

**“R” Value for AP Armaflex®**

**AP Armaflex insulation meets the energy code requirements of international Energy Conservation Code (IECC), International Residential Code (IRC), CA Title 24, ASHRAE 90.1 and ASHRAE 90.2**

Don't compare apples and oranges! Typical “R” values are not applicable for cylindrical systems such as pipe insulation. “R” value or thermal resistance is a measure of the ability of a material to retard heat flow. “R” is the numerical reciprocal of “C” (thermal conductance).

Thermal resistance is used in combination with numerals to designate thermal resistance values: R-8 equals 8 resistance units. The higher the “R” value, the higher the insulating value. This value is normally calculated on a square foot basis.

Thermal resistances (“R” value) for flat surfaces such as for sheet material is easy to calculate. It is simply the thickness of the insulation divided by the thermal conductivity of the insulation. For example, a two inch sheet of AP Armaflex® with a thermal conductivity of 0.25 Btu•in/h•ft²•°F has an “R” value equal to 8.0.

This simple equation is true for any flat homogeneous material with parallel surfaces. It is common knowledge that with a flat layer of insulation that increasing the “R” value increases the thermal efficiency by the same factor.

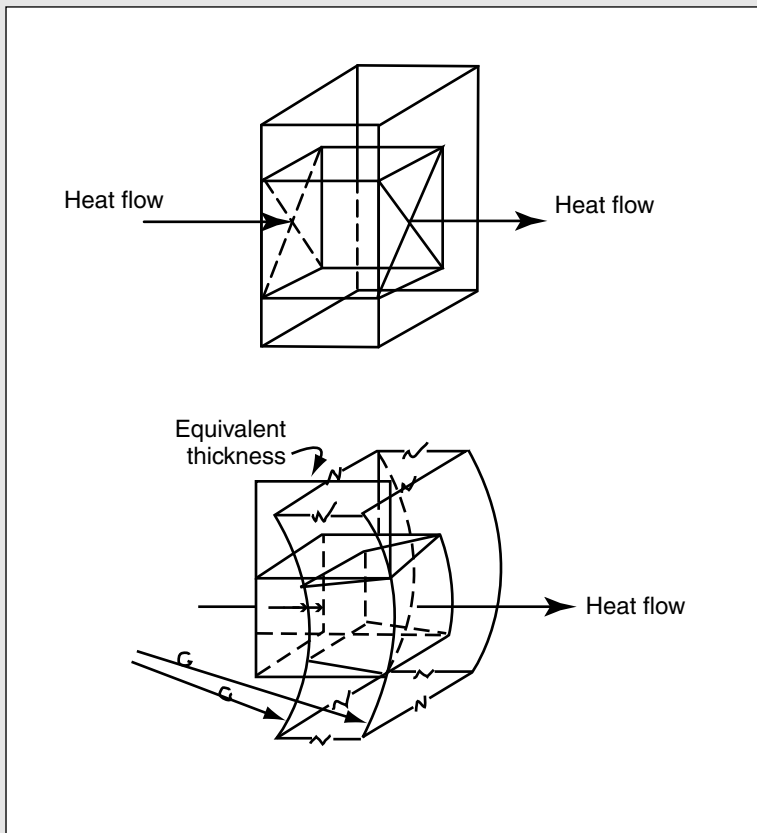
These simple relationships and these typical “R” values don't hold true when looking at cylindrical pipe insulations. For these materials, the heat flow is not the simple straight-through heat flow found with the flat surface material, but rather a radial heat flow. This is true because the inner radius surface area is much smaller than the outer radius surface area.

Because of these differences in surface area, heat flow must be calculated using an equivalent thickness. For cylindrical pipe insulation, the following equation should be used to calculate the “R” value:

$$R = \frac{r_2 \ln\left(\frac{r_2}{r_1}\right)}{k}$$

Where  $r_1$  = uninsulated pipe radius in inches  
 $r_2$  = insulated pipe radius in inches  
 $k$  = thermal conductivity, 0.25 BTU-in/hr ft² °F

This equation yields an “R” value on a **square foot basis**



Using this equation, AP Armaflex Pipe and AP Armaflex SS Insulation have the following “R” values:

**Wall Thickness**

<u>Pipe Insulation ID Size</u>	<u>Nom. 3/8</u>	<u>Nom. 1/2</u>	<u>Nom. 3/4</u>	<u>Nom. 1</u>	<u>Nom. 1-1/2</u>
3/8	2.9	3.4	5.7	7.4	—
1/2	2.7	3.3	5.5	7.2	—
5/8	2.5	3.3	5.5	7.1	11.4
3/4	2.4	3.3	5.4	6.9	10.8
7/8	2.3	3.3	5.4	6.9	10.3
1-1/8	2.2	3.2	5.3	7.2	9.6
1-3/8	2.1	3.1	5.1	7.3	9.0
1-5/8	2.4	3.1	4.9	7.2	8.6
1-1/2 IPS	2.3	3.1	4.8	6.9	8.3
2-1/8	2.3	3.1	4.7	6.7	8.1
2 IPS	2.2	3.1	4.6	6.6	7.8
2-5/8	2.2	3.0	4.5	6.4	7.7
2-1/2 IPS	2.2	3.0	4.4	6.3	7.5
3-1/8	2.2	2.9	4.3	6.2	7.4
3 IPS	2.1	2.9	4.3	6.1	7.2
3-5/8	2.1	2.9	4.2	6.0	7.1
4-1/8	2.1	2.8	4.2	5.9	7.0
4 IPS	2.1	2.8	4.1	5.8	6.8
5 IPS	2.1	2.8	4.0	5.6	6.6
6 IPS	2.0	2.7	3.9	5.5	6.4

You **cannot** compare “R” values calculated for flat surfaces with “R” values calculated for radial surfaces. **They are not the same!**

AP Armaflex Sheet and Roll Insulation R-Values, Square Foot Basis

Wall Thickness (inches)

	3/8	1/2	3/4	1	1-1/2	2
R-Value	1.6	2.1	3.1	4.2	6	8

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