

External Walls Thermal Performance

Data Sheet 8
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Introduction

This data sheet gives guidance for the specification of blocks in conjunction with full fill and partial fill insulation materials to meet Building Regulation requirements for external walls.

To ensure compliance with respect to regulatory requirements for thermal performance, specifiers may adopt any of the procedures described in the Building Regulations Part L (England) 2013 and Part L (Wales) 2014 and Technical Standards Section 6 2015 (Scotland).

Guidance on detailing to minimize thermal bridging may be found at www.cba-blocks.org.uk which gives ψ -values and f-values for the full range of aggregate blocks in cavity walls in conjunction with a range of full and partial fill insulation materials and for solid walls with external insulation.

High levels of thermal insulation can be achieved in a number of different ways using aggregate concrete blocks.

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Insulation options

There are several basic options, which may be considered separately or in conjunction to provide the required thermal performance.

Cavity insulation

- Full fill cavity batts or full fill cavity injected systems.
- Partial fill cavity wall boards.

External insulation

- External insulation protected by render or other applied finish.

Internal insulation

- Insulated dry lining.

Manufacturers should be consulted for design options using their products.

Calculating U-Values

U-values should be calculated using BS EN ISO 6946 'Building components and building elements – Thermal resistance and thermal transmittance – calculation methods', so as to take account of any repeat thermal bridging effect such as mortar joints, plaster dabs, gaps between insulation and where necessary, wall ties.

However, the bridging effect of mortar joints needs only be considered when the difference in thermal resistance between block and mortar is greater than $0.1 \text{ m}^2 \text{ K/W}$, and for many aggregate blocks the use of the full BS EN ISO 6946 method would not be necessary.

BS EN ISO 6946 can also be used to calculate the thermal resistance (R) of voided aggregate blocks by omitting the surface resistance values. R-values of voided blocks for direct use in U-value calculations are normally published by CBA members.

Guidance on the procedures to follow for calculating U values to BS EN ISO 6946 can be found in BR 443 'Conventions for U-value calculations' published by BRE. This is available as a free download. Software has been developed by BRE for calculating U-values. The BRE software can be purchased at: <http://projects.bre.co.uk/uvalues/>

A simplified version of this software for calculating the U-values of walls is available free of charge on www.cba-blocks.org.uk. This gives slightly more conservative U-values than does the BRE software.

Note: To meet Building Regulation structural requirements the inner leaf blockwork should be at least 90mm thick.

Aggregate Concrete Blocks

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The following 3 types of aggregate blocks and their upper limit λ -values are covered by this data sheet:

Ultra lightweight (ULW)
Lightweight (LW)
Dense

$\lambda \leq 0.28$ W/mK
 $\lambda \leq 0.60$ W/mK
 $\lambda \leq 1.33$ W/mK

Example SAP calculations for meeting the requirements of Building Regulations in England, Wales and Scotland

Specification used in example SAP calculations (ENGLAND & WALES)



ADL1A	2013 Edition (England), 2014 Edition (Wales)
SAP conventions	Version 6.1
Orientation	North (Front)
Wall – External	150mm full fill cavity with 0.032 λ insulation for thermal bridging purposes (varies)
Wall – Garage semi exposed	0.24 W/m ² K
Wall – Separating/party	0.00 W/m ² K – assumed fully filled and sealed
Floor purposes	150mm 0.022 λ insulation for thermal bridging
Floor	0.13 W/m ² K
Roof (Plane)	0.10 W/m ² K
Windows	1.40 W/m ² K
Doors	1.20 W/m ² K
Exposed floor (O/G)	0.23 W/m ² K
Garage wall	0.24 W/m ² K
Thermal Mass Parameter	Medium for LW & ULW blocks High for dense blocks
Air permeability	5m ³ /hr
Heating (all units)	Gas combi boiler, 88% efficient, radiators, pumped in a heated space with a delayed start thermostat
Heating controls	Time and temperature Zone Control
Thermal bridging	CBA Details (with Keystone Hi-Therm lintels) ULW $\psi = 0.050$ LW $\psi = 0.050$ Dense $\psi = 0.049$

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Specification used in example SAP calculations (SCOTLAND)



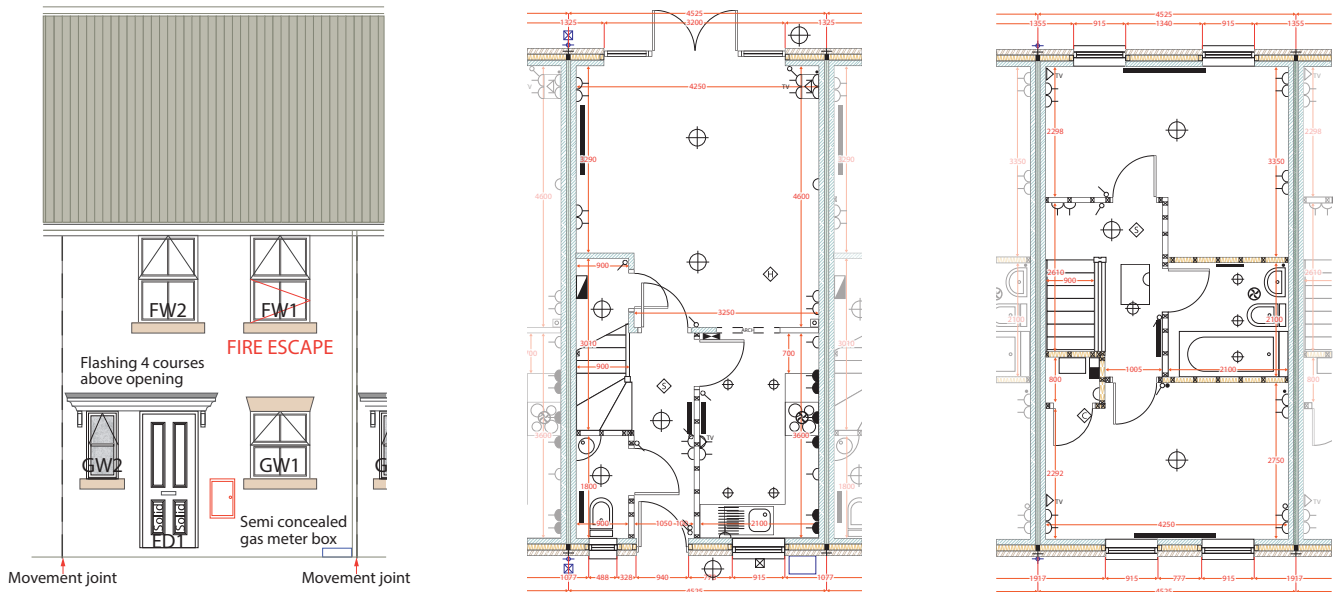
Section 6	2015 Technical Handbook
SAP conventions	Version 6.1
Orientation	North (Front)
Wall – External	All assumed 0.18W/m ² K
Wall – Garage semi exposed	0.24 W/m ² K
Wall – Separating/party	0.00 W/m ² K – assumed fully filled and sealed
Floor purposes	150mm 0.022λ for thermal bridging
Floor	0.13 W/m ² K
Roof (Plane)	0.10 W/m ² K
Windows	1.40 W/m ² K
Doors	1.20 W/m ² K
Exposed floor (O/G)	0.23 W/m ² K
Garage wall	0.24 W/m ² K
Thermal Mass Parameter	Medium for LW & ULW blocks High for dense blocks
Air permeability	5m ³ /hr
Heating (all units)	Gas combi boiler, 88% efficient, radiators, pumped in a heated space with a delayed start thermostat
Heating controls	Time and temperature Zone Control
Thermal bridging	CBA Details (with Keystone Hi-Therm lintels) ULW $\psi = 0.050$ LW $\psi = 0.050$ Dense $\psi = 0.049$
Renewable technology	Variable amount as listed, south at 30° with modest overshadowing

Aggregate Concrete Blocks

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House types covered by example calculations

Mid terrace



Wall U-value required to achieve DER (England and Wales)



BLOCK type	Wall U-value to achieve DER	Y Value	TFEE	DFEE
ULW λ 0.28	0.33* W/m ² K	0.0621	42.80	38.80
LW λ 0.60	0.32* W/m ² K	0.0654	42.80	38.60
Dense λ 1.33	0.25* W/m ² K	0.0771	42.80	38.60

*ADL1A has backstop wall U-values of 0.30 for England and 0.21 for Wales, and these values would need to be met for SAP / ADL1A compliance

PV required to meet requirements of Section 6 (Scotland)

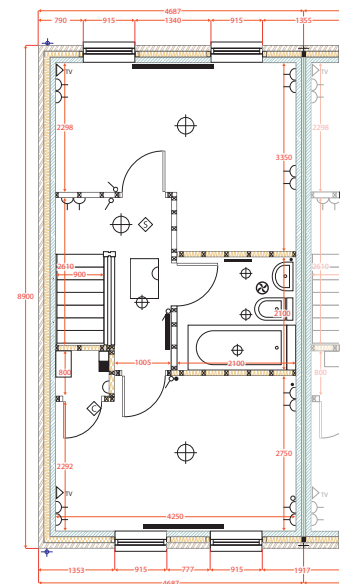
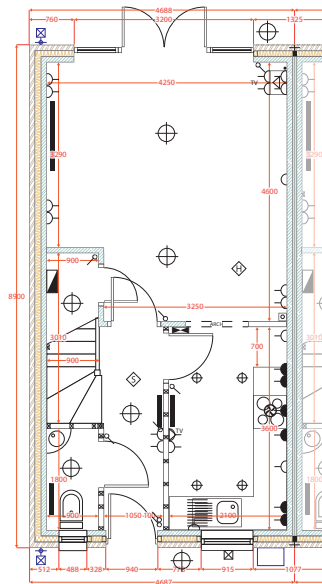


BLOCK type	PV required	Y Value
ULW λ 0.28	0.80 kWp	0.079
LW λ 0.60	0.80 kWp	0.083
Dense λ 1.33	0.80 kWp	0.088

Aggregate Concrete Blocks

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End terrace/Semi detached



Wall U-value required to achieve DER (England and Wales)



BLOCK type	Wall U-value to achieve DER	Y Value	TFEE	DFEE
ULW λ 0.28	0.26* W/m ² K	0.0402	50.90	45.20
LW λ 0.60	0.24* W/m ² K	0.0465	50.90	45.40
Dense λ 1.33	0.21* W/m ² K	0.0555	50.90	45.50

*ADL1A has backstop wall U-values of 0.30 for England and 0.21 for Wales, and these values would need to be met for SAP / ADL1A compliance

PV required to meet requirements of Section 6 (Scotland)

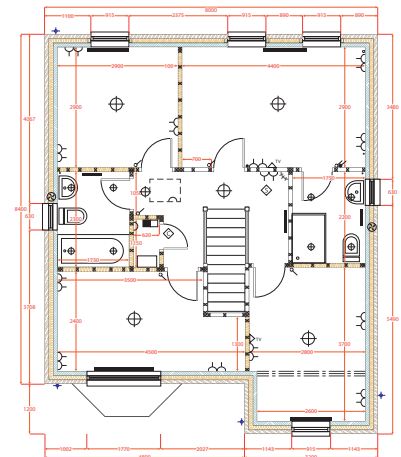
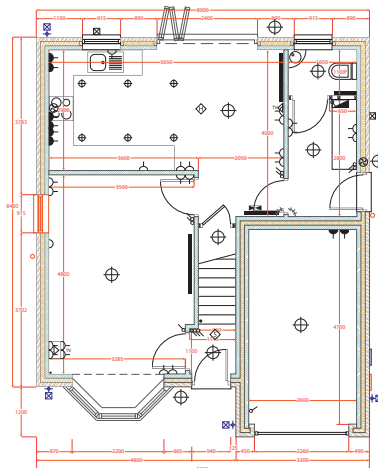


BLOCK type	PV required	Y Value
ULW λ 0.28	0.70 kWp	0.047
LW λ 0.60	0.70 kWp	0.053
Dense λ 1.33	0.75 kWp	0.063

Aggregate Concrete Blocks

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Detached



Wall U-value required to achieve DER (England and Wales)



BLOCK type	Wall U-value to achieve DER	Y Value	TFEE	DFEE
ULW λ 0.28	0.23* W/m ² K	0.0414	60.70	51.90
LW λ 0.60	0.21 W/m ² K	0.0481	60.70	51.60
Dense λ 1.33	0.15 W/m ² K	0.0593	60.70	51.40

*ADL1A has backstop wall U-values of 0.30 for England and 0.21 for Wales, and these values would need to be met for SAP / ADL1A compliance

PV required to meet requirements of Section 6 (Scotland)



BLOCK type	PV required	Y Value
ULW λ 0.28	1.25 kWp	0.042
LW λ 0.60	1.30 kWp	0.048
Dense λ 1.33	1.40 kWp	0.059

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Average U value to achieve DER,

ULW	0.273 W/m ² K
LW	0.256 W/m ² K
Dense	0.203 W/m ² K

Average U value to achieve DER by house type, & Y Value

Mid terrace	0.306 W/m ² K	y = 0.0682
End terrace/semi	0.240 W/m ² K	y = 0.0474
Detached	0.206 W/m ² K	y = 0.0496

U-VALUE SUMMARY TABLE

Cavity width	Cavity type	Residual clear cavity	Insulation λ	ULW block	LW block	Dense block
100mm	Full Fill	n/a	0.032	0.26	0.27	0.28
125mm	Full Fill	n/a	0.032	0.22	0.23	0.24
150mm	Full Fill	n/a	0.032	0.19	0.20	0.20
100mm	Full Fill*	5mm	0.021	0.18	0.19	0.19
125mm	Full Fill*	5mm	0.021	0.15	0.15	0.16
150mm	Full Fill*	5mm	0.021	0.13	0.13	0.13
100mm	Partial Fill	50mm**	0.022	0.27	0.28	0.29
125mm	Partial Fill	50mm**	0.022	0.21	0.21	0.22
150mm	Partial Fill	50mm**	0.022	0.17	0.17	0.17

* based on Xtratherm Cavity Therm insulation

** requires a residual cavity resistance of ≥ 0.644 as declared by insulation manufacturers

All U-values based upon

- Brick or rendered dense block outer leaf
- Standard plasterboard with $\lambda = 0.21$
- 6.2mm cross sectional area wall tie for 125mm / 150mm cavity
- 4.8mm cross sectional area wall tie for 100mm cavity

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