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Building a sustainable future

H+H environmental and sustainability credentials

build with ease

Easy on the planet

Aircrete was conceived as an environmentally friendly product and its manufacture and application continues to be ever more kind to the planet. From the beginning, H+H has vigorously pursued and maintained the highest environmental standards.

H+H is certified to BRE's standard for responsible sourcing of construction products, BES 6001: 2009, obtaining a 'very good' performance rating over all products and manufacturing sites. This clearly demonstrates to customers and other stakeholders in the business that H+H is an ethical company and firmly committed to continually improving its performance on sustainability issues as described in the Responsible Sourcing Policy. The 'very good' rating ensures the maximum number of points for responsible sourcing in Code for Sustainable Homes.

From creation to construction, every environmental aspect of our manufacturing and delivery processes has been enhanced. Our integrated management systems conform to the highest international standards, while our packaging and transportation achieves maximum levels of energy efficiency, conservation and environmental performance.

By providing outstanding thermal insulation, aircrete products add sustainable credentials to any project. In fact, aircrete constructions can achieve the highest rating in the Green Guide to Housing.

Aircrete's environmental credentials extend to its eventual recycling at the end of a building's life. As well as being an inert material that will far outlast the usual 60 year design life expectancy of a building, aircrete is easily recyclable and can be crushed down with other masonry materials and used in future applications.

For all that we've achieved, we're not content to rest on our laurels. Our commitment to the future means H+H leads the field in research and development of aircrete products.

Our commitment

Sustainability is now a priority that touches almost every aspect of our lives. It is fortuitous that for 60 years H+H has been manufacturing aircrete products using pulverised fuel ash (PFA), a by-product from electricity generation that would otherwise go to landfill.

The company has been using recycled waste for decades and it is for this reason that H+H and our products are rightly recognised as environmentally friendly. This extensive and enviable 'green' pedigree has given the company a strong platform on which to build a viable and long-term strategy for the future that embraces all aspects of the sustainability issue in its broadest sense.

Integrated Management Systems (IMS)
A significant step towards the future was the introduction of integrated management systems for H+H production sites. The IMS is registered to PAS99: 2006 and brings together three stand alone management systems for quality, environment and health and safety that comply with the respective international standards ISO 9001, ISO 14001 and OHSAS 18001. The systems enhance the efficient management of our business processes whilst minimising waste.

Our Pollington plant in particular demonstrates a long-term commitment both to the business and the environment by being specifically designed to achieve the highest standards of engineering, efficiency and environmental performance, with integrated and advanced energy conservation and heat recovery systems playing an important part.

Speaking at the opening of the plant, Brian Wilson MP, the then Minister of State for Energy and Construction, remarked, **"This facility shows how construction and good environmental management go hand in hand".**

Environmental Management System (EMS) ISO 14001:2004
H+H operates an environmental management system (EMS), which fully complies with the requirements of the international standard ISO 14001. The EMS is company-wide and covers all aspects of the business that may have an effect on the environment. The EMS assists H+H in managing and improving its environmental performance and meeting compliance with environmental legislation. By setting objectives and targets at each of its sites, H+H is able to achieve continual improvement of environmental issues. The system is third party accredited by BSI.

Quality Management ISO 9001: 2008
H+H operates a quality management system, which fully complies with the requirements of the international ISO 9001 quality standard. The system covers all aspects of the company's business processes, to minimise waste and to enhance customer satisfaction by ensuring that products of the highest quality are supplied and deliveries are made on time.

Health & Safety OHSAS 18001:2007
H+H is fully committed to the continual improvement of its health and safety performance and operates a management system across all its sites that conforms fully to the international health and safety specification, OHSAS 18001:2007. This high standard of health and safety is reflected in the design, installation and maintenance of plant, equipment and services, project management and in the care of others who may be affected by acts of the company or its employees.

Health and Safety
Safety+ is our company initiative based on behavioural change. We aim to bring about a change in employees' thinking on safety by encouraging a stop and think culture, where there is more team work and where vulnerable employees can be identified and looked after. Safety+ for first line managers and supervisors requires
them to adopt personal and team action plans to identify and implement simple improvements in safety culture.
There are regular follow-ups together with support from senior management and a behavioural change consultant.

CIEH Training
Where applicable to their role within the organisation, H+H employees have undertaken a basic certified Health and Safety qualification, covering subjects including Manual Handling, Fire Safety, COSHH and Office Safety. First line managers and supervisors are required to be certified to a minimum IOSH Managing Safely and senior managers must complete the NEBOSH General Certificate.

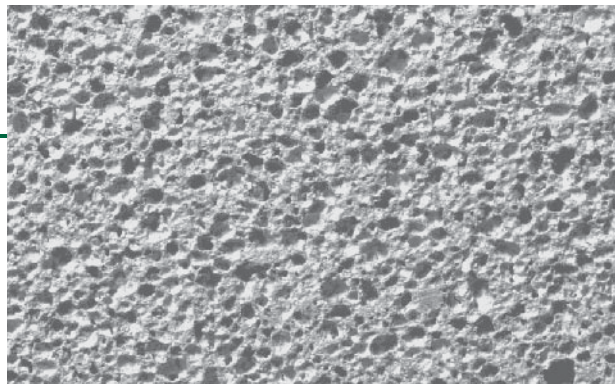
Carbon Trust Standard
In 2008 H+H became the first manufacturer in the industry to achieve certification to the Carbon Trust Standard, for demonstrating year-on-year reductions in the company's carbon footprint.

This was followed by further industry firsts in 2010 with certification to BS EN 16001, the UK's first formal standard for energy management and BSI Kitemark ERV Scheme for carbon reduction. Finally in 2012 H+H achieved certification to BS ISO 50001, the first international standard issued for energy management.

WRAP
WRAP works in partnership to encourage and enable businesses and consumers to be more efficient in their use of materials and to recycle more things more often. This helps to minimise landfill, reduce carbon emissions and improve our environment. H+H products are listed on the WRAP website within the Construction Products Guide. The guide helps project teams identify product options with higher recycled content, which can help them meet a client's requirement for good practice.
For H+H aircrete products it highlights a recycled content between 75-80%, which is certified by WRAP highlighting the environmental benefits of using H+H aircrete products when sustainability is an issue in construction.

For more information, visit the WRAP website:

http://www.rcproducts.wrap.org.uk



Recycled Raw materials

Less than 1% of the raw materials used in the production of H+H's products are imported from overseas. Our production plants are located strategically to ensure that bulk raw materials and finished products for our customers have less distance to travel. In this way, our products support the British economy as well as reducing the environmental impact of transporting raw materials and products.

Three of the most important raw materials used in the manufacturing process are pulverised fuel ash, aluminium powder and water.

Pulverised fuel ash accounts for up to 80% of the material used in the manufacture of H+H Aircrete. Pulverised Fuel Ash (PFA) is a by-product of coal-fired power stations. Most of this product would otherwise be sent for landfill. Waste aircrete from the process is recycled as an aggregate so as to avoid the material having to be landfilled.

Aluminium powder – aircrete relies on an aerated structure for its lightweight and outstanding insulation properties. H+H uses recycled aluminium powder to produce the chemical reaction that creates the aerated structure.

Water – a comprehensive water management system is in place at the company's Pollington (Yorkshire) factory that utilises water from sustainable sources – rainwater and canal water – to be used together with waste water from the manufacturing process. At H+H's other factory, wastewater from the manufacturing process is also recycled. This significantly reduces the quantity of water that needs to be drawn from mains supplies.

The Aircrete Innovation

Since their introduction in the late 1950s, aircrete products have won rapid acceptance throughout the building industry.

Produced by mixing pulverised fuel ash with water to create a slurry, which is pumped into a mixer where binders (cement and lime) are added. Finally, a small amount of aluminium powder is added and the mix is poured.

The addition of the aluminium creates a chemical reaction that produces heat and hydrogen. The hydrogen creates the non-interconnecting cellular structure of the material making the poured mix rise whilst the heat makes it harden. The resulting 'green' material is then cut to size and placed into an autoclave to be cured.

The finished product offers many benefits, as well as reducing the quantity of raw materials per m^2 of product used. The aerated structure is also lightweight. As the cells are not interconnecting, the product offers excellent sound insulation, superb thermal insulation, air-tightness and provides a natural barrier to water ingress and a resistance to sulfate in soils. The product also offers the strength and robustness of a concrete block. It will not burn yet is workable with hand tools.

H+H leads the field in research and development and has been key in introducing to the market new product innovations such as (High Strength) Aircrete, Foundation blocks and the thin layer mortar system. We continue to strive towards new developments.

Creation to Completion – Raw materials and processes

H+H is dedicated to conservation. We seek to achieve the highest levels of energy efficiency and environmental performance, not only in production but also in packaging and transportation. Once our products are on-site, the outstanding properties will deliver genuine benefits in sustainability for both domestic and non-domestic builds, enhancing the environmental credentials of any project.

Every aspect of our manufacturing process has been analysed and environmentally enhanced.

H+H's factories are designed to achieve the highest standards of energy efficiency and all incorporate energy conservation measures, including heat recovery measures that make the use of waste heat to raise the temperature of boiler feed water. Consideration is also given to energy efficiency in purchasing new equipment for our factories and offices.

Most waste material in both cured and uncured state is put back into the process. Uncured material is fed directly back into the process and crushers installed at each factory site can process cured material and recycle it. Most cured material that cannot be recycled within our process is used as bulk aggregate fill. This reduces the amount of virgin mineral extraction, saving resources and energy.

Steam from autoclaves used for the curing process is also recycled, decreasing the energy released into the environment and reducing the CO_2 that would otherwise be required to create new energy.

H+H aircrete is not a pollution risk to either water or air.

Sustainability in packaging and transport
Both the packaging process and the transport of products to site have been refined to achieve maximum efficiencies.

H+H's products are supplied strapped and shrink-wrapped to ensure that the customer receives a quality product. The polythene used in this process has been minimised and waste from the shrink wrapping and strapping is recycled.

Many H+H products are now supplied without the need for pallets and when they are provided, they are collected to be reused wherever possible.

H+H's choice of transport fleet comprises modern, eco-friendly tractor units that minimise toxic emissions. Road-friendly super single tyres lessen both road damage and road noise and trailer cranes fitted with silencer packs further reduce noise pollution. The light weight of H+H's aircrete products also allows savings in energy consumption as a result of lower costs of haulage per m^3 delivered in comparison to many other, heavier structural building materials.

Journeys are monitored to ensure optimised transport efficiency, including return loading. To increase the average load size leaving the factories, transport initiatives have been put in place.
H+H has almost eliminated rigid vehicles ($22m^3$ average load size) from its choice of fleet, replacing them with articulated vehicles ($32m^3$ average load size) to decrease the number of lorry movements and keep emissions to a minimum.

Aircrete in construction – creation to completion

As an environmentally friendly product, aircrete offers many benefits in construction that add to the sustainable credentials of the project, including thermal insulation, thermal mass and air-tightness.

The chemical reaction that forms aircrete's structure, results in each block being made up of millions of non-interconnecting cells. This structure is key to many of the products benefits, as it prevents the passage of heat, sound and moisture through the product.

This is further enhanced by the use of H+H's thin joint system, which reduces the thickness of the mortar joints from 10mm to 2mm and ensures the joints are fully-filled. Using the correct applicator reduces the passage of anything from one side of the wall to the other.

The key benefits that aircrete properties offer are:

Air-tightness
Since air-tightness is now an integral part of achieving Building Regulation compliance, it has become an important factor in the design and construction of any building. Preventing warm air escaping through uncontrolled ventilation and air leakage is a key component of the heat loss through the fabric of a building.

Tests undertaken by Building Services Research and Information Association (BSRIA) have shown that aircrete achieved an air permeability of 0.12m^3/hr/m^2 measured at 50 pascals.

The corresponding value is 1.04m^3/hr/m^2 for aircrete when used with general-purpose mortar. The use of thin layer mortar offers similar values to that of the material itself. Where care and attention to detail has been taken in construction, H+H's products can offer highly airtight solutions.

Using H+H aircrete will therefore make a significant contribution to achieving a Design Air Permeability rate of 10m^3/hr/m^2 or less for dwellings as now required for current compliance.

Thermal insulation
Aircrete products can help optimise a construction's thermal performance and reduce the need for additional insulation. They also offer enhanced thermal insulation when used in foundations and beam and block floors, by reducing the heat that has passed from the heated structure to the outside environment.

Sound insulation
Aircrete's structure reduces the passage of sound, with simple solutions using H+H products comfortably exceeding the requirements of the Building Regulations whether through Pre-Competition Testing or Robust Details; delivering real benefits to people's environments both at home and in the workplace.

When using aircrete robust details as a solution to separating party walls, Robust Details Limited's website shows the current additional credits that can be gained under the Code for Sustainable Homes. For further details visit www.robustdetails.com.

Flooding
Over the next few decades, climate change is likely to lead to increased and new risks of flooding within the lifetime of planned developments. Although planning policy avoids inappropriate new development in the highest flood risk areas, some development will be necessary in places that may be prone to flooding.

In response to these higher risk levels, guidance has been published by the Department for Communities and Local Government. 'Improving The Flood Performance of New Dwellings' and 'Flood Resilient Construction' seek to explain how buildings should be constructed in order to minimise flood damage as part of a package including flood awareness, warning and emergency planning.

Material recommendations are based on the selection at design stage of either a Water Exclusion Strategy or a Water Entry Strategy, based on parameters such as flood depth. Aircrete material can be used as part of either strategy, but performs particularly well in a Water Exclusion Strategy and is a recommended material choice. Additionally, the guide states that "There is evidence that Thin Layer mortar construction (or thin joint, as it is commonly known) is a good flood resilience option".

Thermal Bridging
(Linear Thermal Bridging)
Thermal bridges exist at junctions between elements and where continuity of external fabric insulation is broken or reduced. Additional heat losses associated with these thermal bridges are required to be accounted for in SAP, which in Appendix K gives a procedure based on a linear thermal transmittance value, Ψ (Greek letter Psi – pronounced "si").

The Ψ-value is a property of the thermal bridge junction and is the rate of heat flow per unit length of the thermal bridge. Table K1 of SAP gives values of Ψ applicable to different types of junctions detailed in accordance with the Accredited Construction Details (ACDs). Where ACDs are not used, then even more onerous Default figures must be used. Alternatively, individual junctions can be assessed by a suitably qualified person to enable more beneficial values to be used.

Use of H+H aircrete can significantly reduce the thermal bridge effect at junctions as it will have a far better thermal resistance than denser concrete blocks (which were assumed when developing the ACDs).

For further details contact H+H technical support on 01732 880580 or email tsd@hhcelcon.co.uk

Thermal Mass
The higher average temperatures that are expected because of climate change make summer overheating a potential problem.

A requirement of AD 'L' is that the designer must check for summer overheating. Thermal mass is recognised as one means of reducing this effect (See diagram 1). With masonry homes, the overall temperature is cooler since the aircrete products absorb the heat in the daytime and release this stored heat at cooler times. Summer overheating is typically a problem for light framed systems.

Houses with higher mass also have a beneficial effect on the heating pattern in wintertime. By offering good thermal insulation, thermal inertia and air-tightness properties, aircrete reduces the extremes of the internal temperature within the building, keeping it at a more consistent, comfortable level and reducing the highs and lows that would be seen in lighter structures with minimal thermal inertia or less thermally insulated heavier structures.

Product Life Span
Our BBA certificate (01/3816) Detail Sheet 1, Clause 16 Durability states:

"Aircrete is a durable material. Walls will have a durability equivalent to that of traditional masonry".

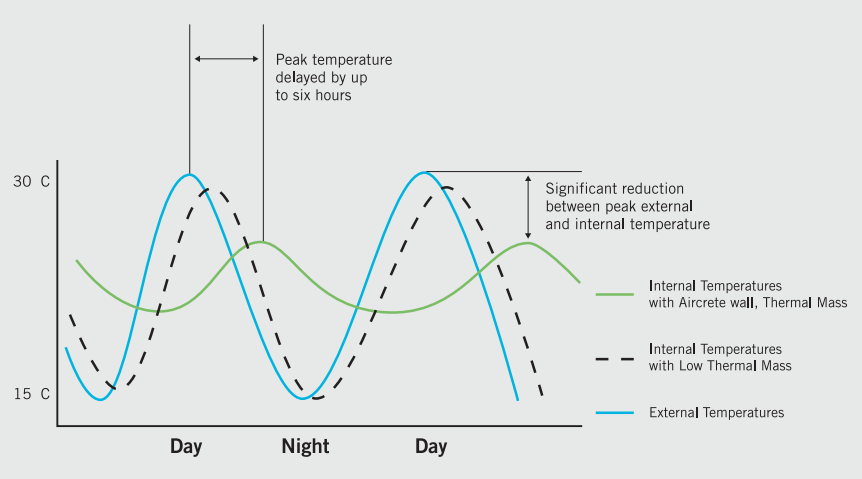
The former HAPM (Housing Association Property Mutual Ltd) Component Life Manual listed aircrete with the highest rating of A (35+ years).

The Green Guide to Housing Specification (BR390, 2000) compares one m^2 of material over a 60-year building life, which includes maintenance, refurbishment and eventual demolition:

"...brickwork and masonry walls will typically last much longer than the assumed 60-year life cycle".

Diagram 1

Stabilising effect of thermal mass on internal temperatures



Aircrete in construction – creation to completion continued

Embodied energy
Embodied energy is the energy consumed in the acquisition of raw materials, their processing, product manufacture, transport to site and the construction process. It can also take into account the energy consumed to maintain, repair, restore, refurbish or replace materials, components or systems during the lifetime of a building. Embodied energy has a direct link to the embodied CO_2 of a material. Table 1 compares the embodied carbon dioxide for common building materials.

BRE Environmental Profile
Claims about the environmental performance of building materials and products are easy to make but difficult to substantiate without a universal measuring system. BRE's Environmental Profiling system provides that measurement.

Environmental Profiles enable manufacturers to demonstrate the environmental performance of their products credibly. They also help designers and specifiers to identify materials that will best fulfill a sustainability brief.

As well as underpinning claims of environmental performance, Environmental Profiles enable manufacturers to compare their products against others, to demonstrate improvements that have been made and to help raise general awareness of environmental performance.

Environmental Profiles measure environmental performance throughout a product's life:

In manufacture (including manufacture of raw materials)

In use in a building (taken over a typical building life and including maintenance and replacement)

At end of life (the waste produced, percentage recycled, etc).

Environmental Profiles are also based on key indicators of sustainability including:

Climate change – from CO^2 and other greenhouse gases especially associated with energy use

Ozone depletion – from gases affecting the ozone layer

Acidification – contribution to the formation of acid rain

Consumption of minerals and water

Emission of pollutants to air and water, including toxicity to humans, ecosystems and chemicals responsible for low-level smog

Quantity of waste sent to disposal

Table 1: Embodied Carbon Dioxide (ECO_2) of Common Building Materials

Component/Material	ECO_2 kg/m^3
Aircrete concrete block	121
Dense concrete aggregate block	147
Generic lightweight aggregate block	168
Gen1: Concrete foundations	173
Timber, UK forest softwood*	185
Timber, UK forest hardwood*	369
RC40: Structural concrete	372
Chipboard, UK Forestry	398
RC50: High strength concrete	436
Structural steel*	15313

* Taken from table 20, www.concentratecentre.com/sustainability/energy_efficiency/embodied_c02.aspx, version 1.1-3 March 2008

'Aerated blocks are much lighter and use less material per m^2 than dense and lightweight aggregate blocks. This gives a better environmental performance than other blockwork.'

'Aircrete performs better than other masonry options because of the low mass of construction.'

Source: The Green Guide to Housing Specification

Ecopoints
In order to consider the importance of several environmental impacts together, BRE has developed Ecopoints as a means of presenting Life Cycle Assessment (LCA) results as a single score result.

BRE's Environmental Profiles Methodology for Construction Products, is used to determine Ecopoints scores and is aimed at providing a fair and consistent approach for all construction products. As such, it enables comparisons to be made between the same building elements made using different construction materials.

The Ecopoints score provides a simple way to understand environmental performance results produced using LCA, reflecting the relative importance of the environmental impacts considered within a total score and allowing comparison of the overall environmental performance of different materials: the higher the score (i.e. the greater the number of Ecopoints), the greater the environmental impact.

We have supplied data for all production to enable BRE to carry out an assessment of Aircrete.

The generic Ecopoints for aircrete is 1.2 points per tonne for cradle to gate. More significantly, this is equivalent to 0.06 points per m^2 100mm wall of low-density aircrete (a better indicator when comparing with other walling and flooring materials).

The Ecopoint score of a material is used to calculate the rating of a building element and published in the BRE's Green Guide.

The Green Guide to specification – England, Wales and Scotland
Using the Ecopoints system in its most basic form allows the assessment of an individual building product, such as blocks, but to enable meaningful comparisons a 'functional unit' of each construction must be made (e.g. 1m^2 of external wall that includes all the elements of the construction in required quantities to make up that m^2).

These 'functional units' are then compared over a given building's life span (60 years), taking into account the build, maintenance and refurbishment and the demolition at the end of its life.

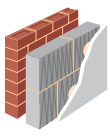
This Life Cycle Assessment (LCA) gives the total environmental impact for each specification. Aircrete products will perform well beyond the 60 years life span used for the assessment.

To simplify all of the above environmental profiles, an easy and straightforward method of rating the environmental impact had to be created. The construction types listed within The Green Guide to Specification therefore has a rating of A+ to E (A+ being the best rating).

Below (Figure 1) are examples of how H+H aircrete performs within the Green Guide to Housing Specification.

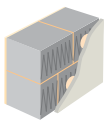
An updated version of the Green Guide was published in 2008 and is available from the BRE website. H+H Constructions have again achieved the highest rating for masonry.

Figure 1: Green Guide Ratings using H+H Products



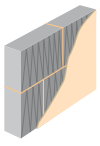
External walls*

Clear cavity
Brickwork/insulation/H+H aircrete cavity wall, plasterboard or plaster with painted finish achieves an 'A+' rating.



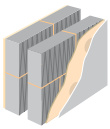
Solid walls
Rendered solid H+H aircrete wall plasterboard or plaster with paint finish achieves an 'A+' rating.

* Consult Green Guide for other external finishes



Internal walls

Partition
An H+H aircrete block partition with a paint finish achieves an 'A+' rating. With plaster it achieves an 'A' and 'B' with plasterboard.



Separating wall
An H+H aircrete block cavity wall with plasterboard can achieve a range of ratings from A to C.

Ground floors
Designing with aircrete and a variety of finishes from chipboard to screed will obtain ratings from 'A+' to 'B'.

The Code for Sustainable Homes

Within the general principles of sustainable construction outlined so far, designers and specifiers need more measurable and accountable methods of assessing whether projects are sustainable. Building on a suite of environmental Life Cycle Analysis (LCA) and design assessment tools (Green Guide to Housing and BREEAM) developed by the BRE, in 2007 the Government introduced the Code for Sustainable Homes (Code) which at the time signalled the possible future direction of Building Regulations in relation to carbon emissions and energy use in homes.

The Code is designed to provide a single national standard for the building of sustainable homes and is meant to guide builders and home buyers. The code is supported by the Technical Guide, which can be found at the DCLG website (www.communities.gov.uk/planningandbuilding). The Technical Guide is regularly updated to take into account changes to Building Regulations and other legislation.

How the code works

The Code measures the sustainability of a home against design categories, rating the 'whole home' as a complete package using a 6 star rating system to calculate the overall sustainability performance. Each level of the Code requires a number of points to be achieved and these are spread across nine Code design categories, being:

- **Energy efficiency**
- **Water efficiency**
- **Materials**
- **Surface Water run off**
- **Waste**
- **Pollution**
- **Health and Well being**
- **Management**
- **Ecology**

Some of these categories can be related to the building, whilst others are site specific and dependent on the local surroundings.

Using H+H aircrete to maximise the Code rating

H+H aircrete products can assist in gaining high star ratings within the Code. A number of the categories in the Code can be specifically related to the fabric of the building and the material therein. Some of the categories have a higher weighting than others, such as energy efficiency, but each needs to be addressed if a high rating is required.

The relevant Category of the Code that can be influenced by the materials and construction used are given as follows:

CfSH Category 1: Energy and CO_2 Emissions

- Ene1: Dwelling Emission Rate (DER)
- Ene2: Fabric Energy Efficiency

CfSH Category 3: Materials

- Mat1: Environmental Impact of Materials
- Mat2: Responsible Sourcing – Building fabric

CfSH Category 7: Health and Well-being

- Hea2: Sound insulation

For each of the Categories listed, our aircrete products and constructions can influence the resulting Code points. The Code Assessor will be able to use the information that follows to optimise the total number of points:

CfSH Category 1: Energy and CO2 Emissions
Ene1: Dwelling Emission Rate (DER)
The Dwelling Emission Rate is obtained from the SAP modelling program in accordance with Part L1A of the Building Regulations. Points are achieved in relation to the DER increase over the baseline Building Regulation standard (Target Emission Rate).

There are a number of ways in which our constructions can assist in improving the level emissions over the TER, being U values, improved linear bridging and airtightness. Aircrete has inherently good thermal characteristics and as such provides the thinnest overall masonry solution compared to other materials. Later in this guide we have indicated how to achieve the various levels of the Code with practical constructions as well as showing typical solutions for a range of U values and build types.

Of equal importance in the determination of DER is the calculation of heat loss through linear thermal bridging or psi values. With low U values in the fabric, the influence of linear thermal bridging becomes more exaggerated. Improving the values with simple H+H constructions greatly reduces the calculated CO_2 emissions. This includes that aspect of

party walls, where our aircrete solutions not only provide zero U value solutions, but have a significant benefit in reducing linear thermal bridging at the junctions and provide additional high scoring solutions in the Health and Well-being section of the Code.

Air permeability with SAP is also an essential factor. Aircrete generally provides a good airtight construction and it is not usually necessary to parge coat or plaster the wall to obtain low air permeability values. As with all construction, attention to detail is required at openings etc.

Masonry within the insulated envelope reduces energy consumption and improves the comfort for occupants by slowing the heating/cooling cycle. This will be further enhanced where concrete intermediate or separating floors are used. Thermal mass is recognised as an important factor in reducing overheating in summer. The examples given later in this literature use the actual thermal mass parameters in the SAP calculations.

Ene2: Fabric Energy Efficiency:
The aim of this section of the Code is to future proof the energy efficiency of dwellings over their whole life by limiting carbon dioxide emissions across the building envelope. The Fabric Energy Efficiency (FEE) is derived from SAP and is defined as the energy demand for space heating and cooling in kWh/m^2/year. As FEE improves in the design more credits are obtained. Our aircrete masonry can once again provide valuable benefits in obtaining a high number of credits to this section of the Code. By following the same principals of obtaining an improved DER in the Ene1 Section of the Code, an improved FEE will result. The 'Fabric First' principle is one that many designers opt for in achieving the Carbon Emission reduction compliance for Part L of the Building Regulations.

CfSH Category 3: Materials
Mat1: Environmental Impact of Materials:
This Section of the Code is aimed at encouraging the use of materials with lower environmental impacts over their life cycle. The primary route for assessment is by looking at various elements of the construction and referring to the BRE's Green Guide to obtain their environmental rating. All commonly used aircrete external wall constructions are rated A+ (the highest number of credits) in the BRE Green Guide, including cavity and solid walls with insulated render systems.

Mat2: Responsible sourcing – Basic Building Elements:
The aim of this Section is to recognise and encourage the specification of responsibly sourced materials for the basic building environmental elements. H+H UK operate a Certified Management System (EMS) complying with ISO 14001, which brings together three individual management systems for environment (ISO 14001), quality (ISO 9001) and health and safety (OHSAS 18001).

In 2010 BRE Global launched a new framework standard for the responsible sourcing of construction products – BRE environmental and Sustainability Standard BES 6001. To meet this Standard, organisations must satisfy certain compulsory elements. In addition, there are higher levels of compliance that can result in a higher performance rating being awarded. This Standard also provides a route to obtaining credits under the BREEAM family of certification schemes. H+H UK Ltd was the third building materials company in the UK to be certified under BES 6001 and the first to achieve a "Very Good Performance" rating. The "Very Good Performance" rating obtained means that H+H products will attract the maximum number of points where our products are used under the Code.

CfSH Category 7: Health & Well-being
Hea2: Sound insulation:
This section of the Code aims to ensure the provision of improved sound insulation to reduce the likelihood of noise complaints from neighbours. Credits are awarded for achieving higher standards of sound insulation than those given in Approved Document E of the Building Regulations and demonstrating it by either using pre-completion testing or Robust Details. Aircrete party and flanking walls have been available for many years, but are now becoming even more popular with the requirement to consider heat loss both owing to venting of air in the cavity and linear thermal bridging.

Solutions are available for both traditional and thin layer mortars. Much research has taken place over recent years and new research is continuously taking place in this area. Our aircrete can provide simple solutions such as two leaves of 100m aircrete with 75mm cavity, parged and dry lined both sides. However, new constructions are constantly evolving. Constructions with a high number of points are available as Robust Details. This includes the filling of the cavity with certain insulation materials without the need for a parge coat. The current situation with regards to constructions and the points they attract can be found on the Robust Details Limited website (www.robustdetails.co.uk).

Case Studies:
H+H have been involved in a number of high profile projects demonstrating a range of constructions to achieve Code ratings up to and including the highest possible, Code 6. Please see our website www.hhcelcon.co.uk to obtain specific details and the latest information about these projects.

Code for Sustainable Homes Solutions for energy & CO_2 emissions

The Solutions shown have been calculated based on a two storey 3 bedroom semi detached house with a floor area of 89m^2.

The included solutions highlight different options for the key components of the code with relevance to energy usage and the reduction of CO_2 required within the key areas of a dwelling:

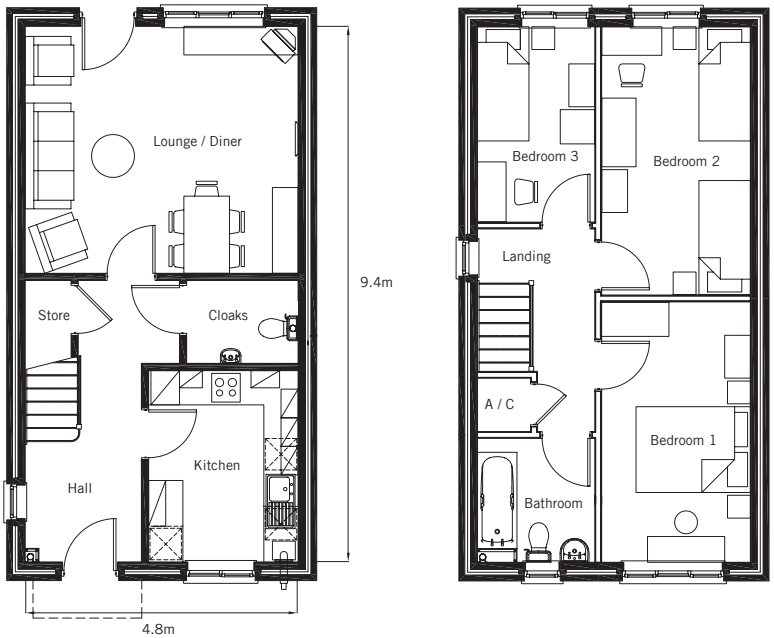
Building fabric – the materials that make up the structure of the unit and the overall units airtightness.

Heating System – the efficiency of the boiler required.

Renewable technology – a method of creating energy (e.g. from the wind or sun) to cover the energy use within the dwelling or at the highest code level to repay the energy debt of the dwelling from energy use in white goods and lighting for example.

The solutions shown opposite offer examples as to how each of the code levels 3 to 5 can be met with different emphasis placed on the variables above. As an example it is possible to achieve a Code Level 3 rating without the use of renewable technology and with only an existing best performing combi-boiler offering 90% efficiency.

The following examples act as a guide, but there are many types of renewable technology available. For example, if combined heat and power (CHP) is used, there are significant reductions achieved.



Example of Code Level Solutions

	Solution 1 Code 3	Solution 2 Code 4	Solution 3 Code 4
Building fabric			
Floors (W/m²K)	**0.15**	**0.15**	**0.11**
Roof (W/m²K)	0.13	0.13	0.11
Walls (W/m²K)	**0.18**	**0.18**	**0.15**
Window (W/m²K)	1.5	1.5	1.0
Doors (W/m²K)	1.5	1.5	1.2
Airtightness (m³/hr/m²)	**7**	**7**	**3**
Heating system			
	90% efficient Gas Combi Boiler	90% efficient Gas Combi Boiler	90% efficient Gas Combi Boiler
All with Interlock, enhanced load			
Weather Compensator	Full zone control	Full zone control	Full zone control
Thermal Mass Parameter	183	183	183
Mechanical Ventilation and Heat Recovery (MVHR)	No	No	Yes
Renewables	No	PV 1kWp	No
Thermal Bridging	**y = 0.085**	**y = 0.085**	**y = 0.026**

Solution 1
This solution highlights that by using aircrete with no renewables a cost effective solution to Code 3 can be achieved. The thermal bridging values used can be reduced further using enhanced aircrete solutions, allowing a relaxation in the fabric U values.

Solution 2
Code 4 can be achieved with the same basic fabric used for a Code 3 with the addition of renewable energy technology. In this case 1kWp of PV is added. The thermal bridging values used can be reduced further using enhanced aircrete solutions, allowing a relaxation in the fabric U values.

Solution 3
This uses an alternative 'fabric first' approach to achieving Code 4 with no renewable energy technology. The U values have been reduced and the equivalent 'y' value based on enhanced aircrete solutions. With an improved airtightness of 3m³/hr/m², MVHR has been added.

Code for Sustainable Homes Solutions

Example of Code Level Solutions

	Solution 4 Code 4	Solution 5 Code 5
Building fabric		
Floors (W/m²K)	**0.18**	**0.15**
Roof (W/m²K)	0.13	0.13
Walls (W/m²K)	**0.18**	**0.18**
Window (W/m²K)	1.4	1.0
Doors (W/m²K)	1.4	1.0
Airtightness (m³/hr/m²)	**5**	**3**
Heating system	90% efficient Gas Combi Boiler	90% efficient Gas Combi Boiler
All with interlock, enhanced load weather compensator	Full zone control	Full zone control
Mechanical Ventilation and Heat Recovery (MVHR)	No	Yes
	See Note below	See Note below
Renewables	0.25kWp photovoltaic (PV)	2.5kWp photovoltaic (PV)
Thermal Bridging	**y = 0.026**	**y = 0.026**

Solution 4
This is a hybrid of the solutions 2 and 3 to achieve Code 4. It focusses on achieving the maximum FEES being suggested by the Zero Carbon Hub for constructions to achieve the future 'zero carbon' target. With a relaxed airtightness, a centralised whole house extract, rather than MVHR has been used. In addition, Flue Gas Heat Recovery (FGHR) and Waste Water Heat Recovery (WWHR) have been used.

Solution 5
For Code 5 compliance one way is to add more renewable energy technology to a Code 4 solution. In this example, U values have been tightened further throughout the fabric. MVHR has been used, whilst retaining the FGHR and WWHR. PV has been increased to meet the more demanding target.

For Code 6 houses it is possible to add more renewable energy technology to achieve compliance.

Heating & Renewable Energy notes:

Heat Pumps (ground, air or water)
These provide a new and clean way of heating buildings in the UK and the system comprises of three basic elements - a ground loop, the heat pump itself and a heat distribution system. These make use of renewable energy stored in the ground, air or water, providing one of the most energy-efficient ways of heating buildings.

These are suitable for a wide variety of building types and are particularly appropriate for low environmental impact projects. Heat collecting pipes in a closed loop, containing water (with antifreeze) are used to extract this stored energy, which can then be used to provide space heating and domestic hot water.

Heat Pumps work best with heating systems, which are optimised to run at a lower water temperature than is commonly used in UK boiler and radiator systems. As such, they make an ideal partner for under floor heating systems. However they can still be used with traditional systems.

MVHR
Mechanical Ventilation with Heat Recovery (MVHR) combine the extraction, ventilation and supply of fresh air in one system, incorporating a heat exchanger to recover heat from the extracted air which is then used to preheat the incoming air. A nominal 70% of wasted heat energy is recovered, however this can be up to 90% depending on the system. To enable this system to work effectively a relatively airtight construction would be required and ducting is required to be fitted.

Photovoltaic (PV)
Photovoltaic systems use cells to convert solar radiation (daylight) into electricity with the greater the intensity of the light increasing the flow of electricity. Individual PV cells are connected together to form a module, with the modules sizes to meet a particular load or need. It should be remembered that 1kilowatt peak (kwp) created by PVs will require around 6-8m² of PV panels.

Sloping rooftops are an ideal site, where modules can simply be mounted using frames. Photovoltaic systems can also be incorporated into the actual building fabric, for example PV roof tiles are now available which can be fitted, as standard tiles would. In addition, PVs can also be incorporated as building facades, canopies and skylights amongst many other applications. Photovoltaic cells are extremely low-maintenance and have very long life span.

Solar panels

Solar panel systems have been around since the 1970's and the technology is now widely developed with a large choice of equipment to suit many applications. They are mainly used to remove the need for hot water heating and are capable of supplying almost all hot water heating during the summer months and about 50% all year round.

A solar water heating system for domestic hot water comprises three main components: solar panels (flat plate (30% efficient) or evacuated tubes (40% efficient)), a hot water cylinder and a plumbing system. Issues to consider are the amount of South facing roof space, the heating systems compatibility and the project's budget.

FEES

Fabric Energy Efficiency Standards (FEES) were developed to ensure minimum standards for the external fabric are maintained without solely relying on improved services or renewable energy sources to meet lower CO_2 targets. The FEE methodology was adopted with the Code for Sustainable Homes November 2010 version, with up to 9 credits available in section Ene2 for achieving a range of specific fabric performance levels.It replaced the previous reliance of Heat Loss Parameter (HLP) as a measure of minimum fabric performance which was required to be <0.8 for Code Level 6 dwellings only.

The Fabric Energy Efficiency (FEE) considers the space heating and cooling demand of a dwelling and is affected by heat losses through the building fabric (U-values, thermal bridging and air permeability) as well as thermal mass and features affecting lighting and solar gains.

The FEE is measured in kWh/m^2/yr and is not influenced by services such as the heating or ventilation systems. This permits different combinations of fabric specification to be used to reach a particular level, allowing flexibility when developing a fabric specification.

Thermal Bridging

The heat loss at junctions of walls, floors and roofs play a major part in CO_2 emissions from a building. By using Accredited Construction Details (ACD), improvements on the default ratings within SAP can be achieved.

The use of H+H Foundation Blocks and H+H aircrete blocks in the walls can offer beneficial thermal bridging values by reducing the heat loss at the junction of the wall, floor and foundation.

Known for their beneficial thermal properties, the use of H+H's products have been further enhanced by research into thermal linear bridging and Psi values.

Details published by Constructive Details Limited (www.constructivedetails.co.uk), show the significant benefit not only of H+H aircrete products when used in walls but also the combination of walling, foundation and flooring blocks.

Thermal By-Pass (separating walls)

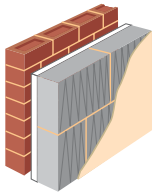
Changes to Part L of the Building Regulations in 2010 drew attention to heat losses associated with party walls which has been previously ignored for regulatory purposes. This included heat channelled through the clear cavities of separating walls (known as thermal by-pass) as well as heat losses at junctions with the external fabric of the dwelling (thermal bridges).

Thermal by-pass can be eliminated by ensuring the cavities are filled with insulation and effective edge sealing is put in place. There are now specific new full-fill cavity Robust Details available, including E-WM-23 and E-WM-24 providing an enhanced acoustic performance to enable 3 credits to be achieved under the Code for Sustainable Homes Health & Well Being section or 4 credits under Eco Homes.

Additional thermal benefits can also be realised by when using H+H aircrete in separating walls to limit heat loss at junctions with external elements. When used in conjunction with aircrete inner leaves, foundation blocks, floor blocks, heat losses at thermal bridges can be reduced by over 35%, enabling CO_2 emission targets to be more easily met or savings to be made on other parts of the insulated fabric without compromising the thermal performance of the dwelling.

H+H Solutions

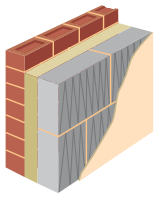
This is just small sample of the available solutions using H+H products. Specific wall construction U-values, as well as beam and block floor U-values can be obtained from our Technical Department.



Partial Fill Cavity
Brick outer leaf
Clear cavity
40mm Kingspan TW50
100mm Standard Grade
Any finish*
0.30W/m²K

Partial Fill Cavity
Brick outer leaf
Clear cavity
45mm Kingspan TW50
100mm Standard Grade
Any finish*
0.28W/m²K

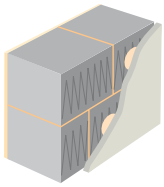
Partial Fill Cavity
Brick outer leaf
Clear cavity
50mm Kingspan TW50
100mm Standard Grade
Plasterboard on dabs
0.25W/m²K



Fully Filled Cavity
Brick outer leaf
75mm Dritherm 32
100mm Standard Grade
Lightweight Plaster
0.30W/m²K

Fully Filled Cavity
Brick outer leaf
100mm Dritherm 37
100mm Standard Grade
Plasterboard on dabs
0.28W/m²K

Fully Filled Cavity
Brick outer leaf
100mm Dritherm 32
100mm Standard Grade
Plasterboard on dabs
0.25W/m²K



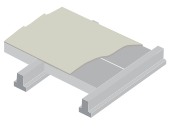
Solid wall - internal insulation
Render finish
215mm Solar Grade
40mm ThermaLine Super
0.30W/m²K

Solid wall - internal insulation
Render finish
215mm Solar Grade
50mm ThermaLine Super
0.26W/m²K

Solid wall - internal insulation
Render finish
215mm Solar Grade
60mm ThermaLine Super
0.23W/m²K

H+H Floor U-Value Solutions

Beam and Block Floor

	0.25W/m²K	0.20W/m²K	0.15W/m²K
Beam & Infill Block 	55mm Celotex GA3000 20mm Tongue & Groove Chipboard / Screed Finish	75mm Celotex GA3000 20mm Tongue & Groove Chipboard / Screed Finish	110mm Celotex GA3000 20mm Tongue & Groove Chipboard / Screed Finish

Note: Incorporating H+H Standard Grade Infill Blocks
Note: Above calculations based on a typical P/A ratio of 0.55

H+H Product Identification

	Strength	Conductivity	Density
Solar Grade	2.9N/mm³	**0.11W/m²K**	460kg/m³
Standard Grade	3.6N/mm³	**0.15W/m²K**	600kg/m³

Partial Fill Cavity Brick outer leaf Clear cavity 65mm Kingspan TW50 **100mm Standard Grade** Plasterboard on dabs **0.22W/m²K**	**Partial Fill Cavity** Brick outer leaf Clear cavity 75mm Kingspan TW50 **100mm Standard Grade** Plasterboard on dabs **0.20W/m²K**	**Partial Fill Cavity** Brick outer leaf Clear cavity 100mm Kingspan TW50 **100mm Standard Grade** Any finish* **0.18W/m²K**	**Partial Fill Cavity** Brick outer leaf Clear cavity 125mm Kingspan K8 **100mm Standard Grade** Lightweight plaster **0.15W/m²K**
Fully Filled Cavity Brick outer leaf 150mm Dritherm 37 **100mm Standard Grade** Plasterboard on dabs **0.22W/m²K**	**Fully Filled Cavity** Brick outer leaf 150mm Dritherm 32 **100mm Standard Grade** Any finish* **0.20W/m²K**	**Fully Filled Cavity** Brick outer leaf 100mm Xtratherm CavityTherm **100mm Standard Grade** Plasterboard on dabs **0.18W/m²K**	**Fully Filled Cavity** Brick outer leaf 150mm Xtratherm CavityTherm **100mm Standard Grade** Any Finish **0.14W/m²K**
Solid wall - internal insulation Render finish **215mm Solar Grade** 70mm ThermaLine Super **0.20W/m²K**	**Solid wall - internal insulation** Render finish **215mm Solar Grade** 70mm ThermaLine Super **0.20W/m²K**	**Solid wall - internal insulation** Render finish **215mm Solar Grade** 80mm ThermaLine Super **0.18W/m²K**	**Solid wall - internal insulation** Render finish **215mm Solar Grade** 25mm TW50 between battens +90mm ThermaLine SUPER **0.15W/m²K**

Notes:
* Any internal finish assumes dense plaster as worst case. Lightweight plaster or Plasterboard on dabs may also be used
Above U-values are not exhaustive, please contact our Technical Department for other constructions or grades of block not shown

For further information, to check our most up-to-date product range or to find your nearest stocking merchant, please visit our website **www.hhcelcon.co.uk** or contact the following departments:

Sales
For sales enquiries or to find your local stockist please contact
Tel: +44 (0)1732 886444
Fax: +44 (0)1732 887013

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Fax: +44 (0)1732 887013
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