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Insulating Values of Expanded Polystyrene

There are three ways to determine the insulating values of Expanded Polystyrene (EPS). Transcon Steel manufactures a 1.0 lbs/cubic foot non-load bearing Ultra Frame panel and a 1.5 lbs/cubic foot load bearing Ultra Frame panel. The Ultra Frame panel can be used for construction in floors, walls, and roofs. Below is an article explaining the different types of calculated insulating values. Charts below supply the raw stated values and estimated finished assembly values for construction types that comprise the use of Ultra Frame panels.

Article from the October 2005 Radiant Panel Report:

Understanding k-values, U-values and R-values

Frequently we see products advertised touting the various thermal properties by expressing one of the values used to describe heat transfer. These are all the same, right? Well, as is frequently said in the radiant industry, it depends.

First, one must understand what the value is describing. While they are similar, they have some fundamental differences.

The “k” value is a measure of thermal conductivity. This is a measurement of the speed at which heat travels through a material by conduction. This measurement is the number of Btu’s per hour that will pass through one square foot of material which is one inch thick with one degree Fahrenheit (1 °F) Delta T across the material (Btuh/sq.ft/in/°F). Note that this refers to material that is one inch thick.

The “U” value is a measure of thermal conductance. This is the rate of heat loss, in Btus per hour, through a square foot of a surface (wall, roof, door, windows, or other building surface) when the Delta T between the air temperature on either side is one degree Fahrenheit (1 °F). Note that this value refers to any thickness of material. As such, various components of an assembly can have their U-values added together to get an assembly U-value. For example, the U-values for a wall assembly would consist of the total of the U-values for siding, insulation, sheetrock, indoor and outdoor air films, and any other component comprising the wall assembly.

The “R” value is a measure of thermal resistance. This is the measure of a material’s resistance to heat flow. The higher the R-value, the better the resistance.

The R-value can be determined from both the k-value and the U-value by simply dividing the number one by either value ($R = 1 \div k\text{-value}$; $R = 1 \div U\text{-value}$). However, the resulting R-value is specific to the value used. If the k-value is used, the resulting R-value is the thermal resistance for one inch of material. If the U-value is used, the resulting R-value applies to the actual thickness of the material or assembly.

Why is this important? Consider a material listed as having a k-value of 0.2. If the product is only 1/2-inch thick, the resulting R-value must be adjusted for the actual product thickness. So, k-0.2 produces an R-5 for one inch of material ($1 \div 0.2 = 5$). The actual product is only 1/2-inch thick, so the actual R-value for the product is only R-2.5.

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However, when the U-value is used, the R-value is always the reciprocal of the U-value. In other words, simply divide one by the U-value to determine the R-value. So, if a wall assembly has a total U-value of 0.052, the actual R-value is 19.2 ($1 \div 0.052 = 19.2$).

A good understanding of these terms will help you evaluate various claims relative to a product's thermal performance.

(Source: 2005 Radiant Panel Report, John Fantauzzi, Nat'l Product Services Manager, Precision Hydronic Products.
<http://radnet.groupee.net/eve/forums/a/tpc/f/4771065301/m/4561075703>)

1.0 #/SF³ Closed Cell Modified Expanded Polystyrene												
Stated Values												
Inches	1	2	3.5	4	5.5	6	7	8	9	10	11	12
R-Value	3	6	10.5	12	16.5	18	21	24	27	30	33	36
U-Value	0.33	0.17	0.10	0.08	0.06	0.06	0.05	0.04	0.04	0.03	0.03	0.03
K-Value	0.33	0.17	0.10	0.08	0.06	0.06	0.05	0.04	0.04	0.03	0.03	0.03
* Core insulated values of EPS per inch thickness												
Estimated Effective Values of Finished Wall Assembly												
Inches	1	2	3.5	4	5.5	6	7	8	9	10	11	12
R-Value	3.9	7.8	13.65	15.6	21.45	23.4	27.3	31.2	35.1	39	42.9	46.8
U-Value	0.26	0.13	0.07	0.06	0.05	0.04	0.04	0.03	0.03	0.03	0.02	0.02
K-Value	0.26	0.13	0.07	0.06	0.05	0.04	0.04	0.03	0.03	0.03	0.02	0.02
* Estimated Effective Values of finished floor, wall, or roof assemblies are based upon a 30% increase in stated insulated value of EPS from above chart.												

1.5 #/SF³ Closed Cell Modified Expanded Polystyrene												
Stated Values												
Inches	1	2	3.5	4	5.5	6	7	8	9	10	11	12
R-Value	4.5	9	15.75	18	24.75	27	31.5	36	40.5	45	49.5	54
U-Value	0.22	0.11	0.06	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.02
K-Value	0.22	0.11	0.06	0.06	0.04	0.04	0.03	0.03	0.02	0.02	0.02	0.02
* Core insulated values of EPS per inch thickness												
Estimated Effective Values of Finished Wall Assembly												
Inches	1	2	3.5	4	5.5	6	7	8	9	10	11	12
R-Value	5.85	11.7	20.475	23.4	32.175	35.1	40.95	46.8	52.65	58.5	64.35	70.2
U-Value	0.17	0.09	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.01
K-Value	0.17	0.09	0.05	0.04	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.01
* Estimated Effective Values of finished floor, wall, or roof assemblies are based upon a 30% increase in stated insulated value of EPS from above chart.												