

## R-Value and Densities Chart

Material	R-Value Per Inch	R-Value Per Unit
Inside Air Film		0.68
Air Space between Studs		0.95
Building Paper		0.06
½ in. Fiberboard Sheathing		1.52
Gypsum Wallboard or Drywall	0.90	--
OSB/Particle Board - Low Density	1.41	--
OSB/Particle Board - Medium Density	1.06	--
Plywood or Wood Panels	1.24	--
Hardwood	0.90	--
Cement Mortar	0.20	--
Sand & Gravel	0.60	--
Stucco	0.20	--
Glass Block	0.51	--
<b>Masonry Systems</b>	<b>R-Value Per Inch</b>	<b>R-V Per Unit</b>
Brick 90 lb/cu ft	0.20	--
Brick 120 lb/cu ft	0.11	--
Concrete pour	0.08	--
Concrete Block Normal wt. 8in. empty core	--	1.11 - 0.97
Concrete Block Normal wt. 12in. empty core	--	1.23
Concrete Block Medium wt. 8in. empty core	--	1.71 - 1.28
Concrete Block Light wt. 8in. empty core	--	3.20 - 1.90
Concrete Block Light wt. 12in. empty core	--	2.60 - 2.30
<b>Roofing</b>	<b>R-Value Per Inch</b>	<b>R-V Per Unit</b>
Roofing Felt		0.06
Asphalt Roll - 90 lb	--	0.15
Asphalt Shingle	--	0.44
Slate ½ in.	--	0.05
Wood	--	0.94
Metal – any	--	0.00
Ceramic Tile – ¼ in.	--	0.20
<b>Siding</b>	<b>R-Value Per Inch</b>	<b>R-V Per Unit</b>
Wood Shingles 16in. – 7in. exp.	--	0.87
Wood Drop 1in. x 8in.	--	0.79
Wood Bevel ¾in. x 10in.	--	1.05
Aluminum/Steel – Hollow	--	0.61
Aluminum/Steel with 3/8in. backer	--	1.82
Vinyl Siding	--	<1.0 – 4.0

Composite – Hardboard siding 0.4375in.	--	0.67
<b>Insulation</b>	<b>R-Value Per Inch</b>	<b>R-V Per Unit</b>
Blankets/Batts - Fiberglass	3.0 - 3.8	--
Blankets/Batts - Rock Wool	3.0 - 3.8	--
Loose Fill - Cellulose	2.8 - 3.7	--
Loose Fill - Fiberglass 0.7 lb/cu ft	2.2	--
Loose Fill - Fiberglass 2.0 lb/cu ft	4.0	--
Loose Fill - Rock Wool	3.1	--
Loose Fill - Vermiculite	2.2	--
Rigid Board - Molded Polystyrene 0.9 lb/cu ft	3.6	--
Rigid Board - Molded Polystyrene 1.6 lb/cu ft	3.6	--
Rigid Board - Extruded Polystyrene 1.9 lb/cu ft	5.0	--
Rigid Board - Extruded Polystyrene - Urethanes	5.6 - 6.3	--
Rigid Board - Extruded Polystyrene – Polyisocyanurate	5.6 - 6.3	--
Sprayed - Cellulose	3.0 - 4.0	--
Foam Filled - Urethane	5.6 - 6.2	--
Vapor barrier	--	0.0

### Common Rules of Thumb

Type of Building Section	R-Value
Wood frame walls	3 plus R-value of the insulation used
Floors above unheated spaces	2 plus R-value of the insulation used
Ceilings	1-1/2 plus R-value of the insulation
Single-glazed windows	0.88
Double-glazed windows	1.67
Doors with glass	Use R-value of the glass for the entire door
Doors without glass	1.67

Typical Masonry Systems	R-Value Per Inch	R-Value Per Unit
Brick - 90 lb/cu ft	0.20	--
Brick - 120 lb/cu ft	0.11	--
Concrete Block - Normal wt. 8in. empty core	--	1.11 - 0.97
Concrete Block - Normal wt. 12in. empty core	--	1.23
Concrete Block - Medium wt. 8in. empty core	--	1.71 - 1.28
Concrete Block - Light weight 8in. empty core	--	3.20 - 1.90
Concrete Block - Light weight 12in. empty core	--	2.60 - 2.30

The following table was taken from the Home Energy Website:

<b>R-Values for Wall Systems</b>				
<b>No.</b>	<b>System Description</b>	<b>Clear Wall R-Value (R<sub>cw</sub>)</b>	<b>Whole Wall R-Value (R<sub>ww</sub>)</b>	<b>(R<sub>ww</sub>/R<sub>cw</sub>) x 100%</b>
1.	12" two-core insulating units concrete 120lb./ft <sup>3</sup> , EPS inserts 1 7/8" thick, grout fillings 24" o.c.	3.7	3.6	97%
2.	12" two-core insulating units wood concrete 40lb./ft <sup>3</sup> , EPS inserts 1 7/8" thick, grout fillings 24" o.c.	9.4	8.6	92%
3.	12" cut-web insulating units concrete 120lb./ft. <sup>3</sup> , EPS inserts 2 1/2" thick, grout fillings 16" o.c.	4.7	4.1	88%
4.	12" cut-web insulating units wood concrete 40lb./ft. <sup>3</sup> , EPS inserts 2 1/2" thick, grout fillings 16" o.c.	10.7	9.2	86%
5.	12" multicore insulating units polystyrene beads concrete 30lb./ft. <sup>3</sup> , EPS inserts in all cores	19.2	14.7	77%
6.	EPS block forms poured in place with concrete, block walls 1 7/8" thick	15.2	15.7	103%
7.	2 x 4 wood stud wall 16" o.c., R-11 batts, 1/2" plywood exterior, 1/2" gypsum board interior	10.6	9.6	91%
8.	2 x 4 wood stud wall 24" o.c., R-11 batts, 1/2" plywood exterior, 1/2" gypsum board interior	10.8	9.9	91%
9.	2 x 6 wood stud wall 24" o.c., R-19 batts, 1/2" plywood exterior, 1/2" gypsum board interior	16.4	13.7	84%
10.	Larsen truss walls 2 x 4 wood stud wall 16" o.c., R-11 batts + 8-in-thick Larsen trusses insulated by 8"-thick batts, 1/2" plywood exterior, 1/2" gypsum board interior	40.4	38.5	95%
11.	Stressed-skin panel wall, 6"-thick foam core + 1/2" oriented strand board (OSB) boards, 1/2" plywood exterior, 1/2" gypsum board interior	24.7	21.6	88%
12.	4" metal stud wall 24" o.c., R-11 batts, 1/2" plywood exterior + 1-in EPS sheathing + 1/2" wood siding, 1/2" gypsum board interior. NAHB Energy Conservation House Details.	14.8	10.9	74%
13.	3 1/2" metal stud wall 16" o.c., R-11 batts, 1/2" plywood exterior + 1/2" wood siding, 1/2" gypsum board interior	7.4	6.1	83%
14.	3 1/2" metal stud wall 16" o.c., R-11 batts, 1/2"	9.9	8.0	81%

	plywood exterior + 1/2" EPS sheathing + 1/2" wood siding, 1/2" gypsum board interior. AISI Manual details			
15.	3 1/2" metal stud wall 16" o.c., R-11 batts, 1/2" plywood exterior + 1" EPS sheathing + 1/2" wood siding, 1/2" gypsum board interior. AISI Manual details	11.8	9.5	81%
16.	3 1/2" metal stud wall 24" o.c., R-11 batts, 1/2" plywood exterior + 1/2" wood siding, 1/2" gypsum board interior. AISI Manual details	9.4	7.1	75%
17.	3 1/2" metal stud wall 24" o.c., R-11 batts, 1/2" plywood exterior + 1/2" EPS sheathing + 1/2" wood siding, 1/2" gypsum board interior. AISI Manual details	11.8	8.9	76%
18.	3 1/2" metal stud wall 24" o.c., R-11 batts, 1/2" plywood exterior + 1" EPS sheathing + 1/2" wood siding, 1/2" gypsum board interior. AISI Manual details	13.3	10.2	77%

DENSITY OF FRESH WATER		DENSITY OF SEA WATER		DENSITY OF ICE		DENSITY OF DRY AIR	
Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	Pounds per cubic foot	Temperature (degrees F)	Pounds per cubic foot
32	62.410	30	64.250	-50	57.670	-10	0.088
40	62.418	40	64.200	-40	57.625	0	0.086
50	62.401	50	64.170	-30	57.600	10	0.085
60	62.358	60	64.100	-20	57.582	20	0.083
70	62.293	70	64.020	-10	57.541	30	0.081
80	62.208	80	63.950	0	57.105	40	0.079
90	62.105	90	63.800	10	57.490	50	0.078
100	61.986	100	63.700	20	57.455	60	0.076
110	61.852			30	57.410	70	0.075
120	61.704					80	0.074

Approximate values in **J / kg °K** of Specific Heat Capacity

Air	1000	Lead	125
Aluminum	900	Mercury	140
Asbestos	840	Nylon	1700
Brass	400	Paraffin	2100
Brick	750	Platinum	135
Concrete	3300	Polythene	2200
Cork	2000	Polystyrene	1300
Glass	600	Rubber	1600
Gold	130	Silver	235
Ice	2100	Steel	450
Iron, cast	500	Water	4200