Interstitial Condensation Risk in a Wall (Glaser Method)

Temperatures, vapour pressures and saturation margins at the surfaces and interfaces of a three-layer wall by the Glaser method, showing where condensation can form.

Method: Glaser steady-state vapour diffusion method

Input parameters

Unit system: SI

Parameter	Value	Unit
Indoor temperature	20.000	°C
Indoor relative humidity	60.000	%
Outdoor temperature	-5.0000	°C
Outdoor relative humidity	90.000	%
Inside surface resistance	0.13000	m²·K/W
Outside surface resistance	0.040000	m²·K/W
Layer 1 (inside) thickness	12.500	mm
Layer 1 conductivity	0.21000	W/(m·K)
Layer 1 vapour resistance factor	10.000	
Layer 2 thickness	100.00	mm
Layer 2 conductivity	0.040000	W/(m·K)
Layer 2 vapour resistance factor	1.0000	
Layer 3 (outside) thickness	100.00	mm
Layer 3 conductivity	0.77000	W/(m·K)
Layer 3 vapour resistance factor	10.000	

Calculated results

Parameter	Value	Unit
Thermal transmittance	0.34972	W/(m²·K)
Inside surface temperature	18.863	°C
Temperature at the layer 1–2 interface	18.343	°C
Temperature at the layer 2–3 interface	-3.5148	°C
Outside surface temperature	-4.6503	°C
Smallest saturation margin (negative = condensation)	-756.34	Pa
Plane of smallest margin (1 inside surface … 4 outside surface)	3.0000	

Notes for this case

- Steady-state Glaser method: temperatures from thermal resistances, vapour pressure falling linearly with vapour diffusion thickness s_d = μd (surface vapour resistances neglected). A negative margin means vapour pressure would exceed saturation there: condensation is predicted; add a vapour control layer on the warm side or ventilate the cold side.
- Condensation predicted at plane 3.

Formula and method

$$T_{j+1} = T_j - q\frac{d_j}{\lambda_j}, \quad p(s_d) = p_i - (p_i - p_o)\frac{s_d}{s_{d,tot}}, \quad s_d = \mu d$$

Variables

T_i	Indoor temperature	K
φ_i	Indoor relative humidity	-
T_o	Outdoor temperature	K
φ_o	Outdoor relative humidity	-
R_{si}	Inside surface resistance	m²·K/W
R_{so}	Outside surface resistance	m²·K/W
d_1	Layer 1 (inside) thickness	m
λ_1	Layer 1 conductivity	W/(m·K)
μ_1	Layer 1 vapour resistance factor	-
d_2	Layer 2 thickness	m
λ_2	Layer 2 conductivity	W/(m·K)
μ_2	Layer 2 vapour resistance factor	-
d_3	Layer 3 (outside) thickness	m
λ_3	Layer 3 conductivity	W/(m·K)
μ_3	Layer 3 vapour resistance factor	-
U	Thermal transmittance	W/(m²·K)
T_{si}	Inside surface temperature	K
T_{12}	Temperature at the layer 1–2 interface	K
T_{23}	Temperature at the layer 2–3 interface	K
T_{so}	Outside surface temperature	K
$\min(p_s - p)$	Smallest saturation margin (negative = condensation)	Pa
k	Plane of smallest margin (1 inside surface … 4 outside surface)	-

Method and standards

Glaser diagram.

Assumptions and limits

- Steady state; one-dimensional; no liquid transport.

References

Glaser steady-state vapour diffusion method

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

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