F)
Cooling Equipment Efficiency (From Table X)	Heating Equipment Efficiency (From Table X)	Cooling Fuel Price $/Million BTU	Heating Fuel Price $/Million BTU	Cooling Energy Cost $/Million BTU [C÷A]	Heating Energy Cost $/Million BTU [D÷B]
2.6	1.9	8x2.93= 23.44	8x2.93= 23.44	9.02	12.34

For fuel prices:

Electricity: $/million BTU = ¢/KWH x 2.93
Natural Gas: $/million BTU = ($/therm or $/CCF) x 10
Fuel Oil: $/million BTU = $/gal. x 7.15

ESTIMATED ENERGY SAVINGS

Code: (1)	(2)	(3)	(4)	(5)	(6)	(7)
Ceiling Area, Square Feet	Cooling Load Factor (From Table Y)	Heating Load Factor (From Table Y)	Annual Cooling Savings, $/yr [(1) x (2) x E] ÷ 1,000,000	Annual Heating Savings, $/yr [(1) x (3) x F]÷ 1,000,000	Total Energy Savings, $/yr [(4)+(5)]	Cost for RB or Insulation, $
1800	2575x0.98= 2524	275x0.88= 242	40.98	5.38	46.36	400

ESTIMATED LIFE CYCLE PRESENT VALUE SAVINGS

Code: (8)	(9)	(10)	(11)	(12)
Cooling Discount Factor (From Table Z)	Heating Discount Factor (From Table Z)	Present Value Cooling Savings, $ [(4) x (8)]	Present Value Heating Savings, $ [(5) x (9)]	Total Present Value Energy Savings, $ [(10) + (11)]
11.50	11.50	471.27	61.87	533.14

Previous Section - Installation Procedures
Next Section - Key to Abbreviations

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