Polyurethane (PU) Foam Insulation

R-Values by Density & Thickness · ASTM C518 @ 75°F mean temperature · Thickness in inches

Foam types by density

Type	Cell structure	Density (lb/ft³)	Density (kg/m³)	R-value per inch	Primary use
Type I Open-cell	Open cell (air-blown)	0.5	8	3.6 – 3.8	Interior walls, attics (sound & air seal)
Type II Closed-cell (standard)	Closed cell (HFC-blown)	2.0	32	6.0 – 6.5	Walls, roofs, crawlspaces vapor retarder
Type III Closed-cell HD (roofing)	Closed cell (HFC-blown)	3.0	48	6.0 – 6.5	Commercial roofing, continuous insulation
Type VI High-density (industrial)	Closed cell	6.0	96	5.5 – 6.0	Industrial, cold storage, structural panels

R-value by thickness

Thickness	Open-cell 0.5 lb/ft³ R-value	Closed-cell 2.0 lb/ft³ R-value	Closed-cell 3.0 lb/ft³ R-value	High-density 6.0 lb/ft³ R-value
1/2"	1.85	3.10	3.15	2.90
3/4"	2.78	4.65	4.72	4.35
1"	3.70	6.20	6.30	5.80
1-1/4"	4.62	7.75	7.88	7.25
1-1/2"	5.55	9.30	9.45	8.70
1-3/4"	6.48	10.85	11.03	10.15
2"	7.40	12.40	12.60	11.60
2-1/4"	8.33	13.95	14.17	13.05
2-1/2"	9.25	15.50	15.75	14.50
2-3/4"	10.18	17.05	17.32	15.95
3"	11.10	18.60	18.90	17.40
3-1/4"	12.03	20.15	20.47	18.85
3-1/2"	12.95	21.70	22.05	20.30
3-3/4"	13.88	23.25	23.62	21.75
4"	14.80	24.80	25.20	23.20
4-1/4"	15.73	26.35	26.77	24.65
4-1/2"	16.65	27.90	28.35	26.10
4-3/4"	17.57	29.45	29.93	27.55
5"	18.50	31.00	31.50	29.00
5-1/4"	19.43	32.55	33.07	30.45
5-1/2"	20.35	34.10	34.65	31.90
5-3/4"	21.28	35.65	36.23	33.35
6"	22.20	37.20	37.80	34.80
6-1/2"	24.05	40.30	40.95	37.70
7"	25.90	43.40	44.10	40.60
7-1/2"	27.75	46.50	47.25	43.50
8"	29.60	49.60	50.40	46.40

Physical properties by density (ASTM C591-22, ASTM C1029)

Property	Test method	Open-cell 0.5 lb/ft³	Closed-cell 2.0 lb/ft³	Closed-cell 3.0 lb/ft³	High-density 6.0 lb/ft³
Density, min (lb/ft³)	ASTM D1622	0.4 – 0.6	1.8 – 2.2	2.8 – 3.2	5.5 – 6.5
Density, min (kg/m³)	ASTM D1622	6.4 – 9.6	29 – 35	45 – 51	88 – 104
R-value per inch @ 75°F	ASTM C518	3.6 – 3.8	6.0 – 6.5	6.0 – 6.5	5.5 – 6.0
Thermal conductivity (BTU·in/hr·ft²·°F)	ASTM C518 / C177	~0.27	~0.16	~0.16	~0.17
Compressive strength @ 10% deform. (psi)	ASTM D1621	0.1 – 0.3	20 – 35	35 – 50	100 – 150
Tensile strength (psi)	ASTM D1623	~2 – 5	50 – 75	75 – 110	150 – 200

Property	Test method	Open-cell 0.5 lb/ft³	Closed-cell 2.0 lb/ft³	Closed-cell 3.0 lb/ft³	High-density 6.0 lb/ft³
Water absorption (% vol, 96 hr)	ASTM D2842	10%	< 1%	< 0.8%	< 0.5%
Water vapor permeance (perm·in)	ASTM E96	10	~ 1.1	~ 0.8	~ 0.4
Closed-cell content (%)	ASTM D2856	< 10%	90%	90%	95%
Dimensional stability, 7 days (% linear)	ASTM D2126	< 8%	< 5%	< 3%	< 2%
Flame spread index	ASTM E84	< 75	< 25	< 25	< 25
Smoke developed index	ASTM E84	< 450	< 450	< 450	< 450
Max service temperature (°F)	—	175	200	250	300
Vapor retarder class (@ 2")	ASTM E96	None	Class II	Class I	Class I
Air barrier performance	ASTM E283 / E2178	No	Yes (≥1")	Yes (≥1")	Yes

• R-values for open-cell foam are stable over time (air-blown, no gas loss). Closed-cell values are aged per FTC 16 CFR Part 460 regulations.product data sheets for design purposes.
• High-density 6.0 lb/ft³ foam shows slightly lower R-value per inch compared to 2–3 lb foam due to increased solid conduction through the denser polymer matrix.
• R-values calculated as: thickness (in) × R per inch. For thicknesses not listed, use linear interpolation between nearest values.
• Sources: ASTM C591-22, ASTM C1029 (Type I & II SPF), Gaco 183M Product Data Sheet, SPFA Technical Guide, American Chemistry Council PUR/PIR Report, Highperformanceinsulation.eu.
• Note: These are typical/representative values. Specific products may vary. Always verify with manufacturer product data sheets for design purposes.

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