Insulation R-Value Chart: R-Values Per Inch (For 51 Materials)

by

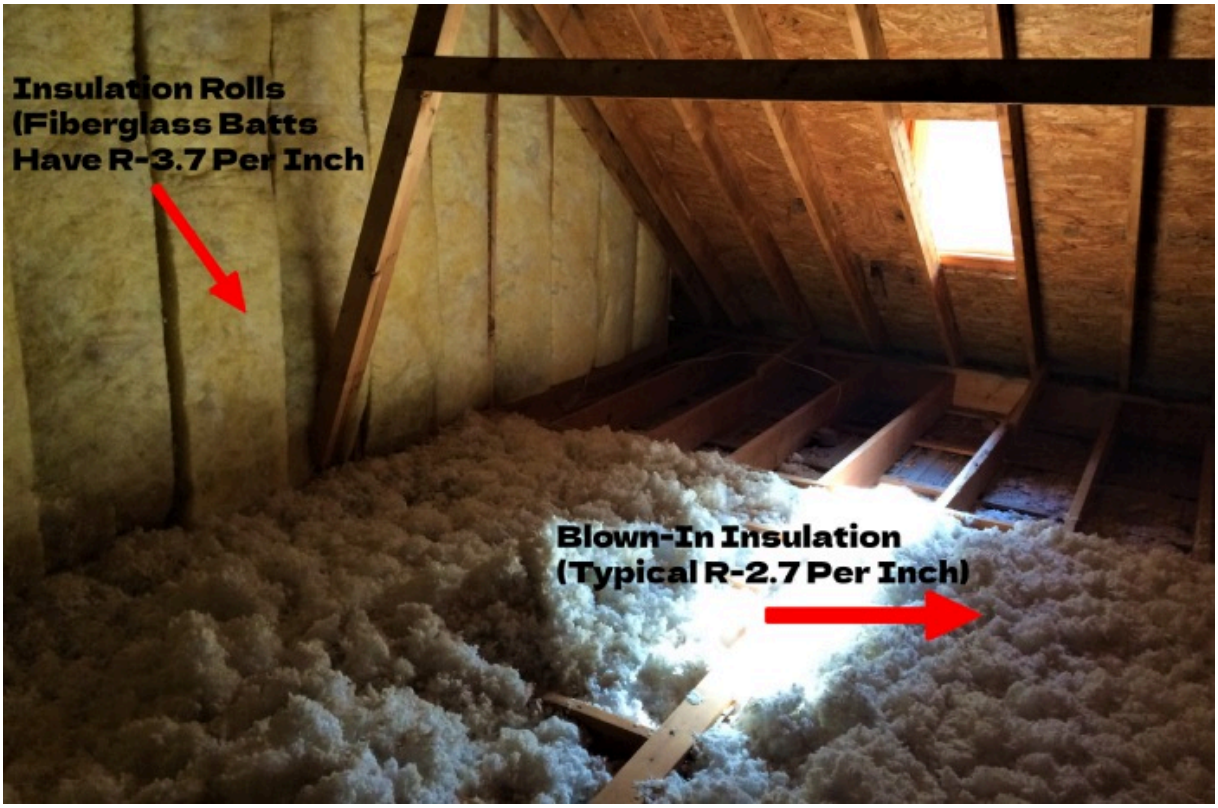
When thinking about insulation, the key metric you have to think about is the insulation R-value. As we have talked about in the post about types of insulations here different materials and types of insulations have different R-values. To help you choose ***adequate* insulation**, we have summarized the R-values of **51 most common insulation materials** *(check the insulation R-value chart below)*.

The range of R-values of insulation materials spans from materials with R-10 insulation values per inch like vacuum insulated panels and silica aerosol to below R-1 values per inch like bricks, glass, and poured concrete.

Here is the key thing:

When comparing the thermal resistance of insulation materials, you have to compare R-values ***per inch* of thickness**. That means that the insulation R-value chart you will find below is basically an insulation thickness chart, based on 1 inch of insulation.

Example: Fiberglass batt has a typical R-value of R-3.7 per inch of thickness. That means that if we were to use 4-inch fiberglass batts, the overall R-value would be R-14.8.



Example of applying R-3.7 per inch fiberglass batts on attic walls and blown-in insulation on the attic floor (typical R-value of R-2.7 per inch).

To help you out determine what is the R-value of insulation materials with thickness over 1 inch, we have included R-values for:

- **2-inch thickness.** *Example:* Closed-cell spray foam has a typical R-value of R-6 per inch. That means that 2-inch closed-cell spray foam has an insulation R-value of R-12.
- **4-inch thickness.** *Example:* High-density EPS has a typical R-value of R-4.2 per inch. That means that 4-inch EPS has an insulation R-value of R-16.8.
- **8-inch thickness.** *Example:* Phenolic rigid panel has a typical R-value of R-4.5 per inch. That means that an 8-inch phenolic rigid panel has an insulation R-value of R-38.

You can find all of these insulation R-values per inch and per 2, 4, and 8 inches in the following insulation R-value chart:

Note: Below the table, we address some of the key questions regarding these insulation R-values like what is the best R-value, . You can also use the comment section if you don't find your answer and we will try to help you out.

Insulation R-Value Chart (Per 1, 2, 4, 8 Inches Thickness)

Insulation Material:	R-Value Per Inch:	2 Inch R-Value:	4 Inch R-Value:	8 Inch R-Value:
Vacuum Insulated Panel (VIP)	**R-25 Per Inch**	R-50	R-100	R-200
Silica Aerosol	**R-10.3 Per Inch**	R-20.6	R-41.2	R-82.4
Polyurethane Rigid Panel (CFC/HCFC Expanded) New	**R-7.5 Per Inch**	R-15	R-30	R-60
Polyurethane Rigid Panel (CFC/HCFC Expanded) After 5-10 Years	**R-6.25 Per Inch**	R-12.5	R-25	R-50
Polyurethane Rigid Panel (Pentane Expanded) New	**R-6.8 Per Inch**	R-13.6	R-27.2	R-54.4
Polyurethane Rigid Panel (Pentane Expanded) After 5-10 Years	**R-5.5 Per Inch**	R-11	R-22	R-44
Foil-Faced Polyisocyanurate Rigid Panel (Pentane Expanded) New	**R-6.8 Per Inch**	R-13.6	R-27.2	R-54.4
Foil-Faced Polyisocyanurate Rigid Panel (Pentane Expanded) After 5-10 Years	**R-5.5 Per Inch**	R-11	R-22	R-44
Closed-Cell Polyurethane Spray Foam	**R-6 Per Inch**	R-12	R-24	R-48
Urea Foam	**R-5.25 Per Inch**	R-10.5	R-21	R-42
Urea-Formaldehyde Panels	**R-5.5 Per Inch**	R-11	R-22	R-44
High-Density XPS	**R-5.2 Per Inch**	R-10.4	R-20.8	R-41.6
Low-Density XPS	**R-4.15 Per Inch**	R-8.3	R-16.6	R-33.2
Polystyrene Board	**R-5 Per Inch**	R-10	R-20	R-40
Phenolic Spray Foam	**R-5.9 Per Inch**	R-11.8	R-23.6	R-47.2
Polyisocyanurate Spray Foam	**R-6.3 Per Inch**	R-12.6	R-25.2	R-50.4
High-Density EPS	**R-4.2 Per Inch**	R-8.4	R-16.8	R-33.6

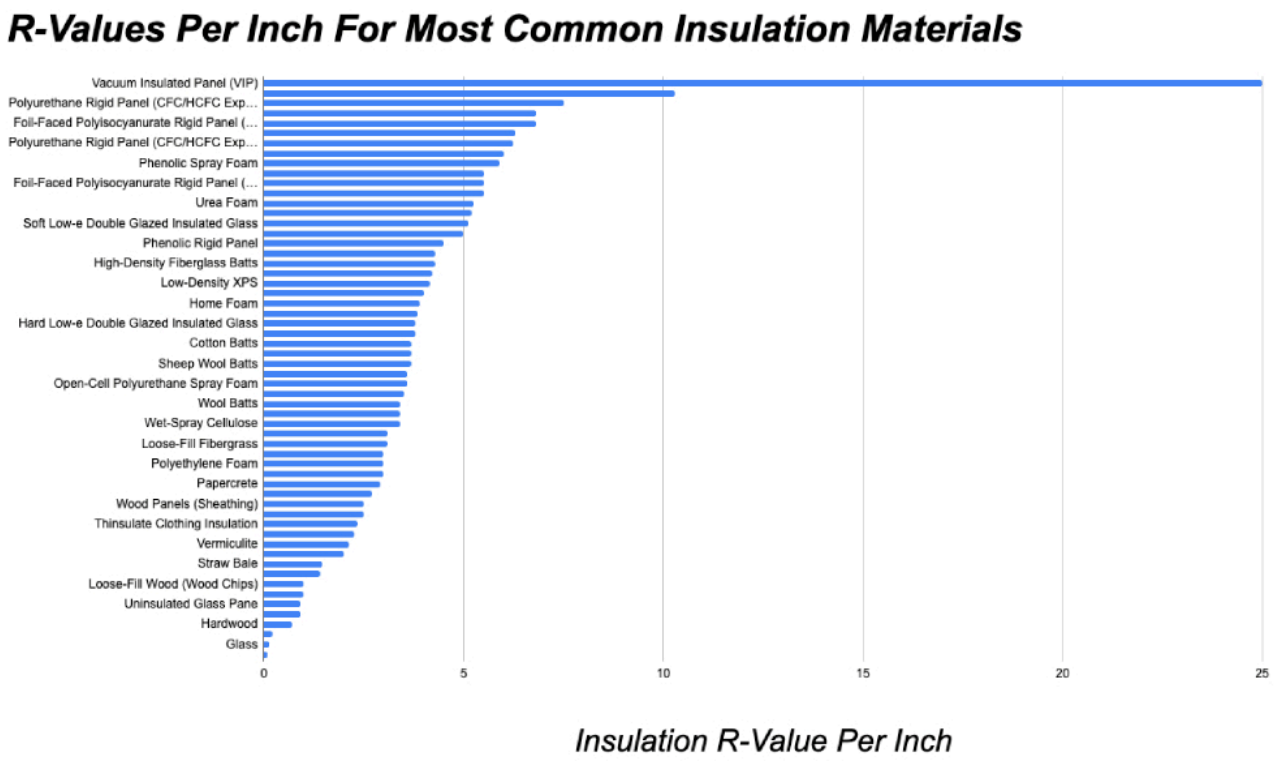
Low-Density EPS	**R-3.85 Per Inch**	R-7.7	R-15.4	R-30.8
Phenolic Rigid Panel	**R-4.5 Per Inch**	R-9	R-18	R-38
Urea-Formaldehyde Foam	**R-4.3 Per Inch**	R-8.6	R-17.2	R-34.4
Icynene Loose-Fill	**R-4 Per Inch**	R-8	R-16	R-32
Home Foam	**R-3.9 Per Inch**	R-7.8	R-15.6	R-31.2
Cotton Batts	**R-3.7 Per Inch**	R-7.4	R-14.8	R-29.6
High-Density Fiberglass Batts	**R-4.3 Per Inch**	R-8.6	R-17.2	R-34.4
Icynene Spray	**R-3.6 Per Inch**	R-7.2	R-14.4	R-28.8
Open-Cell Polyurethane Spray Foam	**R-3.6 Per Inch**	R-7.2	R-14.4	R-28.8
Fiberglass Batts	**R-3.7 Per Inch**	R-7.4	R-14.8	R-29.6
Rice Hulls	**R-3 Per Inch**	R-6	R-12	R-24
Cardboard	**R-3.5 Per Inch**	R-7	R-14	R-28
Wool Batts	**R-3.4 Per Inch**	R-6.8	R-13.6	R-27.2
Loose-Fill Cellulose	**R-3.4 Per Inch**	R-6.8	R-13.6	R-27.2
Wet-Spray Cellulose	**R-3.4 Per Inch**	R-6.8	R-13.6	R-27.2
Polyethylene Foam	**R-3 Per Inch**	R-6	R-12	R-24
Loose-Fill Perlite	**R-2.7 Per Inch**	R-5.4	R-10.8	R-21.6
Papercrete	**R-2.9 Per Inch**	R-5.8	R-11.6	R-23.2
Loose-Fill Wool	**R-3.1 Per Inch**	R-6.2	R-12.4	R-24.8

Loose-Fill Fibergrass	**R-3.1 Per Inch**	R-6.2	R-12.4	R-24.8
Wood Panels (Sheathing)	**R-2.5 Per Inch**	R-5	R-10	R-20
Rigid Panel Fiberglass	**R-2.5 Per Inch**	R-5	R-10	R-20
Loose-Fill Vermiculite	**R-2.25 Per Inch**	R-4.5	R-9	R-18
Vermiculite	**R-2.13 Per Inch**	R-4.26	R-8.52	R-17.04
Cementitious Foam	**R-3 Per Inch**	R-6	R-12	R-24
Thinsulate Clothing Insulation	**R-2.35 Per Inch**	R-4.7	R-9.4	R-18.8
Straw Bale	**R-1.45 Per Inch**	R-2.9	R-5.8	R-11.6
Softwood	**R-1.41 Per Inch**	R-2.82	R-5.64	R-11.28
Loose-Fill Wood (Wood Chips)	**R-1 Per Inch**	R-2	R-4	R-8
Cellular Concrete	**R-1 Per Inch**	R-2	R-4	R-8
Drywall	**R-0.9 Per Inch**	R-1.8	R-3.6	R-7.2
Hardwood	**R-0.71 Per Inch**	R-1.42	R-2.84	R-5.68
Sheep Wool Batts	**R-3.7 Per Inch**	R-7.4	R-14.8	R-29.6
Glass	**R-0.14 Per Inch**	R-0.28	R-0.56	R-1.12
Brick	**R-0.2 Per Inch**	R-0.4	R-0.8	R-1.6
Poured Concrete	**R-0.08 Per Inch**	R-0.16	R-0.32	R-0.64
Soft Low-e Double Glazed Insulated Glass	**R-5.11 Per Inch**	R-10.22	R-20.44	R-40.88
Hard Low-e Double Glazed Insulated Glass	**R-3.8 Per**	R-7.6	R-15.2	R-30.4

	Inch			
Double Glazed Insulated Glass	**R-2 Per Inch**	R-4	R-8	R-16
Triple Glazed Insulated Glass	**R-3.8 Per Inch**	R-7.6	R-15.2	R-30.4
Uninsulated Glass Pane	**R-0.91 Per Inch**	R-1.82	R-3.64	R-7.28

This R-value thickness table is pretty easy to use. You just check which material you want to use, read off the R-value, and compare the R-value of your material with other materials.

Here is a chart that illustrates graphically the differences between R-values for different insulation materials:



Let's address some of the questions we usually get when advising about insulation materials and their R-values:

Is A Higher R-Value Better For Insulation?

This goes without saying; higher R-values are better for insulation. The relationship

between R-value and insulation is positive and linear.

Example: An R-10 insulation is twice as effective as R-5 insulation.

The higher the R-value insulation you use, the less you will spend on heating (in the winter) and cooling (in the summer).

What Is The Best R-Value For Insulation?

Same logic here; the higher the R-value, the better the insulation. The best R-value for insulation is as high as possible. Obviously, you will have to find a compromise between the R-value, the thickness of walls, ceilings, floors, roof, how much can you spend on insulation, and so on.

We can talk a bit about benchmarks about what is a good r value for insulation:

- Exterior walls should have an R-value ranging from R-13 to R-23. A good R-value for exterior walls is R-23.
- Attics can have R-30, R-38, or R-49. The best R-value for attics is R-49, or even higher. Is R30 insulation good for the attic? Well, it is about average; R-49 is better for the attic.
- Ceilings can also have R-30, R-38, or R-49. If you can get a ceiling R-value of R-49, that is a good R-value.

As you can see, it makes sense to have high (R-40 or more) insulation values for places over your head (attics, ceilings). That's where the hot air usually deprives your house of heat in the winter (increasing the cost of heating), and that is where the sun is shining in the summer, increasing the cost of air conditioning.

What Insulation Has The Highest R-Value?

In three words: Vacuum insulated panels (VIPs). These panels have, according to Wikipedia, *'about five times the thermal resistance (R-value) per unit thickness'*.

As you can see from the insulation R-value chart above, vacuum insulated panels have a typical R-value of R-25 per inch of thickness. Some VIPs can have R-value as high as R-45 or even R-50 per inch. This is an insulation material with the highest R-value altogether.

What Insulation Is Best For Exterior Walls?

A good exterior wall R-value is R-23. To achieve that, you can use any of these exterior wall insulation materials:

- Fiberglass.
- Foam boards.
- Cellulose-based insulation.
- Batt insulation.
- Closed-cell or open-cell spray foam. Closed-cell spray foam is better for exterior walls because it is water-resistant, has a higher R-value per inch of thickness than open-cell type, but is also costlier.

Applying closed-cell spray foam on interior walls. Typical R-value is R-6 per inch.

What Is The Highest R-Value For A 2×4 Wall?

A 2×4 wall can hold either R-13 or R-15 fiberglass batts. So, if you were to use batt insulation, the highest R-value for a 2×4 wall is R-15.

This means that you are using a 4-inch batt with an average R-value of R-3.75 per inch of thickness.

Some people also ask if you can put R19 in 2×4 walls. Sadly, batts don't have sufficient R-value per inch to accommodate for R-19 2×4 walls.

What Is The Highest R-Value For A 2×6 Wall?

A 2×6 wall can hold either R-13, R-15, R-19, or R-21 fiberglass batts. So, if you were to use batt insulation, the highest R-value for a 2×6 wall is R-21.

This means that you are using a 6-inch batt with an average R-value of R-3.5 per inch of thickness.

As stated before, if you have some questions regarding the insulation R-value chart, you can use the comments below and we will try to find an answer for you.