Cantilevered balconies on an ETICS wall

Thermal bridge calculation report after ISO 10211:2017

Project	KOALA showcase
Detail ID	D-07
Author	KOALA
Date	2026-11-10
Software	KOALA 1.0.10.0
Units	SI

Results

Heat flow

L3D = 2.75 W/K heat flow 82.5 W (Interior – Exterior)

Mean U = 0.208 W/(m² K) over the room-side surface of 13.2 m², thermal bridges included

Lowest inside surface temperature, Interior: 13.6 °C, fRsi = 0.787 (on Gypsum plaster)

Rsi 0.250 m² K/W, surface-temperature solve

Notes and warnings on this calculation are listed in the appendix at the end of the report.

Description of the structure

3.0 m wall bay: 160 mm EPS on 240 mm calcium silicate masonry, 200 mm reinforced concrete floor slab. Left balcony cast straight through the insulation; right balcony on an 80 mm thermal-break module with stainless-steel tension bars and pressure bearings. Model: KoalaShowcase_Balcony.3dm.

Model views

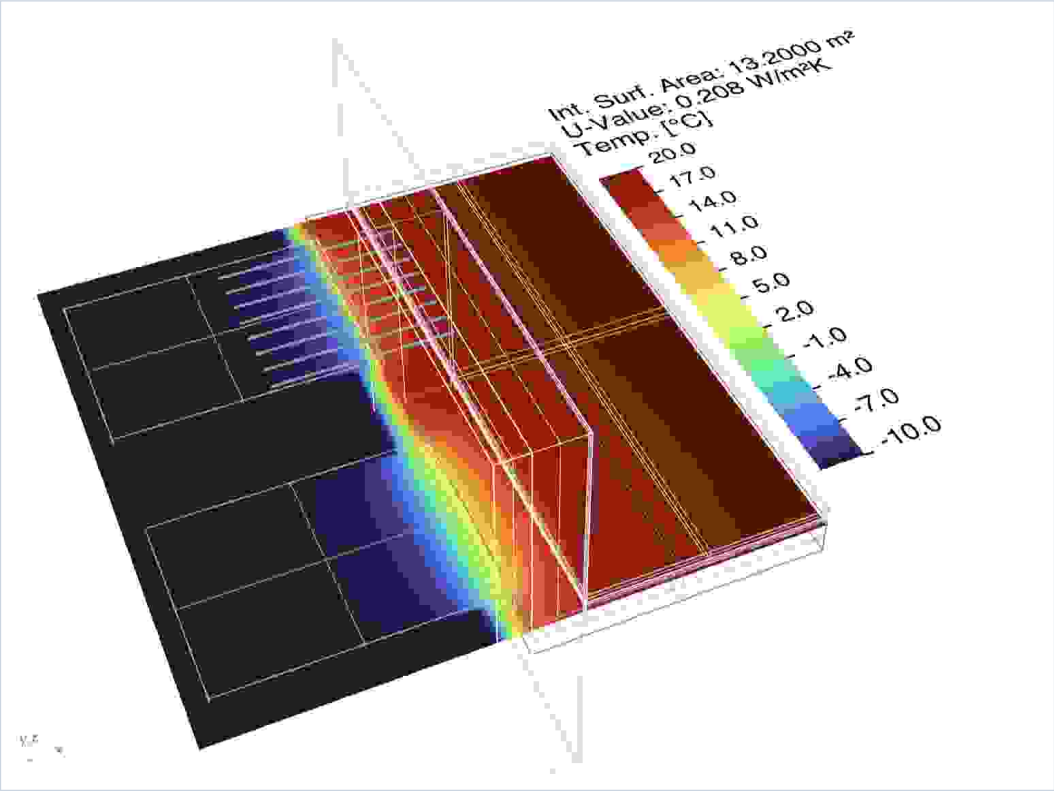


Figure 1. The model in Rhino, with the temperature on a plan through the floor slab.

Sections

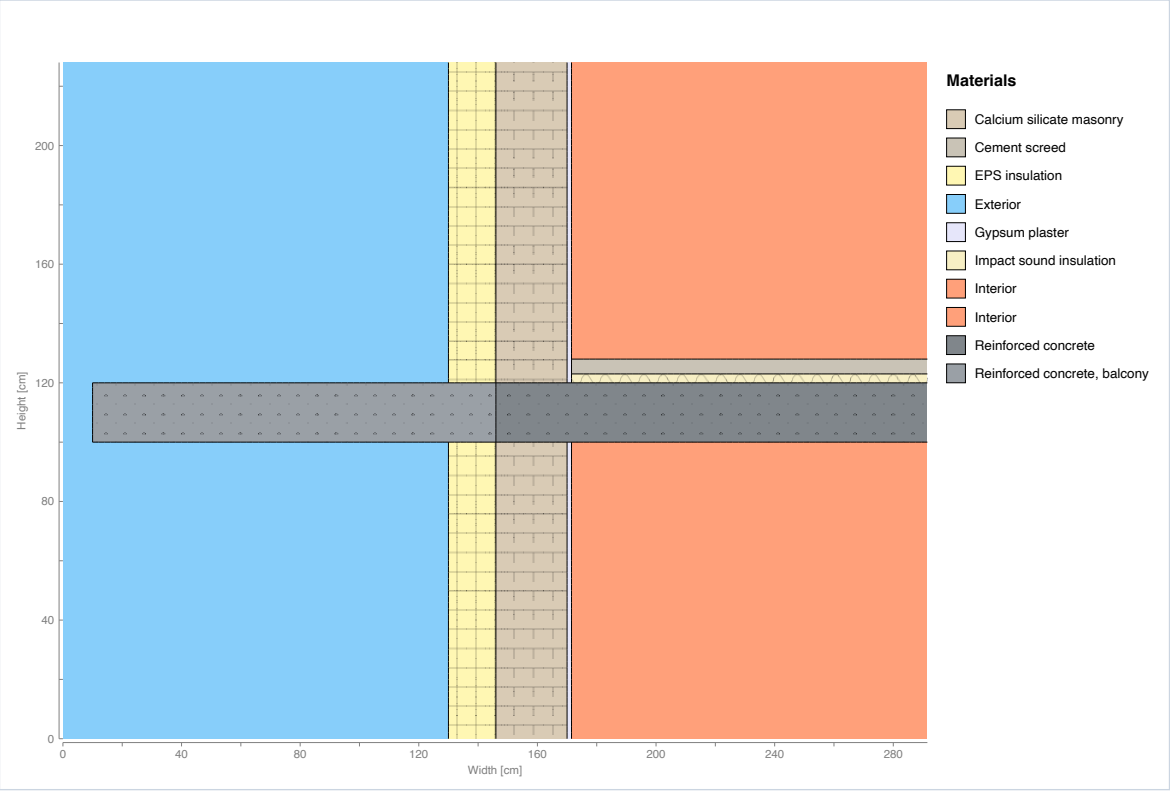


Figure 2. Through the continuous balcony: materials and boundary conditions. Heat flow; plane at y = 0.700 m.

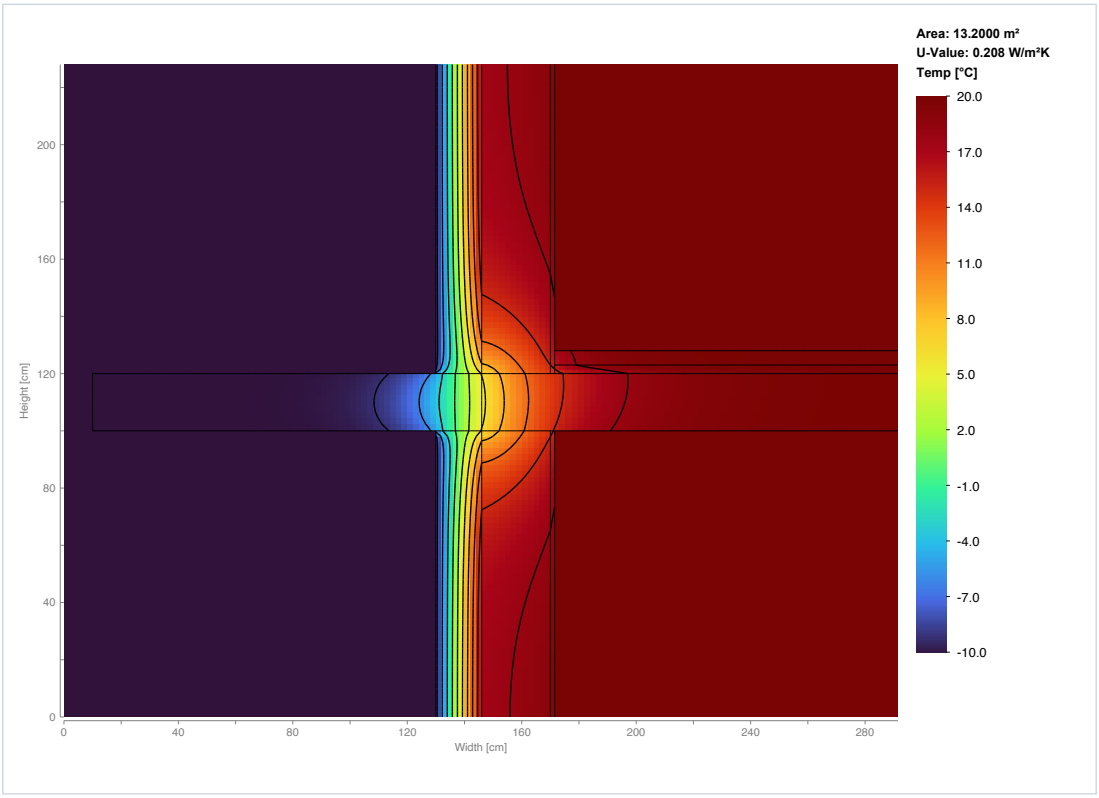


Figure 3. Through the continuous balcony: temperature. Heat flow; plane at y = 0.700 m.

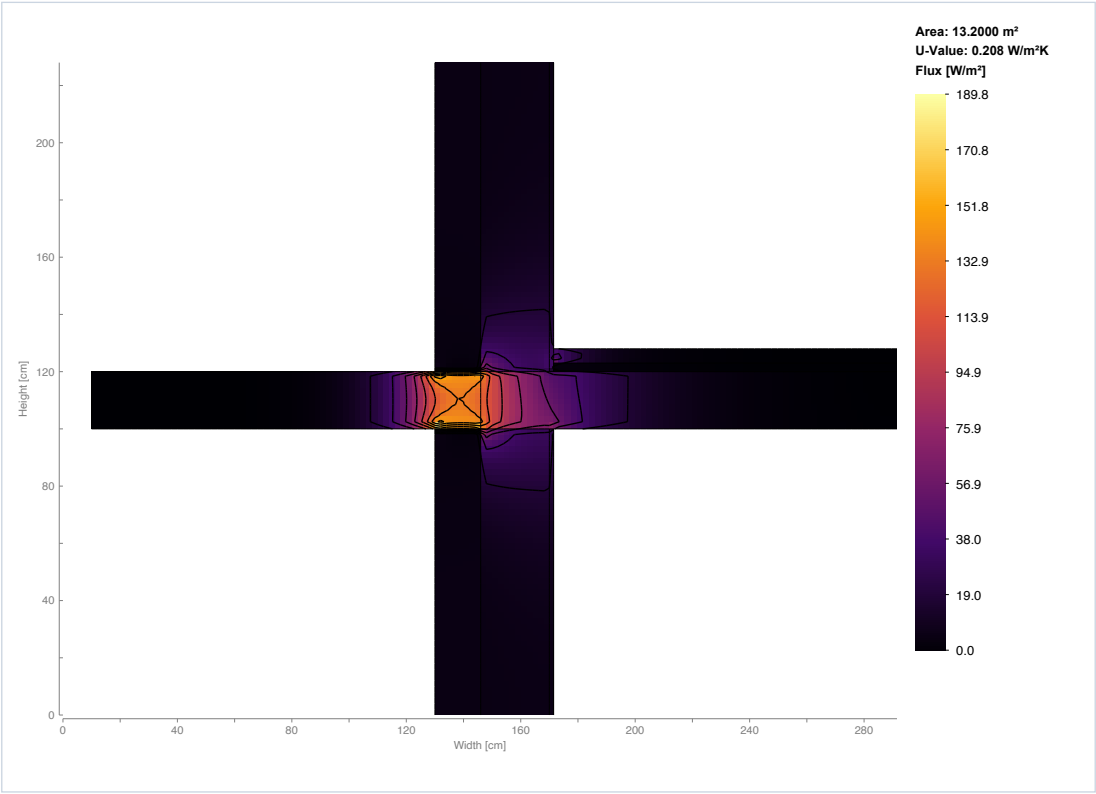


Figure 4. Through the continuous balcony: heat flux density. Heat flow; plane at y = 0.700 m.

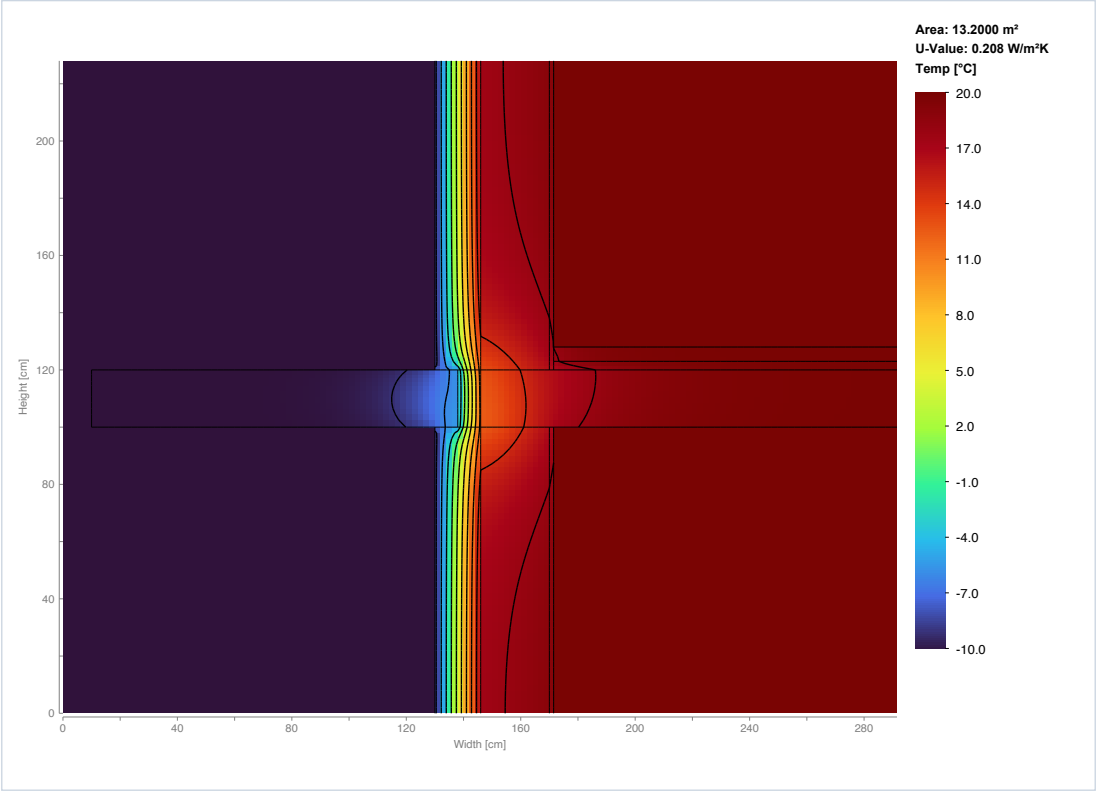


Figure 5. Through the thermally broken balcony: temperature. Heat flow; plane at y = 2.31 m.

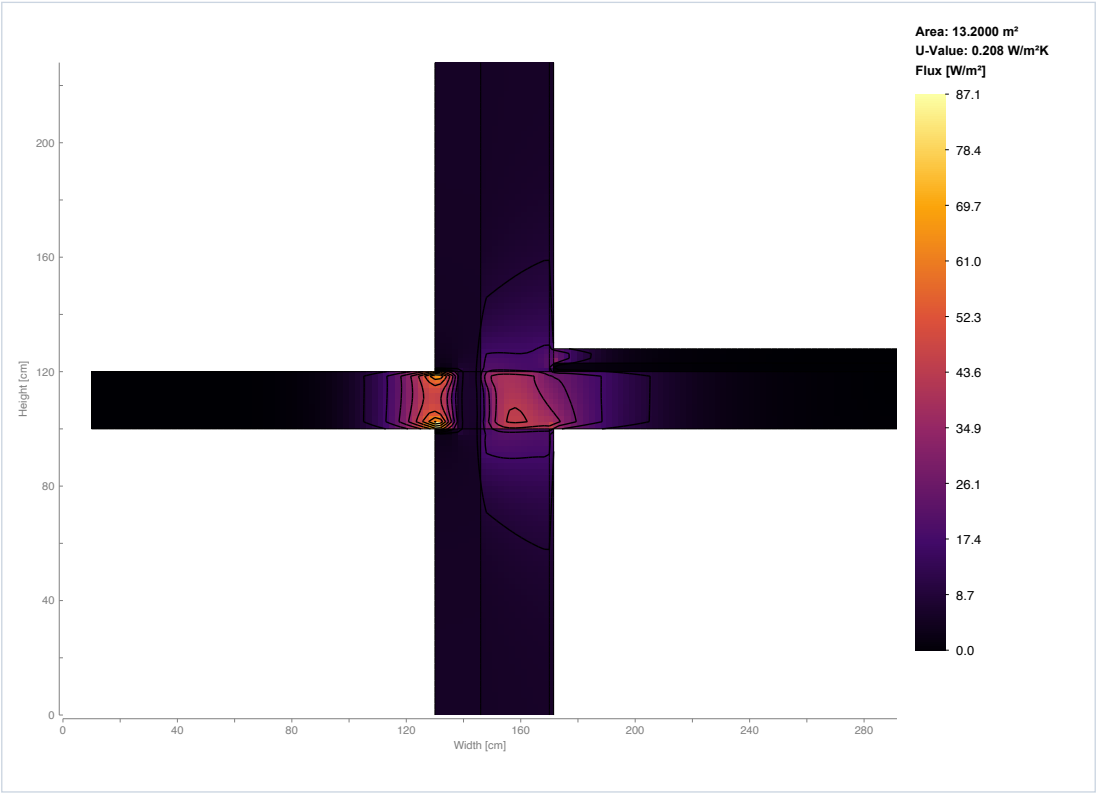


Figure 6. Through the thermally broken balcony: heat flux density. Heat flow; plane at y = 2.31 m.

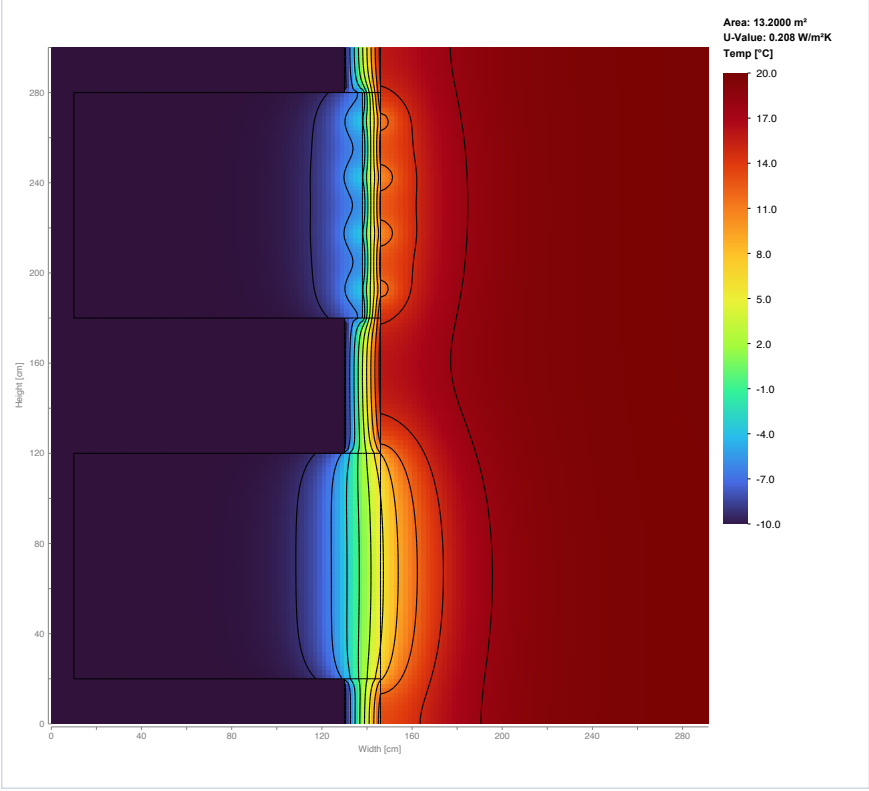


Figure 7. Plan through the floor slab: temperature. Heat flow; plane at z = 0.100 m.

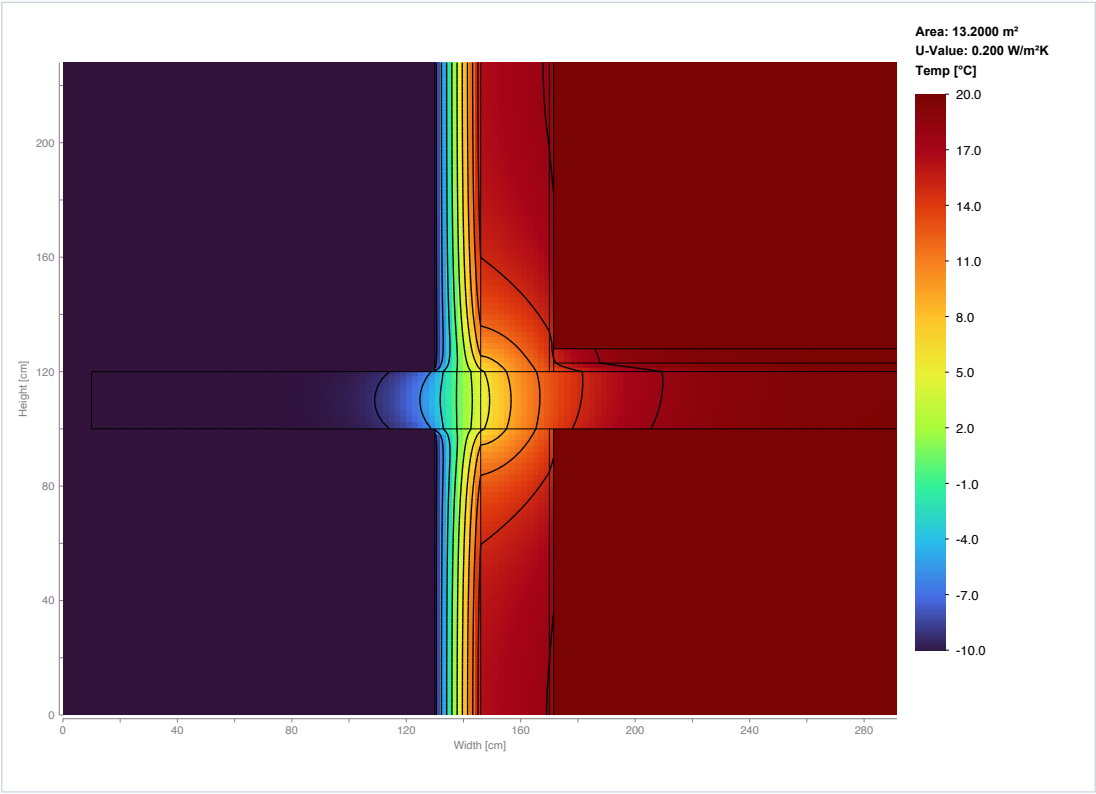


Figure 8. Surface temperatures, continuous balcony: temperature. Surface temperature (ISO 13788); plane at y = 0.700 m.

Calculation data

KOALA's test suite checks the 3D solver against the test reference cases 1 to 4 of ISO 10211:2017 Annex C; the measured values are published in the KOALA validation tables.

Cases

Case	Heat flow	Surface temperature (ISO 13788)
Purpose	heatFlow	temperature
Model	3-D	3-D
Extent x (m)	2.92	2.92
Extent y (m)	3.00	3.00
Extent z (m)	2.28	2.28
Section depth (m)		
Cells x	146	146
Cells y	156	156
Cells z	116	116
Target cell (mm)	20.0	20.0
Smallest cell (mm)	12.0	12.0
Largest cell (mm)	25.0	25.0

Materials

Case	Material	Thermal conductivity (W/(m K))	Volume in model (m³)
Heat flow	Stainless steel	15.0	0.00239
Heat flow	Thermal break (mineral wool)	0.0310	0.0154
Heat flow	Reinforced concrete, balcony	2.30	0.527
Heat flow	Reinforced concrete	2.30	0.872
Heat flow	Cement screed	1.40	0.180
Heat flow	Impact sound insulation	0.0400	0.108
Heat flow	Gypsum plaster	0.510	0.0936
Heat flow	Calcium silicate masonry	0.990	1.50
Heat flow	EPS insulation	0.0350	1.03
Surface temperature (ISO 13788)	Stainless steel	15.0	0.00239
Surface temperature (ISO 13788)	Thermal break (mineral wool)	0.0310	0.0154
Surface temperature (ISO 13788)	Reinforced concrete, balcony	2.30	0.527
Surface temperature (ISO 13788)	Reinforced concrete	2.30	0.872
Surface temperature (ISO 13788)	Cement screed	1.40	0.180
Surface temperature (ISO 13788)	Impact sound insulation	0.0400	0.108
Surface temperature (ISO 13788)	Gypsum plaster	0.510	0.0936
Surface temperature (ISO 13788)	Calcium silicate masonry	0.990	1.50
Surface temperature (ISO 13788)	EPS insulation	0.0350	1.03

Boundary conditions

Case	Environment	Side	Temperature (°C)	Surface resistance (m² K/W)	Relative humidity (%)	Area applied to (m²)	Heat flow into the model (W)
Heat flow	Interior	Interior	20.0	0.130	50.0	13.2	82.5
Heat flow	Exterior	Exterior	-10.0	0.0400	80.0	12.6	-82.5
Surface temperature (ISO 13788)	Interior	Interior	20.0	0.250	50.0	13.2	79.1
Surface temperature (ISO 13788)	Exterior	Exterior	-10.0	0.0400	80.0	12.6	-79.1

Thermal coupling coefficients

Case	Heat flow	Surface temperature (ISO 13788)
Between	Interior – Exterior	Interior – Exterior
Symbol	L3D	L3D
Value	2.75	2.64
Unit	W/K	W/K
Indoor heat flow	82.5	79.1
Outdoor heat flow	-82.5	-79.1
Heat flow unit	W	W
Room-side surface (m²)	13.2	13.2
Mean U over it (W/(m² K))	0.208	0.200

Temperature factors

Case	Heat flow	Surface temperature (ISO 13788)
Room	Interior	Interior
Solid	Gypsum plaster	Gypsum plaster
Minimum surface temperature (°C)	15.1	13.6
fRsi	0.838	0.787
x (m)	0.415	0.415
y (m)	0.680	0.660
z (m)	0	0
Indoor temperature (°C)	20.0	20.0
Outdoor temperature (°C)	-10.0	-10.0

Estimate of error

Case	Heat balance quotient	Coupling coefficient	At half the cell size	Unit	Relative change	Change of fRsi
Heat flow	8.65E-011	2.75		W/K		
Surface temperature (ISO 13788)	4.71E-011	2.64		W/K		

Declarations

Clause	Item	Statement
8.2	Source of the thermal conductivities	Design values after ISO 10456; thermal-break module from the manufacturer's declaration
7.3.2	Dimensional adjustments	None
7.3.3	Quasi-homogeneous layers	None
8.1	Non-standard values	None
14.1 b	Calculated temperature of an adjacent area	None

Completeness

Clause	Item	Status	Note
14.1 a	Description of the structure: plans, dimensions and materials	Provided	
14.1 a	Known alterations or measurements of a completed building	Not applicable	
14.1 b	2-D or 3-D geometrical model with dimensions	Provided	
14.1 b	Construction and auxiliary planes, thermal conductivities	Provided	Every axis-aligned face is a grid plane; the grid shape and cell-size range are stated per case.
8.2	Source of the thermal conductivities	Provided	Design values after ISO 10456; thermal-break module from the manufacturer's declaration
14.1 b	Applied boundary temperatures	Provided	
14.1 b	Calculated boundary temperature of an adjacent area	Provided	None
14.1 b	Surface resistances and the areas to which they apply	Provided	
7.3.2	Dimensional adjustments	Provided	None
7.3.3	Quasi-homogeneous layers and their conductivities	Provided	None
8.1	Non-standard values, with justification	Provided	None
14.2.1	Thermal coupling coefficient L3D or L2D	Provided	
14.2.1	Linear thermal transmittance, stating internal or external dimensions	Not applicable	No Ψ or χ is defined.
14.2.1	Temperature factor fRsi at the lowest surface temperature of each room, with its location	Provided	
14.2.1	Temperature weighting factors	Not applicable	Two boundary temperatures only.
14.2.4	Heat flow rates for the stated boundary temperatures	Provided	
14.2.4	Minimum surface temperatures and their locations	Provided	
14.2.5	Difference between calculations with n and 2n subdivisions	Missing	Not calculated at half the cell size: Heat flow, Surface temperature (ISO 13788)
14.2.5	Sum of the heat flows over the total heat flow	Provided	

Limits and notes

Kind	Text
Limit of the method	One indoor and one outdoor boundary temperature. Coupling coefficients between more than two environments and temperature weighting factors (ISO 10211 10.3, 13.1.2, Annex E) are not calculated.

Kind	Text
Limit of the method	Wall/floor junctions with the ground (ISO 10211 12.4, 12.5) are outside this report.
Limit of the method	Steady state; thermal conductivities do not depend on temperature and there are no internal heat sources.
Limit of the method	Rectilinear grid: surfaces inclined to the grid axes are stepped.
Note: Heat flow	Humidity is a steady-state vapour diffusion screening (Glaser) with the boundary humidities; it is not a transient hygrothermal simulation.
Note: Heat flow	No vapour resistance factor (μ = 1, as still air) for: Thermal break (mineral wool), Impact sound insulation. Set μ for these materials before relying on the humidity field.

Appendix: notes and warnings

What a reader of this report needs to know before relying on it, gathered from the calculation and its checks.

Missing for a complete report (ISO 10211 clause 14)

- 14.2.5: Difference between calculations with n and 2n subdivisions. Not calculated at half the cell size: Heat flow, Surface temperature (ISO 13788)

Notes from the calculation

- Heat flow: Humidity is a steady-state vapour diffusion screening (Glaser) with the boundary humidities; it is not a transient hygrothermal simulation.
- Heat flow: No vapour resistance factor (μ = 1, as still air) for: Thermal break (mineral wool), Impact sound insulation. Set μ for these materials before relying on the humidity field.