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Thermal Compliance

September 2007

build with ease

H+H celcon

Aircrete /aerkri:t/ noun., adj.

1. autoclaved, aerated concrete (AAC) **2.** (cel)lular (con)crete (CELCON). One of the lightest forms of concrete with structural, thermal, sound, fire and freeze/thaw properties, extensively used in Europe where known as ‘gasbeton’. Used in the UK since the 1950s; today known as ‘aircrete’. Comprises pulverised fuel ash (PFA), sand, cement, aluminium powder, lime and water. Used as blocks in a range of thicknesses and face formats for internal and external walls above and below dpc and as infill in beam and block floors; used as a material for reinforced floor elements.


Introduction

H+H UK Limited is well known for the beneficial thermal performance of their products, which offer simple solutions that meet and surpass the most demanding building requirements.

In using our products thermal performance is only one of the benefits that can be gained:

Versatile building material
Offering benefits too numerous to list, our products help offer simple solutions to all the relevant Building Regulations and are the product of choice for the construction of Foundations, Floors and Walls.

Technical Support
Providing first class technical support we can advise on how to meet specific U-value requirements using our products.

Customer service
Our sales team is organised around the needs of our customers, to provide a continuity of care by our knowledgeable and professional staff.

Innovation
Our Research and Development laboratories are UKAS accredited. We are constantly looking for new and improved methods of delivering product solutions to meet the needs of our ever-changing environment.

Quality products
As part of an international group dedicated to the manufacture of aircrete, our factories are BS EN ISO 9001 and BS EN ISO 14001 compliant.

Sustainability
Made using 80% recycled material, with 99% of raw materials being sourced within the UK, constructions using our products obtain the highest ratings in the Green Guide to Housing Specification and assist with the Code for Sustainable Homes Compliance.

Delivery
With factories and distribution depots strategically placed around the UK our experienced staff are able to offer a responsive and helpful service.

Following the new measures to make buildings more energy efficient, saving one million tonnes of carbon per year (announced by the then ODPM and Defra on 13 September 2005), Part L was published 15th march 2006 with the definitive version placed on the DCLG website 31st March 2006.

"The Energy White Paper produced by the Government in 2003, acknowledged the reality of climate change and stated a commitment to putting the UK on path to cutting carbon dioxide emissions by 60 per cent before 2050, with real progress by 2020.

With around half of all CO_2 emissions coming from building energy use, the Building Regulations are a key part of the Government efforts to tackle climate change through higher building standards."

Angela Smith MP
Parliamentary Under Secretary of State.


Approved Document L – England / Wales and supporting documents

Approved Document L

Laid out in four documents Approved Document L is split into dwellings (L1) and buildings other than dwellings (L2) both of these sections are then subdivided into new build (L1A and L2A) and work in existing buildings (L1B and L2B). Note; Rooms for Residential Purposes e.g. nursing homes or student accommodation are addressed in L2A and L2B respectively.

For flats or other residential buildings with common areas, if the common areas are heated then AD L2A has to be used for the common areas. Conservatories under 30m^2 attached to a dwelling remain exempt from Building Regulations. A conservatory built as part of a new dwelling, provided the thermal separation between the dwelling and the conservatory is constructed to a standard comparable to the rest of the external envelope of the new dwelling, should be ignored when assessing the performance of the new dwelling.

The only route to show compliance to Part L is through either the new SAP 2005 procedure for dwellings or a calculation tool known as SBEM (Simplified Building Energy Model) for non-domestic buildings.

Supporting Documents

The Approved Documents rely upon a number of other 'second tier' documents to enable the Regulations to be met. The major ones include:

- **The Governments Standard Assessments Procedure for Energy Rating of Dwellings 'SAP 2005'**
- **The National Calculation Methodology for determining the energy performance of buildings Part 1: A guide to the application of the SBEM and other approved calculation tools for building regulation purposes in the UK (2006 Edition, ISBN 1-85946-227-8)**
- **Accredited Construction Details for Part L, 2006 Edition**
- **Low or Zero Carbon Energy Sources: Strategic Guide, 2006 Edition**
- **Domestic Heating Compliance Guide, 2006 Edition**
- **Non Domestic Heating Cooling and Ventilation Compliance Guide, 2006 Edition**
- **CE129 Reducing overheating – A designers guide**

There are other guidance documents referenced in the Approved Documents.

Part L publication 2006

The document has been published in four parts:

ADL1A – for construction of new dwellings
ADL1B – for work in existing dwellings and extensions
ADL2A – for construction of new non-domestic buildings and large extensions
ADL2B – for work in existing non-domestic buildings and small extensions

Details can be found at the following website address:

www.planningportal.gov.uk/england/professionals/en/1115314110382.html
for Approved Documents

www.planningportal.gov.uk/england/professionals/en/1115314255826.html
for Accredited Details

SAP2005

This calculation procedure will report the CO_2 emissions (C_H and C_L) arising from:

I. The provision of space and water heating, (C_H) (which includes the energy used by pumps and fans) and

II. The use of internal fixed lighting (C_L)

III. Problems of overheating, if any

IV. U-values below a certain level

There is a checklist of features critical to achieving the DER and which must be reported to the Building Control. This checklist (see Appendix A of ADL1) is completed with data from the SAP calculation plus additional detail from the Builder's submission.

Approved Document L1A

Work in new dwellings

The Principle

AD L1A gives guidance for new dwellings. In general, for dwellings there are five criteria to show compliance once the target has been set. These are:

Criterion 1 The predicted rate of carbon dioxide emissions Dwellings Emission Rate (DER) is not greater than the Target Emissions Rate (TER).

Criterion 2 The performance of the building fabric and the fixed building services is no worse than given design limits set out in the Approved Document, for example maximum fabric U-values.

Criterion 3 The dwelling has the appropriate passive control measures to limit the effect of solar gains on indoor temperatures, the aim being to reduce or eliminate the need for air conditioning.

Criterion 4 The performance of the dwelling, as built, is consistent with the DER.

Criterion 5 The necessary provisions for energy efficient operation of the dwelling are put in place.

The key to meeting the Regulations is by comparing the target and design carbon dioxide emissions of the building. The Target Emission Rate (TER), expressed as a quantity of CO_2 per m^2 of floor area per year, is calculated for the new dwelling using SAP2005. No other method is allowed.

Calculating the TER

To calculate the TER the designer will need to determine, by using SAP2005, the emissions from a 'notional' dwelling of same size and shape as actual dwelling using the 'reference values' (essentially Elemental Part L 2002 values). The 'reference values' are built into the SAP procedures and are based on the external envelope and certain other fixed criteria.

TER is determined from the formula:

TER = (CH x fuel factor + CL) x (1 - improvement factor)

The fuel factor is taken from a table in the Approved Document and varies from 1.0 where mains gas is used to 1.47 for grid electricity. The improvement factor for this revision of Part L is 20%. Once the designer has entered the new dwelling data into SAP2005 the TER and DER values are shown, the DER value being calculated on the U-values and data entered by the designer.

Two sets of DER will be needed:

Design–Draft The first DER calculation is at the design stage using design assumptions.

Design–Final The second DER calculation is at completion stage using "as built data" and the actual air permeability figures.

Secondary heating

The regulations assume 10% of the dwelling's heat will come from an electrically heated secondary appliance unless an alternative appliance is specified. A condensing gas fire or flueless gas fire in the lounge could achieve a significant saving on CO_2 emissions over the default assumption.

Where the building contains more than one dwelling, such as in a terrace of houses or in a block of flats, the regulations can be met if either:

I. Every individual dwelling has a DER that is no greater than its corresponding TER or

II. The building DER is no greater than the building TER. The building DER is the floor area-weighted average of the individual DERs and is calculated in the same way as the building TER. However, if adopting the building DER approach, it will still be necessary to provide the information for each dwelling so that individual energy performance certificates can be produced.

There are certain limits on design flexibility such as; maximum average U-value (a) (see diagram 1)(to ensure that each construction element plays a significant part in meeting the requirements), long stop values (b) (see diagram 1). In addition to these maximum average U-values an upper limit on air permeability of $10m^3/hr/m^2$ is given as 'reasonable'. The only exception to this is for small sites (see under "Air Tightness").

Diagram 1 (from Table 2 AD L1A and Table 1 AD L1B)
Limiting U-value standards (W/m^2K)

Element	(a) Area-weighted dwelling average	(b) Worst individual sub-element
Wall	0.35	0.70
Floor	0.25	0.70
Roof	0.25	0.35
Windows, roof lights, glazed doors	2.2	3.3

Approved Document L1A continued

Work in new dwellings continued

Who can calculate it?

The Regulations do not specify the qualifications for persons carrying out the TER and DER for Building Regulation purposes. It is the Building Control Body's responsibility to ensure compliance. They may check all calculations themselves or they may accept the TER, DER and SAP rating depending on the competence of the person carrying out the calculations. The Energy Performance Building Directive requires the Energy Performance Certificate to be issued ONLY by independent qualified / accredited experts such as an Authorised SAP Assessor.

Quality of construction

The Approved Document also extends the concept of 'Quality of construction and commissioning' aimed primarily at checking the continuity of insulation, by air pressure testing and by the commissioning of heating and hot water services. To check the insulation is reasonably continuous over the whole building, there are two approaches:

1) The first is to use the updated 'Accredited Construction Details (ACD)'.

   These cover both thermal bridging and air tightness detailing and are on www.planningportal.gov.uk/england/professionals/en/1115314255826.html

2) The second approach is to show equivalence to such details by using the guidance in Building Research Establishment (BRE) Information Paper (IP) 17/01: "Assessing the effects of thermal bridging at junctions and around openings in the external elements of buildings".

   This requires the builder to demonstrate that construction processes achieve the required levels of consistency. The designer will calculate the linear thermal transmittance value for each junction using the values in table K of SAP2005 rather than assuming the default value for Accredited Construction Details. For further details see Thermal Linear Bridging, page 8.

Air Tightness

For air permeability, air pressure testing is now generally required in AD L1 as well as AD L2. Evidence will be required to show that the 'design air permeability' of the building envelope which is the uncontrolled air leakage expressed as m^3 of airflow per hour, per m^2 ($m^3/hr/m^2$) of exposed building area has been achieved by the dwelling in question.

Of course, the overall Airtightness of any construction is only as good as the 'weakest link'. The panel (Aircrete's Air Permeability) shows the high performance of aircrete masonry, which is further enhanced with an internal finish. Examples of critical areas would be the junctions between the various parts of the fabric: floor, walls and ceilings, not forgetting the junction between any openings within those elements – windows, doors, hatches, service openings, recessed fittings.

Where mechanical ventilation (controlled airflow) is used, its efficiency and performance will also have a critical impact on the overall airtightness.

Procedure for Thermal calculations to AD L1 2006

For each plot there are three stages

I. Design draft: This enables the designer to check compliance and make any necessary changes to the initial specification.

II. Design final: Once the design details have been finalised, the checking authority will require this.

III. As built draft and final: Once the dwelling has been built and the Assessor has been advised of the site test results, the design final calculation can be advanced to the as-built draft calculation. Then

a. If remedial work on site is NOT required, the draft stage can be by passed and the final calculation made for submission to the checking authority

b. If the remedial work is required, then the draft stage is recalculated once the re-tested site values are notified to the assessor who will then produce the final calculation for submission to the checking authority.

In summary, for dwellings using the 'Accredited Construction Details' it is one test of each type taken from the first batch of completed units. Where Accredited Construction Details are not used, table 3 of L1A (not shown) gives the testing regime. Designers, will achieve an overall cost effective solution where the simple guidance of the Accredited Construction Details are used.

If the pressure testing gives a figure worse than that assumed in the DER (the design of the actual dwelling), there are methods to deal with this in the Approved Document. If the as-built DER is worse than the TER, remedial measures have to be taken until the TER is achieved. This could be as simple as extra loft insulation, but will depend upon the degree of failure.

It may be prudent for the designer in conjunction with the builder to opt for a permeability value of 10 until such time as experience has shown that in practice a better value can be achieved. An improvement in U-values elsewhere may reduce the burden of airtightness e.g. by reducing the wall U-value to 0.27W/m^{2}K which is still easily achieved with an aircrete construction. If the builder has a high confidence of providing the appropriate level of workmanship, then cost benefits can be gained in relaxing the overall design. However, in standard construction values from 7 to 9 have been reported, where care is given to workmanship.

For small sites (one or two dwellings) the builder does not have to test if he can show that he has had a successful test on the same dwelling type in the past year or he takes a design air permeability of 15m^3/hr/m^2 and compensates by better fabric etc. In practice, however, using such a value in design may not be workable.

Because Airtightness and the performance of constructions to date is not a concept with which most builders are currently familiar, a 'learning curve' allowance has been made to enable builders to develop techniques for constructing to appropriate standards of Airtightness.

For further information on the subject of airtightness please see **www.bsria.co.uk**

Aircrete's Air Permeability

Tests undertaken by Building Services Research and Information Association (BSRIA) have shown that Celcon aircrete blockwork achieved an air permeability of approximately 0.12m^3/hr/m^2 measured at 50 pascals. The corresponding value is 1.04m^3/hr/m^2 for Celcon aircrete using general purpose mortar. The use of thin layer mortar will improve this.

Building Operation & commissioning

The heating and hot water system should be commissioned so that at completion, the system and their controls are left in the intended working order and can operate efficiently.

Another requirement is that sufficient information should be provided about the building, the fixed building services and their maintenance so that the building can be operated efficiently.

Celcon Solutions

Whilst there is much flexibility available to the designer, for wall constructions it is likely that the range of wall U-values will be from 0.30 to 0.27W/m^{2}K, depending upon air permeability values, boiler efficiency and fuel type.

H+H UK have simple, cost-effective constructions to meet these values, see the back of this document for examples, that can easily be accommodated with cavities of 100mm or less. In many cases the upgraded wall design can be achieved by replacing any existing aggregate concrete block with an aircrete block.

Floor constructions are likely to be in the range of 0.22 to 0.20W/m^{2}K, with beam and Celcon block or Celcon Flooring System solutions being suitable, see the back of this document for examples. However compensatory measures may be used to allow U-values of 0.25W/m^{2}K to be used.

Achieving Compliance

There are a large number of factors to be taken into consideration when trying to achieve the TER. For most dwellings the range of workable elemental U-values is as follows:

Walls	0.30 – 0.27
Floors	0.25 – 0.20
Roof	0.16 – 0.13
Windows and doors	1.80 – 1.50

In most situations these values will be found to provide a cost effective and practical solution.

See case studies and solutions.

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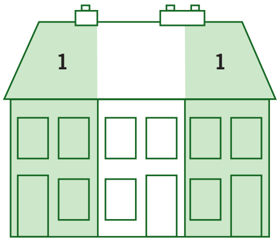
Approved Document L1A continued

Work in new dwellings continued

Case Studies

The following case studies are based on real houses. They show the u-values for the fabric of the building that are required to achieve a pass to Approved Document L – England and Wales.



1: End terrace 3 bedroom dwelling with ground floor area of approx. 40m².

Building Fabric Insulation

Element	U-value (W/m²K)	Area (m²)	Heat loss (W/K)
Ground floor	0.25	39.98	10.0
Walls	0.30	77.64	23.3
Roof	0.16	39.98	6.4
Window/Doors	1.80	11.11	20.0

Space/Water Heating	
Boiler	90.0% SEDBUK, Gas fired
Controls	Time and Temperature Zone Control
Secondary Heating	Electric room heaters (default)
Air Permeability	
Design value of	$10m^3/(h.m^2)$ @ 50Pa
Target Emission Rate (TER)	22.79
Dwelling Emission Rate (DER)	22.64
Result	**PASS**

2.1: Mid terrace 3 bedroom dwelling with ground floor area of approx. 40m². With less exposed walls the area has less impact on the overall thermal benefit gained from the dwelling.

Building Fabric Insulation

Element	U-value (W/m²K)	Area (m²)	Heat loss (W/K)
Ground floor	0.25	39.98	10.0
Walls	0.30	34.61	10.4
Roof	0.16	39.98	6.4
Window/Doors	1.80	11.11	20.0

Space/Water Heating	
Boiler	90.0% SEDBUK, Gas fired
Controls	Time and Temperature Zone Control
Secondary Heating	Electric room heaters (default)
Air Permeability	
Design value of	$10m^3/(h.m^2)$ @ 50Pa
Target Emission Rate (TER)	20.25
Dwelling Emission Rate (DER)	20.36
Result	**FAIL**

2.2: **Mid terrace 3 bedroom dwelling with ground floor area of approx. 40m^2. By improving the wall U-values to 0.27W/m^{2}K and keeping all other factors the same allows the mid terrace to pass.**

Building Fabric Insulation

Element	U-value (W/m^{2}K)	Area (m^2)	Heat loss (W/K)
Ground floor	0.25	39.98	10.0
Walls	0.27	34.61	9.3
Roof	0.16	39.98	6.4
Window/Doors	1.80	11.11	20.0

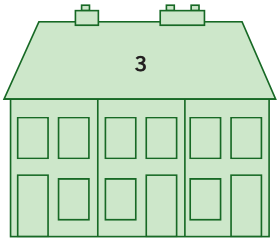
Space/Water Heating

Boiler	90.0% SEDBUK, Gas fired
Controls	Time and Temperature Zone Control
Secondary Heating	Electric room heaters (default)

Air Permeability

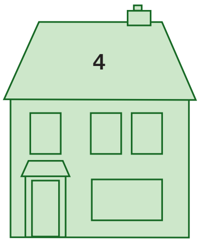
Design value of	10m^3/(h.m^2) @ 50Pa
Target Emission Rate (TER)	20.25
Dwelling Emission Rate (DER)	20.22
Result	**PASS**

3: **Terrace of 3, 3 bedroom dwellings with ground floor area of 120m^2. Another option is to look at the 3 dwellings together, [referred to as the "multiple dwelling" option (see Approval Document L1, clauses 23 & 30)] you can take an average of the results. This allows an overall pass which includes the individually failed mid-terrace unit.**



Unit	TER	DER	Floor Area (A)	TER x A	DER x A
End terrace unit (1)	22.79	22.64	79.96	1822.29	1810.29
Mid terrace unit (2.1)	20.25	20.36	79.96	1619.19	1627.99
End terrace unit (1)	22.79	22.64	79.96	1822.29	1810.29
Totals	**65.83**	**65.64**	**239.88**	**5263.77**	**5248.57**
Average TER	21.94	(5263.77 / 239.88)			
Average DER	21.88	(5248.57 / 239.88)			
Result	**PASS**				

4: **Detached 4 bedroom dwelling with ground floor area of 73m^2.**



Building Fabric Insulation

Element	U-value (W/m^{2}K)	Area (m^2)	Heat loss (W/K)
Ground floor	0.25	73.24	18.3
Walls	0.30	155.43	46.6
Roof	0.16	73.24	11.7
Window/Doors	1.80	33.92	61.1

Space/Water Heating

Boiler	90.0% SEDBUK, Gas fired
Controls	Time and Temperature Zone Control
Secondary Heating	Electric room heaters (default)

Air Permeability

Design value of	10m^3/(h.m^2) @ 50Pa
Target Emission Rate (TER)	21.43
Dwelling Emission Rate (DER)	20.71
Result	**PASS**

Approved Document L1A continued

Work in new dwellings continued

Thermal mass

With higher average seasonal temperatures now expected due to climate change, summer overheating is potentially a real problem. With masonry homes, the overall temperature is more constant because Aircrete blocks absorb the heat – unlike light framing systems where overheating in summer is a common problem. Conversely, in wintertime (although not currently recognised by the Building Regulations), houses with higher mass have a beneficial effect on the heating pattern.

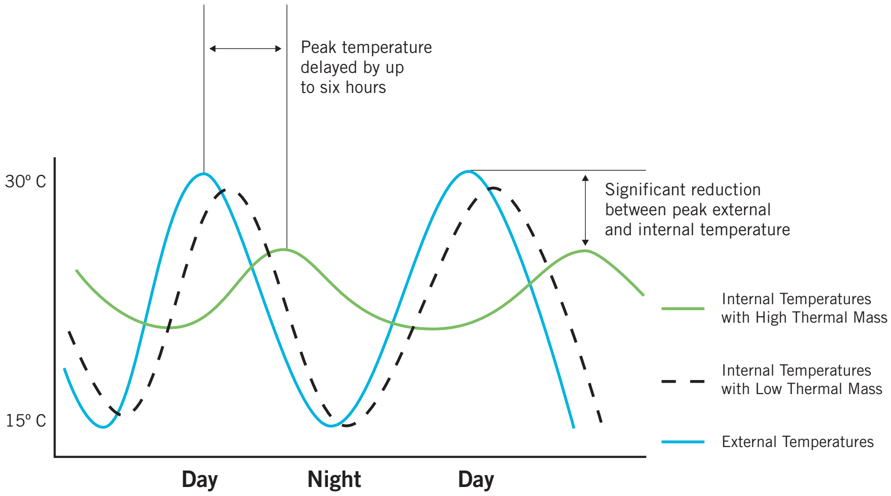
The cellular structure of Aircrete has inherent qualities that minimise heat loss, thereby saving energy. Structures built using Aircrete also have the ability to store heat, which can then be released back in the property as the temperature drops.

This in turn creates a comfortable living environment as temperature highs and lows are reduced by the gradual filtration of heat back into the property. The need for supplementary heating and cooling systems is also reduced – again saving on energy.

A report by Arup has shown that if weather patterns change as anticipated, using masonry construction such as Aircrete would delay the requirement for air conditioning – therefore saving energy throughout the overall service life of the house, when compared to lighter weight construction.

Diagram 2

Stabilising effect of thermal mass on internal temperatures



Linear Thermal Bridging

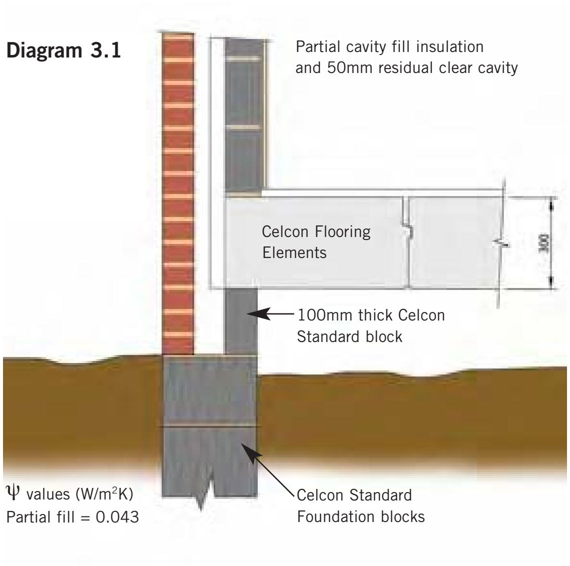
Aircrete has long been known for its beneficial thermal properties, these thermal benefits have recently been further enhanced by research into linear thermal bridging and Psi values. The use of H+H UK's foundation blocks, the Celcon Flooring System and Celcon aircrete blocks in the walls can offer beneficial thermal values due to the reduction in the heat loss at the junction of the wall, floor and foundation.

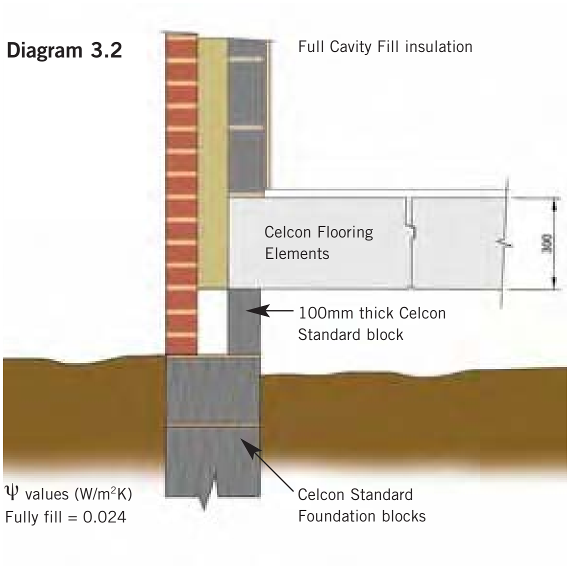
Example

Where using Celcon Flooring System in conjunction with H+H UK's Foundation blocks below dpc and walling blocks as the internal leaf of a cavity wall, the construction can offer an improvement in thermal performance equivalent to using a floor solution that achieves $0.17 W/m^2K$.

The improvement is possible by significantly bettering the Psi (Ψ) values offered by adopting Accredited Construction Details through a reduction in the linear thermal transmittance.
Psi is a measurement of the heat loss at non-repeating linear bridges, in this case at the junction of the wall and the floor. As the heat loss through the main fabric of the building reduces due to more stringent Building Regulations, the heat loss at these junctions increase and the Psi value becomes more relevant.

Working with the Building Services Limited, H+H UK have had assessments carried out to evaluate specific Psi values for our products, which can now be used for the U-value for H+H UK's products thus benefiting the overall SAP calculation.





Example, using Partial Fill cavity insulation

The Calculated U-value (using the default Accredited Construction Detail value U_2 = 0.25W/m^{2}K
Resultant U-value U_1 = **0.18W/m^{2}K**

Where:

P/A = 0.60 (ratio of the floor exposed perimeter to the exposed area)
Ψ_2 = 0.16 (default Accredited Construction Detail value)
Ψ_1 = 0.043 (calculated value from Building Services Limited for H+H UK construction)

As $[(U_1 \times A) + (\Psi_1 (P/A)] = [(U_2 \times A) + (\Psi_2 (P/A)]$,
then $U_1 - U_2 = (P/A) (\Psi_1 - \Psi_2)$,
where U_1 = 0.25, and U_2 = 0.60 (0.16 – 0.043) = 0.07
Thus, Resultant U-value = 0.25 – 0.07 = 0.18W/m^{2}K

Using a Fully Filled cavity insulation the results will be similar (see Table below)

Equivalent Floor U-values using Celcon products' calculated Psi values

Perimeter/Area	Floor U-value (W/m^{2}K) using ACD default Ψ values	Equivalent with partial filled cavity insulation	Equivalent with fully filled cavity insulation
0.60	0.25	0.18	0.17
0.50	0.24	0.18	0.17
0.40	0.23	0.18	0.18
0.30	0.22	0.18	0.18

The Celcon Flooring System offers equivalent U-values of 0.17 W/m^{2}K instead of 0.25 W/m^{2}K for floors with no additional insulation.

Approved Document L1B

Work in existing dwellings and extensions

As part of AD L1B (work in existing dwellings), element values (see diagram 4) are used to determine compliance.

Extensions

Either under L1B where doors / windows do not exceed 25% of floor area and U-values as diagram 4, or for greater design flexibility use SAP2005 taking the whole dwelling into account using Table 1 ADL1B (which is the same as diagram 1 from Table 2 AD L1A) within this document.

Material Alterations

Diagram 4 (from Table 4 AD L1B)
Standards for thermal elements (W/m²K)

Element	(a)Extensions	(b)Renovations
Wall	0.30	0.35*
Floor	0.22*	0.25*
Roof	0.16 ceiling	0.16 ceiling
	0.20 rafter	0.20 rafter

* A lesser provision may be appropriate, depending on floor conditions.

See wall solutions page 12/13 for specific construction details.

Renovation of Thermal Elements

Diagram 5
Upgrading retained thermal elements

Element	(a)Threshold value W/m²K	(b)Improved value W/m²K
Cavity wall*	0.70	0.55
Other wall type	0.70	0.35
Floor	0.70	0.25
Roof	0.35 ceiling	0.16 ceiling
	0.35 rafter	0.16 rafter
	0.35 flat	0.16 flat

* This only applies in the case of a wall suitable for the installation of cavity insulation. Where this is not the case it should be treated as for 'other wall type'.

Approved Document L2A

Work in new buildings other than dwellings and large extensions (L2A)

The only route to showing compliance to Part L is through the new Simplified Building Energy Model (SBEM). A version of the program is available from **www.ncm.bre.co.uk/index.jsp**

There are as with AD L1A five criteria to demonstrate compliance.

1) Meeting a CO_2 emission rate
2) Meeting design limits for fabric and services. These are essentially long-stop values, since using these would not give you a compliant building.
3) Check that naturally ventilated parts of the building are not likely to overheat too often.
4) Testing of building – air tightness and services
5) Provision of necessary information for building owner/occupier.

The Target CO_2 Emission Rate (TER) is the required performance parameter and it can be calculated using either SBEM or 'other approved software'. As in AD L1A, a notional building of the same size and shape as the proposed building has its emissions calculated $C_{notional}$. The notional building fabric and services are broadly those of Part L 2002.

$C_{notional}$ is then reduced by two factors to achieve the required TER.

- There is the 'improvement factor' of 15% for heated and naturally ventilated areas and 20% for air-conditioned and also heated and mechanically ventilated spaces.
- There is the 'Low and Zero Carbon benchmark' of 10%. This implements the requirement in Article 5 of the Energy Performance of Buildings Directive. This does not mean you have to provide 10% of the buildings energy use through LZCs but makes provision for recognition of the effect of low or zero carbon energy supply systems "in appropriate circumstances".

This results in an overall reduction from the notional building's 2002-based numbers of 23.5% for naturally ventilated areas and 28% for air-conditioned or mechanically ventilated areas.

The designer has to show that the Building Emission Rate (BER) is better than the previously calculated TER. The BER has to be calculated using the same software as used to get the original TER. This should not be difficult since entering the building data into SBEM will give the notional building emissions and also the proposed building emissions (the BER). As with dwellings, two BER runs will be needed. As in AD L1A, there are limits on U-values, air permeability and building services including controls.

The final BER should take as-built details and the test data from air tightness, ductwork and fan commissioning. Most buildings have to be air tested, but there are a number of exceptions given.

All building services must be commissioned so that at completion systems and controls are in working order.

Approved Document L2B

Work in existing buildings other than dwellings (L2B)

New Regulation 17D has been introduced requiring cost-effective consequential improvements. As with AD L1B, the aim is to improve the performance of the existing building stock by capturing the controlled elements of the building when work is carried out. Because performance cannot readily be assessed via the 'notional' approach, elemental standards are invoked for testing compliance (see diagram 6).

Should you have any questions regarding this subject or any other subject regarding the use of Celcon's products please contact Celcon's Technical Services Department.

Diagram 6 (from Approved Document L2B)
Standards for thermal elements

Element[1]	Standard for new thermal elements	Standard for replacement thermal elements
Wall	0.30	0.35[3]
Pitched roof – insulation at ceiling level	0.16	0.16
Pitched roof – insulation at rafter level	0.20	0.20
Flat roof or roof with integral insulation	0.20	0.25
Floors[4]	0.22[4]	0.25[4]

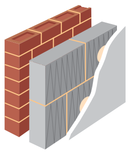
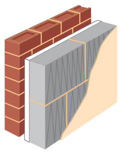
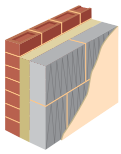
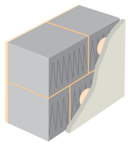
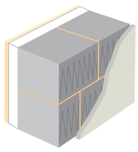
Notes:
1 'Roof includes the roof parts of dormer windows and 'wall' parts of dormer windows.
2 A lesser provision may be appropriate where meeting such a standard would result in a reduction of more than 5% in the internal floor area of the room bounded by the wall.
3 The U-value of the floor of an extension can be calculated using the exposed perimeter and floor area of the whole enlarged building.
4 A lesser provision may be appropriate where meeting such a standard would create significant problems in relation to adjoining floor levels.

Diagram 7 (from Approved Document L2B)
Upgrading retained thermal elements

Element[1]	(a) Threshold U-value W/m²k	(b) Improved U-value W/m²k
Cavity Wall	0.70	0.35[3]
Other Wall type	0.70	0.35[3]
Pitched roof – insulation at ceiling level	0.35	0.16
Pitched roof – insulation at rafter level	0.35	0.20
Flat roof or roof with integral insulation	0.35	0.25
Floors[4]	0.35	0.25[5]

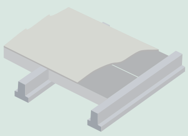
Notes:
1 'Roof includes the roof parts of dormer windows and 'wall' parts of dormer windows.
2 This only applies in the case of a cavity wall capable of accepting insulation. Where this is not the case it should be treated as for 'other wall type'.
3 A lesser provision may be appropriate where meeting such a standard would result in a reduction of more than 5% in the internal floor area of the room bounded by the wall.
4 The U-value of the floor of an extension can be calculated using the exposed perimeter and floor area of the whole enlarged building.
5 A lesser provision may be appropriate where meeting such a standard would create significant problems in relation to adjoining floor levels.

Wall solutions 10mm Mortar

		0.35W/m²K	0.30W/m²K	0.27W/m²K
Clear Cavity		Brick outer leaf Clear cavity **100mm Celcon Standard** 50mm Thermaline SUPER **0.34W/m²K**	Brick outer leaf Clear cavity **100mm Celcon Standard** 60mm Thermaline SUPER **0.29W/m²K**	Brick outer leaf Clear cavity **100mm Celcon Standard** 65mm ThermaLine SUPER **0.27W/m²K**
Partial Fill Cavity		Brick outer leaf 50mm Clear cavity 30mm Kingspan TW50 **100mm Celcon Standard** Any finish **0.35W/m²K**	Brick outer leaf 50mm Clear cavity 40mm Kingspan TW50 **100mm Celcon Standard** 12.5mm PB on dabs **0.29W/m²K**	Brick outer leaf 50mm Clear cavity 50mm Kingspan TW50 **100mm Celcon Standard** Any finish **0.27W/m²K**
Fully Filled Cavity		Brick outer leaf 75mm Dritherm **100mm Celcon Standard** Any finish **0.34W/m²K**	Brick outer leaf 85mm Dritherm **100mm Celcon Standard** 12.5mm PB on dabs **0.30W/m²K**	Brick outer leaf 100mm Rockwool/Dritherm **100mm Celcon Standard** 12.5mm PB on dabs **0.27W/m²K**
Solid Wall		Render finish **215mm Celcon Solar** 40mm ThermaLine PLUS **0.35W/m²K**	Render finish **215mm Celcon Solar** 55mm ThermaLine PLUS **0.29W/m²K**	Render Finish **215mm Celcon Solar** 60mm ThermaLine SUPER **0.24W/m²K**
			11mm WeberTherm XM 65mm Expanded polystyrene **215mm Celcon Standard** 12.5mm PB on dabs **0.30W/m²K**	11mm WeberTherm XM 40mm Phenolic Insulation **215mm Celcon Solar** 13mm Lightweight Plaster **0.27W/m²K**

This is just a small sample of the available solutions using H+H UK's products.
For further information or specific U-value requirements please contact H+H UK's Technical Department

Floor Solutions

		0.22W/m²K*	0.20W/m²K*
Beam & Block Flooring**		65mm Screed 100mm EPS **Beam & Celcon FloorBlock Infil** **0.22W/m²K***	65mm Screed 120mm EPS **Beam & Celcon FloorBlock Infil** **0.20W/m²K***

*Includes 2 courses of 275mm Celcon Foundation blocks
**P/A value taken as an average detached house (0.60)

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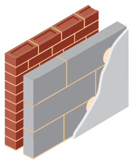
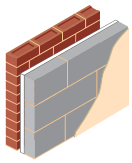
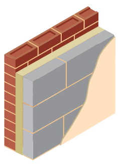
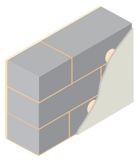
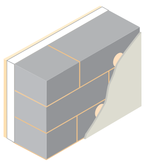
Wall Solutions Thin-Joint (2mm)

	0.35W/m^{2}K	0.30W/m^{2}K	0.27W/m^{2}K
Clear Cavity 	Brick outer leaf Clear cavity **100mm Celcon Standard** 50mm ThermaLine SUPER **0.33W/m^{2}K**	Brick outer leaf Clear cavity **100mm Celcon Standard** 57.5mm Kooltherm K17 **0.29W/m^{2}K**	Brick outer leaf Clear cavity **100mm Celcon Solar** 57.5mm Kooltherm K17 **0.27W/m^{2}K**
Partial Fill Cavity 	Brick outer leaf 50mm Clear cavity 30mm Kingspan TW50 **100mm Celcon Standard** Any finish **0.34W/m^{2}K**	Brick outer leaf 50mm Clear cavity 30mm Kingspan TW50 **100mm Celcon Solar** 12.5mm PB on dabs **0.30W/m^{2}K**	Brick outer leaf 50mm Clear cavity 45mm Kingspan TW50 **100mm Celcon Standard** 12.5mm PB on dabs **0.27W/m^{2}K**
Fully Filled Cavity 	Brick outer leaf 65mm Dritherm/Rockwool **100mm Celcon Standard** Lightweight plaster **0.35W/m^{2}K**	Brick outer leaf 85mm Dritherm/Rockwool **100mm Celcon Standard** Lightweight plaster **0.30W/m^{2}K**	Brick outer leaf 100mm Rockwool/Dritherm **100mm Celcon Standard** Lightweight plaster **0.27W/m^{2}K**
Solid Wall 	Render finish **215mm Celcon Solar** 40mm ThermaLine BASIC **0.34W/m^{2}K**	Render finish **215mm Celcon Solar** 45mm ThermaLine PLUS **0.29W/m^{2}K**	Render Finish **215mm Celcon Solar** 55mm ThermaLine PLUS **0.27W/m^{2}K**
		11mm WeberTherm XM 65mm Expanded polystyrene **215mm Celcon Standard** 13mm Lightweight Plaster **0.30W/m^{2}K**	11mm WeberTherm XM 35mm Phenolic Insulation **215mm Celcon Solar** 13mm Lightweight Plaster **0.27W/m^{2}K**

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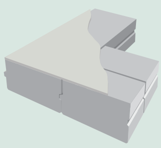
	0.25W/m^{2}K*	0.20W/m^{2}K*
Celcon Flooring System** 	65mm Screed No insulation **Celcon Flooring System** **0.25W/m^{2}K*** **(0.17W/m^{2}K)†**	65mm Screed 35mm EPS **Celcon Flooring System** **0.20W/m^{2}K*** **(0.12W/m^{2}K)†**

*Includes 2 courses of 275mm Celcon Foundation blocks
**P/A value taken as an average detached house (0.60)

† For further explanation of how to simply achieve these improved U-values, see the Linear Thermal Bridging section or speak to our Technical Department

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