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Re: Insulation Efficiency

TO WHOM IT MAY CONCERN:

“Insulation efficiency” is not a standard which is accepted industry wide. However, the concept is very useful to illustrate the law of diminishing returns when considering the value of additional insulation.

First, a comparative base case must be selected for zero efficiency. For this analysis, ½" plywood was used for the base case. Thus, ½" plywood (with no other insulation) would be considered to have an insulating efficiency of zero.

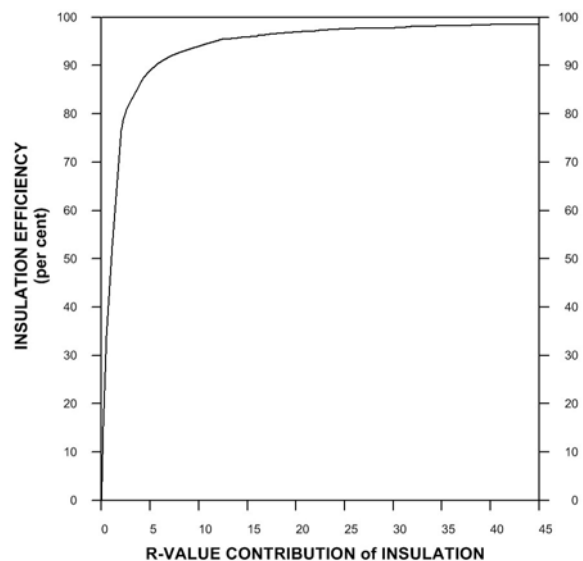
A wall which allowed no heat to pass through it would have an efficiency of 100 % (an impossible situation).

A ½" plywood wall insulated with spray-applied polyurethane foam (SPF) would have varying insulation efficiencies which would increase with the foam thickness.

As you can see from the table and chart below, as insulation thickness increases, the added efficiency becomes less and less.

Insulation Efficiency Based on ½-inch Plywood = 0 %

Inches of SPF	R-Value	Efficiency
0	0.62	0.0%
0.5	3.82	83.8%
1	7.02	91.2%
1.5	10.2	93.9%
2	13.4	95.4%
2.5	16.6	96.3%
3	19.8	96.9%
3.5	23.0	97.3%
4	26.2	97.6%
4.5	29.4	97.9%
5	32.6	98.1%
5.5	35.8	98.3%
6	39.0	98.4%



For this analysis, the R-value of the plywood base case is 0.62 °F•ft²•hr/Btu and the R-value of the SPF is 6.4 °F•ft²•hr/Btu. The formulas for calculated insulation efficiency are provided below.

$$\text{Heat Loss} = Q = \frac{A \cdot \Delta T}{R}$$

Where: A = Area
 ΔT = Temperature Difference
 R = R-value of Insulation

$$\begin{aligned} \text{Efficiency} &= \left[1 - \left(\frac{Q}{Q_{BASE}} \right) \right] \cdot 100\% = \left[1 - \left(\frac{\frac{A \cdot \Delta T}{R}}{\frac{A \cdot \Delta T}{R_{BASE}}} \right) \right] \cdot 100\% \\ &= \left[1 - \left(\frac{R_{BASE}}{R} \right) \right] \cdot 100\% \end{aligned}$$

If you have any questions on the above, we will be glad to discuss them with you.

Sincerely,
NCFI Polyurethanes, Div. of BMC



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