

HEAT LOAD REPORT · HEAT LOAD CALCULATION

Heat loss of the building

153.3 m² · 13 rooms · θ_e -20 °C

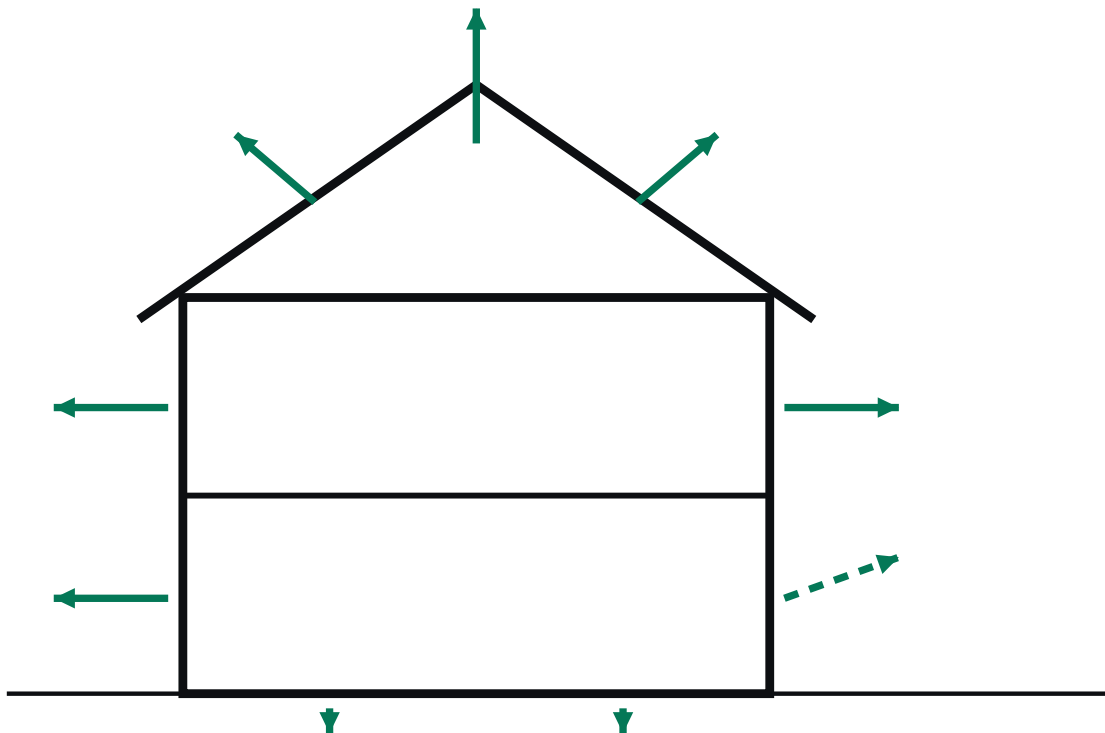
FOR

Sarah Fox

14 Rowan Close, Leeds

INSTALLER

Mark Miller



Heat loss

4.57 kW

Specific

29.8 W/m²

Area

153.3 m²

Building overview

The building needs **4.57 kW** at -20 °C outside. 72% of it leaves through the building elements, 17% through ventilation.

Calculations per EN 12831-1:2017

Calculations performed in accordance with EN 12831-1:2017 for residential buildings with continuous heating, or intermittent heating within Annex F.2 scope, with natural / mechanical / MVHR ventilation, without air transfer devices (ATDs) or designed cross-room transfer airflow. U-values per EN ISO 6946; ground heat transfer per EN ISO 13370 with U_{equiv} and EN 12831-1:2017 Formula (8); thermal bridges via the additive method of Annex B.2.1.

4.57 kW

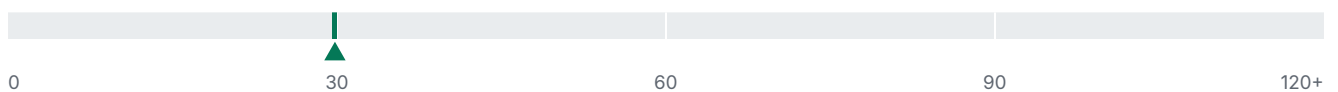
Design heat loss of the building · the cover figure

29.8 W/m²

Design heat load index

Heated floor area	153.3 m ²	Design outdoor temperature	-20 °C
Ventilation type	Mechanical with heat recovery (MVHR)		

Where the index sits on the W/m² axis



Design heat load per m² of heated area to EN 12831-1. This is not the energy class from an energy performance certificate, which grades annual energy demand in kWh/(m²·yr).

Heat loss distribution



Component	Heat loss W	Share
■ Transmission	3,285	72%
■ Ventilation	779	17%
▨ Thermal bridges	507	11%
Total (cover page)	4,570	100%

Room summary

Each room has its own design heat loss - size its radiator or loops to it.

Living room needs the most: **793 W**.

ROOM			LOSSES W			RESULT	
Room	T °C	V m³	Transm.	Vent.	Bridges	Total W	
Kitchen-diner	20.0	46.1	482	32	49	563	
WC	20.0	8.9	111	6	4	120	
Utility room	20.0	21.8	257	21	36	314	
Porch	20.0	6.9	114	47	9	170	
Hall	20.0	28.4	74	193	0	267	
Living room	20.0	60.1	581	161	51	793	
Guest room	20.0	35.6	338	87	40	464	
Children's room	20.0	40.4	251	89	69	409	
Bathroom *	24.0	21.0	267	11	28	305	
Study	20.0	21.0	229	80	46	354	
Landing	20.0	24.1	63	164	25	252	
Main bedroom	20.0	49.0	360	114	79	553	
Bedroom	20.0	43.2	333	91	72	496	
TOTAL			3,460	1,096	508	5,060	

Sum of rooms 5,060 W · Building 4,570 W · difference 490 W - 316 W is the wind: each room is counted with the wind on its own side, the building with the wind once; 174 W is the partitions to other heated rooms (marked *), which count in the room's load, not the building's. [\[2\]](#)

* Includes internal partitions to other heated rooms. They count for this room only and are not part of the building load on the cover page.

[\[2\]](#) EN 12831-1:2017, Formula (2) – the building's load without partitions to other heated rooms.

Element details

TOTAL is the same figure as in the room summary and in the underfloor heating import. [1] and [2] beside a floor's U point to the notes in section #06.

ELEMENT		DATA				RESULT
Name	Type	A (m²)	U (W/m²K)	ΔT (K)	b_u	Q (W)
Kitchen-diner 20.0 °C · 46.1 m³ · ΔT 40.0 K						
Screed + EPS 10 cm + XPS 15 cm	Floor on ground	171	0.122 [1][2]	40.0	1.00	120.7
Porotherm 25 + graphite EPS 20 cm	External wall	176	0.134	40.0	1.00	94.2
Aerated concrete 600, 12 cm + plaster	Wall to unheated space	4.9	1.208	40.0	0.40	94.0
Window	Window / door	2.70	0.90	40.0	1.00	97.2
Window	Window / door	2.10	0.90	40.0	1.00	75.6
Transmission through envelopes						482 W
Ventilation						32 W
Thermal bridges						49 W
TOTAL · Kitchen-diner						563 W
WC 20.0 °C · 8.9 m³ · ΔT 40.0 K						
Screed + EPS 10 cm + XPS 15 cm	Floor on ground	3.3	0.122 [1][2]	40.0	1.00	23.3
Aerated concrete 600, 12 cm + plaster	Wall to unheated space	4.5	1.208	40.0	0.40	87.8
Transmission through envelopes						111 W
Ventilation						6 W
Thermal bridges						4 W
TOTAL · WC						120 W
Utility room 20.0 °C · 21.8 m³ · ΔT 40.0 K						
Screed + EPS 10 cm + XPS 15 cm	Floor on ground	8.1	0.122 [1][2]	40.0	1.00	57.0
Porotherm 25 + graphite EPS 20 cm	External wall	15.5	0.134	40.0	1.00	82.8
Aerated concrete 600, 12 cm + plaster	Wall to unheated space	4.9	1.208	40.0	0.40	94.0
Small window	Window / door	0.64	0.90	40.0	1.00	23.0
Transmission through envelopes						257 W
Ventilation						21 W
Thermal bridges						36 W
TOTAL · Utility room						314 W
Porch 20.0 °C · 6.9 m³ · ΔT 40.0 K						
Screed + EPS 10 cm + XPS 15 cm	Floor on ground	2.6	0.122 [1][2]	40.0	1.00	18.1
Porotherm 25 + graphite EPS 20 cm	External wall	2.4	0.134	40.0	1.00	13.0
Front door	Window / door	1.89	1.10	40.0	1.00	83.2

Transmission through envelopes							114 W
Ventilation							47 W
Thermal bridges							9 W
TOTAL · Porch							170 W
Hall 20.0 °C · 28.4 m³ · ΔT 40.0 K							
Screed + EPS 10 cm + XPS 15 cm	Floor on ground	10.5	0.122 [1][2]	40.0	1.00		74.2
Transmission through envelopes							74 W
Ventilation							193 W
Thermal bridges							0 W
TOTAL · Hall							267 W
Living room 20.0 °C · 60.1 m³ · ΔT 40.0 K							
Screed + EPS 10 cm + XPS 15 cm	Floor on ground	22.3	0.122 [1][2]	40.0	1.00		157.3
Porotherm 25 + graphite EPS 20 cm	External wall	176	0.134	40.0	1.00		94.5
Window	Window / door	2.70	0.90	40.0	1.00		97.2
Patio door	Window / door	5.28	1.10	40.0	1.00		232.3
Transmission through envelopes							581 W
Ventilation							161 W
Thermal bridges							51 W
TOTAL · Living room							793 W
Guest room 20.0 °C · 35.6 m³ · ΔT 40.0 K							
Screed + EPS 10 cm + XPS 15 cm	Floor on ground	13.2	0.122 [1][2]	40.0	1.00		93.2
Porotherm 25 + graphite EPS 20 cm	External wall	15.4	0.134	40.0	1.00		82.4
Window	Window / door	2.10	0.90	40.0	1.00		75.6
Window	Window / door	2.40	0.90	40.0	1.00		86.4
Transmission through envelopes							338 W
Ventilation							87 W
Thermal bridges							40 W
TOTAL · Guest room							464 W
Children's room 20.0 °C · 40.4 m³ · ΔT 40.0 K							
Porotherm 25 + graphite EPS 20 cm	External wall	18.1	0.134	40.0	1.00		97.0
Teriva + rock wool 30 cm	Ceiling under unheated space (attic)	15.5	0.121	40.0	0.90		67.8
Window	Window / door	2.40	0.90	40.0	1.00		86.4
Transmission through envelopes							251 W
Ventilation							89 W
Thermal bridges							69 W
TOTAL · Children's room							409 W
Bathroom 24.0 °C · 21.0 m³ · ΔT 44.0 K							
Porotherm 25 + graphite EPS 20 cm	External wall	4.8	0.134	44.0	1.00		28.1

Partition: sand-lime 12 cm + plaster *	Wall to another heated space	101	1.704	44.0	0.09	68.8
Partition: sand-lime 12 cm + plaster *	Wall to another heated space	101	1.704	44.0	0.09	68.8
Partition: sand-lime 12 cm + plaster *	Wall to another heated space	5.4	1.704	44.0	0.09	36.9
Teriva + rock wool 30 cm	Ceiling under unheated space (attic)	8.1	0.121	44.0	0.90	38.8
Small window	Window / door	0.64	0.90	44.0	1.00	25.3
Transmission through envelopes						267 W
of which internal partitions *						174 W
Ventilation						11 W
Thermal bridges						28 W
TOTAL · Bathroom						305 W
Study 20.0 °C · 21.0 m³ · ΔT 40.0 K						
Porotherm 25 + graphite EPS 20 cm	External wall	11.9	0.134	40.0	1.00	63.8
Teriva + rock wool 30 cm	Ceiling under unheated space (attic)	8.1	0.121	40.0	0.90	35.3
Window	Window / door	1.50	0.90	40.0	1.00	54.0
Window	Window / door	2.10	0.90	40.0	1.00	75.6
Transmission through envelopes						229 W
Ventilation						80 W
Thermal bridges						46 W
TOTAL · Study						354 W
Landing 20.0 °C · 24.1 m³ · ΔT 40.0 K						
Porotherm 25 + graphite EPS 20 cm	External wall	4.2	0.134	40.0	1.00	22.3
Teriva + rock wool 30 cm	Ceiling under unheated space (attic)	9.3	0.121	40.0	0.90	40.6
Transmission through envelopes						63 W
Ventilation						164 W
Thermal bridges						25 W
TOTAL · Landing						252 W
Main bedroom 20.0 °C · 49.0 m³ · ΔT 40.0 K						
Porotherm 25 + graphite EPS 20 cm	External wall	17.5	0.134	40.0	1.00	93.7
Teriva + rock wool 30 cm	Ceiling under unheated space (attic)	18.8	0.121	40.0	0.90	82.3
Window	Window / door	3.00	0.90	40.0	1.00	108.0
Window	Window / door	2.10	0.90	40.0	1.00	75.6
Transmission through envelopes						360 W
Ventilation						114 W
Thermal bridges						79 W
TOTAL · Main bedroom						553 W
Bedroom 20.0 °C · 43.2 m³ · ΔT 40.0 K						
Porotherm 25 + graphite EPS 20 cm	External wall	16.4	0.134	40.0	1.00	88.0

Teriva + rock wool 30 cm	Ceiling under unheated space (attic)	16.6	0.121	40.0	0.90	72.6
Window	Window / door	2.10	0.90	40.0	1.00	75.6
Window	Window / door	2.70	0.90	40.0	1.00	97.2
Transmission through envelopes						333 W
Ventilation						91 W
Thermal bridges						72 W
TOTAL · Bedroom						496 W

Calculation method

Calculations were performed per EN 12831-1 (room-by-room building heat load), EN ISO 6946 (thermal resistance of building components) and EN ISO 13370 (heat transfer to the ground). The report shows the input data, assumptions, and intermediate results of every calculation step.

$$\Phi_{HL,i} = \Phi_{T,i} + \Phi_{V,i} + \Phi_{hu,i} - \Phi_{gain,i}$$

EN 12831-1:2017, 6.3.1.3, Formula (3)

The room's heat loss - the Total column of the summary and TOTAL in the details. $\Phi_{T,i}$ is the elements, the ground and the bridges, partitions to other heated rooms (*) included. $\Phi_{gain,i}$ is 0 by default (Annex B.2.18).

$$\Phi_{HL,BE} = \Sigma(\Phi_{T,ie} + \Phi_{T,iae} + \Phi_{T,iaBE} + \Phi_{T,ig}) + \Phi_{V,BE} + \Sigma\Phi_{hu,i} - \Sigma\Phi_{gain,i}$$

EN 12831-1:2017, 6.3.1.2, Formula (2)

The building's heat loss on the cover - size the heat source to it. Partitions between heated rooms ($\Phi_{T,ia}$) are not in it, and ventilation counts the wind once.

$$\Phi_{T,k} = A_k \cdot U_k \cdot \Delta T \cdot b_u$$

EN 12831-1:2017, 6.3.2, Formulae (6)-(7); b_u per 6.3.2.5; U per EN ISO 6946

Every row of the element details: the net area (windows taken off the wall), the element's U, the temperature difference and the factor for the space behind it.

$$\Phi_{TB} = \Delta U_{TB} \cdot A \cdot \Delta T \cdot b_u$$

EN 12831-1:2017, Annex B.2.1 (additive method)

Thermal bridges for every element and window to the outside or an unheated space (Formula (6)). None on a floor on the ground (Formula (8) has no bridge term) or on elements to heated rooms, flats and buildings (the note under Formula (7)).

$$\Phi_{V,i} = \rho c_p \cdot [\max(q_{v,env,i}; q_{v,min,i} - q_{v,techn,i}) \cdot (\theta_{int,i} - \theta_e) + q_{v,sup,i} \cdot (\theta_{int,i} - \theta_{rec,z})]$$

EN 12831-1:2017, 6.3.3.3, Formula (17); $f_{dir,z} = 2$ in Formula (18), Annex B.2.14

The room's ventilation: infiltration from n50 or the minimum flow (Table B.7), and the supply air warmed by heat recovery where there is one. $\rho c_p = 0.34 \text{ Wh}/(\text{m}^3 \cdot \text{K})$.

Important information

- Actual heat demand may differ from the calculated value depending on user behaviour, weather conditions, and the technical condition of the building.
- Thermal transmittance coefficients U were taken from data entered by the calculation author. It is recommended to verify envelope parameters during construction.
- The design outdoor temperature was adopted in accordance with the building location. Changing this value affects the calculation result.

See the method: a reference house calculated in full: heatalgo.com/en/compliance

Assumptions and notes

REFERENCES

$$\Phi = A \cdot U_{\text{equiv}} \cdot \Delta T \cdot f_{\theta, \text{ann}} \cdot f_{\text{GW}} \cdot f_{\text{ig}}$$

EN 12831-1:2017, Formula (8); U_{equiv} per EN ISO 13370

[1] Floor on ground - U_{equiv} computed per EN ISO 13370 from the characteristic dimension $B' = A / (0.5 \cdot P)$ and the equivalent thickness d_t ($d_t + 0.5 \cdot z$ for a floor below ground level). The floor's heat loss per EN 12831-1:2017 Formula (8): $\Phi = A \cdot U_{\text{equiv}} \cdot \Delta T \cdot f_{\theta, \text{ann}} \cdot f_{\text{GW}} \cdot f_{\text{ig}}$, where $f_{\theta, \text{ann}} = 1.45$ (Annex B.2.3), $f_{\text{GW}} = 1.00$ or 1.15 from the groundwater level, and $f_{\text{ig}} = 1.00$.

[2] B' of the building: $P = 37.96$ m, $A = 76.93$ m² - taken for the floors marked [2] (Annex E).

Room loads and the building total (for the installer)

The values in the room summary are each room's design heat load - size that room's radiator or underfloor heating loops from them. For underfloor heating take the whole figure - the loss through the floor stays in the load (EN 1264-3, Formula 5), and it is added to the water flow separately. The rooms add up to more than the building total on the cover because the wind allowance is counted for each room separately, with the wind on that room's side ($f_{\text{dir}, z} = 2$, EN 12831-1 Annex B.2.14). The building takes the wind once, so size the heat source (heat pump, boiler) from the cover total.

Partitions to other heated rooms (the rooms marked * in the summary) count in the room's load - size its radiator or loops on them too - but not in the building total (EN 12831-1, Formula (2)), because that heat stays in the building. This is the second reason the rooms differ from the cover total; a partition to a warmer room can also lower the sum.

Numerical assumptions and calculation parameters

Values used in the calculation - they let a technical reviewer (installer, designer) reproduce the result. The client does not need to read these.

A_env dimension basis	internal	Thermal bridges (ΔU_{TB})	0.05 W/(m ² ·K)
Air tightness n50	1.5 h ⁻¹	Air change rate	0.50 h ⁻¹
Heat recovery efficiency	82%	Ventilation - building loss ($\Phi_{\text{V, build}}$)	779 W

What this report rests on

EN 12831-1	The heat loss of the rooms (Formula 3) and of the building (Formula 2), room by room: transmission, ventilation, bridges (Annex B.2.1), heating-up.
EN ISO 6946	The thermal resistance and the U-value of every element.
EN ISO 13370	Heat transfer via the ground: a floor's U_{equiv} from B' and d_t (notes [1], [2]).

Calculation character: full engineering calculations with transparently documented intermediate results
Software: HeatAlgo - calculation system. Formulas and sources of the figures: page #05.

INSTALLER
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