U-Value of a Wall or Roof from Its Layers

Thermal transmittance (U-value) of a wall, roof or panel from up to five layers' thickness and conductivity, surface resistances and an air gap.

Method: Series thermal resistances U = 1/(R_si + Σd/λ + R_g + R_se) (ISO 6946 principle)

Input parameters

Unit system: SI

Parameter	Value	Unit
Layer 1 thickness	15.000	mm
Layer 1 conductivity	0.72000	W/(m·K)
Layer 2 thickness	230.00	mm
Layer 2 conductivity	0.84000	W/(m·K)
Layer 3 thickness	50.000	mm
Layer 3 conductivity	0.035000	W/(m·K)
Layer 4 thickness	0	mm
Layer 4 conductivity	1.0000	W/(m·K)
Layer 5 thickness	0	mm
Layer 5 conductivity	1.0000	W/(m·K)
Air gap resistance (0 if none)	0	m²·K/W
Inside surface resistance	0.13000	m²·K/W
Outside surface resistance	0.040000	m²·K/W
Temperature difference (for the heat flow)	20.000	K

Calculated results

Parameter	Value	Unit
Total resistance	1.8932	m²·K/W
U-value	0.52820	W/(m²·K)
Heat flow per m²	0.010564	kW/m²

Notes for this case

- Surface resistances and conductivities from your standard or the material makers; thermal bridges are not included.

Formula and method

$$U = \frac{1}{R_{si} + \sum d_i/\lambda_i + R_g + R_{se}}$$

Variables

d_1	Layer 1 thickness	m
λ_1	Layer 1 conductivity	W/(m·K)
d_2	Layer 2 thickness	m
λ_2	Layer 2 conductivity	W/(m·K)
d_3	Layer 3 thickness	m
λ_3	Layer 3 conductivity	W/(m·K)
d_4	Layer 4 thickness	m
λ_4	Layer 4 conductivity	W/(m·K)

d_5	Layer 5 thickness	m
λ_5	Layer 5 conductivity	W/(m·K)
R_g	Air gap resistance (0 if none)	m²·K/W
R_{si}	Inside surface resistance	m²·K/W
R_{se}	Outside surface resistance	m²·K/W
ΔT	Temperature difference (for the heat flow)	K
R_T	Total resistance	m²·K/W
U	U-value	W/(m²·K)
q	Heat flow per m²	W/m²

Method and standards

Series resistances.

Assumptions and limits

- One-dimensional, homogeneous layers.

References

- Series thermal resistances U = 1/(R_si + Σd/λ + R_g + R_se) (ISO 6946 principle)

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/hvac/loads/wall-u-value-layers

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.