OUTLINE ENERGY ASSESSMENT
MILTON KEYNES EAST
MARCH 2021

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Outline Energy Statement

St James Group Limited

Milton Keynes East

Final

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ABOUT HODKINSON CONSULTANCY

Our team of technical specialists offer advanced levels of expertise and experience to our clients. We have a wide experience of the construction and development industry and tailor teams to suit each individual project.

We are able to advise at all stages of projects from planning applications to handover. Our emphasis is to provide innovative and cost-effective solutions that respond to increasing demands for quality and construction efficiency.

Executive Summary

The purpose of this Energy Statement is to demonstrate the ambition of St James Group Ltd for the Milton Keynes (MK) East site. It is anticipated that the site will be subject to advancing energy standards over time, with St James recognising the importance of considering these changes at the outset.

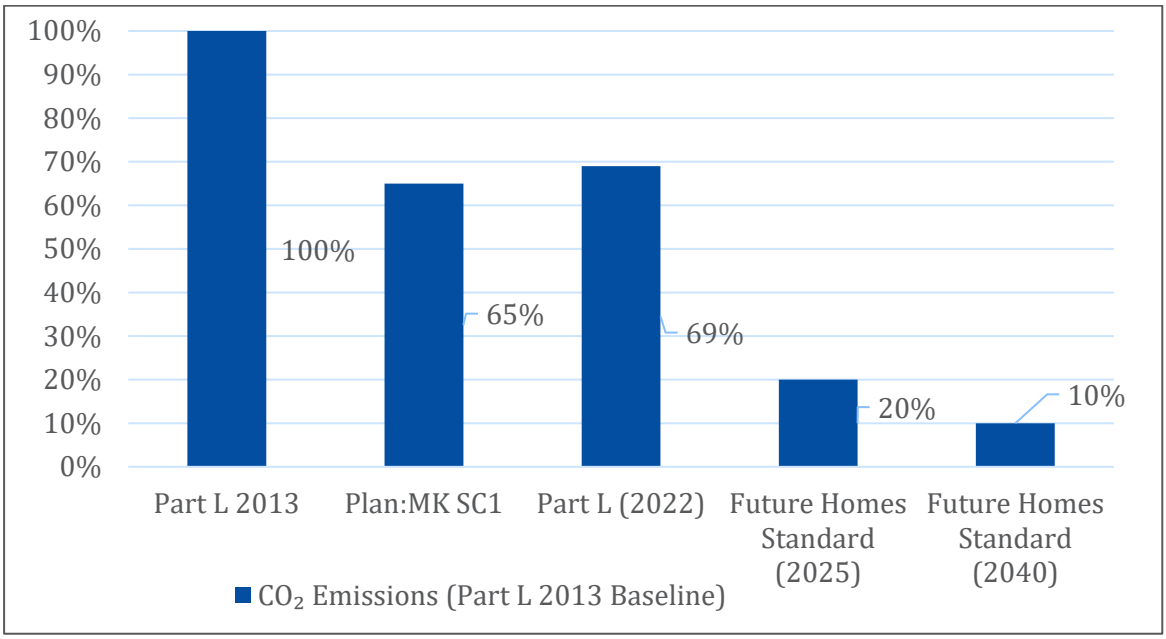
The site will deliver approximately 4,000 homes up to a maximum of 4,600, with the first predicted to be completed in 2024 and the last in 2048. A significant provision of non-residential space is also proposed, including schools, a community hub, and industrial units. During this prolonged build timeline, policies and regulations are expected to escalate, enabling low-carbon developments to be delivered and the impacts of climate change to be mitigated.

This Outline Energy Statement aims to ensure a standards-based approach is adopted, as well as accounting for a development timeline that is likely to span multiple changes in regulation and policy. As such, a prescriptive energy strategy to be adhered to across the site is not set out. Nonetheless, key future-proofing measures which will provide flexibility for the site to meet varying standards are set. For instance, no new home will be connected to the natural gas grid, with all heating requirements to originate from low or zero carbon sources. The most likely solution is the use of heat pumps, however alternatives may arise through future technological developments which later phases of the site could incorporate. Parameters for indicative specifications that are compliant with potential increases in standards are also provided, in order to demonstrate the long-term vision St James have for this site. Delivery against these potential standards with key future-proofing measures means an excellent level of energy performance will be obtained from the outset. Each development phase will detail a specific energy strategy through a Reserved Matters Energy Statement which intends to tie into the principles set out in this report.

The summary graph shown below outlines the improving carbon performance of a development complying with the escalating standards which are expected to come into effect. The presence of low or zero carbon heating in all homes should enable all initial MK East homes to significantly exceed the CO_2 reduction requirements of Policy SC1 of Plan:MK and the incoming Part L 2021 update (expected in 2022). For homes completed following the adoption of the Future Homes Standard (adoption planned for 2025) further uplifts in the build specification may be required. Indicative specifications have been used within this Energy Statement to provide an indication of the performance that could be achieved across these time periods.

Further regulatory and policy changes are anticipated into the 2030s. It is difficult to ascertain what these may be, however the Energy Statement does outline some possible directions these could take. The Summary Graph has added a potential carbon performance with the FHS specification but with BEIS 2040 CO_2 emission factors. Additionally, the site may look to explore a number of ambitious energy infrastructure concepts, which will be outlined within this report.

St James are keen to demonstrate their commitment to building in low and zero carbon principles from the outset at MK East. Recently introduced Berkeley Group science-based targets align with Milton Keynes' Sustainability Strategy, both of which commit to adopting measures which assist in limiting warming to 1.5°C (as set out in the Paris Climate Agreement, 2015).



Summary Graph: Enhancing Carbon Performance of Site

The Summary Table below demonstrates how the indicative specifications within this document will enable substantial reductions in CO_2 emissions beyond the current build standards, achieving all policy and Part L standards. For clarity, Part L 2021 calculations have utilised SAP 10.1 emission factors, with FHS calculations using BEIS 2030 projected emission factors. The BEIS 2040 factors are only illustrative for the Summary Graph. Any remaining site CO_2 emissions will be offset via the Councils offsetting fund, to be calculated at the time of each Reserved Matters application.

Summary Table: Site CO_2 Performance				
	Regulated		**Total**	
Residential				
Baseline (Part L 2013)	**7,696,400**		**13,777,500**	
Indicative Site Emissions	**Part L (2021)**	**FHS (2025)**	**Part L (2021)**	**FHS (2025)**
	135,900	1,019,000	239,800	1,928,100
	1,154,900		**2,167,900**	
Reduction (%) over Baseline	**85%**		**84%**	
Non-Residential				
Baseline (Part L 2013)	**409,400**		**1,365,500**	
Indicative Site Emissions	**Part L (2021)**	**FHS (2025)**	**Part L (2021)**	**FHS (2025)**
	69,400	37,300	138,200	57,300
	106,700		**195,500**	
Reduction (%) over Baseline	**74%**		**86%**	

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CONTENTS

1. INTRODUCTION

1.1 This Outline Energy Statement for the proposed development at the Milton Keynes East site has been prepared by Hodkinson Consultancy, a specialist energy and environmental consultancy for planning and development.

1.2 By considering energy and carbon emissions at this early concept stage and integrating them into the masterplan, a development and community with high levels of sustainability can be achieved. This document will consider appropriate measures which could be included in line with relevant adopted and emerging policies and regulations that will change over time.

1.3 The outline energy strategy for the site is to be formulated to address a number of key objectives:

> To ensure a close association with the Council's ambitious and developing climate initiatives for the full duration of the site's development. At the centre of this sits the aim of assisting limiting warming to 1.5°C through the application of a progressive agenda of energy and sustainability measures at MK East;

> To provide high-quality homes and non-residential spaces, taking into account specific site characteristics that link to the energy strategy, such as acoustics, thermal comfort, and air quality;

> To lock in low carbon design principles right from the beginning, in order to assist in the delivery of a rapidly evolving and diversifying set of standards (both regulatory and planning). The objective of this Outline Energy Statement is to provide a framework of standards and potential approaches, rather than to prescribe specific strategies;

> To ensure a resilient supply of low carbon and reasonably-priced energy is available to residents and businesses alike. Opportunities to utilise the site as a generator of clean power as well as a consumer will be investigated.

1.4 Policy and regulation for housing standards are currently changing. It is anticipated that over time there will be changes in technology and understanding which will result in changes to national and local requirements. To align with these requirements this development will build to the standards prevalent at the time of construction.

1.5 St James have also set a number of ambitious group sustainability targets. These will be set out within this report.

1.6 By delivering to these tightening requirements as the site timeline progresses this will enable the development to contribute to the UK's commitment to reduce carbon emission by 100% (from a 1990 baseline) by 2050 as set out in the Climate Change Act (2008), as well as align with the UN's 1.5°C warming limit.

2. DEVELOPMENT OVERVIEW

Site Location

2.1 The proposed development site at Milton Keynes East is located to the north east of Milton Keynes town centre, as shown in Figure below.

Figure 1: Site Location – Map data © 2021 Google

Proposed Development

2.2 The proposed development is described as follows:

"Hybrid planning application encompassing: (i) outline element (with all matters reserved) for a large-scale mixed-use urban extension (creating a new community) comprising: residential development; employment including business, general industry and storage/distribution uses; a secondary school and primary schools; a community hub containing a range of commercial and community uses; a new

linear park along the River Ouzel corridor; open space and linked amenities; new redways, access roads and associated highways improvements; associated infrastructure works; and (ii) detailed element for strategic highway and multi-modal transport infrastructure, including: new road and redway extensions; a new bridge over the M1 motorway; a new bridge over the River Ouzel; works to the Tongwell Street corridor between Tongwell roundabout and Pineham roundabout including new bridge over the River Ouzel; alignment alterations to A509 and Newport Road; and associated utilities, lighting, earthworks and drainage works."

2.3 The proposed site layout is shown in the submitted Parameter Plans and Design and Access Statement.

3. RELEVANT PLANNING POLICY

3.1 The following planning policies and requirements have informed the sustainable design of the proposed development.

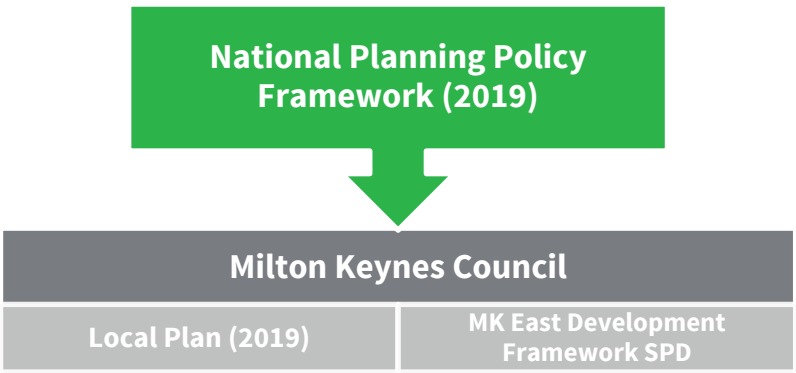


Figure 2: Relevant Planning Policy Documents

National Policy: NPPF

3.2 The revised National Planning Policy Framework (NPPF) was published on the 19th June 2019 and sets out the Government's planning policies for England.

3.3 The NPPF provides a framework for achieving sustainable development, which has been summarised as "*meeting the needs of the present without compromising the ability of future generations to meet their own needs*" (Resolution 42/187 of the United National General Assembly). At the heart of the framework is a **presumption in favour of sustainable development**.

3.4 The document states that the planning system has three overarching objectives which are interdependent and need to be pursued in mutually supportive ways:

a) **An economic objective** – to help build a strong, responsive and competitive economy, by ensuring that sufficient land of the right types is available in the right places and at the right time to support growth, innovation and improved productivity; and by identifying and coordinating the provision of infrastructure;

b) **A social objective** – to support strong, vibrant and healthy communities, by ensuring that a sufficient number and range of homes can be provided to meet the needs of present and future generations; and by fostering a well-designed and safe built environment, with accessible services and open spaces that reflect current and future needs and support communities' health, social and cultural well-being; and

c) **An environmental objective** – to contribute to protecting and enhancing our natural, built and historic environment; including making effective use of land, helping to improve biodiversity, using natural resources prudently, minimising waste and pollution, and mitigating and adapting to climate change, including moving to a low carbon economy.

Local Policy: Milton Keynes Council

Plan: MK Local Plan

3.5 Milton Keynes Council Local Plan document 'Plan:MK' was adopted in March 2019.

3.6 The key requirement set out in **Policy SC1 Sustainable Construction** concerning energy carbon relates to clause K:

'Development proposals for 11 or more dwellings and non-residential development with a floor space of 1,000 sqm or more will be required to submit an Energy and Climate Statement that demonstrates how the proposal will achieve the applicable requirements below:

1. Achieve a 19% carbon reduction improvement upon the requirements within Building Regulations Approved Document Part L 2013, or achieve any higher standard than this that is required under new national planning policy or Building Regulations.

2. Provide on-site renewable energy generation, or connection to a renewable or low carbon community energy scheme, that contributes to a further 20% reduction in the residual carbon emissions subsequent to (1) above.

3. Make financial contributions to the Council's carbon offset fund to enable the residual carbon emissions subsequent to the (1) and (2) above to be offset by other local initiatives.

4. Calculate Indoor Air Quality and Overheating Risk performance for proposed new dwellings.

5. Implement a recognised quality regime that ensures the 'as built' performance (energy use, carbon emissions, indoor air quality and overheating risk) matches the calculated design performance of all dwellings in (4) above.

6. Put in place a recognised monitoring regime to allow the assessment of energy use, indoor air quality and overheating risk for 10% of the proposed dwellings for the first five years of their occupancy and ensure that the information recovered is provided to the applicable occupiers and the planning authority.'

3.7 **Policy SC2 Community Heat Networks and Large Scale Renewable Energy Schemes** states that:

> Proposals for over 100 homes and non-residential developments of over 1,000 sqm will be expected to consider the integration of community energy networks in the development. This consideration should form part of development proposals and take into account the site's characteristics and the existing cooling, heat and power demands on adjacent sites.

> All new developments in proximity of an existing or proposed combined heat and power (CHP), combined cooling, heat, and power (CCHP) station or local energy network will be expected to connect to the network unless it can be demonstrated that a better alternative for reducing carbon emissions can be achieved; heating and/or cooling loads of the scheme do not justify a CHP connection; or the cost of achieving this would make the proposed development unviable.

Milton Keynes East Development Framework SPD (2020)

3.8 The Milton Keynes East Development Framework was adopted in March 2020. The SPD provides guidance on how the allocated of Milton Keynes East within Plan:MK should be planned and developed. The site has been allocated to deliver around 5,000 new homes, 105 ha of employment land, a comprehensive transport network and supporting social and green infrastructure.

MK Sustainability Strategy (2019-2050)

3.9 Milton Keynes Council's Sustainability Strategy is the long-term vision to create a sustainable city which embraces innovation, creates high quality jobs and recognises it has a vital role in tackling the global challenges of climate change.

3.10 The main Sustainable Principles are:

> Green Energy – Maximise the use of renewable energy, reducing carbon and providing resilience to the grid.

> Circular Economy – Increasing the efficient use of resources to reuse materials, use less water and ensure the best use of land.

> Low Emissions – Reducing the level of emissions from transport, industry and agriculture and ensure clean air.

3.11 The strategy aligns its ambitions with the 1.5°C limiting warming target as defined by the UN (Paris Agreement, 2015).

Sustainable Construction SPD (Draft)

3.12 A consultation on the new Sustainable Construction SPD was ran though November and December 2020. An Adoption date is as of yet unclear, although it predominantly aims to build on the key energy and sustainability related policies set out in Plan:MK.

3.13 Further detail is provided on the carbon offsetting arrangements (Annex E). The proposed methodology is to include both regulated and unregulated CO_2 emissions, with a set one-off carbon price of £200 to apply to both residential and non-residential proposals.

4. PART L & BERKELEY TARGETS

Building Regulations (Part L)

Part L (2021)

4.1 Building Regulations Part L 2013 currently sets the minimum requirements for new developments. However, a comprehensive update has been consulted upon and is due for introduction in 2022. This is prior to the first plots are expected to be started on at the proposed Milton Keynes East site.

4.2 The Part L (2021) standard aims to future proof new dwellings for low-carbon heating systems and takes a significant step towards the proposed Future Homes standard. Key areas to address include the rapid decarbonisation of the electricity grid, and the corresponding inertia to do the same in the gas grid. This aligns with the Government's proposed intentions to seek for new dwellings not to be connected to the gas grid from 2025.

4.3 The baseline will represent a 31% improvement over the Part L 2013 baseline. In addition to the enhanced carbon and Fabric Energy Efficiency (FEE) targets, a Primary Energy metric will be introduced. This will ensure designers pay as much attention to energy as they do carbon.

4.4 The new Part L will adopt an updated version of the Standard Assessment Procedure (SAP). The latest iteration is SAP 10.1 but there is expected to be a further update prior to adoption within the Building Regulations.

4.5 The emission factors within current Part L 2013 (SAP 2012) are no longer reflective of the proportion of renewable power flowing onto the grid. The updated emission factors will give a more accurate estimate of the carbon dioxide emissions of a development.

4.6 Table 1, below, shows how carbon emission factors are predicted to change over time, with a significant reduction in the electrical factor and very little movement in the gas factor.

Table 1: Carbon emission factors

	SAP 2012	SAP 10.1	BEIS Predicted 2030	BEIS Predicted 2040	BEIS Predicted 2050
Gas (kg.CO_2/kWh)	0.216	0.210	0.210	0.210	0.210
Electricity (kg.CO_2/kWh)	0.519	0.136	0.083	0.041	0.028

4.7 New homes will therefore benefit significantly from sourcing heating needs from the electricity grid. This is the current intention for all homes at the Milton Keynes East site, which aim to utilise highly efficiency heat pumps. For homes planned for the later phases, a role may develop for hydrogen should sufficient technological and economic progress occur at a national level. This will be kept under review as the site develops, but is considered too experimental to build into the energy strategy now.

Future Homes Standard (2025)

4.8 Only very limited information currently exists as to the uplift sought between the Part L (2021update and the Future Homes Standard in 2025. A sperate consultation is proposed in 2023. It is stated within the Part L (2021) consultation document that a 75-80% reduction in carbon emissions beyond the current Part L 2013 baseline is anticipated, which is a significant enhancement beyond the 31% reduction expected for Part L 2021 over Part L 2013.

4.9 Nonetheless, the current intention to seek for new dwellings not to connect to the gas grid from 2025 aligns with the adoption of the Future Homes Standard, as should be seen as a fulcrum of the standard. The proposed use of heat pumps for much of the site's heating needs will lock in substantial CO_2 reductions and ensure the Primary Energy demands are kept low.

Berkeley Group Standards

4.10 All developments, including Milton Keynes East, will aim to reduce their impact on climate change by achieving Berkeley Group's science-based targets. These have been developed to align with the same 1.5°C warming limiting target as is followed in the MK Sustainability Strategy. They include:

- A 40% reduction in operational energy use by 2030 over a 2019 baseline (set to be the average Dwelling Emission Rate (DER) across the Berkeley Homes portfolio). This exceeds the requirements of Policy SC1 within Plan: MK, and as a result of the Part L updates is expected to be achieved well before 2030;
- A 40% reduction in whole life carbon by 2030 over a calculated 2019 baseline;
- All domestic appliances will achieve a minimum A to A++ energy efficiency rating.

4.11 Further Berkeley homes standards are set out within the accompanying Sustainability Statement.

Calculation Methodology

4.12 The estimated annual energy demand for dwellings has been calculated using Standard Assessment Procedure methodology (SAP). SAP calculates the Regulated energy demands associated with hot water, space heating and fixed electrical items. The unregulated energy demands for appliances and cooking are taken from BRE standard occupancy calculations.

4.13 Outputs have then been extracted and converted to align with the changing carbon emission factors as shown in Table 1. Part L (2021) calculations have been processed against the SAP 10.1 emission factors, with Future Homes Standard calculations against the BEIS 2030 predicted values. Attention has also been paid to performance against the new Primary Energy metric which is to be introduced.

4.14 Calculations have been performed on sample dwelling types from similar sites. These encompass an array of house and flats types which differ in orientation and take account of the impact of exposed floors, mid floors dwelling, and roof areas. The selected dwellings therefore represent a fair aggregation of the likely proposed unit mix.

4.15 The estimated annual energy demand for the proposed non-residential aspects has been calculated using Simplified Building Energy Model methodology. The unregulated energy demands for appliances and cooking are taken from additional SBEM output documents. A calculation process similar to that of the SAP outputs has been followed in order to understand the impact of future standards.

4.16 The indicative build timeline for the site envisages the vast majority of homes and non-residential spaces to be delivered after the planned introduction of the Future Homes Standard in 2025. It is worth noting that the Part L (2021) update incoming in 2022 was originally planned for 2020, so it would not be unreasonable to anticipate a similar delay in the adoption of a further enhancement in the shape of the Future Homes Standard. The calculations reflected within this report have thus assumed a breakdown as outlined in Table 2.

Table 2: Accommodation Split

	Part L (2021)	Future Homes Standard
No. of Homes	300	4,300
Non-Residential (m^2)	14,500m^2	33,800m^2

4.17 It is acknowledged that as much of the site's timeline extends into the 2040s it is highly unlikely that the Future Homes Standard will remain the live regulatory standard by that point. Discussion as to how this could evolve is provided in Section 6 of this report, however calculations have not been undertaken on the basis that little information on this is available.

Baseline Emissions

4.18 A Part L (2013) baseline has been calculated for the homes and non-residential areas. The fuel factor (1.55 for electricity) as set out in SAP 2012 has been removed to allow for a clearer comparison with the site's potential emissions.

Table 3: Baseline Emissions

	Regulated	Total
Residential		
Baseline (Part L 2013)	**7,696,400**	**13,777,500**
Non-Residential		
Baseline (Part L 2013)	**409,400**	**1,365,500**

5. FUTURE-PROOFED DESIGN

5.1 As outlined earlier, the scope of potential development for the site will result in a trajectory of changing energy standards across different build phases. The most appropriate approach given the substantial changes incoming, and the incomplete information currently available to exactly what some of these changes are, is for St James to embed key future-proofing principles into the design of all buildings. This retains flexibility for the site so that the most appropriate technology at the time of delivery can be provided to meet the changing policy and regulatory requirements.

5.2 Section 5 of this report outlines how St James will lay the groundwork for enhancing standards from the outset.

Build Form & Fabric Efficiency

5.3 The development of an energy efficient building can be assisted significantly by design fundamentals such as shape, complexity, and orientation. This is discussed within this section.

5.4 St James are conscious of the need to promote individual building aesthetics, in order to establish a site character and enhance social value, but to do so in such a way which does not encourage unnecessary construction complexity in the build form which could result in a loss in energy performance. Designs which unnecessarily increase the surface area of the thermal envelope or push for extensive or elaborate detailing would not be maximising the energy efficiency from the build form.

5.5 The focus on not embedding an overly complex design will particularly assist in minimising heat losses from thermal bridges. In well insulated buildings, as much as 30% of heat loss can occur through thermal bridges, which occur when highly conductive elements (e.g. metal studs) in the wall construction enable a low resistance escape route for heat. Some key starting points to ensure the design progresses on the right track from an early stage are set out below:

> Cantilevered balconies, where provided, are to be provided with structural thermal breaks;

> The insulation line is to be kept as continuous and unbroken as possible;

> Where highly conductive materials must penetrate the main insulation line for structural reasons, thermal pads will be utilised to mitigate heat transfer;

> No plot shall encounter significant insulation omissions, such as with exposed concrete floors or floor perimeters.

5.6 Bespoke modelling will be undertaken on key junction types such as window surrounds, balconies, parapets, and intermediate floors for all plot iterations. This will ensure an inadequate design does not become an inadequate junction.

5.7 Outline principles such as maximising passive solar gains through carefully orienting buildings and minimising expansive glazed areas on facades which benefit least from this will be considered from the outset. As a general rule of thumb expansive glazed areas are best reserved for southerly facing orientations, but with the provision of sufficient shading to counteract summer overheating. Passive solar gains effectively provide 'free' heat, which is particularly beneficial within the winter months, and thus reduces the demands on the building heating system.

5.8 High standards of fabric efficiency will be targeted in all buildings, with all element U-values exceeding the expected minimum performance standards in the respective Part L iterations which apply at the time of build. Indicative specifications have been used in this Outline Energy Statement, with the targeted U-values set out in the table below.

Table 4: Indicative Build Specifications

	Part L (2021)	Future Homes Standard
Homes		
External Walls	0.18 W/m^2.K	0.15 W/m^2.K
Party Walls	0.00 W/m^2.K	0.00 W/m^2.K
Ground Floors	0.16 W/m^2.K	0.10 W/m^2.K
Upper Floors (Exposed)	0.16 W/m^2.K	0.10 W/m^2.K
Roofs (Pitched)	0.11 W/m^2.K	0.10 W/m^2.K
Roofs (Flat)	0.16 W/m^2.K	0.10 W/m^2.K
Glazing	1.40 W/m^2.K	1.20 W/m^2.K
Non-Residential		
External Walls	0.18 W/m^2.K	0.12 W/m^2.K
Ground Floors	0.13 W/m^2.K	0.10 W/m^2.K
Roofs (Flat)	0.16 W/m^2.K	0.10 W/m^2.K
Glazing	1.40 W/m^2.K	1.10 W/m^2.K

Heating

5.9 In addition to high standards of fabric efficiency, St James are committed to the delivery of low carbon heating systems in all buildings. The technological development of heating systems is fast-paced, and as such it would be inappropriate to specify a specific type for the full site at this stage. St James nonetheless recognise the need to future-proof all buildings for the deployment of low carbon heating. All dwellings will therefore be provided with low temperature wet heating systems, and crucially no home shall be heated using natural gas.

5.10 Space within all plots for the location of a hot water cylinder will also be allowed for as a future-proofing measure.

Heat Pumps

5.11 The most likely heat source for the provision of low carbon heating in homes is air source heat pumps (ASHPs), and it is anticipated that at least in the initial years of the site this will be utilised in all homes. ASHPs are also expected to deliver the vast majority of heating needs to the non-residential spaces. In this way the decarbonisation progress of the grid is locked into the site from the beginning, with highly efficient heat pumps enabling a much greater CO_2 and Primary Energy performance than direct electric systems.

5.12 ASHPs generate heat via compression of a refrigerant which has extracted ambient heat from the external air. The compressive action raises the temperature of the refrigerant and allows it to provide very efficient heating. The use of ground source heat pumps (GSHPs) will also be investigated, as certain benefits related to operational efficiencies could be demonstrable. However, these are more location specific than ASHPs and it may prove that the more complex and intrusive installation works mean it cannot be accommodated in most areas of the site. Each Reserved Matters energy strategy will determine this.

5.13 There are several variants of the ASHP set-up. The most conventional arrangement can be delivered either in a monobloc or split form, with the former housing all heat pump equipment (minus the hot water cylinder) in an outside unit and the latter requiring an additional unit internally as well.

5.14 An exhaust air heat pump (EAHP) provides an alternative set-up to this arrangement. The central advantage of this system is that it requires no external plant, with all equipment housed within the home. EAHPs also act as a centralised ventilation system, removing the need to install a separate system for this. They are, however, a much more uncommon presence within the UK due to the more specialised nature of the equipment and limited supply chain. They would be unlikely to be used in houses or non-residential spaces, but may present an option in some flats were siting an external unit is proving difficult.

5.15 The images below represent the EAHP (on the left) and the more conventional monobloc/split systems (to the right). In both instances the internal units are relatively large. The EAHP has no external unit, however it does require the installation of ducting which may require additional ceiling space compared with other systems.

Figure 3: EAHP (e.g. NIBE) and split system (e.g. Daikin Alterma).

Heat Network

5.16 The potential for a site heat network as per Policy SC2 will also be investigated. Whilst St James are aware of the role that heat networks have to play in the delivery of low carbon heating, it is important that their rollout is applied sensibly to those sites which would benefit clearly from this form of heat distribution. Typically, these are of medium to high density with a medium to high heat demand. This is because density brings efficiencies in both costs (capital and operational) and energy performance (large pipe runs increase heat losses).

5.17 Whilst the site will have a medium to high heat demand due to the number of buildings proposed, it will only have a low density. Most of the dwellings are expected to be houses, with the apartments only low-rise in nature. Heating demands will also be reduced by the excellent standards of energy efficiency across the site. Much of the non-residential provision is also industrial, with correspondingly low heating requirements. A heat network is therefore not considered to be appropriate for the whole site.

5.18 St James are nonetheless keen to stress that a heat network operating in the higher density community hub region of the site has not been ruled out. The most likely area would be central hub of the site, where the apartments are located close to two schools and a number of other commercial uses.

5.19 Importantly, it is reiterated that the provision of low temperature wet distribution systems in all dwellings across the site will not rule out the possibility of a heat network connection at a later date. Therefore, dwellings can be future-proofed both for low carbon heating and the possibility of a heat network. The appropriateness of the latter would be subject to an in-depth feasibility study to ensure residents would not be incurring unreasonable heating costs and that the network could be ran efficiently.

Ventilation & Air Tightness

5.20 The air tightness of the buildings will be greatly assisted by the build form and fabric efficiency principles which St James will embed into all designs. Ensuring a high level of air tightness is beneficial for the following reasons:

> Reduces heat loss as a result of draughts through gaps in the building fabric;

> Prevents infiltration of humidity from internal warm air into cooler external building fabric.

5.21 Often the greatest risk to a high level of air tightness in a building comes during construction, where e.g. fixings between fabric elements tend to result in the air tightness layer becoming compromised. St James will ensure close monitoring of site contractors to minimise this risk.

5.22 As the fabric efficiency standards improve further with time, it is also expected that air tightness will do the same. The table below outlines how this could be followed at MK East.

Table 5: Indicative Air Permeability Targets

	Part L (2021)	Future Homes Standard
Houses	5.0 $m^3/h.m^2$	3.0 $m^3/h.m^2$
Flats	3.0 $m^3/h.m^2$	3.0 $m^3/h.m^2$
Non-Residential	5.0 $m^3/h.m^2$	2.0 $m^3/h.m^2$

5.23 Mechanical Ventilation Heat Recovery (MVHR) is expected to be installed in all apartments. These systems will remove stale air and odours from kitchens and wet rooms, whilst retaining the heat within the home. The performance of these systems will be assisted by the higher levels of air tightness which are achievable in apartments.

5.24 The provision of MVHR to houses will be investigated, however it may be determined that natural ventilation or decentralised mechanical extract ventilation (dMEV) could provide the ventilation needs more efficiently whilst still enabling the appropriate energy and carbon standards to be achieved.

5.25 Space within ceilings could be reserved in all houses to allow for centralised systems to be installed should it be shown to be beneficial in terms of energy and running cost savings. The indicative specification for FHS compliance in this report has assumed MVHR will be present for houses, but that it may not be required for Part L 2021 compliance.

Thermal Comfort

5.26 Minimising the risk of overheating is important so as to ensure that buildings are adapted to climate change and remain comfortable to occupy in the future. Principles identified through focusing on build form and thermal mass will prevent excesses heat building up in periods of extreme heat. Further measures are also to be considered to reduce any risk further still. An Overheating Mitigation Strategy report has also been undertaken for this application, outlining the framework within which this is considered. Further detail on thermal comfort can be found within this report, however a few examples which find relevance in the energy strategies have been set out as follows:

> Solar control glazing. A g-value of 0.45 has been assumed in the calculations for the homes in this Outline Energy Statement, with a g-value of 0.32 assumed for the non-residential spaces. Bespoke modelling will be undertaken as part of each Reserved Matters application to refine this value. Importantly, it is recognised that a balanced approach which ensures carbon and comfort are not siloed but instead work together needs to be followed. Ideally, this g-value should not be so low as to offset energy efficiency gains from the fabric specification (due to stilting passive winter heat gains), but should also not be so high as to result in uncomfortable summer conditions.

> Positioning of bedrooms. These are the most sensitive rooms to overheating risk, and so orienting them away from a southerly direction where possible will be investigated;

> Shading to a significant proportion of the windows from the presence of balconies for apartments. The balconies will provide solar shading during the summer months when the sun is high in the sky, but allow the beneficial winter solar gains when the sun is lower in the sky;

> High performance MVHR systems to all apartments will assist in background ventilation. Cross ventilation should be achievable in most houses;

> Openable windows to allow for purging of internal heat.

5.27 Separate mechanical cooling systems will only be considered if the combination of passive measures are insufficient to alleviate any overheating risk.

Renewables

5.28 The low carbon heating systems which are likely to be providing heating and hot water to all buildings will contribute a substantial renewables capacity to the site.

5.29 Photovoltaic (PV) panels may also be installed to appropriate roof spaces across the site to allow buildings to generate their own renewable power. This power could then have a variety of uses, including (but not limited to):

> Being used within the building at the time of generation;

> Being stored within the building, either through a mechanism (such as a PV diverter) which enables excess power to be stored as heat in the hot water cylinder, or through other means such as a battery. The stored energy would likely then be used later in that day when demand in the building was higher;

> Being sold to the mains grid, under the Smart Export Tariff scheme (or a similar arrangement).

5.30 The potential for using PV generation in other buildings on site is examined in Section 6.

Appliances & Smart Technology

5.31 It is expected that smart technology will play an increasing role in the efficient operation of future buildings. With an increasing number of devices coming with connectivity features, energy consumption can be managed more efficiently ensuring that wastage is minimised.

5.32 It is expected that smart technology will be increasingly integrated into domestic appliances. These could be coupled with time-of-use energy tariffs to enable energy consumption to occur at times when grid carbon content is low e.g. dishwashers running automatically during the night.

5.33 As technology advances, increasingly efficient appliances will be available to the market. By installing high efficiency appliances in dwellings e.g. induction hobs for cooking, unregulated energy demand (and the associated carbon emissions) will be reduced.

5.34 All white goods are expected to have high energy efficiency ratings that will reduce energy consumption. Berkeley Group have a target for all domestic appliances to achieve a minimum A to A++ energy efficiency rating.

Potential CO_2 Reductions

5.35 The table below outlines how the adoption of the indicative specifications would translate to savings in CO_2 emissions against the current Part L (2013) baseline. As outlined earlier, SAP 10.1 emission factors and BEIS 2030 projected factors have been used for the calculating the prospective

emissions reductions from the Part L (2021) and FHS specifications, respectively. Further detail on the calculations can be found in Appendices A, B, and C.

Table 6: Emissions Reductions

	Regulated		Total	
Residential				
Baseline (Part L 2013)	**7,696,400**		**13,777,500**	
Indicative Site Emissions	**Part L (2021)**	**FHS (2025)**	**Part L (2021)**	**FHS (2025)**
	135,900	1,019,000	239,800	1,928,100
	1,154,900		**2,167,900**	
Reduction (%) over Baseline	**85%**		**84%**	
Non-Residential				
Baseline (Part L 2013)	**409,400**		**1,365,500**	
Indicative Site Emissions	**Part L (2021)**	**FHS (2025)**	**Part L (2021)**	**FHS (2025)**
	69,400	37,300	138,200	57,300
	106,700		**195,500**	
Reduction (%) over Baseline	**74%**		**86%**	

Offsetting

5.36 Any residual CO_2 emissions will be offset, in line with Policy SC1 and the draft Sustainable Construction SPD. The proposed methodology within the draft SPD is currently to include both regulated and unregulated CO_2 emissions, with a set one-off carbon price of £200 (indexed) to apply to both residential and non-residential proposals. This is to be calculated for each Reserved Matters energy strategy.

5.37 It should be noted that should any of the concepts raised in Section 6 be delivered, emissions reduced from these activities may show a reduction on-site equivalent to 100% (or more), therefore no longer requiring an offsetting contribution.

Employment Area

5.38 ASHPs have been highlighted as the most likely heating system for homes and most of the non-residential spaces on site. The exception to this is the treatment of the larger employment units on the southern edge of the development. These are very large spaces and are unlikely to require heating to the same comfort criteria as the other non-residential uses. It is therefore considered unsuitable for the installation of ASHPs to be responsible for meeting these differing heating requirements.

5.39 Large units of the type proposed at MK East are often only heated to temperatures sufficient to avoid condensation or frost problems. It is likely that these buildings would qualify for the low energy exemptions within Part L2A of the Building Regulations, meaning that the compliance metrics that the other non-residential spaces must achieve do not apply. The cleanest form of heating is the heat that is never generated in the first place, so the low heating needs of these buildings demonstrates an important low carbon principle.

5.40 Nonetheless, St James are aware of the other energy requirements that these buildings are likely to still have. Electrical demands from lighting and machinery are likely to be significant. Plant and lighting installations with high efficiencies and a strong track record of reliability will therefore be prioritised. The provision of rooflights covering up to 15% of the total roof area will assist in reducing lighting demands. Further natural lighting concepts such as translucent cladding are often provided on units of these types. Many of these aspects have been adopted on the nearby Magnitude 314 warehouse, which can be seen as the leading example of a net zero building of this type.

5.41 Where these units have accompanying office space, these areas will utilise low or zero carbon heating sources and meet the requirements of the applicable standards and policies at the time of build. Insulating standards for these areas are expected to be similar to those proposed for other non-residential buildings across the site. Any glazed areas will be specified appropriately to balance both energy and overheating considerations.

5.42 The provision of large roof spaces from these employment units also presents an opportunity to install sizeable arrays of PV panels, an opportunity St James fully intend to maximise by offering this endeavour to all prospective tenants. It is a central element of the energy strategy for these buildings that the roofspace is utilised as much as possible and actively contributes to the performance of the building. No usable area of the roof shall remain without some secondary purpose, either to act as a provider of natural light into the building or to house renewable generating plant. Because of this, it may be possible for these buildings to be not only operationally zero carbon, but possibly carbon negative.

5.43 Sophisticated energy monitoring of the units will allow for analysis of how energy is used following completion of the building. This will assist in minimising any performance gap identified and ensure users are interacting positively with the building.

5.44 It is recognised that a significant proportion of a buildings carbon emissions is linked to construction and the procurement of materials. The volume of cement and steelworks within buildings of this type requires particular attention, with St James committed to ensuring all design and construction practices can quantify embodied carbon effectively and provide methods of reducing this outlay. As an example of what can be done under strong leadership, the Magnitude 314 building was certified by the UKGBC as the first net zero carbon building for construction of its kind. Material passports were developed to enable the design team to track the sourcing of specification items as well as understanding the proportion of recycled content in them and how straightforward it would be to recycle them in future. Specialist sustainability champions were also appointed to ensure this was monitored throughout the design and build timescale.

6. CONCEPTS & LONG-TERM SCENARIOS

6.1 The size and large timescales of the proposed development of the MK East site allow St James to appraise the feasibility of a number of ambitious infrastructural concepts. All concepts will require bespoke feasibility studies if considered to be taken further, however the fact that they have been raised and will be considered demonstrates the visionary thinking of St James for this site. It is worth stating that all Building Regulations and MK policy standards will be met at all stages of the build and do not depend on the presence of any of the concepts introduced in this section.

6.2 This section will also outline a potential longer-term trajectory for the Part L standards, beyond the Future Homes Standard.

Concepts

6.3 From discussions within the project team and with Milton Keynes' sustainability officers, four concepts have emerged which may be explored in further detail as the site develops. This number should not be considered exhaustive, and St James will routinely evaluate opportunities for the site throughout the build programme.

Water Source Heat Pump & Biogas From Sewage Treatment Works

6.4 Located on the other side of the M1 Motorway to the site is the Cotton Valley sewage treatment works, ran by Anglian Water. The outflow water leaving the works is understood to be warmer than the water system it is discharged into. This therefore represents a potential opportunity to harness this waste heat via a water source heat pump (WSHP) and use it in nearby buildings, such as on the MK East site.

6.5 The treatment works also produces significant volumes of biogas. It is understood that installed CHP engine(s) on the site may already be utilising at least some of this. Any CHP engine would be producing heat as part of its operation, and this heat may not be currently harnessed. This would therefore represent an additional opportunity to capture zero carbon heat for MK East. It is also unclear whether any installed engines are burning off all biogas from the treatment works, or whether a sizeable proportion is still being emitted. Additional CHP capacity could therefore be installed to provide both zero carbon electricity and more heat.

6.6 A commercial benefit both to the MK East site and the treatment works could also be established if CHP electricity could be directed (via a private wire arrangement) to any installed WSHPs. Further information on the current installed plant, potential availability of additional biogas, and waste heat at the works has been requested from Anglian Water.

6.7 Depending on the capacity of heat that could be reliably extracted from the treatment works, this may prove to be the most feasible of the concepts set out in this chapter.

Hydrogen

6.8 The potential use of hydrogen for heating has been brought into the public consciousness following its inclusion as a central component of the Government's 10 Point Plan (November 2020), which sets out a roadmap for bringing online cleaner energy and transport infrastructure.

6.9 There are a number of very significant technical and commercial challenges which will need to be overcome before hydrogen can become a widely available heating fuel source. Even taking an optimistic view that they will be overcome with time, it is highly unlikely to be providing a significant contribution to heating UK buildings at any point in the 2020s.

6.10 At the scale of a closed microgrid for specific sites, it may present a more feasible option. A number of projects across the UK are running closed microgrids on an increased share of hydrogen in the overall gas mix. St James will monitor the progress of clean hydrogen deployment and will consider its inclusion in the site energy strategy at a point in time if a detailed case can be made for it. It is worth noting that it would cause compatibility difficulties with buildings which had already been delivered using heat pumps.

Wind Power

6.11 Wind power from large turbines (generally 1MW turbines upwards) provides the largest contribution to the UK renewables mix in terms of capacity and generation. Large turbines are also a more efficient form of generation than for instance PV panels, with capacity factors (actual generation over a prolonged time period vs maximum potential generation) for large turbines in the 30-40% range, compared to only 10-20% for PV panels. A 1MW turbine could be expected to generate around 3,000 MWh/yr, which could contribute up to 15% of the site's total energy requirements when fully built out (excluding transport). However, as a result of planning rules introduced from 2015 the uptake of onshore wind turbines has largely stopped, with almost all deployment now offshore.

6.12 The size and proposals for the MK East site may present an opportunity to investigate the application of wind power on the site. Any installation would be sited away from homes, such as on or near the employment land close to the M1, in order to minimise visual impacts. Alternatively, St James could assist with installation of wind power at a more appropriate off-site location. Any prospective installation would be subject to detailed feasibility studies.

PV Generation – Surplus Supply

6.13 The application of PV panels across appropriate areas of the site will be assessed. The indicative specifications outlined in Section 5 do not require their inclusion for the Part L or MK policy targets to be met, with the likely use of heat pumps providing the significant energy and CO_2 savings needed. Nonetheless, further changes in standards may necessitate their use. Outside of the

considerations of Part L and policy, other advantages could be realised with the installation of PV arrays. These could include energy security and running cost savings across wider utility needs.

6.14 The buying and selling of electricity is strictly regulated. As such it would be very challenging to implement a set-up where surplus electricity generated from PV arrays on commercial and communal roofspaces could be sold to individual dwellings. However, an opportunity to use this in landlord areas or to sell to other commercial customers at MK East may arise. St James will evaluate whether a case could be made for installing large arrays on communal or commercial roofspaces in order to enable this to occur.

Future Standards

6.15 Whilst a pathway for the development of standards throughout the 2020s can be followed, the nature of further evolutions into the 2030s and 2040s are only speculative at this point. Changes in technologies and sciences may point both regulation and policy in a very different direction.

6.16 Nonetheless, it can be said that the principle of passive design is likely to remain a central element to whatever standards do emerge. The UK Green Building Council (UKGBC) have proposed a target of 15kWh/m^2/yr for space heating demands in dwellings as a barometer of what a Zero Carbon home could be. This target is challenging, particularly in houses, and further enhancements beyond those outlined within the indicative Future Homes Standard specification in Section 5 would likely be required.

6.17 A consultation on incorporating the installation of electric vehicle (EV) charging points into the Building Regulations was also ran last year, with a response and update still awaited from this. Exemptions under certain criteria are permitted, however should this progress it is expected that the majority of homes at MK East would be required to be fitted with an EV charging point as part of the delivered home.

7. SUMMARY

7.1 The purpose of this Energy Statement is to demonstrate the ambition of St James Group Ltd for the Milton Keynes (MK) East site. It is anticipated that the site will be subject to advancing energy standards over time, with St James recognising the importance of considering these changes at the outset.

7.2 The site approximately 4,000 homes up to a maximum of 4,600, with the first predicted to be completed in 2024 and the last in 2048. A significant provision of non-residential space is also proposed, including schools, a community hub, and industrial units. During this prolonged build timeline, policies and regulations are expected to escalate, enabling low-carbon developments to be delivered and the impacts of climate change to be mitigated.

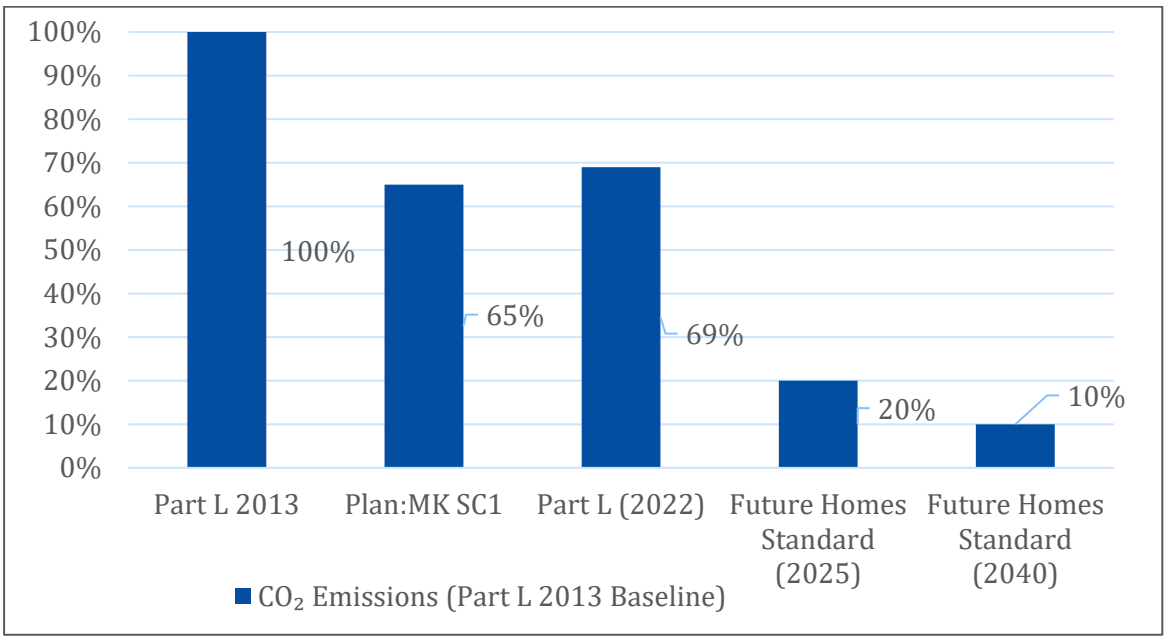
7.3 This Outline Energy Statement aims to ensure a standards-based approach is adopted, as well as accounting for a development timeline that is likely to span multiple changes in regulation and policy. As such, a prescriptive energy strategy to be adhered to across the site is not set out. Nonetheless, key future-proofing measures which will provide flexibility for the site to meet varying standards are set. For instance, no new home will be connected to the natural gas grid, with all heating requirements to originate from low or zero carbon sources. The most likely solution is the use of heat pumps, however alternatives may arise through future technological developments which later phases of the site could incorporate. Parameters for indicative specifications that are compliant with potential increases in standards are also provided, in order to demonstrate the long-term vision St James have for this site. Delivery against these potential standards with key future-proofing measures means an excellent level of energy performance will be obtained from the outset. Each development phase will detail a specific energy strategy through a Reserved Matters Energy Statement which intends to tie into the principles set out in this report.

7.4 The summary graph shown below outlines the improving carbon performance of a development complying with the escalating standards which are expected to come into effect. The presence of low or zero carbon heating in all homes should enable all initial MK East homes to significantly exceed the CO_2 reduction requirements of Policy SC1 of Plan:MK and the incoming Part L 2021 update (expected in 2022). For homes completed following the adoption of the Future Homes Standard (adoption planned for 2025) further uplifts in the build specification may be required. Indicative specifications have been used within this Energy Statement to provide an indication of the performance that could be achieved across these time periods.

7.5 Further regulatory and policy changes are anticipated into the 2030s. It is difficult to ascertain what these may be, however the Energy Statement does outline some possible directions these could take. The Summary Graph has added a potential carbon performance with the FHS specification but

with BEIS 2040 CO_2 emission factors. Additionally, the site may look to explore a number of ambitious energy infrastructure concepts, which will be outlined within this report.

7.6 St James are keen to demonstrate their commitment to building in low and zero carbon principles from the outset at MK East. Recently introduced Berkeley Group science-based targets align with Milton Keynes' Sustainability Strategy, both of which commit to adopting measures which assist in limiting warming to 1.5°C (as set out in the Paris Climate Agreement, 2015).



Summary Graph: Enhancing Carbon Performance of Site

7.7 The Summary Table below demonstrates how the indicative specifications within this document will enable substantial reductions in CO_2 emissions beyond the current build standards, achieving all policy and Part L standards. For clarity, Part L 2021 calculations have utilised SAP 10.1 emission factors, with FHS calculations using BEIS 2030 projected emission factors. The BEIS 2040 factors are only illustrative for the Summary Graph. Any remaining site CO_2 emissions will be offset via the Councils offsetting fund, to be calculated at the time of each Reserved Matters application.

Summary Table: Site CO_2 Performance				
	Regulated		Total	
Residential				
Baseline (Part L 2013)	7,696,400		13,777,500	
Indicative Site Emissions	Part L (2021)	FHS (2025)	Part L (2021)	FHS (2025)
	135,900	1,019,000	239,800	1,928,100
	1,154,900		2,167,900	
Reduction (%) over Baseline	85%		84%	
Non-Residential				
Baseline (Part L 2013)	409,400		1,365,500	
Indicative Site Emissions	Part L (2021)	FHS (2025)	Part L (2021)	FHS (2025)
	69,400	37,300	138,200	57,300
	106,700		195,500	
Reduction (%) over Baseline	74%		86%	

APPENDICES

Appendix A
Part L 2021 & FHS Calculations

Appendix B
TER and DER Worksheets

Appendix C
SBEM BRUKL Outputs

Appendix A

Part L 2021 & FHS Calculations

Appendix B - Part L 20201 FHS Calculations

SAP & SBEM Outputs per Dwelling Type Part L 2021

Description	Energy (kWh/yr)				Energy (kWh/m²/yr)		Regulated CO_2 (kg/m2/yr)		Total CO_2 (kg/m2/yr)	
	Space Heating	Hot Water	Regulated Electrical	Unregulated Appliances & Cooking	TFEE	DFEE	TER (SAP 2012)	DER	TER (SAP 2012)	DER
Residential										
1B2P MF ET	488	979	340	1,263	33.2	32.8	16.87	4.87	29.85	8.27
2B4P MF MT	581	1,108	482	1,825	33.4	32.2	15.00	4.04	27.97	7.44
3 Bed End	1,529	1,155	360	2,113	53.4	50.8	17.89	4.90	30.87	8.30
3B5P GF End	1,398	1,163	565	2,168	61.9	58.4	19.34	4.90	32.32	8.30
4 Bed Detached	2,890	1,234	487	3,500	60.1	56.4	16.70	4.48	29.68	7.88
4 Bed End Terrace	2,294	1,229	470	3,263	50.5	50.0	15.09	4.16	28.06	7.56
5 Bed Detached	4,368	1,254	595	5,175	61.0	57.8	15.36	4.08	28.34	7.48
Non-Residential										
Primary School	1.13	1.76	13.25	18.54			12.00	2.14	21.62	4.66
Retail	4.39	1.70	42.31	20.26			37.90	6.42	48.41	9.17
Pub	2.57	28.94	59.36	110.43			70.10	12.05	127.41	27.07
Office	4.86	0.68	22.45	42.19			19.00	3.71	40.90	9.45
Nursery	0.04	0.40	21.28	13.87			13.90	2.88	21.10	4.77
Large Retail	6.06	0.40	48.49	20.26			37.10	7.29	47.61	10.04
Health Centre	1.32	0.82	21.97	36.09			19.30	3.20	38.03	8.11
Gym	1.50	0.00	55.64	84.60			30.20	7.58	74.11	19.08

Site Calculations Part L 2021

Description	Unit Area (m2)	No. Units	Energy (kWh/yr)				Energy (kWh/yr)		Regulated CO_2 (kg/yr)		Total CO_2 (kg/m2/yr)	
			Space Heating	Hot Water	Regulated Electrical	Unregulated Appliances & Cooking	TFEE	DFEE	TER	DER	TER	DER
Residential												
1B2P MF ET	51	39	19,113	38,328	13,320	49,402	65,646	64,816	33,338	9,623	58,978	16,342
2B4P MF MT	73	59	34,076	65,026	28,267	107,120	143,155	138,013	64,267	17,322	119,862	31,890
3 Bed End	85	91	139,581	105,480	32,891	192,880	412,070	392,242	138,046	37,802	238,151	64,033
3B5P GF End	87	16	22,799	18,956	9,211	35,340	87,501	82,483	27,344	6,931	45,685	11,738
4 Bed Detached	140	36	103,669	44,256	17,473	125,543	301,807	283,226	83,883	22,494	149,040	39,568
4 Bed End Terrace	131	26	59,845	32,072	12,253	85,109	171,886	170,149	51,358	14,167	95,529	25,742
5 Bed Detached	207	33	142,450	40,875	19,389	168,750	411,818	390,420	103,703	27,569	191,284	50,519
TOTAL (Residential)			**521,531**	**344,993**	**132,803**	**764,144**	**1,593,881**	**1,521,348**	**501,939**	**135,909**	**898,530**	**239,832**
Area Weighted Average (/m2)							**52.1**	**49.8**	**16.42**	**4.45**	**29.4**	**7.8**
Improvement over Target							**4.6%**		**72.9%**		**73.3%**	
Non-Residential												
Primary School	3,000		3,390	5,280	39,750	55,620			36,000	6,420	64,867	13,985
Retail	2,000		8,780	3,400	84,620	40,520			75,800	12,836	96,830	18,346
Pub	1,000		2,570	28,940	59,360	110,430			70,100	12,049	127,413	27,068
Office	2,000		9,720	1,360	44,900	84,380			38,000	7,423	81,793	18,899
Nursery	2,000		80	800	42,560	27,740			27,800	5,760	42,197	9,533
Large Retail	1,500		9,090	600	72,735	30,390			55,650	10,930	71,422	15,063
Health Centre	2,000		2,640	1,640	43,940	72,180			38,600	6,394	76,061	16,210
Gym	1,000		1,500	0	55,640	84,600			30,200	7,577	74,107	19,082
TOTAL (Non-Residential)			**37,770**	**42,020**	**443,505**	**505,860**			**372,150**	**69,389**	**634,691**	**138,186**
Area Weighted Average (/m2)									**25.67**	**4.79**	**43.8**	**9.5**
Improvement over Target									**81.4%**		**78.2%**	

SAP & SBEM Outputs per Dwelling Type - BEIS 2030 (Future Homes Standard)

Description	Energy (kWh/yr)				Energy (kWh/m²/yr)		Regulated CO_2 (kg/m2/yr)		Total CO_2 (kg/m2/yr)	
	Space Heating	Hot Water	Regulated Electrical	Unregulated Appliances & Cooking	TFEE	DFEE	TER (SAP 2012)	DER	TER (SAP 2012)	DER
Residential										
1B2P MF ET	329	979	340	1,263	33.2	27.3	16.87	2.71	29.85	4.78
2B4P MF MT	417	1,108	482	1,825	33.4	27.4	15.00	2.28	27.97	4.36
3 Bed End	892	1,155	589	2,113	53.4	39.7	17.89	2.59	30.87	4.66
3B5P GF End	1,112	1,163	565	2,168	61.9	46.8	19.34	2.72	32.32	4.79
4 Bed Detached	1,648	1,234	955	3,500	60.1	45.6	16.70	2.27	29.68	4.35
4 Bed End Terrace	1,245	1,229	920	3,263	50.5	41.4	15.09	2.16	28.06	4.23
5 Bed Detached	2,517	1,254	1,170	5,175	61.0	47.6	15.36	1.98	28.34	4.06
Non-Residential										
Schools	0.62	1.76	11.24	18.54			12.00	1.10	21.62	1.70

Site Calculations BEIS 2030 (Future Homes Standard)

Description	Unit Area (m2)	No. Units	Energy (kWh/yr)				Energy (kWh/yr)		Regulated CO_2 (kg/yr)		Total CO_2 (kg/m2/yr)	
			Space Heating	Hot Water	Regulated Electrical	Unregulated Appliances & Cooking	TFEE	DFEE	TER	DER	TER	DER
Residential												
1B2P MF ET	51	561	184,417	549,363	190,916	708,098			477,845	76,750	845,348	135,522
2B4P MF MT	73	841	350,790	932,035	405,159	1,535,380			921,162	140,103	1,718,024	267,539
3 Bed End	85	1309	1,167,784	1,511,886	770,782	2,764,620			1,978,665	286,388	3,413,503	515,851
3B5P GF End	87	234	259,972	271,700	132,031	506,535			391,931	55,087	654,822	97,130
4 Bed Detached	140	514	847,360	634,333	491,167	1,799,457			1,202,323	163,747	2,136,241	313,102
4 Bed End Terrace	131	374	465,606	459,700	343,813	1,219,891			736,131	105,337	1,369,254	206,588
5 Bed Detached	207	467	1,176,193	585,877	546,673	2,418,750			1,486,409	191,626	2,741,740	392,382
TOTAL (Residential)			**4,452,121**	**4,944,894**	**2,880,542**	**10,952,731**			**7,194,466**	**1,019,037**	**12,878,933**	**1,928,114**
Area Weighted Average (/m2)									**235.38**	**33.34**	**421.4**	**63.1**
Improvement over Target									**85.8%**		**85.0%**	
Non-Residential												
Schools	33800		20,956	59,488	379,912	626,652			405,600	37,254	730,832	57,328
TOTAL (Non-Residential)			**20,956**	**59,488**	**379,912**	**626,652**			**405,600**	**37,254**	**730,832**	**57,328**
Area Weighted Average (/m2)									**12.00**	**1.10**	**21.6**	**1.7**
Improvement over Target									**90.8%**		**92.2%**	

HODKINSON

Appendix B

TER and DER Worksheets

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	3B5P GF End	**Issued on Date**	16/03/2021
Assessment Reference	2	**Prop Type Ref**	
Property	x, Balham, SW12 0JH		

SAP Rating	83 B	**DER**	18.71	**TER**	28.53
Environmental	85 B	**% DER<TER**	34.42		
CO_2 Emissions (t/year)	1.31	**DFEE**	58.35	**TFEE**	61.90
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.75		

Assessor Details	Mr. Jonathan Peck, Jonathan Peck, Tel: 02036031622, Jonathan@hodkinsonconsultancy.com	**Assessor ID**	T296-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Ground-floor flat, total floor area 87 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 28.53 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.71 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)61.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)58.3 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.36 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
Mitsubishi ECODAN 5kW PUHZ-W50VHA-BS

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: Measured cylinder loss: 1.50 kWh/day
Permitted by DBSCG 1.89 OK
Primary pipework insulated: Yes OK

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.60
Maximum 1.5 OK
MVHR efficiency: 88%
Minimum: 70% OK

---
9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 6.48 m², No overhang
Windows facing North East: 5.51 m², No overhang
Windows facing North West: 7.42 m², No overhang
Air change rate: 3.00 ach
Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Door U-value 1.00 W/m²K
Air permeability 3.0 m³/m²h

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	86.7000 (1b)	x	2.5000 (2b)	=	216.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	216.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	74.8000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2886	0.2854	0.2822	0.2663	0.2631	0.2471	0.2471	0.2439	0.2535	0.2631	0.2694	0.2758	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.2000	1.0000	2.2000			(26)
Opening Type 2 (Uw = 1.40)			19.4100	1.3258	25.7330			(27)
Floor 1			86.7000	0.1600	13.8720			(28a)
External	65.7000	21.6100	44.0900	0.1800	7.9362			(29a)
Sheltered	50.5000		50.5000	0.1800	9.0900			(29a)
Total net area of external elements Aum(A, m2)			202.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	58.8312			(33)
Party			23.7000	0.0000	0.0000			(32)
Party Ceiling 1			86.7000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	16.4684	(36)
Total fabric heat loss (33) + (36) =	75.2996	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.6402	20.4122	20.1842	19.0442	18.8162	17.6762	17.6762	17.4482	18.1322	18.8162	19.2722	19.7282	(38)
Heat transfer coeff	95.9397	95.7117	95.4837	94.3438	94.1158	92.9758	92.9758	92.7478	93.4318	94.1158	94.5717	95.0277	(39)
Average = Sum(39)m / 12 =												94.2868	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1066	1.1039	1.1013	1.0882	1.0855	1.0724	1.0724	1.0698	1.0776	1.0855	1.0908	1.0961	(40)
HLP (average)												1.0875	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5778 (42)
Average daily hot water use (litres/day)	95.4228 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.9651	101.1482	97.3313	93.5144	89.6975	85.8806	85.8806	89.6975	93.5144	97.3313	101.1482	104.9651	(44)
Energy conte	155.6603	136.1415	140.4858	122.4789	117.5214	101.4121	93.9732	107.8356	109.1235	127.1729	138.8192	150.7486	(45)
Energy content (annual)										Total = Sum(45)m =		1501.3730	(45)

Distribution loss (46)m = 0.15 x (45)m

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	23.3490	20.4212	21.0729	18.3718	17.6282	15.2118	14.0960	16.1753	16.3685	19.0759	20.8229	22.6123	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	204.0327	179.8327	188.8582	169.2909	165.8938	148.2241	142.3456	156.2080	155.9355	175.5453	185.6312	199.1210	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	204.0327	179.8327	188.8582	169.2909	165.8938	148.2241	142.3456	156.2080	155.9355	175.5453	185.6312	199.1210	(64)
								Total per year (kWh/year) = Sum(64)m =				2070.9190	(64)
Heat gains from water heating, kWh/month													
	90.4550	80.2200	85.4094	78.1738	77.7738	71.1691	69.9440	74.5533	73.7332	80.9829	83.6070	88.8218	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.7609	18.4396	14.9961	11.3530	8.4865	7.1647	7.7417	10.0629	13.5065	17.1495	20.0160	21.3379	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	232.8739	235.2904	229.2009	216.2371	199.8726	184.4922	174.2172	171.8007	177.8902	190.8540	207.2186	222.5989	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.8890	35.8890	35.8890	35.8890	35.8890	35.8890	35.8890	35.8890	35.8890	35.8890	35.8890	35.8890	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.1122	-103.1122	-103.1122	-103.1122	-103.1122	-103.1122	-103.1122	-103.1122	-103.1122	-103.1122	-103.1122	-103.1122	(71)
Water heating gains (Table 5)													
	121.5792	119.3750	114.7976	108.5748	104.5347	98.8460	94.0108	100.2060	102.4072	108.8480	116.1208	119.3842	(72)
Total internal gains													
	436.8811	434.7721	420.6617	397.8319	374.5608	352.1699	337.6367	343.7367	355.4709	378.5187	405.0225	424.9881	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4800	10.6334	0.4500	0.8000	0.7700	17.1903	(74)
Northeast	5.5100	11.2829	0.4500	0.8000	0.7700	15.5099	(75)
Northwest	7.4200	11.2829	0.4500	0.8000	0.7700	20.8863	(81)

Solar gains	53.5865	106.9371	189.3014	308.8759	415.4495	443.4474	414.5966	330.0577	229.7629	129.6439	67.0023	44.0537	(83)
Total gains	490.4676	541.7092	609.9631	706.7079	790.0103	795.6174	752.2333	673.7944	585.2337	508.1625	472.0248	469.0417	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	62.7564	62.9059	63.0561	63.8180	63.9726	64.7570	64.7570	64.9162	64.4410	63.9726	63.6642	63.3587	
alpha	5.1838	5.1937	5.2037	5.2545	5.2648	5.3171	5.3171	5.3277	5.2961	5.2648	5.2443	5.2239	
util living area													
	0.9985	0.9972	0.9921	0.9677	0.8801	0.7000	0.5339	0.6116	0.8789	0.9845	0.9970	0.9988	(86)
Tweekday	18.3701	18.5490	18.9022	19.4117	19.8173	19.9956	20.0204	20.0188	19.8982	19.3870	18.8043	18.3481	
Tweekend	20.2148	20.2932	20.4493	20.6759	20.8725	20.9729	20.9947	20.9897	20.9075	20.6609	20.4026	20.2023	
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9	
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	19.9955	19.9976	19.9998	20.0105	20.0127	20.0234	20.0234	20.0256	20.0191	20.0127	20.0084	20.0041	(88)
util rest of house													
	0.9980	0.9962	0.9892	0.9551	0.8363	0.6120	0.4206	0.4928	0.8164	0.9764	0.9958	0.9984	(89)
Tweekday	18.3701	18.5490	18.9022	19.4117	19.8173	19.9956	20.0204	20.0188	19.8982	19.3870	18.8043	18.3481	
Tweekend	18.3701	18.5490	18.9022	19.4117	19.8173	19.9956	20.0204	20.0188	19.8982	19.3870	18.8043	18.3481	
MIT 2	19.9955	19.9976	19.9998	20.0105	20.0127	20.0234	20.0234	20.0256	20.0191	20.0127	20.0084	20.0041	(90)
Living area fraction									fLA = Living area / (4) =			0.2031	(91)
MIT	20.1995	20.2012	20.2029	20.2115	20.2132	20.2218	20.2218	20.2235	20.2184	20.2132	20.2098	20.2063	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1995	20.2012	20.2029	20.2115	20.2132	20.2218	20.2218	20.2235	20.2184	20.2132	20.2098	20.2063	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9964	0.9898	0.9581	0.8462	0.6310	0.4442	0.5180	0.8311	0.9784	0.9961	0.9985	(94)
Useful gains	489.5384	539.7558	603.7716	677.0841	668.5408	502.0320	334.1322	349.0302	486.4049	497.1804	470.1734	468.3462	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1525.3939	1464.5055	1308.4062	1067.1685	801.2269	522.6913	336.7397	354.6232	571.6493	904.7542	1239.8144	1521.0470	(97)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	770.6765	621.4318	524.2482	280.8607	98.7185	0.0000	0.0000	0.0000	0.0000	303.2350	554.1415	783.2094	(98)
Space heating												3936.5215	(98)
Space heating per m2											(98) / (4) =	45.4039	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												281.5163	(206)
Efficiency of secondary/supplementary heating system, %												100.0000	(208)
Space heating requirement												1398.3283	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	770.6765	621.4318	524.2482	280.8607	98.7185	0.0000	0.0000	0.0000	0.0000	303.2350	554.1415	783.2094	(98)
Space heating efficiency (main heating system 1)													
	281.5163	281.5163	281.5163	281.5163	281.5163	0.0000	0.0000	0.0000	0.0000	281.5163	281.5163	281.5163	(210)
Space heating fuel (main heating system)													
	273.7591	220.7445	186.2231	99.7671	35.0667	0.0000	0.0000	0.0000	0.0000	107.7149	196.8417	278.2111	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	204.0327	179.8327	188.8582	169.2909	165.8938	148.2241	142.3456	156.2080	155.9355	175.5453	185.6312	199.1210	(64)
Efficiency of water heater												178.1250	(216)
(217)m	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	(217)
Fuel for water heating, kWh/month													
	114.5447	100.9587	106.0256	95.0405	93.1334	83.2135	79.9133	87.6957	87.5427	98.5518	104.2140	111.7873	(219)
Water heating fuel used												1162.6212	(219)
Annual totals kWh/year													
Space heating fuel - main system												1398.3283	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7500)													
mechanical ventilation fans (SFP = 0.7500)												198.3263	(230a)
Total electricity for the above, kWh/year												198.3263	(231)
Electricity for lighting (calculated in Appendix L)												366.6436	(232)
Total delivered energy for all uses												3125.9194	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1398.3283	0.5190	725.7324	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1162.6212	0.5190	603.4004	(264)
Space and water heating			1329.1328	(265)
Pumps and fans	198.3263	0.5190	102.9313	(267)
Energy for lighting	366.6436	0.5190	190.2881	(268)
Total CO2, kg/year			1622.3521	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.7100	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		18.7100	ZC1
Total Floor Area	TFA	86.7000	
Assumed number of occupants	N	2.5778	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.9165	ZC2
CO2 emissions from cooking, equation (L16)		2.0861	ZC3
Total CO2 emissions		36.7126	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		36.7126	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	86.7000 (1b)	x	2.5000 (2b)	=	216.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	216.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1384	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3884	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3301	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4209	0.4127	0.4044	0.3632	0.3549	0.3136	0.3136	0.3054	0.3301	0.3549	0.3714	0.3879	(22b)
Effective ac	0.5886	0.5852	0.5818	0.5659	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.2000	1.0000	2.2000			(26)
TER Opening Type (Uw = 1.40)			19.4100	1.3258	25.7330			(27)
Floor 1			86.7000	0.1300	11.2710			(28a)
External	65.7000	21.6100	44.0900	0.1800	7.9362			(29a)
Sheltered	50.5000		50.5000	0.1800	9.0900			(29a)
Total net area of external elements Aum(A, m2)			202.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.2302			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.6609	(36)
Total fabric heat loss					(33) + (36) =		67.8911	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.1007	41.8546	41.6134	40.4805	40.2685	39.2818	39.2818	39.0991	39.6619	40.2685	40.6973	41.1456	(38)
Heat transfer coeff	109.9917	109.7457	109.5045	108.3716	108.1596	107.1729	107.1729	106.9902	107.5529	108.1596	108.5884	109.0367	(39)
Average = Sum(39)m / 12 =												108.3705	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2686	1.2658	1.2630	1.2500	1.2475	1.2361	1.2361	1.2340	1.2405	1.2475	1.2525	1.2576	(40)
HLP (average)												1.2499	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.5778 (42)
Average daily hot water use (litres/day)		95.4228 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.9651	101.1482	97.3313	93.5144	89.6975	85.8806	85.8806	89.6975	93.5144	97.3313	101.1482	104.9651	(44)
Energy conte	155.6603	136.1415	140.4858	122.4789	117.5214	101.4121	93.9732	107.8356	109.1235	127.1729	138.8192	150.7486	(45)
Energy content (annual)										Total = Sum(45)m =		1501.3730	(45)
Distribution loss (46)m = 0.15 x (45)m	23.3490	20.4212	21.0729	18.3718	17.6282	15.2118	14.0960	16.1753	16.3685	19.0759	20.8229	22.6123	(46)

Water storage loss:		
Store volume		150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.3938 (48)
Temperature factor from Table 2b		0.5400 (49)
Enter (49) or (54) in (55)		0.7527 (55)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss
23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 (56)
If cylinder contains dedicated solar storage
23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
202.2552 178.2272 187.0807 167.5708 164.1163 146.5039 140.5681 154.4305 154.2153 173.7678 183.9110 197.3436 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
202.2552 178.2272 187.0807 167.5708 164.1163 146.5039 140.5681 154.4305 154.2153 173.7678 183.9110 197.3436 (64)
Total per year (kWh/year) = Sum(64)m = 2049.9904 (64)
Heat gains from water heating, kWh/month
89.0330 78.9356 83.9874 76.7977 76.3518 69.7930 68.5220 73.1313 72.3570 79.5609 82.2309 87.3998 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
20.7594 18.4383 14.9950 11.3522 8.4859 7.1642 7.7411 10.0622 13.5055 17.1483 20.0146 21.3363 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
232.8739 235.2904 229.2009 216.2371 199.8726 184.4922 174.2172 171.8007 177.8902 190.8540 207.2186 222.5989 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
35.8890 35.8890 35.8890 35.8890 35.8890 35.8890 35.8890 35.8890 35.8890 35.8890 35.8890 35.8890 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-103.1122 -103.1122 -103.1122 -103.1122 -103.1122 -103.1122 -103.1122 -103.1122 -103.1122 -103.1122 -103.1122 -103.1122 (71)
Water heating gains (Table 5)
119.6680 117.4637 112.8864 106.6635 102.6234 96.9347 92.0995 98.2947 100.4959 106.9367 114.2095 117.4729 (72)
Total internal gains
437.9683 435.8595 421.7494 398.9198 375.6489 353.2581 338.7248 344.8247 356.5586 379.6061 406.1097 426.0752 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4800	10.6334	0.6300	0.7000	0.7700	21.0581	(74)
Northeast	5.5100	11.2829	0.6300	0.7000	0.7700	18.9997	(75)
Northwest	7.4200	11.2829	0.6300	0.7000	0.7700	25.5857	(81)

Solar gains 65.6435 130.9979 231.8942 378.3730 508.9256 543.2231 507.8808 404.3207 281.4595 158.8138 82.0778 53.9657 (83)
Total gains 503.6118 566.8574 653.6436 777.2928 884.5745 896.4813 846.6056 749.1453 638.0181 538.4199 488.1876 480.0410 (84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.7390	54.8617	54.9825	55.5573	55.6662	56.1787	56.1787	56.2746	55.9802	55.6662	55.4464	55.2184	
alpha	4.6493	4.6574	4.6655	4.7038	4.7111	4.7452	4.7452	4.7516	4.7320	4.7111	4.6964	4.6812	
util living area	0.9982	0.9966	0.9906	0.9633	0.8734	0.7009	0.5411	0.6233	0.8816	0.9835	0.9966	0.9986	(86)
MIT	19.5854	19.7249	20.0020	20.4016	20.7517	20.9386	20.9856	20.9731	20.8086	20.3664	19.9123	19.5632	(87)
Th 2	19.8655	19.8677	19.8699	19.8802	19.8822	19.8912	19.8912	19.8929	19.8877	19.8822	19.8783	19.8742	(88)
util rest of house	0.9976	0.9954	0.9870	0.9487	0.8251	0.6041	0.4128	0.4895	0.8152	0.9746	0.9952	0.9981	(89)
MIT 2	17.9869	18.1921	18.5969	19.1751	19.6404	19.8513	19.8861	19.8819	19.7279	19.1352	18.4738	17.9604	(90)
Living area fraction									fLA = Living area / (4) =			0.2031	(91)
MIT	18.3116	18.5034	18.8823	19.4242	19.8661	20.0721	20.1095	20.1036	19.9474	19.3853	18.7660	18.2859	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3116	18.5034	18.8823	19.4242	19.8661	20.0721	20.1095	20.1036	19.9474	19.3853	18.7660	18.2859	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9932	0.9825	0.9409	0.8243	0.6211	0.4390	0.5165	0.8196	0.9690	0.9930	0.9970	(94)
Useful gains	501.7383	562.9746	642.2103	731.3633	729.1360	556.8005	371.6275	386.9553	522.8898	521.7076	484.7660	478.6130	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1541.1556	1492.9184	1355.9129	1140.5266	883.2406	586.4640	376.1180	396.2455	628.9094	950.2112	1266.7931	1535.8806	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	773.3265	624.9222	530.9948	294.5976	114.6538	0.0000	0.0000	0.0000	0.0000	318.8067	563.0595	786.6071	(98)
Space heating												4006.9682	(98)
Space heating per m2											(98) / (4) =	46.2165	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4285.5275	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	773.3265	624.9222	530.9948	294.5976	114.6538	0.0000	0.0000	0.0000	0.0000	318.8067	563.0595	786.6071	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	827.0871	668.3660	567.9088	315.0776	122.6244	0.0000	0.0000	0.0000	0.0000	340.9697	602.2027	841.2910	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.2552	178.2272	187.0807	167.5708	164.1163	146.5039	140.5681	154.4305	154.2153	173.7678	183.9110	197.3436	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.0523	87.8850	87.4452	86.3042	83.8788	79.8000	79.8000	79.8000	79.8000	86.4125	87.6078	88.1300	(217)
Fuel for water heating, kWh/month													
	229.6989	202.7959	213.9404	194.1628	195.6590	183.5889	176.1505	193.5219	193.2523	201.0910	209.9254	223.9233	(219)
Water heating fuel used												2417.7103	(219)
Annual totals kWh/year													
Space heating fuel - main system												4285.5275	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												366.6167	(232)
Total delivered energy for all uses												7144.8546	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4285.5275	0.2160	925.6739	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2417.7103	0.2160	522.2254	(264)
Space and water heating			1447.8994	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	366.6167	0.5190	190.2741	(268)
Total CO2, kg/m2/year			1677.0985	(272)
Emissions per m2 for space and water heating			16.7001	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.1946	(272b)
Emissions per m2 for pumps and fans			0.4490	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.7001 * 1.55) + 2.1946 + 0.4490, rounded to 2 d.p.			28.5300	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	3 Bed End	**Issued on Date**	16/03/2021
Assessment Reference	3	**Prop Type Ref**	
Property	Type 2 End, Stratford-upon-Avon, CV36		

SAP Rating	86 B	**DER**	16.19	**TER**	26.26
Environmental	87 B	**% DER<TER**	38.36		
CO_2 Emissions (t/year)	1.17	**DFEE**	39.74	**TFEE**	53.41
General Requirements Compliance	Pass	**% DFEE<TFEE**	25.60		

Assessor Details	Mr. Jonathan Peck, Jonathan Peck, Tel: 02036031622, Jonathan@hodkinsonconsultancy.com	**Assessor ID**	T296-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 85 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 26.26 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.19 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)39.7 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.18 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
Mitsubishi ECODAN 5kW PUHZ-W50VHA-BS

Secondary heating system: None

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5 Cylinder insulation
Hot water storage: Measured cylinder loss: 1.50 kWh/day
Permitted by DBSCG 1.89 OK
Primary pipework insulated: Yes OK

---

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

---

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

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8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.71
Maximum 1.5 OK
MVHR efficiency: 86%
Minimum: 70% OK

---

9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.84 m², No overhang
Windows facing East: 3.27 m², No overhang
Windows facing South: 6.49 m², No overhang
Windows facing West: 0.70 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

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10 Key features

Party wall U-value	0.00 W/m²K
Roof U-value	0.10 W/m²K
Floor U-value	0.10 W/m²K
Door U-value	1.00 W/m²K
Thermal bridging y-value	0.038 W/m²K
Air permeability	3.0 m³/m²h

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	42.2500 (1b)	x	2.3900 (2b)	=	100.9775	(1b) - (3b)
First floor	42.2500 (1c)	x	2.6100 (2c)	=	110.2725	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	211.2500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							0 * 10	=	0.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			0.0000 / (5) =	0.0000	(8)
Pressure test				Yes	
Measured/design AP50				3.0000	
Infiltration rate				0.1500	(18)
Number of sides sheltered				1	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.1388	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1769	0.1734	0.1700	0.1526	0.1492	0.1318	0.1318	0.1283	0.1388	0.1492	0.1561	0.1630	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	73.1000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3114	0.3079	0.3045	0.2871	0.2837	0.2663	0.2663	0.2628	0.2733	0.2837	0.2906	0.2975	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.20)			18.3000	1.1450	20.9542			(27)
Ground Floor			42.2500	0.1000	4.2250			(28a)
External Wall	92.0000	20.4200	71.5800	0.1500	10.7370			(29a)
Main Roof	42.2500		42.2500	0.1000	4.2250			(30)
Total net area of external elements Aum(A, m2)			176.5000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	42.2612			(33)
Party Wall			44.5000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.6805	(36)
Total fabric heat loss (33) + (36) =	48.9417	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	21.7089	21.4671	21.2253	20.0162	19.7744	18.5653	18.5653	18.3235	19.0489	19.7744	20.2580	20.7416	(38)
Heat transfer coeff	70.6506	70.4088	70.1670	68.9579	68.7161	67.5070	67.5070	67.2652	67.9907	68.7161	69.1997	69.6834	(39)
Average = Sum(39)m / 12 =												68.8975	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8361	0.8332	0.8304	0.8161	0.8132	0.7989	0.7989	0.7960	0.8046	0.8132	0.8189	0.8247	(40)
HLP (average)												0.8154	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5427 (42)
Average daily hot water use (litres/day)	94.5897 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.0486	100.2650	96.4815	92.6979	88.9143	85.1307	85.1307	88.9143	92.6979	96.4815	100.2650	104.0486	(44)
Energy conte	154.3011	134.9527	139.2591	121.4095	116.4953	100.5266	93.1527	106.8940	108.1707	126.0625	137.6071	149.4324	(45)
Energy content (annual)										Total = Sum(45)m =		1488.2637	(45)

Distribution loss (46)m = 0.15 x (45)m

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	23.1452	20.2429	20.8889	18.2114	17.4743	15.0790	13.9729	16.0341	16.2256	18.9094	20.6411	22.4149	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	202.6735	178.6439	187.6315	168.2215	164.8677	147.3386	141.5251	155.2664	154.9827	174.4349	184.4191	197.8048	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.6735	178.6439	187.6315	168.2215	164.8677	147.3386	141.5251	155.2664	154.9827	174.4349	184.4191	197.8048	(64)
								Total per year (kWh/year) = Sum(64)m =				2057.8097	(64)
Heat gains from water heating, kWh/month													
	90.0030	79.8247	85.0016	77.8183	77.4326	70.8747	69.6712	74.2402	73.4164	80.6137	83.2040	88.3842	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.3982	18.1175	14.7342	11.1547	8.3383	7.0395	7.6064	9.8872	13.2705	16.8500	19.6664	20.9651	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	228.5881	230.9601	224.9827	212.2575	196.1941	181.0968	171.0109	168.6389	174.6163	187.3416	203.4049	218.5022	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	(71)
Water heating gains (Table 5)													
	120.9718	118.7868	114.2494	108.0809	104.0761	98.4371	93.6441	99.7852	101.9672	108.3518	115.5610	118.7959	(72)
Total internal gains													
	431.0990	429.0053	415.1071	392.6339	369.7493	347.7142	333.4022	339.4521	350.9948	373.6841	399.7732	419.4041	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.8400	10.6334	0.4500	0.7000	0.7700	18.1983	(74)
East	3.2700	19.6403	0.4500	0.7000	0.7700	14.0197	(76)
South	6.4900	46.7521	0.4500	0.7000	0.7700	66.2353	(78)
West	0.7000	19.6403	0.4500	0.7000	0.7700	3.0012	(80)

Solar gains	101.4545	176.5507	252.1103	331.0694	388.6224	393.8368	376.3467	332.0529	279.1724	197.9095	122.1844	86.4015	(83)
Total gains	532.5535	605.5560	667.2174	723.7033	758.3717	741.5511	709.7490	671.5049	630.1673	571.5936	521.9576	505.8057	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	83.0574	83.3426	83.6298	85.0962	85.3956	86.9251	86.9251	87.2376	86.3068	85.3956	84.7988	84.2103	
alpha	6.5372	6.5562	6.5753	6.6731	6.6930	6.7950	6.7950	6.8158	6.7538	6.6930	6.6533	6.6140	
util living area													
	0.9970	0.9923	0.9776	0.9228	0.7851	0.5763	0.4178	0.4595	0.7156	0.9453	0.9921	0.9978	(86)
Tweekday	19.3914	19.5425	19.7574	20.0106	20.1462	20.1929	20.1954	20.1979	20.1783	20.0081	19.6668	19.3764	
Tweekend	20.6022	20.6685	20.7643	20.8780	20.9486	20.9714	20.9738	20.9737	20.9635	20.8736	20.7189	20.5919	
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9	
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	20.2222	20.2246	20.2271	20.2394	20.2419	20.2543	20.2543	20.2568	20.2493	20.2419	20.2370	20.2320	(88)
util rest of house													
	0.9960	0.9899	0.9707	0.9008	0.7374	0.5120	0.3474	0.3860	0.6489	0.9247	0.9892	0.9971	(89)
Tweekday	19.3914	19.5425	19.7574	20.0106	20.1462	20.1929	20.1954	20.1979	20.1783	20.0081	19.6668	19.3764	
Tweekend	19.3914	19.5425	19.7574	20.0106	20.1462	20.1929	20.1954	20.1979	20.1783	20.0081	19.6668	19.3764	
MIT 2	20.2222	20.2246	20.2271	20.2394	20.2419	20.2543	20.2543	20.2568	20.2493	20.2419	20.2370	20.2320	(90)
Living area fraction										fLA = Living area / (4) =		0.2639	(91)
MIT	20.4274	20.4292	20.4311	20.4401	20.4420	20.4511	20.4511	20.4529	20.4474	20.4420	20.4383	20.4347	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4274	20.4292	20.4311	20.4401	20.4420	20.4511	20.4511	20.4529	20.4474	20.4420	20.4383	20.4347	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9906	0.9727	0.9071	0.7506	0.5292	0.3660	0.4055	0.6672	0.9308	0.9901	0.9973	(94)
Useful gains	530.5818	599.8777	649.0140	656.4661	569.2256	392.4153	259.7962	272.2721	420.4260	532.0445	516.7809	504.4399	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	1139.4133	1093.3958	977.5007	795.7846	600.7140	394.9894	259.9753	272.6200	431.5663	676.3017	923.0088	1131.2881	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	452.9706	331.6441	244.3941	100.3093	23.4274	0.0000	0.0000	0.0000	0.0000	107.3274	292.4841	466.3751	(98)
Space heating												2018.9322	(98)
Space heating per m2											(98) / (4) =	23.8927	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												226.2549	(206)
Efficiency of secondary/supplementary heating system, %												100.0000	(208)
Space heating requirement												892.3265	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	452.9706	331.6441	244.3941	100.3093	23.4274	0.0000	0.0000	0.0000	0.0000	107.3274	292.4841	466.3751	(98)
Space heating efficiency (main heating system 1)													
	226.2549	226.2549	226.2549	226.2549	226.2549	0.0000	0.0000	0.0000	0.0000	226.2549	226.2549	226.2549	(210)
Space heating fuel (main heating system)													
	200.2037	146.5799	108.0172	44.3347	10.3544	0.0000	0.0000	0.0000	0.0000	47.4365	129.2719	206.1282	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.6735	178.6439	187.6315	168.2215	164.8677	147.3386	141.5251	155.2664	154.9827	174.4349	184.4191	197.8048	(64)
Efficiency of water heater												178.1250	(216)
(217)m	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	(217)
Fuel for water heating, kWh/month													
	113.7816	100.2913	105.3370	94.4401	92.5573	82.7164	79.4527	87.1671	87.0078	97.9284	103.5335	111.0483	(219)
Water heating fuel used												1155.2616	(219)
Annual totals kWh/year													
Space heating fuel - main system												892.3265	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.8875)													
mechanical ventilation fans (SFP = 0.8875)												228.7309	(230a)
Total electricity for the above, kWh/year												228.7309	(231)
Electricity for lighting (calculated in Appendix L)												360.2389	(232)
Total delivered energy for all uses												2636.5579	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	892.3265	0.5190	463.1174	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1155.2616	0.5190	599.5807	(264)
Space and water heating			1062.6982	(265)
Pumps and fans	228.7309	0.5190	118.7114	(267)
Energy for lighting	360.2389	0.5190	186.9640	(268)
Total CO2, kg/year			1368.3736	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.1900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		16.1900	ZC1
Total Floor Area	TFA	84.5000	
Assumed number of occupants	N	2.5427	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.0304	ZC2
CO2 emissions from cooking, equation (L16)		2.1305	ZC3
Total CO2 emissions		34.3508	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.3508	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	42.2500 (1b)	x	2.3900 (2b)	=	100.9775	(1b) - (3b)
First floor	42.2500 (1c)	x	2.6100 (2c)	=	110.2725	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	211.2500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1420	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3920	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3626	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4623	0.4533	0.4442	0.3989	0.3898	0.3445	0.3445	0.3354	0.3626	0.3898	0.4079	0.4261	(22b)
Effective ac	0.6069	0.6027	0.5987	0.5795	0.5760	0.5593	0.5593	0.5563	0.5657	0.5760	0.5832	0.5908	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			18.3000	1.3258	24.2614			(27)
Ground Floor			42.2500	0.1300	5.4925			(28a)
External Wall	92.0000	20.4200	71.5800	0.1800	12.8844			(29a)
Main Roof	42.2500		42.2500	0.1300	5.4925			(30)
Total net area of external elements Aum(A, m2)			176.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.2508			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.5805	(36)
Total fabric heat loss (33) + (36) =	60.8313	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.3067	42.0174	41.7338	40.4018	40.1526	38.9925	38.9925	38.7777	39.4394	40.1526	40.6568	41.1838	(38)
Heat transfer coeff	103.1380	102.8487	102.5651	101.2331	100.9839	99.8238	99.8238	99.6090	100.2706	100.9839	101.4880	102.0151	(39)
Average = Sum(39)m / 12 =												101.2319	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2206	1.2171	1.2138	1.1980	1.1951	1.1813	1.1813	1.1788	1.1866	1.1951	1.2010	1.2073	(40)
HLP (average)												1.1980	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5427 (42)
Average daily hot water use (litres/day)	94.5897 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.0486	100.2650	96.4815	92.6979	88.9143	85.1307	85.1307	88.9143	92.6979	96.4815	100.2650	104.0486	(44)
Energy conte	154.3011	134.9527	139.2591	121.4095	116.4953	100.5266	93.1527	106.8940	108.1707	126.0625	137.6071	149.4324	(45)
Energy content (annual)										Total = Sum(45)m =		1488.2637	(45)
Distribution loss (46)m = 0.15 x (45)m	23.1452	20.2429	20.8889	18.2114	17.4743	15.0790	13.9729	16.0341	16.2256	18.9094	20.6411	22.4149	(46)

Water storage loss:	
Store volume	150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3938 (48)
Temperature factor from Table 2b	0.5400 (49)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55) 0.7527 (55)

Total storage loss

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)

If cylinder contains dedicated solar storage

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

Total heat required for water heating calculated for each month

	200.8960	177.0384	185.8540	166.5013	163.0902	145.6184	139.7476	153.4889	153.2625	172.6574	182.6989	196.0273 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	200.8960	177.0384	185.8540	166.5013	163.0902	145.6184	139.7476	153.4889	153.2625	172.6574	182.6989	196.0273 (64)

Total per year (kWh/year) = Sum(64)m = 2036.8811 (64)

Heat gains from water heating, kWh/month

	88.5810	78.5404	83.5796	76.4421	76.0106	69.4986	68.2492	72.8182	72.0402	79.1917	81.8278	86.9622 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.3982	18.1175	14.7342	11.1547	8.3383	7.0395	7.6064	9.8872	13.2705	16.8500	19.6664	20.9651	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	228.5881	230.9601	224.9827	212.2575	196.1941	181.0968	171.0109	168.6389	174.6163	187.3416	203.4049	218.5022	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	(71)

Water heating gains (Table 5)

	119.0605	116.8755	112.3381	106.1696	102.1648	96.5258	91.7328	97.8739	100.0559	106.4405	113.6498	116.8847	(72)

Total internal gains

	432.1877	430.0940	416.1959	393.7226	370.8380	348.8030	334.4910	340.5408	352.0835	374.7728	400.8619	420.4929	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.8400	10.6334	0.6300	0.7000	0.7700	25.4777	(74)
East	3.2700	19.6403	0.6300	0.7000	0.7700	19.6276	(76)
South	6.4900	46.7521	0.6300	0.7000	0.7700	92.7294	(78)
West	0.7000	19.6403	0.6300	0.7000	0.7700	4.2016	(80)

Solar gains	142.0363	247.1709	352.9544	463.4972	544.0714	551.3715	526.8854	464.8740	390.8414	277.0733	171.0581	120.9621	(83)
Total gains	574.2240	677.2650	769.1502	857.2198	914.9094	900.1745	861.3764	805.4148	742.9250	651.8461	571.9201	541.4550	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8952	57.0552	57.2130	57.9658	58.1088	58.7841	58.7841	58.9109	58.5222	58.1088	57.8202	57.5214	
alpha	4.7930	4.8037	4.8142	4.8644	4.8739	4.9189	4.9189	4.9274	4.9015	4.8739	4.8547	4.8348	
util living area													
	0.9965	0.9919	0.9794	0.9397	0.8404	0.6658	0.5006	0.5531	0.7997	0.9605	0.9925	0.9974	(86)
MIT	19.7379	19.9195	20.1937	20.5379	20.8123	20.9563	20.9912	20.9859	20.8921	20.5324	20.0717	19.7089	(87)
Th 2	19.9036	19.9063	19.9090	19.9216	19.9239	19.9350	19.9350	19.9370	19.9307	19.9239	19.9192	19.9142	(88)
util rest of house													
	0.9954	0.9892	0.9722	0.9183	0.7873	0.5725	0.3843	0.4332	0.7185	0.9421	0.9895	0.9965	(89)
MIT 2	18.2357	18.5016	18.8992	19.3914	19.7460	19.9071	19.9319	19.9315	19.8485	19.3952	18.7336	18.2008	(90)
Living area fraction									fLA = Living area / (4) =			0.2639	(91)
MIT	18.6321	18.8758	19.2408	19.6939	20.0274	20.1840	20.2114	20.2098	20.1239	19.6953	19.0867	18.5988	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6321	18.8758	19.2408	19.6939	20.0274	20.1840	20.2114	20.2098	20.1239	19.6953	19.0867	18.5988	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9934	0.9856	0.9664	0.9128	0.7930	0.5955	0.4151	0.4650	0.7349	0.9370	0.9863	0.9949	(94)
Useful gains	570.4301	667.4996	743.2964	782.4899	725.5079	536.0738	357.6002	374.5078	545.9573	610.7939	564.0587	538.7032	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1478.1886	1437.3939	1306.7616	1092.7044	840.9324	557.4141	360.5057	379.4872	604.0177	918.4798	1216.5113	1468.8938	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	675.3723	517.3690	419.2181	223.3545	85.8758	0.0000	0.0000	0.0000	0.0000	228.9183	469.7659	692.0618	(98)
Space heating												3311.9357	(98)
Space heating per m2											(98) / (4) =	39.1945	(99)

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3542.1772	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	675.3723	517.3690	419.2181	223.3545	85.8758	0.0000	0.0000	0.0000	0.0000	228.9183	469.7659	692.0618	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	722.3233	553.3358	448.3616	238.8818	91.8458	0.0000	0.0000	0.0000	0.0000	244.8324	502.4234	740.1731	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	200.8960	177.0384	185.8540	166.5013	163.0902	145.6184	139.7476	153.4889	153.2625	172.6574	182.6989	196.0273	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.8009	87.5085	86.9201	85.5982	83.1927	79.8000	79.8000	79.8000	79.8000	85.5671	87.2251	87.8985	(217)
Fuel for water heating, kWh/month													
	228.8085	202.3099	213.8216	194.5151	196.0390	182.4792	175.1222	192.3420	192.0583	201.7802	209.4569	223.0155	(219)
Water heating fuel used												2411.7484	(219)
Annual totals kWh/year													
Space heating fuel - main system												3542.1772	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												360.2389	(232)
Total delivered energy for all uses												6389.1646	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3542.1772	0.2160	765.1103	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2411.7484	0.2160	520.9377	(264)
Space and water heating			1286.0479	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	360.2389	0.5190	186.9640	(268)
Total CO2, kg/m2/year			1511.9369	(272)
Emissions per m2 for space and water heating			15.2195	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.2126	(272b)
Emissions per m2 for pumps and fans			0.4607	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2195 * 1.55) + 2.2126 + 0.4607, rounded to 2 d.p.			26.2600	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	3 Bed End	**Issued on Date**	16/03/2021
Assessment Reference	2	**Prop Type Ref**	
Property	Type 2 End, Stratford-upon-Avon, CV36		

SAP Rating	84 B	**DER**	18.70	**TER**	26.26
Environmental	85 B	**% DER<TER**	28.80		
CO_2 Emissions (t/year)	1.37	**DFEE**	50.84	**TFEE**	53.41
General Requirements Compliance	Pass	**% DFEE<TFEE**	4.81		

Assessor Details	Mr. Jonathan Peck, Jonathan Peck, Tel: 02036031622, Jonathan@hodkinsonconsultancy.com	**Assessor ID**	T296-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Semi-Detached House, total floor area 85 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 26.26 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.70 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)53.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.8 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.11 (max. 0.20)	0.11 (max. 0.35)	OK
Openings	1.39 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

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3 Air permeability
Air permeability at 50 pascals: 5.00 (design value)
Maximum 10.0 OK

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4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
Mitsubishi ECODAN 5kW PUHZ-W50VHA-BS

Secondary heating system: None

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5 Cylinder insulation
Hot water storage: Measured cylinder loss: 1.50 kWh/day
Permitted by DBSCG 1.89 OK
Primary pipework insulated: Yes OK

---

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

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7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---

8 Mechanical ventilation
Not applicable

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9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing North: 7.84 m², No overhang
Windows facing East: 3.27 m², No overhang
Windows facing South: 6.49 m², No overhang
Windows facing West: 0.70 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

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10 Key features
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	42.2500	(1b)	x 2.3900	(2b) =	100.9775	(1b) - (3b)
First floor	42.2500	(1c)	x 2.6100	(2c) =	110.2725	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		211.2500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1420	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3920	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3626	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4623	0.4533	0.4442	0.3989	0.3898	0.3445	0.3445	0.3354	0.3626	0.3898	0.4079	0.4261	(22b)
Effective ac	0.6069	0.6027	0.5987	0.5795	0.5760	0.5593	0.5593	0.5563	0.5657	0.5760	0.5832	0.5908	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.3000	2.7560			(26)
Opening Type 2 (Uw = 1.40)			18.3000	1.3258	24.2614			(27)
Ground Floor			42.2500	0.1600	6.7600			(28a)
External Wall	92.0000	20.4200	71.5800	0.1800	12.8844			(29a)
Main Roof	42.2500		42.2500	0.1100	4.6475			(30)
Total net area of external elements Aum(A, m2)			176.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		51.3093			(33)
Party Wall			44.5000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.1386	(36)
Total fabric heat loss (33) + (36) =	62.4479	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.3067	42.0174	41.7338	40.4018	40.1526	38.9925	38.9925	38.7777	39.4394	40.1526	40.6568	41.1838	(38)
Heat transfer coeff	104.7546	104.4653	104.1817	102.8497	102.6005	101.4404	101.4404	101.2256	101.8873	102.6005	103.1047	103.6317	(39)
Average = Sum(39)m / 12 =												102.8485	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2397	1.2363	1.2329	1.2172	1.2142	1.2005	1.2005	1.1979	1.2058	1.2142	1.2202	1.2264	(40)
HLP (average)												1.2171	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5427 (42)
Average daily hot water use (litres/day)	94.5897 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.0486	100.2650	96.4815	92.6979	88.9143	85.1307	85.1307	88.9143	92.6979	96.4815	100.2650	104.0486	(44)
Energy conte	154.3011	134.9527	139.2591	121.4095	116.4953	100.5266	93.1527	106.8940	108.1707	126.0625	137.6071	149.4324	(45)
Energy content (annual)										Total = Sum(45)m =		1488.2637	(45)
Distribution loss (46)m = 0.15 x (45)m	23.1452	20.2429	20.8889	18.2114	17.4743	15.0790	13.9729	16.0341	16.2256	18.9094	20.6411	22.4149	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	202.6735	178.6439	187.6315	168.2215	164.8677	147.3386	141.5251	155.2664	154.9827	174.4349	184.4191	197.8048	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	202.6735	178.6439	187.6315	168.2215	164.8677	147.3386	141.5251	155.2664	154.9827	174.4349	184.4191	197.8048	(64)
									Total per year (kWh/year) = Sum(64)m =			2057.8097	(64)
Heat gains from water heating, kWh/month													
	90.0030	79.8247	85.0016	77.8183	77.4326	70.8747	69.6712	74.2402	73.4164	80.6137	83.2040	88.3842	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.3982	18.1175	14.7342	11.1547	8.3383	7.0395	7.6064	9.8872	13.2705	16.8500	19.6664	20.9651	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	228.5881	230.9601	224.9827	212.2575	196.1941	181.0968	171.0109	168.6389	174.6163	187.3416	203.4049	218.5022	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	(71)
Water heating gains (Table 5)													
	120.9718	118.7868	114.2494	108.0809	104.0761	98.4371	93.6441	99.7852	101.9672	108.3518	115.5610	118.7959	(72)
Total internal gains													
	431.0990	429.0053	415.1071	392.6339	369.7493	347.7142	333.4022	339.4521	350.9948	373.6841	399.7732	419.4041	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.8400	10.6334	0.4500	0.7000	0.7700	18.1983	(74)
East	3.2700	19.6403	0.4500	0.7000	0.7700	14.0197	(76)
South	6.4900	46.7521	0.4500	0.7000	0.7700	66.2353	(78)
West	0.7000	19.6403	0.4500	0.7000	0.7700	3.0012	(80)

Solar gains	101.4545	176.5507	252.1103	331.0694	388.6224	393.8368	376.3467	332.0529	279.1724	197.9095	122.1844	86.4015	(83)
Total gains	532.5535	605.5560	667.2174	723.7033	758.3717	741.5511	709.7490	671.5049	630.1673	571.5936	521.9576	505.8057	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.0172	56.1723	56.3252	57.0546	57.1932	57.8473	57.8473	57.9701	57.5936	57.1932	56.9136	56.6241	
alpha	4.7345	4.7448	4.7550	4.8036	4.8129	4.8565	4.8565	4.8647	4.8396	4.8129	4.7942	4.7749	
util living area													
	0.9975	0.9950	0.9884	0.9677	0.9078	0.7699	0.6026	0.6529	0.8707	0.9764	0.9950	0.9981	(86)
Tweekday	18.1230	18.3452	18.7091	19.1968	19.6131	19.8597	19.9119	19.9089	19.7753	19.2587	18.6150	18.0969	
Tweekend	20.1388	20.2365	20.3976	20.6137	20.8113	20.9442	20.9867	20.9806	20.8902	20.6385	20.3517	20.1240	
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9	
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	19.8884	19.8911	19.8938	19.9063	19.9087	19.9196	19.9196	19.9217	19.9154	19.9087	19.9039	19.8989	(88)
util rest of house													
	0.9966	0.9932	0.9841	0.9546	0.8683	0.6776	0.4677	0.5191	0.8023	0.9643	0.9929	0.9974	(89)
Tweekday	18.1230	18.3452	18.7091	19.1968	19.6131	19.8597	19.9119	19.9089	19.7753	19.2587	18.6150	18.0969	
Tweekend	18.1230	18.3452	18.7091	19.1968	19.6131	19.8597	19.9119	19.9089	19.7753	19.2587	18.6150	18.0969	
MIT 2	19.8884	19.8911	19.8938	19.9063	19.9087	19.9196	19.9196	19.9217	19.9154	19.9087	19.9039	19.8989	(90)
Living area fraction									fLA = Living area / (4) =			0.2639	(91)
MIT	20.1817	20.1837	20.1857	20.1949	20.1967	20.2047	20.2047	20.2062	20.2016	20.1967	20.1932	20.1895	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.1817	20.1837	20.1857	20.1949	20.1967	20.2047	20.2047	20.2062	20.2016	20.1967	20.1932	20.1895	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9969	0.9937	0.9854	0.9585	0.8802	0.7043	0.5050	0.5567	0.8231	0.9680	0.9935	0.9976	(94)
Useful gains	530.9043	601.7635	657.4994	693.6810	667.5047	522.2772	358.4399	373.8384	518.6818	553.3175	518.5801	504.5880	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1663.6849	1596.6200	1425.7995	1161.6808	871.7622	568.5468	365.6659	385.2882	621.6779	984.6228	1349.9663	1657.0204	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	842.7888	668.5435	571.6153	336.9599	151.9675	0.0000	0.0000	0.0000	0.0000	320.8911	598.5980	857.4097	(98)

Space heating		4348.7739 (98)
Space heating per m2	(98) / (4) =	51.4648 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	284.4674 (206)
Efficiency of secondary/supplementary heating system, %	100.0000 (208)
Space heating requirement	1528.7422 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	842.7888	668.5435	571.6153	336.9599	151.9675	0.0000	0.0000	0.0000	0.0000	320.8911	598.5980	857.4097	(98)
Space heating efficiency (main heating system 1)	284.4674	284.4674	284.4674	284.4674	284.4674	0.0000	0.0000	0.0000	0.0000	284.4674	284.4674	284.4674	(210)
Space heating fuel (main heating system)	296.2690	235.0158	200.9423	118.4529	53.4218	0.0000	0.0000	0.0000	0.0000	112.8042	210.4276	301.4087	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	202.6735	178.6439	187.6315	168.2215	164.8677	147.3386	141.5251	155.2664	154.9827	174.4349	184.4191	197.8048	(64)
Efficiency of water heater												178.1250	(216)
(217)m	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	(217)
Fuel for water heating, kWh/month	113.7816	100.2913	105.3370	94.4401	92.5573	82.7164	79.4527	87.1671	87.0078	97.9284	103.5335	111.0483	(219)
Water heating fuel used												1155.2616	(219)
Annual totals kWh/year													
Space heating fuel - main system												1528.7422	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												360.2389	(232)
Total delivered energy for all uses												3044.2427	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1528.7422	0.5190	793.4172	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1155.2616	0.5190	599.5807	(264)
Space and water heating			1392.9980	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	360.2389	0.5190	186.9640	(268)
Total CO2, kg/year			1579.9620	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.7000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		18.7000	ZC1
Total Floor Area	TFA	84.5000	
Assumed number of occupants	N	2.5427	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.0304	ZC2
CO2 emissions from cooking, equation (L16)		2.1305	ZC3
Total CO2 emissions		36.8608	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		36.8608	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	42.2500 (1b)	x	2.3900 (2b)	=	100.9775	(1b) - (3b)
First floor	42.2500 (1c)	x	2.6100 (2c)	=	110.2725	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	84.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	211.2500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1420	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3920	(18)
Number of sides sheltered		1	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.9250	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3626	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4623	0.4533	0.4442	0.3989	0.3898	0.3445	0.3445	0.3354	0.3626	0.3898	0.4079	0.4261	(22b)
Effective ac	0.6069	0.6027	0.5987	0.5795	0.5760	0.5593	0.5593	0.5563	0.5657	0.5760	0.5832	0.5908	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Opening Type (Uw = 1.40)			18.3000	1.3258	24.2614			(27)
Ground Floor			42.2500	0.1300	5.4925			(28a)
External Wall	92.0000	20.4200	71.5800	0.1800	12.8844			(29a)
Main Roof	42.2500		42.2500	0.1300	5.4925			(30)
Total net area of external elements Aum(A, m2)			176.5000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		50.2508			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.5805	(36)
Total fabric heat loss (33) + (36) =	60.8313	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.3067	42.0174	41.7338	40.4018	40.1526	38.9925	38.9925	38.7777	39.4394	40.1526	40.6568	41.1838	(38)
Heat transfer coeff	103.1380	102.8487	102.5651	101.2331	100.9839	99.8238	99.8238	99.6090	100.2706	100.9839	101.4880	102.0151	(39)
Average = Sum(39)m / 12 =												101.2319	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2206	1.2171	1.2138	1.1980	1.1951	1.1813	1.1813	1.1788	1.1866	1.1951	1.2010	1.2073	(40)
HLP (average)												1.1980	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5427 (42)
Average daily hot water use (litres/day)	94.5897 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.0486	100.2650	96.4815	92.6979	88.9143	85.1307	85.1307	88.9143	92.6979	96.4815	100.2650	104.0486	(44)
Energy conte	154.3011	134.9527	139.2591	121.4095	116.4953	100.5266	93.1527	106.8940	108.1707	126.0625	137.6071	149.4324	(45)
Energy content (annual)										Total = Sum(45)m =		1488.2637	(45)
Distribution loss (46)m = 0.15 x (45)m	23.1452	20.2429	20.8889	18.2114	17.4743	15.0790	13.9729	16.0341	16.2256	18.9094	20.6411	22.4149	(46)

Water storage loss:	
Store volume	150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3938 (48)
Temperature factor from Table 2b	0.5400 (49)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Enter (49) or (54) in (55) 0.7527 (55)

Total storage loss

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)

If cylinder contains dedicated solar storage

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

Total heat required for water heating calculated for each month

	200.8960	177.0384	185.8540	166.5013	163.0902	145.6184	139.7476	153.4889	153.2625	172.6574	182.6989	196.0273 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	200.8960	177.0384	185.8540	166.5013	163.0902	145.6184	139.7476	153.4889	153.2625	172.6574	182.6989	196.0273 (64)

Total per year (kWh/year) = Sum(64)m = 2036.8811 (64)

Heat gains from water heating, kWh/month

	88.5810	78.5404	83.5796	76.4421	76.0106	69.4986	68.2492	72.8182	72.0402	79.1917	81.8278	86.9622 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	127.1361	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	20.3982	18.1175	14.7342	11.1547	8.3383	7.0395	7.6064	9.8872	13.2705	16.8500	19.6664	20.9651	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	228.5881	230.9601	224.9827	212.2575	196.1941	181.0968	171.0109	168.6389	174.6163	187.3416	203.4049	218.5022	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	35.7136	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	-101.7089	(71)

Water heating gains (Table 5)

	119.0605	116.8755	112.3381	106.1696	102.1648	96.5258	91.7328	97.8739	100.0559	106.4405	113.6498	116.8847	(72)

Total internal gains

	432.1877	430.0940	416.1959	393.7226	370.8380	348.8030	334.4910	340.5408	352.0835	374.7728	400.8619	420.4929	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	7.8400	10.6334	0.6300	0.7000	0.7700	25.4777	(74)
East	3.2700	19.6403	0.6300	0.7000	0.7700	19.6276	(76)
South	6.4900	46.7521	0.6300	0.7000	0.7700	92.7294	(78)
West	0.7000	19.6403	0.6300	0.7000	0.7700	4.2016	(80)

Solar gains	142.0363	247.1709	352.9544	463.4972	544.0714	551.3715	526.8854	464.8740	390.8414	277.0733	171.0581	120.9621	(83)
Total gains	574.2240	677.2650	769.1502	857.2198	914.9094	900.1745	861.3764	805.4148	742.9250	651.8461	571.9201	541.4550	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.8952	57.0552	57.2130	57.9658	58.1088	58.7841	58.7841	58.9109	58.5222	58.1088	57.8202	57.5214	
alpha	4.7930	4.8037	4.8142	4.8644	4.8739	4.9189	4.9189	4.9274	4.9015	4.8739	4.8547	4.8348	
util living area													
	0.9965	0.9919	0.9794	0.9397	0.8404	0.6658	0.5006	0.5531	0.7997	0.9605	0.9925	0.9974	(86)
MIT	19.7379	19.9195	20.1937	20.5379	20.8123	20.9563	20.9912	20.9859	20.8921	20.5324	20.0717	19.7089	(87)
Th 2	19.9036	19.9063	19.9090	19.9216	19.9239	19.9350	19.9350	19.9370	19.9307	19.9239	19.9192	19.9142	(88)
util rest of house													
	0.9954	0.9892	0.9722	0.9183	0.7873	0.5725	0.3843	0.4332	0.7185	0.9421	0.9895	0.9965	(89)
MIT 2	18.2357	18.5016	18.8992	19.3914	19.7460	19.9071	19.9319	19.9315	19.8485	19.3952	18.7336	18.2008	(90)
Living area fraction									fLA = Living area / (4) =			0.2639	(91)
MIT	18.6321	18.8758	19.2408	19.6939	20.0274	20.1840	20.2114	20.2098	20.1239	19.6953	19.0867	18.5988	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.6321	18.8758	19.2408	19.6939	20.0274	20.1840	20.2114	20.2098	20.1239	19.6953	19.0867	18.5988	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9934	0.9856	0.9664	0.9128	0.7930	0.5955	0.4151	0.4650	0.7349	0.9370	0.9863	0.9949	(94)
Useful gains	570.4301	667.4996	743.2964	782.4899	725.5079	536.0738	357.6002	374.5078	545.9573	610.7939	564.0587	538.7032	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1478.1886	1437.3939	1306.7616	1092.7044	840.9324	557.4141	360.5057	379.4872	604.0177	918.4798	1216.5113	1468.8938	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	675.3723	517.3690	419.2181	223.3545	85.8758	0.0000	0.0000	0.0000	0.0000	228.9183	469.7659	692.0618	(98)
Space heating												3311.9357	(98)
Space heating per m2											(98) / (4) =	39.1945	(99)

8c. Space cooling requirement

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	93.5000	(206)
Efficiency of secondary/supplementary heating system, %	0.0000	(208)
Space heating requirement	3542.1772	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	675.3723	517.3690	419.2181	223.3545	85.8758	0.0000	0.0000	0.0000	0.0000	228.9183	469.7659	692.0618	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	722.3233	553.3358	448.3616	238.8818	91.8458	0.0000	0.0000	0.0000	0.0000	244.8324	502.4234	740.1731	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	200.8960	177.0384	185.8540	166.5013	163.0902	145.6184	139.7476	153.4889	153.2625	172.6574	182.6989	196.0273	(64)
Efficiency of water heater												79.8000	(216)
(217)m	87.8009	87.5085	86.9201	85.5982	83.1927	79.8000	79.8000	79.8000	79.8000	85.5671	87.2251	87.8985	(217)
Fuel for water heating, kWh/month													
	228.8085	202.3099	213.8216	194.5151	196.0390	182.4792	175.1222	192.3420	192.0583	201.7802	209.4569	223.0155	(219)
Water heating fuel used												2411.7484	(219)
Annual totals kWh/year													
Space heating fuel - main system												3542.1772	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												360.2389	(232)
Total delivered energy for all uses												6389.1646	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	3542.1772	0.2160	765.1103	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2411.7484	0.2160	520.9377	(264)
Space and water heating			1286.0479	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	360.2389	0.5190	186.9640	(268)
Total CO2, kg/m2/year			1511.9369	(272)
Emissions per m2 for space and water heating			15.2195	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.2126	(272b)
Emissions per m2 for pumps and fans			0.4607	(272c)
Target Carbon Dioxide Emission Rate (TER) = (15.2195 * 1.55) + 2.2126 + 0.4607, rounded to 2 d.p.			26.2600	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	2B4P MF MT	**Issued on Date**	16/03/2021
Assessment Reference	3	**Prop Type Ref**	
Property	2B4P, x, Stratford Upon Avon, CV36		

SAP Rating	89 B	**DER**	14.26	**TER**	21.61
Environmental	90 B	**% DER<TER**	34.02		
CO_2 Emissions (t/year)	0.88	**DFEE**	27.35	**TFEE**	33.41
General Requirements Compliance	Pass	**% DFEE<TFEE**	18.15		

Assessor Details	Mr. Jonathan Peck, Jonathan Peck, Tel: 02036031622, Jonathan@hodkinsonconsultancy.com	**Assessor ID**	T296-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Mid-floor flat, total floor area 73 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 21.61 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.26 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)33.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)27.3 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.17 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
Mitsubishi ECODAN 5kW PUHZ-W50VHA-BS

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage Measured cylinder loss: 1.50 kWh/day
Permitted by DBSCG 1.89 OK
Primary pipework insulated: Yes OK

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.53
Maximum 1.5 OK
MVHR efficiency: 89%
Minimum: 70% OK

---
9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing West: 10.43 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Door U-value 1.00 W/m²K
Air permeability 3.0 m³/m²h

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.0000 (1b)	x	2.5000 (2b)	=	182.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	182.5000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1163	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	75.6500	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2700	0.2671	0.2642	0.2496	0.2467	0.2322	0.2322	0.2293	0.2380	0.2467	0.2525	0.2583	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.8900	1.0000	1.8900			(26)
Opening Type 2 (Uw = 1.20)			10.4300	1.1450	11.9427			(27)
External Wall	24.3000	12.3200	11.9800	0.1500	1.7970			(29a)
Corridor Wall	24.3000		24.3000	0.1500	3.6450			(29a)
Total net area of external elements Aum(A, m2)			48.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		19.2747			(33)
Party Wall			41.0000	0.0000	0.0000			(32)
Party Floor 1			73.0000					(32d)
Party Ceiling 1			73.0000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	5.6116	(36)
Total fabric heat loss (33) + (36) =	24.8863	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2589	16.0838	15.9088	15.0337	14.8586	13.9835	13.9835	13.8085	14.3336	14.8586	15.2087	15.5588	(38)
Heat transfer coeff	41.1452	40.9702	40.7952	39.9200	39.7450	38.8698	38.8698	38.6948	39.2199	39.7450	40.0950	40.4451	(39)
Average = Sum(39)m / 12 =												39.8763	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5636	0.5612	0.5588	0.5468	0.5445	0.5325	0.5325	0.5301	0.5373	0.5445	0.5492	0.5540	(40)
HLP (average)												0.5463	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3167 (42)
Average daily hot water use (litres/day)	89.2216 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	98.1438	94.5749	91.0061	87.4372	83.8683	80.2995	80.2995	83.8683	87.4372	91.0061	94.5749	98.1438	(44)
Energy conte	145.5444	127.2941	131.3561	114.5194	109.8841	94.8216	87.8662	100.8277	102.0319	118.9084	129.7978	140.9520	(45)
Energy content (annual)										Total = Sum(45)m =		1403.8037	(45)

Distribution loss (46)m = 0.15 x (45)m

	21.8317	19.0941	19.7034	17.1779	16.4826	14.2232	13.1799	15.1242	15.3048	17.8363	19.4697	21.1428	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	193.9168	170.9853	179.7285	161.3314	158.2565	141.6336	136.2386	149.2001	148.8439	167.2808	176.6098	189.3244	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	193.9168	170.9853	179.7285	161.3314	158.2565	141.6336	136.2386	149.2001	148.8439	167.2808	176.6098	189.3244	(64)
								Total per year (kWh/year) = Sum(64)m =				1973.3497	(64)
Heat gains from water heating, kWh/month													
	87.0914	77.2782	82.3738	75.5273	75.2344	68.9778	67.9134	72.2231	71.3752	78.2350	80.6074	85.5645	(65)

5. Internal gains (see Table 5 and 5a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Metabolic gains (Table 5), Watts													
(66)m	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.9169	16.8018	13.6642	10.3446	7.7327	6.5283	7.0541	9.1691	12.3068	15.6263	18.2382	19.4427	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	204.1952	206.3141	200.9745	189.6072	175.2580	161.7717	152.7621	150.6432	155.9828	167.3501	181.6993	195.1856	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	(71)
Water heating gains (Table 5)													
	117.0584	114.9974	110.7175	104.8990	101.1215	95.8025	91.2815	97.0741	99.1322	105.1545	111.9547	115.0060	(72)
Total internal gains													
	397.9210	395.8638	383.1067	362.6014	341.8627	321.8530	308.8482	314.6370	325.1723	345.8814	369.6427	387.3847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
West	10.4300	19.6403	0.4500	0.8000	0.7700	51.1055	(80)

Solar gains	51.1055	99.9731	164.6415	240.1198	294.2759	301.2437	286.7963	246.3538	191.4849	118.6265	63.7225	42.0266	(83)
Total gains	449.0264	495.8369	547.7482	602.7212	636.1386	623.0968	595.6445	560.9907	516.6572	464.5080	433.3652	429.4114	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	123.2086	123.7350	124.2658	126.9900	127.5493	130.4210	130.4210	131.0110	129.2570	127.5493	126.4357	125.3414	
alpha	9.2139	9.2490	9.2844	9.4660	9.5033	9.6947	9.6947	9.7341	9.6171	9.5033	9.4290	9.3561	
util living area													
	0.9930	0.9813	0.9337	0.7797	0.5796	0.3992	0.2871	0.3173	0.5233	0.8441	0.9776	0.9949	(86)
Tweekday	19.9988	20.1410	20.3276	20.4584	20.4791	20.4911	20.4912	20.4933	20.4865	20.4488	20.2316	19.9823	
Tweekend	20.7754	20.8388	20.9253	20.9878	20.9992	21.0000	21.0000	21.0000	20.9998	20.9801	20.8752	20.7647	
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9	
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	20.4628	20.4650	20.4672	20.4781	20.4803	20.4912	20.4912	20.4933	20.4868	20.4803	20.4759	20.4715	(88)
util rest of house													
	0.9911	0.9765	0.9196	0.7514	0.5478	0.3675	0.2539	0.2823	0.4846	0.8134	0.9711	0.9935	(89)
Tweekday	19.9988	20.1410	20.3276	20.4584	20.4791	20.4911	20.4912	20.4933	20.4865	20.4488	20.2316	19.9823	
Tweekend	19.9988	20.1410	20.3276	20.4584	20.4791	20.4911	20.4912	20.4933	20.4865	20.4488	20.2316	19.9823	
MIT 2	20.4628	20.4650	20.4672	20.4781	20.4803	20.4912	20.4912	20.4933	20.4868	20.4803	20.4759	20.4715	(90)
Living area fraction										fLA = Living area / (4) =		0.3616	(91)
MIT	20.6571	20.6585	20.6599	20.6668	20.6682	20.6752	20.6752	20.6766	20.6724	20.6682	20.6654	20.6627	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6571	20.6585	20.6599	20.6668	20.6682	20.6752	20.6752	20.6766	20.6724	20.6682	20.6654	20.6627	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9919	0.9784	0.9250	0.7618	0.5593	0.3790	0.2659	0.2950	0.4986	0.8249	0.9737	0.9941	(94)
Useful gains	445.3780	485.1082	506.6443	459.1660	355.8027	236.1293	158.4013	165.4805	257.6074	383.1751	421.9592	426.8670	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	673.0164	645.6282	577.6544	469.7317	356.4416	236.1413	158.4016	165.4813	257.7686	400.1610	543.9066	665.8336	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	169.3630	107.8694	52.8315	7.6073	0.4753	0.0000	0.0000	0.0000	0.0000	12.6376	87.8022	177.7912 (98)
Space heating												616.3776 (98)
Space heating per m2											(98) / (4) =	8.4435 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	147.8266 (206)
Efficiency of secondary/supplementary heating system, %	100.0000 (208)
Space heating requirement	416.9598 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	169.3630	107.8694	52.8315	7.6073	0.4753	0.0000	0.0000	0.0000	0.0000	12.6376	87.8022	177.7912	(98)
Space heating efficiency (main heating system 1)													
	147.8266	147.8266	147.8266	147.8266	147.8266	0.0000	0.0000	0.0000	0.0000	147.8266	147.8266	147.8266	(210)
Space heating fuel (main heating system)													
	114.5687	72.9702	35.7388	5.1461	0.3216	0.0000	0.0000	0.0000	0.0000	8.5489	59.3954	120.2701	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	193.9168	170.9853	179.7285	161.3314	158.2565	141.6336	136.2386	149.2001	148.8439	167.2808	176.6098	189.3244	(64)
Efficiency of water heater												178.1250	(216)
(217)m	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	(217)
Fuel for water heating, kWh/month													
	108.8656	95.9917	100.9002	90.5720	88.8458	79.5136	76.4848	83.7615	83.5615	93.9120	99.1494	106.2874	(219)
Water heating fuel used												1107.8454	(219)
Annual totals kWh/year													
Space heating fuel - main system												416.9598	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6625)													
mechanical ventilation fans (SFP = 0.6625)												147.5056	(230a)
Total electricity for the above, kWh/year												147.5056	(231)
Electricity for lighting (calculated in Appendix L)												334.0784	(232)
Total delivered energy for all uses												2006.3892	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	416.9598	0.5190	216.4021	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1107.8454	0.5190	574.9718	(264)
Space and water heating			791.3739	(265)
Pumps and fans	147.5056	0.5190	76.5554	(267)
Energy for lighting	334.0784	0.5190	173.3867	(268)
Total CO2, kg/year			1041.3160	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.2600	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.2600	ZC1
Total Floor Area	TFA	73.0000	
Assumed number of occupants	N	2.3167	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.5756	ZC2
CO2 emissions from cooking, equation (L16)		2.3918	ZC3
Total CO2 emissions		33.2274	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		33.2274	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.0000 (1b)	x	2.5000 (2b)	=	182.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	182.5000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1644	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4144	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3211	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4095	0.4014	0.3934	0.3533	0.3452	0.3051	0.3051	0.2971	0.3211	0.3452	0.3613	0.3773	(22b)
Effective ac	0.5838	0.5806	0.5774	0.5624	0.5596	0.5465	0.5465	0.5441	0.5516	0.5596	0.5653	0.5712	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.40)			10.4300	1.3258	13.8277			(27)
External Wall	24.3000	12.3200	11.9800	0.1800	2.1564			(29a)
Corridor Wall	24.3000		24.3000	0.1800	4.3740			(29a)
Total net area of external elements Aum(A, m2)			48.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.2481			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1968	(36)
Total fabric heat loss					(33) + (36) =		26.4449	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.1612	34.9651	34.7729	33.8704	33.7015	32.9154	32.9154	32.7698	33.2182	33.7015	34.0431	34.4003	(38)
Heat transfer coeff	61.6060	61.4100	61.2178	60.3152	60.1463	59.3602	59.3602	59.2146	59.6630	60.1463	60.4880	60.8451	(39)
Average = Sum(39)m / 12 =												60.3144	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8439	0.8412	0.8386	0.8262	0.8239	0.8132	0.8132	0.8112	0.8173	0.8239	0.8286	0.8335	(40)
HLP (average)												0.8262	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.3167 (42)
Average daily hot water use (litres/day)		89.2216 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	98.1438	94.5749	91.0061	87.4372	83.8683	80.2995	80.2995	83.8683	87.4372	91.0061	94.5749	98.1438	(44)
Energy conte	145.5444	127.2941	131.3561	114.5194	109.8841	94.8216	87.8662	100.8277	102.0319	118.9084	129.7978	140.9520	(45)
Energy content (annual)										Total = Sum(45)m =		1403.8037	(45)
Distribution loss (46)m = 0.15 x (45)m	21.8317	19.0941	19.7034	17.1779	16.4826	14.2232	13.1799	15.1242	15.3048	17.8363	19.4697	21.1428	(46)

Water storage loss:		
Store volume		150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.3938 (48)
Temperature factor from Table 2b		0.5400 (49)
Enter (49) or (54) in (55)		0.7527 (55)
Total storage loss		

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	192.1393	169.3798	177.9510	159.6113	156.4790	139.9135	134.4611	147.4226	147.1238	165.5033	174.8896	187.5469	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	192.1393	169.3798	177.9510	159.6113	156.4790	139.9135	134.4611	147.4226	147.1238	165.5033	174.8896	187.5469	(64)
								Total per year (kWh/year) = Sum(64)m =				1952.4211	(64)
Heat gains from water heating, kWh/month													
	85.6694	75.9939	80.9518	74.1512	73.8124	67.6017	66.4914	70.8011	69.9991	76.8130	79.2312	84.1425	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4438	17.2698	14.0448	10.6328	7.9481	6.7102	7.2506	9.4246	12.6496	16.0616	18.7463	19.9842	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	204.1952	206.3141	200.9745	189.6072	175.2580	161.7717	152.7621	150.6432	155.9828	167.3501	181.6993	195.1856	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	(71)
Water heating gains (Table 5)													
	115.1471	113.0861	108.8062	102.9877	99.2102	93.8912	89.3702	95.1628	97.2210	103.2432	110.0434	113.0947	(72)
Total internal gains													
	399.5366	397.4205	384.5760	363.9782	343.1668	323.1236	310.1334	315.9811	326.6039	347.4054	371.2395	389.0150	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
West	10.4300	19.6403	0.6300	0.7000	0.7700	62.6042	(80)

Solar gains	62.6042	122.4671	201.6859	294.1468	360.4879	369.0235	351.3255	301.7834	234.5690	145.3175	78.0601	51.4826	(83)
Total gains	462.1408	519.8876	586.2619	658.1250	703.6548	692.1472	661.4588	617.7645	561.1729	492.7229	449.2995	440.4976	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	82.2882	82.5509	82.8100	84.0492	84.2852	85.4014	85.4014	85.6113	84.9679	84.2852	83.8091	83.3172	
alpha	6.4859	6.5034	6.5207	6.6033	6.6190	6.6934	6.6934	6.7074	6.6645	6.6190	6.5873	6.5545	
util living area													
	0.9969	0.9927	0.9762	0.9088	0.7517	0.5444	0.3944	0.4399	0.7063	0.9478	0.9924	0.9977	(86)
MIT	20.2260	20.3557	20.5699	20.8200	20.9584	20.9957	20.9996	20.9991	20.9790	20.7832	20.4604	20.2045	(87)
Th 2	20.2154	20.2177	20.2200	20.2307	20.2326	20.2419	20.2419	20.2437	20.2384	20.2326	20.2286	20.2244	(88)
util rest of house													
	0.9960	0.9904	0.9690	0.8843	0.7025	0.4819	0.3267	0.3681	0.6389	0.9278	0.9897	0.9970	(89)
MIT 2	19.1773	19.3677	19.6770	20.0275	20.1948	20.2392	20.2418	20.2433	20.2229	19.9878	19.5292	19.1530	(90)
Living area fraction										fLA = Living area / (4) =		0.3616	(91)
MIT	19.5566	19.7250	19.9999	20.3141	20.4709	20.5128	20.5158	20.5167	20.4964	20.2754	19.8659	19.5332	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5566	19.7250	19.9999	20.3141	20.4709	20.5128	20.5158	20.5167	20.4964	20.2754	19.8659	19.5332	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9886	0.9665	0.8872	0.7183	0.5044	0.3512	0.3941	0.6625	0.9291	0.9880	0.9961	(94)
Useful gains	459.7781	513.9663	566.6188	583.8838	505.4645	349.1394	232.3071	243.4774	371.7652	457.7857	443.9066	438.7926	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	939.8959	910.4036	826.4344	688.4433	527.5401	350.9863	232.4446	243.7662	381.6258	581.9427	772.1857	932.9524	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	357.2077	266.4058	193.3027	75.2828	16.4242	0.0000	0.0000	0.0000	0.0000	92.3728	236.3609	367.6549	(98)
Space heating												1605.0119	(98)
Space heating per m2											(98) / (4) =	21.9865	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1716.5903	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	357.2077	266.4058	193.3027	75.2828	16.4242	0.0000	0.0000	0.0000	0.0000	92.3728	236.3609	367.6549	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	382.0403	284.9260	206.7409	80.5164	17.5660	0.0000	0.0000	0.0000	0.0000	98.7944	252.7924	393.2138	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	192.1393	169.3798	177.9510	159.6113	156.4790	139.9135	134.4611	147.4226	147.1238	165.5033	174.8896	187.5469	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.4459	86.0171	85.0348	82.9430	80.7064	79.8000	79.8000	79.8000	79.8000	83.3291	85.6179	86.5785	(217)
Fuel for water heating, kWh/month													
	222.2654	196.9140	209.2684	192.4350	193.8867	175.3302	168.4976	184.7401	184.3656	198.6140	204.2675	216.6206	(219)
Water heating fuel used												2347.2051	(219)
Annual totals kWh/year													
Space heating fuel - main system												1716.5903	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.3842	(232)
Total delivered energy for all uses												4482.1795	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1716.5903	0.2160	370.7835	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2347.2051	0.2160	506.9963	(264)
Space and water heating			877.7798	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.3842	0.5190	178.2164	(268)
Total CO2, kg/m2/year			1094.9212	(272)
Emissions per m2 for space and water heating			12.0244	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.4413	(272b)
Emissions per m2 for pumps and fans			0.5332	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.0244 * 1.55) + 2.4413 + 0.5332, rounded to 2 d.p.			21.6100	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	2B4P MF MT	**Issued on Date**	16/03/2021
Assessment Reference	2	**Prop Type Ref**	
Property	2B4P, x, Stratford Upon Avon, CV36		

SAP Rating	88 B	**DER**	15.43	**TER**	21.61
Environmental	89 B	**% DER<TER**	28.61		
CO_2 Emissions (t/year)	0.94	**DFEE**	32.21	**TFEE**	33.41
General Requirements Compliance	Pass	**% DFEE<TFEE**	3.60		

Assessor Details	Mr. Jonathan Peck, Jonathan Peck, Tel: 02036031622, Jonathan@hodkinsonconsultancy.com	**Assessor ID**	T296-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Mid-floor flat, total floor area 73 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 21.61 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.43 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)33.4 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)32.2 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.34 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Heat pump with radiators or underfloor - Electric	
Mitsubishi ECODAN 5kW PUHZ-W50VHA-BS		
Secondary heating system:	None	

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.50 kWh/day	
Permitted by DBSCG 1.89	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%

Minimum	75%	OK

8 Mechanical ventilation
Continuous supply and extract system

Specific fan power:	0.53	
Maximum	1.5	OK
MVHR efficiency:	89%	
Minimum:	70%	OK

9 Summertime temperature

Overheating risk (Midlands):	Not significant	OK
Based on:		
Overshading:	Average	
Windows facing West:	10.43 m², No overhang	
Air change rate:	6.00 ach	
Blinds/curtains:	Light-coloured curtain or roller blind, closed 100% of daylight hours	

10 Key features

Party wall U-value	0.00 W/m²K
Door U-value	1.00 W/m²K
Air permeability	3.0 m³/m²h

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.0000 (1b)	x	2.5000 (2b)	=	182.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	182.5000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1163	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	75.6500	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2700	0.2671	0.2642	0.2496	0.2467	0.2322	0.2322	0.2293	0.2380	0.2467	0.2525	0.2583	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.8900	1.0000	1.8900			(26)
Opening Type 2 (Uw = 1.40)			10.4300	1.3258	13.8277			(27)
External Wall	24.3000	12.3200	11.9800	0.1800	2.1564			(29a)
Corridor Wall	24.3000		24.3000	0.1800	4.3740			(29a)
Total net area of external elements Aum(A, m2)			48.6000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		22.2481			(33)
Party Wall			41.0000	0.0000	0.0000			(32)
Party Floor 1			73.0000					(32d)
Party Ceiling 1			73.0000					(32b)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							8.6602	(36)
Total fabric heat loss					(33) + (36) =		30.9083	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	16.2589	16.0838	15.9088	15.0337	14.8586	13.9835	13.9835	13.8085	14.3336	14.8586	15.2087	15.5588	(38)
Heat transfer coeff	47.1671	46.9921	46.8171	45.9419	45.7669	44.8917	44.8917	44.7167	45.2418	45.7669	46.1169	46.4670	(39)
Average = Sum(39)m / 12 =												45.8982	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6461	0.6437	0.6413	0.6293	0.6269	0.6150	0.6150	0.6126	0.6198	0.6269	0.6317	0.6365	(40)
HLP (average)												0.6287	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.3167 (42)
Average daily hot water use (litres/day)	89.2216 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	98.1438	94.5749	91.0061	87.4372	83.8683	80.2995	80.2995	83.8683	87.4372	91.0061	94.5749	98.1438	(44)
Energy conte	145.5444	127.2941	131.3561	114.5194	109.8841	94.8216	87.8662	100.8277	102.0319	118.9084	129.7978	140.9520	(45)
Energy content (annual)										Total = Sum(45)m =		1403.8037	(45)

Distribution loss (46)m = 0.15 x (45)m

	21.8317	19.0941	19.7034	17.1779	16.4826	14.2232	13.1799	15.1242	15.3048	17.8363	19.4697	21.1428	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	193.9168	170.9853	179.7285	161.3314	158.2565	141.6336	136.2386	149.2001	148.8439	167.2808	176.6098	189.3244	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	193.9168	170.9853	179.7285	161.3314	158.2565	141.6336	136.2386	149.2001	148.8439	167.2808	176.6098	189.3244	(64)
								Total per year (kWh/year) = Sum(64)m =				1973.3497	(64)
Heat gains from water heating, kWh/month													
	87.0914	77.2782	82.3738	75.5273	75.2344	68.9778	67.9134	72.2231	71.3752	78.2350	80.6074	85.5645	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	18.9169	16.8018	13.6642	10.3446	7.7327	6.5283	7.0541	9.1691	12.3068	15.6263	18.2382	19.4427	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	204.1952	206.3141	200.9745	189.6072	175.2580	161.7717	152.7621	150.6432	155.9828	167.3501	181.6993	195.1856	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	(71)
Water heating gains (Table 5)													
	117.0584	114.9974	110.7175	104.8990	101.1215	95.8025	91.2815	97.0741	99.1322	105.1545	111.9547	115.0060	(72)
Total internal gains													
	397.9210	395.8638	383.1067	362.6014	341.8627	321.8530	308.8482	314.6370	325.1723	345.8814	369.6427	387.3847	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
West	10.4300	19.6403	0.4500	0.8000	0.7700	51.1055	(80)

Solar gains	51.1055	99.9731	164.6415	240.1198	294.2759	301.2437	286.7963	246.3538	191.4849	118.6265	63.7225	42.0266	(83)
Total gains	449.0264	495.8369	547.7482	602.7212	636.1386	623.0968	595.6445	560.9907	516.6572	464.5080	433.3652	429.4114	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	107.4784	107.8787	108.2820	110.3446	110.7666	112.9260	112.9260	113.3680	112.0522	110.7666	109.9258	109.0977	
alpha	8.1652	8.1919	8.2188	8.3563	8.3844	8.5284	8.5284	8.5579	8.4701	8.3844	8.3284	8.2732	
util living area													
	0.9956	0.9890	0.9616	0.8536	0.6613	0.4608	0.3316	0.3666	0.6008	0.9040	0.9872	0.9968	(86)
Tweekday	19.7406	19.8945	20.1247	20.3398	20.3996	20.4164	20.4166	20.4187	20.4105	20.3200	20.0116	19.7216	
Tweekend	20.6881	20.7561	20.8605	20.9620	20.9954	20.9998	21.0000	21.0000	20.9984	20.9485	20.8042	20.6765	
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9	
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	20.3887	20.3908	20.3929	20.4037	20.4058	20.4166	20.4166	20.4187	20.4123	20.4058	20.4015	20.3972	(88)
util rest of house													
	0.9943	0.9859	0.9516	0.8260	0.6216	0.4189	0.2876	0.3203	0.5511	0.8774	0.9831	0.9958	(89)
Tweekday	19.7406	19.8945	20.1247	20.3398	20.3996	20.4164	20.4166	20.4187	20.4105	20.3200	20.0116	19.7216	
Tweekend	19.7406	19.8945	20.1247	20.3398	20.3996	20.4164	20.4166	20.4187	20.4105	20.3200	20.0116	19.7216	
MIT 2	20.3887	20.3908	20.3929	20.4037	20.4058	20.4166	20.4166	20.4187	20.4123	20.4058	20.4015	20.3972	(90)
Living area fraction									fLA = Living area / (4) =			0.3616	(91)
MIT	20.6098	20.6111	20.6125	20.6193	20.6207	20.6276	20.6276	20.6289	20.6248	20.6207	20.6180	20.6152	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6098	20.6111	20.6125	20.6193	20.6207	20.6276	20.6276	20.6289	20.6248	20.6207	20.6180	20.6152	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9948	0.9871	0.9555	0.8364	0.6361	0.4341	0.3035	0.3371	0.5692	0.8876	0.9847	0.9962	(94)
Useful gains	446.7055	489.4284	523.3615	504.0918	404.6664	270.4629	180.7992	189.0925	294.0842	412.3201	426.7492	427.7851	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	769.2839	738.2982	660.7050	538.4083	408.2725	270.5875	180.8040	189.1039	295.1942	458.6161	623.4068	762.7660	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	239.9984	167.2405	102.1835	24.7079	2.6830	0.0000	0.0000	0.0000	0.0000	34.4442	141.5935	249.2258 (98)
Space heating												962.0767 (98)
Space heating per m2											(98) / (4) =	13.1791 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	165.7192 (206)
Efficiency of secondary/supplementary heating system, %	100.0000 (208)
Space heating requirement	580.5462 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	239.9984	167.2405	102.1835	24.7079	2.6830	0.0000	0.0000	0.0000	0.0000	34.4442	141.5935	249.2258	(98)
Space heating efficiency (main heating system 1)													
	165.7192	165.7192	165.7192	165.7192	165.7192	0.0000	0.0000	0.0000	0.0000	165.7192	165.7192	165.7192	(210)
Space heating fuel (main heating system)													
	144.8223	100.9180	61.6606	14.9095	1.6190	0.0000	0.0000	0.0000	0.0000	20.7847	85.4418	150.3904	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	193.9168	170.9853	179.7285	161.3314	158.2565	141.6336	136.2386	149.2001	148.8439	167.2808	176.6098	189.3244	(64)
Efficiency of water heater												178.1250	(216)
(217)m	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	(217)
Fuel for water heating, kWh/month													
	108.8656	95.9917	100.9002	90.5720	88.8458	79.5136	76.4848	83.7615	83.5615	93.9120	99.1494	106.2874	(219)
Water heating fuel used												1107.8454	(219)
Annual totals kWh/year													
Space heating fuel - main system												580.5462	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6625)													
mechanical ventilation fans (SFP = 0.6625)												147.5056	(230a)
Total electricity for the above, kWh/year												147.5056	(231)
Electricity for lighting (calculated in Appendix L)												334.0784	(232)
Total delivered energy for all uses												2169.9756	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	580.5462	0.5190	301.3035	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1107.8454	0.5190	574.9718	(264)
Space and water heating			876.2753	(265)
Pumps and fans	147.5056	0.5190	76.5554	(267)
Energy for lighting	334.0784	0.5190	173.3867	(268)
Total CO2, kg/year			1126.2173	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.4300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.4300	ZC1
Total Floor Area	TFA	73.0000	
Assumed number of occupants	N	2.3167	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		16.5756	ZC2
CO2 emissions from cooking, equation (L16)		2.3918	ZC3
Total CO2 emissions		34.3974	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		34.3974	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	73.0000 (1b)	x	2.5000 (2b)	=	182.5000	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	73.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	182.5000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1644	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4144	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3211	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4095	0.4014	0.3934	0.3533	0.3452	0.3051	0.3051	0.2971	0.3211	0.3452	0.3613	0.3773	(22b)
Effective ac	0.5838	0.5806	0.5774	0.5624	0.5596	0.5465	0.5465	0.5441	0.5516	0.5596	0.5653	0.5712	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.40)			10.4300	1.3258	13.8277			(27)
External Wall	24.3000	12.3200	11.9800	0.1800	2.1564			(29a)
Corridor Wall	24.3000		24.3000	0.1800	4.3740			(29a)
Total net area of external elements Aum(A, m2)			48.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	22.2481			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							4.1968	(36)
Total fabric heat loss					(33) + (36) =		26.4449	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	35.1612	34.9651	34.7729	33.8704	33.7015	32.9154	32.9154	32.7698	33.2182	33.7015	34.0431	34.4003	(38)
Heat transfer coeff	61.6060	61.4100	61.2178	60.3152	60.1463	59.3602	59.3602	59.2146	59.6630	60.1463	60.4880	60.8451	(39)
Average = Sum(39)m / 12 =												60.3144	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8439	0.8412	0.8386	0.8262	0.8239	0.8132	0.8132	0.8112	0.8173	0.8239	0.8286	0.8335	(40)
HLP (average)												0.8262	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.3167 (42)
Average daily hot water use (litres/day)		89.2216 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	98.1438	94.5749	91.0061	87.4372	83.8683	80.2995	80.2995	83.8683	87.4372	91.0061	94.5749	98.1438	(44)
Energy conte	145.5444	127.2941	131.3561	114.5194	109.8841	94.8216	87.8662	100.8277	102.0319	118.9084	129.7978	140.9520	(45)
Energy content (annual)										Total = Sum(45)m =		1403.8037	(45)
Distribution loss (46)m = 0.15 x (45)m	21.8317	19.0941	19.7034	17.1779	16.4826	14.2232	13.1799	15.1242	15.3048	17.8363	19.4697	21.1428	(46)

Water storage loss:		
Store volume		150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.3938 (48)
Temperature factor from Table 2b		0.5400 (49)
Enter (49) or (54) in (55)		0.7527 (55)
Total storage loss		

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	192.1393	169.3798	177.9510	159.6113	156.4790	139.9135	134.4611	147.4226	147.1238	165.5033	174.8896	187.5469	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	192.1393	169.3798	177.9510	159.6113	156.4790	139.9135	134.4611	147.4226	147.1238	165.5033	174.8896	187.5469	(64)
								Total per year (kWh/year) = Sum(64)m =				1952.4211	(64)
Heat gains from water heating, kWh/month													
	85.6694	75.9939	80.9518	74.1512	73.8124	67.6017	66.4914	70.8011	69.9991	76.8130	79.2312	84.1425	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	115.8350	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	19.4438	17.2698	14.0448	10.6328	7.9481	6.7102	7.2506	9.4246	12.6496	16.0616	18.7463	19.9842	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	204.1952	206.3141	200.9745	189.6072	175.2580	161.7717	152.7621	150.6432	155.9828	167.3501	181.6993	195.1856	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	34.5835	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	-92.6680	(71)
Water heating gains (Table 5)													
	115.1471	113.0861	108.8062	102.9877	99.2102	93.8912	89.3702	95.1628	97.2210	103.2432	110.0434	113.0947	(72)
Total internal gains													
	399.5366	397.4205	384.5760	363.9782	343.1668	323.1236	310.1334	315.9811	326.6039	347.4054	371.2395	389.0150	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
West	10.4300	19.6403	0.6300	0.7000	0.7700	62.6042	(80)

Solar gains	62.6042	122.4671	201.6859	294.1468	360.4879	369.0235	351.3255	301.7834	234.5690	145.3175	78.0601	51.4826	(83)
Total gains	462.1408	519.8876	586.2619	658.1250	703.6548	692.1472	661.4588	617.7645	561.1729	492.7229	449.2995	440.4976	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	82.2882	82.5509	82.8100	84.0492	84.2852	85.4014	85.4014	85.6113	84.9679	84.2852	83.8091	83.3172	
alpha	6.4859	6.5034	6.5207	6.6033	6.6190	6.6934	6.6934	6.7074	6.6645	6.6190	6.5873	6.5545	
util living area													
	0.9969	0.9927	0.9762	0.9088	0.7517	0.5444	0.3944	0.4399	0.7063	0.9478	0.9924	0.9977	(86)
MIT	20.2260	20.3557	20.5699	20.8200	20.9584	20.9957	20.9996	20.9991	20.9790	20.7832	20.4604	20.2045	(87)
Th 2	20.2154	20.2177	20.2200	20.2307	20.2326	20.2419	20.2419	20.2437	20.2384	20.2326	20.2286	20.2244	(88)
util rest of house													
	0.9960	0.9904	0.9690	0.8843	0.7025	0.4819	0.3267	0.3681	0.6389	0.9278	0.9897	0.9970	(89)
MIT 2	19.1773	19.3677	19.6770	20.0275	20.1948	20.2392	20.2418	20.2433	20.2229	19.9878	19.5292	19.1530	(90)
Living area fraction										fLA = Living area / (4) =		0.3616	(91)
MIT	19.5566	19.7250	19.9999	20.3141	20.4709	20.5128	20.5158	20.5167	20.4964	20.2754	19.8659	19.5332	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.5566	19.7250	19.9999	20.3141	20.4709	20.5128	20.5158	20.5167	20.4964	20.2754	19.8659	19.5332	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9949	0.9886	0.9665	0.8872	0.7183	0.5044	0.3512	0.3941	0.6625	0.9291	0.9880	0.9961	(94)
Useful gains	459.7781	513.9663	566.6188	583.8838	505.4645	349.1394	232.3071	243.4774	371.7652	457.7857	443.9066	438.7926	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	939.8959	910.4036	826.4344	688.4433	527.5401	350.9863	232.4446	243.7662	381.6258	581.9427	772.1857	932.9524	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	357.2077	266.4058	193.3027	75.2828	16.4242	0.0000	0.0000	0.0000	0.0000	92.3728	236.3609	367.6549	(98)
Space heating												1605.0119	(98)
Space heating per m2											(98) / (4) =	21.9865	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1716.5903	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	357.2077	266.4058	193.3027	75.2828	16.4242	0.0000	0.0000	0.0000	0.0000	92.3728	236.3609	367.6549	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	382.0403	284.9260	206.7409	80.5164	17.5660	0.0000	0.0000	0.0000	0.0000	98.7944	252.7924	393.2138	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	192.1393	169.3798	177.9510	159.6113	156.4790	139.9135	134.4611	147.4226	147.1238	165.5033	174.8896	187.5469	(64)
Efficiency of water heater												79.8000	(216)
(217)m	86.4459	86.0171	85.0348	82.9430	80.7064	79.8000	79.8000	79.8000	79.8000	83.3291	85.6179	86.5785	(217)
Fuel for water heating, kWh/month													
	222.2654	196.9140	209.2684	192.4350	193.8867	175.3302	168.4976	184.7401	184.3656	198.6140	204.2675	216.6206	(219)
Water heating fuel used												2347.2051	(219)
Annual totals kWh/year													
Space heating fuel - main system												1716.5903	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												343.3842	(232)
Total delivered energy for all uses												4482.1795	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1716.5903	0.2160	370.7835	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2347.2051	0.2160	506.9963	(264)
Space and water heating			877.7798	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	343.3842	0.5190	178.2164	(268)
Total CO2, kg/m2/year			1094.9212	(272)
Emissions per m2 for space and water heating			12.0244	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.4413	(272b)
Emissions per m2 for pumps and fans			0.5332	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.0244 * 1.55) + 2.4413 + 0.5332, rounded to 2 d.p.			21.6100	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	1B2P MF ET	**Issued on Date**	16/03/2021
Assessment Reference	3	**Prop Type Ref**	
Property	1B2P, x, Stratford Upon Avon, CV36		

SAP Rating	88 B	**DER**	16.94	**TER**	24.35
Environmental	90 B	**% DER<TER**	30.42		
CO_2 Emissions (t/year)	0.73	**DFEE**	27.29	**TFEE**	33.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.83		

Assessor Details	Mr. Jonathan Peck, Jonathan Peck, Tel: 02036031622, Jonathan@hodkinsonconsultancy.com	**Assessor ID**	T296-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Mid-floor flat, total floor area 51 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 24.35 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 16.94 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)33.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)27.3 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.16 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
Mitsubishi ECODAN 5kW PUHZ-W50VHA-BS

Secondary heating system: None

5 Cylinder insulation
Hot water storage: Measured cylinder loss: 1.50 kWh/day
Permitted by DBSCG 1.89 OK
Primary pipework insulated: Yes OK

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.53
Maximum 1.5 OK
MVHR efficiency: 89%
Minimum: 70% OK

9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing East: 8.06 m², No overhang
Air change rate: 6.00 ach
Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

10 Key features
Party wall U-value 0.00 W/m²K
Door U-value 1.00 W/m²K
Air permeability 3.0 m³/m²h

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.5000 (1b)	x	2.5000 (2b)	=	126.2500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.2500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1163	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	75.6500	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2700	0.2671	0.2642	0.2496	0.2467	0.2322	0.2322	0.2293	0.2380	0.2467	0.2525	0.2583	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.8900	1.0000	1.8900			(26)
Opening Type 2 (Uw = 1.20)			8.0600	1.1450	9.2290			(27)
External Wall	16.6000	9.9500	6.6500	0.1500	0.9975			(29a)
Corridor Wall	16.6000		16.6000	0.1500	2.4900			(29a)
Total net area of external elements Aum(A, m2)			33.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		14.6065			(33)
Party Wall			40.2300	0.0000	0.0000			(32)
Party Floor 1			50.5000					(32d)
Party Ceiling 1			50.5000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	4.2556	(36)
Total fabric heat loss (33) + (36) =	18.8621	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.2476	11.1265	11.0054	10.4000	10.2789	9.6735	9.6735	9.5524	9.9157	10.2789	10.5211	10.7632	(38)
Heat transfer coeff	30.1097	29.9886	29.8675	29.2621	29.1410	28.5356	28.5356	28.4145	28.7778	29.1410	29.3832	29.6254	(39)
Average = Sum(39)m / 12 =												29.2318	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.5962	0.5938	0.5914	0.5794	0.5771	0.5651	0.5651	0.5627	0.5699	0.5771	0.5818	0.5866	(40)
HLP (average)												0.5788	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7048 (42)
Average daily hot water use (litres/day)	74.6897 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.1587	79.1711	76.1835	73.1959	70.2083	67.2207	67.2207	70.2083	73.1959	76.1835	79.1711	82.1587	(44)
Energy conte	121.8389	106.5611	109.9615	95.8671	91.9868	79.3776	73.5550	84.4055	85.4135	99.5412	108.6570	117.9945	(45)
Energy content (annual)										Total = Sum(45)m =		1175.1599	(45)

Distribution loss (46)m = 0.15 x (45)m

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	18.2758	15.9842	16.4942	14.3801	13.7980	11.9066	11.0333	12.6608	12.8120	14.9312	16.2986	17.6992	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	170.2113	150.2523	158.3339	142.6791	140.3592	126.1896	121.9274	132.7779	132.2255	147.9136	155.4690	166.3669	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	170.2113	150.2523	158.3339	142.6791	140.3592	126.1896	121.9274	132.7779	132.2255	147.9136	155.4690	166.3669	(64)
								Total per year (kWh/year) = Sum(64)m =				1744.7059	(64)
Heat gains from water heating, kWh/month													
	79.2094	70.3845	75.2601	69.3254	69.2835	63.8427	63.1550	66.7627	65.8496	71.7954	73.5781	77.9311	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.4965	11.9874	9.7488	7.3805	5.5170	4.6577	5.0328	6.5418	8.7804	11.1488	13.0122	13.8716	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	148.5325	150.0738	146.1898	137.9211	127.4834	117.6735	111.1198	109.5785	113.4626	121.7312	132.1689	141.9788	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	(71)
Water heating gains (Table 5)													
	106.4642	104.7389	101.1561	96.2853	93.1230	88.6704	84.8857	89.7349	91.4578	96.4992	102.1918	104.7461	(72)
Total internal gains													
	317.0656	315.3725	305.6671	290.1594	274.6959	259.5740	249.6108	254.4277	262.2732	277.9516	295.9453	309.1689	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	8.0600	19.6403	0.4500	0.8000	0.7700	39.4928	(76)

Solar gains	39.4928	77.2563	127.2302	185.5576	227.4078	232.7924	221.6278	190.3750	147.9739	91.6711	49.2429	32.4770	(83)
Total gains	356.5584	392.6289	432.8973	475.7170	502.1037	492.3663	471.2386	444.8027	410.2471	369.6227	345.1882	341.6459	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	116.4723	116.9426	117.4167	119.8459	120.3439	122.8971	122.8971	123.4208	121.8629	120.3439	119.3521	118.3765	
alpha	8.7648	8.7962	8.8278	8.9897	9.0229	9.1931	9.1931	9.2281	9.1242	9.0229	8.9568	8.8918	
util living area													
	0.9852	0.9651	0.8984	0.7302	0.5388	0.3709	0.2664	0.2939	0.4837	0.7914	0.9578	0.9887	(86)
Tweekday	20.0219	20.1624	20.3303	20.4343	20.4499	20.4615	20.4615	20.4637	20.4570	20.4291	20.2480	20.0037	
Tweekend	20.7974	20.8610	20.9409	20.9910	20.9994	21.0000	21.0000	21.0000	20.9998	20.9859	20.8956	20.7857	
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9	
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	20.4334	20.4356	20.4377	20.4485	20.4507	20.4615	20.4615	20.4637	20.4572	20.4507	20.4464	20.4420	(88)
util rest of house													
	0.9814	0.9570	0.8798	0.7005	0.5073	0.3397	0.2338	0.2596	0.4458	0.7574	0.9469	0.9857	(89)
Tweekday	20.0219	20.1624	20.3303	20.4343	20.4499	20.4615	20.4615	20.4637	20.4570	20.4291	20.2480	20.0037	
Tweekend	20.0219	20.1624	20.3303	20.4343	20.4499	20.4615	20.4615	20.4637	20.4570	20.4291	20.2480	20.0037	
MIT 2	20.4334	20.4356	20.4377	20.4485	20.4507	20.4615	20.4615	20.4637	20.4572	20.4507	20.4464	20.4420	(90)
Living area fraction									fLA = Living area / (4) =			0.4430	(91)
MIT	20.6844	20.6856	20.6868	20.6928	20.6940	20.7001	20.7001	20.7013	20.6976	20.6940	20.6916	20.6892	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6844	20.6856	20.6868	20.6928	20.6940	20.7001	20.7001	20.7013	20.6976	20.6940	20.6916	20.6892	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9832	0.9608	0.8884	0.7138	0.5213	0.3535	0.2483	0.2748	0.4626	0.7728	0.9520	0.9871	(94)
Useful gains	350.5643	377.2424	384.5700	339.5723	261.7394	174.0612	116.9977	122.2182	189.7753	285.6382	328.6193	337.2439	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	493.3285	473.3876	423.7242	345.0827	262.0951	174.0691	116.9979	122.2187	189.8656	294.1502	399.3649	488.4984	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	106.2166	64.6096	29.1307	3.9674	0.2646	0.0000	0.0000	0.0000	0.0000	6.3329	50.9368	112.5333 (98)
Space heating												373.9920 (98)
Space heating per m2											(98) / (4) =	7.4058 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	113.7426 (206)
Efficiency of secondary/supplementary heating system, %	100.0000 (208)
Space heating requirement	328.8056 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	106.2166	64.6096	29.1307	3.9674	0.2646	0.0000	0.0000	0.0000	0.0000	6.3329	50.9368	112.5333	(98)
Space heating efficiency (main heating system 1)													
	113.7426	113.7426	113.7426	113.7426	113.7426	0.0000	0.0000	0.0000	0.0000	113.7426	113.7426	113.7426	(210)
Space heating fuel (main heating system)													
	93.3833	56.8033	25.6111	3.4881	0.2326	0.0000	0.0000	0.0000	0.0000	5.5678	44.7826	98.9368	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.2113	150.2523	158.3339	142.6791	140.3592	126.1896	121.9274	132.7779	132.2255	147.9136	155.4690	166.3669	(64)
Efficiency of water heater												178.1250	(216)
(217)m	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	(217)
Fuel for water heating, kWh/month													
	95.5572	84.3522	88.8892	80.1006	78.7981	70.8433	68.4505	74.5420	74.2319	83.0392	87.2809	93.3990	(219)
Water heating fuel used												979.4840	(219)
Annual totals kWh/year													
Space heating fuel - main system												328.8056	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6625)													
mechanical ventilation fans (SFP = 0.6625)												102.0416	(230a)
Total electricity for the above, kWh/year												102.0416	(231)
Electricity for lighting (calculated in Appendix L)												238.3516	(232)
Total delivered energy for all uses												1648.6828	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	328.8056	0.5190	170.6501	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	979.4840	0.5190	508.3522	(264)
Space and water heating			679.0023	(265)
Pumps and fans	102.0416	0.5190	52.9596	(267)
Energy for lighting	238.3516	0.5190	123.7045	(268)
Total CO2, kg/year			855.6664	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			16.9400	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		16.9400	ZC1
Total Floor Area	TFA	50.5000	
Assumed number of occupants	N	1.7048	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.4292	ZC2
CO2 emissions from cooking, equation (L16)		3.1667	ZC3
Total CO2 emissions		37.5358	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		37.5358	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.5000 (1b)	x	2.5000 (2b)	=	126.2500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.2500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1584	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4084	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3165	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4036	0.3957	0.3877	0.3482	0.3403	0.3007	0.3007	0.2928	0.3165	0.3403	0.3561	0.3719	(22b)
Effective ac	0.5814	0.5783	0.5752	0.5606	0.5579	0.5452	0.5452	0.5429	0.5501	0.5579	0.5634	0.5692	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.40)			8.0600	1.3258	10.6856			(27)
External Wall	16.6000	9.9500	6.6500	0.1800	1.1970			(29a)
Corridor Wall	16.6000		16.6000	0.1800	2.9880			(29a)
Total net area of external elements Aum(A, m2)			33.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.7606			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.1150 (36)
Total fabric heat loss	(33) + (36) =	19.8756 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.2239	24.0922	23.9631	23.3565	23.2430	22.7148	22.7148	22.6169	22.9183	23.2430	23.4726	23.7126	(38)
Heat transfer coeff	44.0995	43.9678	43.8387	43.2321	43.1187	42.5904	42.5904	42.4926	42.7939	43.1187	43.3482	43.5882	(39)
Average = Sum(39)m / 12 =												43.2316	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8733	0.8706	0.8681	0.8561	0.8538	0.8434	0.8434	0.8414	0.8474	0.8538	0.8584	0.8631	(40)
HLP (average)												0.8561	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7048 (42)
Average daily hot water use (litres/day)	74.6897 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.1587	79.1711	76.1835	73.1959	70.2083	67.2207	67.2207	70.2083	73.1959	76.1835	79.1711	82.1587	(44)
Energy conte	121.8389	106.5611	109.9615	95.8671	91.9868	79.3776	73.5550	84.4055	85.4135	99.5412	108.6570	117.9945	(45)
Energy content (annual)										Total = Sum(45)m =		1175.1599	(45)
Distribution loss (46)m = 0.15 x (45)m	18.2758	15.9842	16.4942	14.3801	13.7980	11.9066	11.0333	12.6608	12.8120	14.9312	16.2986	17.6992	(46)

Water storage loss:	
Store volume	150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3938 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.7527 (55)
Total storage loss	

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	168.4338	148.6468	156.5564	140.9590	138.5817	124.4694	120.1499	131.0004	130.5054	146.1361	153.7489	164.5894	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	168.4338	148.6468	156.5564	140.9590	138.5817	124.4694	120.1499	131.0004	130.5054	146.1361	153.7489	164.5894	(64)
								Total per year (kWh/year) = Sum(64)m =				1723.7773	(64)
Heat gains from water heating, kWh/month													
	77.7874	69.1001	73.8381	67.9493	67.8615	62.4665	61.7330	65.3407	64.4735	70.3734	72.2019	76.5091	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.8216	12.2763	9.9837	7.5583	5.6499	4.7699	5.1541	6.6994	8.9920	11.4174	13.3258	14.2058	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	148.5325	150.0738	146.1898	137.9211	127.4834	117.6735	111.1198	109.5785	113.4626	121.7312	132.1689	141.9788	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	(71)
Water heating gains (Table 5)													
	104.5529	102.8276	99.2448	94.3740	91.2117	86.7591	82.9744	87.8236	89.5465	94.5879	100.2805	102.8348	(72)
Total internal gains													
	318.4795	316.7501	306.9907	291.4259	275.9175	260.7749	250.8208	255.6740	263.5735	279.3089	297.3476	310.5919	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	8.0600	19.6403	0.6300	0.7000	0.7700	48.3787	(76)

Solar gains	48.3787	94.6390	155.8569	227.3081	278.5746	285.1706	271.4941	233.2094	181.2681	112.2971	60.3225	39.7843	(83)
Total gains	366.8582	411.3891	462.8477	518.7340	554.4921	545.9456	522.3148	488.8834	444.8416	391.6061	357.6701	350.3762	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.5234	79.7616	79.9966	81.1189	81.3324	82.3412	82.3412	82.5308	81.9497	81.3324	80.9017	80.4562	
alpha	6.3016	6.3174	6.3331	6.4079	6.4222	6.4894	6.4894	6.5021	6.4633	6.4222	6.3934	6.3637	
util living area													
	0.9937	0.9862	0.9596	0.8686	0.6957	0.4965	0.3585	0.3992	0.6472	0.9163	0.9852	0.9952	(86)
MIT	20.2717	20.4079	20.6246	20.8575	20.9701	20.9970	20.9997	20.9994	20.9855	20.8239	20.5087	20.2473	(87)
Th 2	20.1903	20.1925	20.1947	20.2050	20.2069	20.2159	20.2159	20.2176	20.2124	20.2069	20.2030	20.1989	(88)
util rest of house													
	0.9919	0.9821	0.9482	0.8379	0.6450	0.4369	0.2948	0.3316	0.5800	0.8883	0.9801	0.9937	(89)
MIT 2	19.2240	19.4224	19.7311	20.0494	20.1805	20.2141	20.2158	20.2173	20.2022	20.0158	19.5775	19.1954	(90)
Living area fraction										fLA = Living area / (4) =		0.4430	(91)
MIT	19.6881	19.8589	20.1269	20.4073	20.5303	20.5609	20.5630	20.5638	20.5492	20.3738	19.9900	19.6614	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6881	19.8589	20.1269	20.4073	20.5303	20.5609	20.5630	20.5638	20.5492	20.3738	19.9900	19.6614	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9904	0.9800	0.9471	0.8463	0.6662	0.4633	0.3230	0.3616	0.6093	0.8948	0.9784	0.9925	(94)
Useful gains	363.3238	403.1745	438.3670	438.9825	369.3806	252.9293	168.7123	176.7765	271.0567	350.4250	349.9554	347.7364	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	678.6066	657.7110	597.3831	497.4865	380.7495	253.8766	168.7871	176.9289	275.9852	421.4314	558.7585	673.9330	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	234.5704	171.0485	118.3080	42.1229	8.4585	0.0000	0.0000	0.0000	0.0000	52.8288	150.3382	242.6903	(98)
Space heating												1020.3656	(98)
Space heating per m2											(98) / (4) =	20.2053	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1091.3001	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	234.5704	171.0485	118.3080	42.1229	8.4585	0.0000	0.0000	0.0000	0.0000	52.8288	150.3382	242.6903	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	250.8774	182.9396	126.5326	45.0512	9.0465	0.0000	0.0000	0.0000	0.0000	56.5014	160.7895	259.5618	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	168.4338	148.6468	156.5564	140.9590	138.5817	124.4694	120.1499	131.0004	130.5054	146.1361	153.7489	164.5894	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.6975	85.1889	84.0788	82.0315	80.3465	79.8000	79.8000	79.8000	79.8000	82.3863	84.7541	85.8482	(217)
Fuel for water heating, kWh/month													
	196.5447	174.4908	186.2021	171.8353	172.4801	155.9767	150.5638	164.1609	163.5406	177.3791	181.4058	191.7215	(219)
Water heating fuel used												2086.3013	(219)
Annual totals kWh/year													
Space heating fuel - main system												1091.3001	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												244.0946	(232)
Total delivered energy for all uses												3496.6960	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1091.3001	0.2160	235.7208	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2086.3013	0.2160	450.6411	(264)
Space and water heating			686.3619	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	244.0946	0.5190	126.6851	(268)
Total CO2, kg/m2/year			851.9720	(272)
Emissions per m2 for space and water heating			13.5913	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.5086	(272b)
Emissions per m2 for pumps and fans			0.7708	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.5913 * 1.55) + 2.5086 + 0.7708, rounded to 2 d.p.			24.3500	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	1B2P MF ET	**Issued on Date**	16/03/2021
Assessment Reference	2	**Prop Type Ref**	
Property	1B2P, x, Stratford Upon Avon, CV36		

SAP Rating	87 B	**DER**	18.58	**TER**	24.35
Environmental	89 B	**% DER<TER**	23.68		
CO_2 Emissions (t/year)	0.78	**DFEE**	32.80	**TFEE**	33.22
General Requirements Compliance	Pass	**% DFEE<TFEE**	1.26		

Assessor Details	Mr. Jonathan Peck, Jonathan Peck, Tel: 02036031622, Jonathan@hodkinsonconsultancy.com	**Assessor ID**	T296-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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DWELLING AS DESIGNED

Mid-floor flat, total floor area 51 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 24.35 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 18.58 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)33.2 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)32.8 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	(no floor)		
Roof	(no roof)		
Openings	1.32 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability

Air permeability at 50 pascals:	3.00 (design value)	
Maximum	10.0	OK

4 Heating efficiency

Main heating system:	Heat pump with radiators or underfloor - Electric	
Mitsubishi ECODAN 5kW PUHZ-W50VHA-BS		
Secondary heating system:	None	

5 Cylinder insulation

Hot water storage	Measured cylinder loss: 1.50 kWh/day	
Permitted by DBSCG 1.89	OK	
Primary pipework insulated:	Yes	OK

6 Controls

Space heating controls:	Time and temperature zone control	OK
Hot water controls:	Cylinderstat	OK
	Independent timer for DHW	OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%

Minimum	75%	OK

8 Mechanical ventilation
Continuous supply and extract system

Specific fan power:	0.53	
Maximum	1.5	OK
MVHR efficiency:	89%	
Minimum:	70%	OK

9 Summertime temperature

Overheating risk (Midlands):	Not significant	OK
Based on:		
Overshading:	Average	
Windows facing East:	8.06 m², No overhang	
Air change rate:	6.00 ach	
Blinds/curtains:	Light-coloured curtain or roller blind, closed 100% of daylight hours	

10 Key features

Party wall U-value	0.00 W/m²K
Door U-value	1.00 W/m²K
Air permeability	3.0 m³/m²h

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.5000 (1b)	x	2.5000 (2b)	=	126.2500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.2500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1163	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1482	0.1453	0.1424	0.1279	0.1250	0.1104	0.1104	0.1075	0.1163	0.1250	0.1308	0.1366	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	75.6500	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2700	0.2671	0.2642	0.2496	0.2467	0.2322	0.2322	0.2293	0.2380	0.2467	0.2525	0.2583	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			1.8900	1.0000	1.8900			(26)
Opening Type 2 (Uw = 1.40)			8.0600	1.3258	10.6856			(27)
External Wall	16.6000	9.9500	6.6500	0.1800	1.1970			(29a)
Corridor Wall	16.6000		16.6000	0.1800	2.9880			(29a)
Total net area of external elements Aum(A, m2)			33.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.7606			(33)
Party Wall			40.2300	0.0000	0.0000			(32)
Party Floor 1			50.5000					(32d)
Party Ceiling 1			50.5000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	6.8736	(36)
Total fabric heat loss	(33) + (36) = 23.6342	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	11.2476	11.1265	11.0054	10.4000	10.2789	9.6735	9.6735	9.5524	9.9157	10.2789	10.5211	10.7632	(38)
Heat transfer coeff	34.8818	34.7607	34.6396	34.0342	33.9131	33.3077	33.3077	33.1866	33.5499	33.9131	34.1553	34.3975	(39)
Average = Sum(39)m / 12 =												34.0039	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.6907	0.6883	0.6859	0.6739	0.6715	0.6596	0.6596	0.6572	0.6644	0.6715	0.6763	0.6811	(40)
HLP (average)												0.6733	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7048 (42)
Average daily hot water use (litres/day)	74.6897 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.1587	79.1711	76.1835	73.1959	70.2083	67.2207	67.2207	70.2083	73.1959	76.1835	79.1711	82.1587	(44)
Energy conte	121.8389	106.5611	109.9615	95.8671	91.9868	79.3776	73.5550	84.4055	85.4135	99.5412	108.6570	117.9945	(45)
Energy content (annual)										Total = Sum(45)m =		1175.1599	(45)

Distribution loss (46)m = 0.15 x (45)m

	18.2758	15.9842	16.4942	14.3801	13.7980	11.9066	11.0333	12.6608	12.8120	14.9312	16.2986	17.6992	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	170.2113	150.2523	158.3339	142.6791	140.3592	126.1896	121.9274	132.7779	132.2255	147.9136	155.4690	166.3669	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	170.2113	150.2523	158.3339	142.6791	140.3592	126.1896	121.9274	132.7779	132.2255	147.9136	155.4690	166.3669	(64)
								Total per year (kWh/year) = Sum(64)m =				1744.7059	(64)
Heat gains from water heating, kWh/month													
	79.2094	70.3845	75.2601	69.3254	69.2835	63.8427	63.1550	66.7627	65.8496	71.7954	73.5781	77.9311	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.4965	11.9874	9.7488	7.3805	5.5170	4.6577	5.0328	6.5418	8.7804	11.1488	13.0122	13.8716	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	148.5325	150.0738	146.1898	137.9211	127.4834	117.6735	111.1198	109.5785	113.4626	121.7312	132.1689	141.9788	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	(71)
Water heating gains (Table 5)													
	106.4642	104.7389	101.1561	96.2853	93.1230	88.6704	84.8857	89.7349	91.4578	96.4992	102.1918	104.7461	(72)
Total internal gains													
	317.0656	315.3725	305.6671	290.1594	274.6959	259.5740	249.6108	254.4277	262.2732	277.9516	295.9453	309.1689	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	8.0600	19.6403	0.4500	0.8000	0.7700	39.4928	(76)

Solar gains	39.4928	77.2563	127.2302	185.5576	227.4078	232.7924	221.6278	190.3750	147.9739	91.6711	49.2429	32.4770	(83)
Total gains	356.5584	392.6289	432.8973	475.7170	502.1037	492.3663	471.2386	444.8027	410.2471	369.6227	345.1882	341.6459	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	100.5380	100.8882	101.2409	103.0418	103.4096	105.2892	105.2892	105.6734	104.5293	103.4096	102.6765	101.9536	
alpha	7.7025	7.7259	7.7494	7.8695	7.8940	8.0193	8.0193	8.0449	7.9686	7.8940	7.8451	7.7969	
util living area													
	0.9910	0.9798	0.9400	0.8139	0.6221	0.4327	0.3110	0.3432	0.5617	0.8657	0.9762	0.9931	(86)
Tweekday	19.8349	19.9549	20.1253	20.2733	20.3114	20.3267	20.3269	20.3292	20.3212	20.2635	20.0460	19.8213	
Tweekend	20.7516	20.8049	20.8833	20.9533	20.9747	20.9779	20.9780	20.9781	20.9768	20.9453	20.8416	20.7422	
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9	
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	20.3490	20.3512	20.3533	20.3639	20.3660	20.3767	20.3767	20.3788	20.3724	20.3660	20.3618	20.3575	(88)
util rest of house													
	0.9885	0.9744	0.9258	0.7827	0.5818	0.3907	0.2669	0.2968	0.5117	0.8332	0.9690	0.9912	(89)
Tweekday	19.8349	19.9549	20.1253	20.2733	20.3114	20.3267	20.3269	20.3292	20.3212	20.2635	20.0460	19.8213	
Tweekend	19.8349	19.9549	20.1253	20.2733	20.3114	20.3267	20.3269	20.3292	20.3212	20.2635	20.0460	19.8213	
MIT 2	20.3490	20.3512	20.3533	20.3639	20.3660	20.3767	20.3767	20.3788	20.3724	20.3660	20.3618	20.3575	(90)
Living area fraction									fLA = Living area / (4) =			0.4430	(91)
MIT	20.6374	20.6386	20.6398	20.6457	20.6469	20.6528	20.6528	20.6540	20.6504	20.6469	20.6445	20.6421	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.6374	20.6386	20.6398	20.6457	20.6469	20.6528	20.6528	20.6540	20.6504	20.6469	20.6445	20.6421	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9897	0.9770	0.9325	0.7969	0.5998	0.4093	0.2864	0.3174	0.5340	0.8482	0.9724	0.9921	(94)
Useful gains	352.8927	383.5848	403.6584	379.1059	301.1382	201.5124	134.9852	141.1661	219.0576	313.5306	335.6634	338.9571	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	569.8773	547.0838	489.7957	399.7548	303.4161	201.6049	134.9895	141.1756	219.7659	340.7205	462.6160	565.5671	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	161.4365	109.8713	64.0861	14.8672	1.6947	0.0000	0.0000	0.0000	0.0000	20.2293	91.4059	168.5979 (98)
Space heating												632.1888 (98)
Space heating per m2											(98) / (4) =	12.5186 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000 (201)
Fraction of space heat from main system(s)	1.0000 (202)
Efficiency of main space heating system 1 (in %)	129.4322 (206)
Efficiency of secondary/supplementary heating system, %	100.0000 (208)
Space heating requirement	488.4323 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	161.4365	109.8713	64.0861	14.8672	1.6947	0.0000	0.0000	0.0000	0.0000	20.2293	91.4059	168.5979	(98)
Space heating efficiency (main heating system 1)													
	129.4322	129.4322	129.4322	129.4322	129.4322	0.0000	0.0000	0.0000	0.0000	129.4322	129.4322	129.4322	(210)
Space heating fuel (main heating system)													
	124.7266	84.8871	49.5133	11.4864	1.3093	0.0000	0.0000	0.0000	0.0000	15.6292	70.6206	130.2596	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	170.2113	150.2523	158.3339	142.6791	140.3592	126.1896	121.9274	132.7779	132.2255	147.9136	155.4690	166.3669	(64)
Efficiency of water heater												178.1250	(216)
(217)m	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	(217)
Fuel for water heating, kWh/month													
	95.5572	84.3522	88.8892	80.1006	78.7981	70.8433	68.4505	74.5420	74.2319	83.0392	87.2809	93.3990	(219)
Water heating fuel used												979.4840	(219)
Annual totals kWh/year													
Space heating fuel - main system												488.4323	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.6625)													
mechanical ventilation fans (SFP = 0.6625)												102.0416	(230a)
Total electricity for the above, kWh/year												102.0416	(231)
Electricity for lighting (calculated in Appendix L)												238.3516	(232)
Total delivered energy for all uses												1808.3094	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	488.4323	0.5190	253.4963	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	979.4840	0.5190	508.3522	(264)
Space and water heating			761.8485	(265)
Pumps and fans	102.0416	0.5190	52.9596	(267)
Energy for lighting	238.3516	0.5190	123.7045	(268)
Total CO2, kg/year			938.5126	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			18.5800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		18.5800	ZC1
Total Floor Area	TFA	50.5000	
Assumed number of occupants	N	1.7048	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		17.4292	ZC2
CO2 emissions from cooking, equation (L16)		3.1667	ZC3
Total CO2 emissions		39.1758	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		39.1758	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	50.5000 (1b)	x	2.5000 (2b)	=	126.2500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	50.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	126.2500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							2 * 10 =	20.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	20.0000 / (5) =	0.1584	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.4084	(18)
Number of sides sheltered		3	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.7750	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3165	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4036	0.3957	0.3877	0.3482	0.3403	0.3007	0.3007	0.2928	0.3165	0.3403	0.3561	0.3719	(22b)
Effective ac	0.5814	0.5783	0.5752	0.5606	0.5579	0.5452	0.5452	0.5429	0.5501	0.5579	0.5634	0.5692	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			1.8900	1.0000	1.8900			(26)
TER Opening Type (Uw = 1.40)			8.0600	1.3258	10.6856			(27)
External Wall	16.6000	9.9500	6.6500	0.1800	1.1970			(29a)
Corridor Wall	16.6000		16.6000	0.1800	2.9880			(29a)
Total net area of external elements Aum(A, m2)			33.2000					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		16.7606			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K		250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)		3.1150 (36)
Total fabric heat loss	(33) + (36) =	19.8756 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	24.2239	24.0922	23.9631	23.3565	23.2430	22.7148	22.7148	22.6169	22.9183	23.2430	23.4726	23.7126	(38)
Heat transfer coeff	44.0995	43.9678	43.8387	43.2321	43.1187	42.5904	42.5904	42.4926	42.7939	43.1187	43.3482	43.5882	(39)
Average = Sum(39)m / 12 =												43.2316	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8733	0.8706	0.8681	0.8561	0.8538	0.8434	0.8434	0.8414	0.8474	0.8538	0.8584	0.8631	(40)
HLP (average)												0.8561	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	1.7048 (42)
Average daily hot water use (litres/day)	74.6897 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	82.1587	79.1711	76.1835	73.1959	70.2083	67.2207	67.2207	70.2083	73.1959	76.1835	79.1711	82.1587	(44)
Energy conte	121.8389	106.5611	109.9615	95.8671	91.9868	79.3776	73.5550	84.4055	85.4135	99.5412	108.6570	117.9945	(45)
Energy content (annual)										Total = Sum(45)m =		1175.1599	(45)
Distribution loss (46)m = 0.15 x (45)m	18.2758	15.9842	16.4942	14.3801	13.7980	11.9066	11.0333	12.6608	12.8120	14.9312	16.2986	17.6992	(46)

Water storage loss:	
Store volume	150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.3938 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.7527 (55)
Total storage loss	

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	168.4338	148.6468	156.5564	140.9590	138.5817	124.4694	120.1499	131.0004	130.5054	146.1361	153.7489	164.5894	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	168.4338	148.6468	156.5564	140.9590	138.5817	124.4694	120.1499	131.0004	130.5054	146.1361	153.7489	164.5894	(64)
								Total per year (kWh/year) = Sum(64)m =				1723.7773	(64)
Heat gains from water heating, kWh/month													
	77.7874	69.1001	73.8381	67.9493	67.8615	62.4665	61.7330	65.3407	64.4735	70.3734	72.2019	76.5091	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	85.2415	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	13.8216	12.2763	9.9837	7.5583	5.6499	4.7699	5.1541	6.6994	8.9920	11.4174	13.3258	14.2058	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	148.5325	150.0738	146.1898	137.9211	127.4834	117.6735	111.1198	109.5785	113.4626	121.7312	132.1689	141.9788	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	31.5241	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	-68.1932	(71)
Water heating gains (Table 5)													
	104.5529	102.8276	99.2448	94.3740	91.2117	86.7591	82.9744	87.8236	89.5465	94.5879	100.2805	102.8348	(72)
Total internal gains													
	318.4795	316.7501	306.9907	291.4259	275.9175	260.7749	250.8208	255.6740	263.5735	279.3089	297.3476	310.5919	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
East	8.0600	19.6403	0.6300	0.7000	0.7700	48.3787	(76)

Solar gains	48.3787	94.6390	155.8569	227.3081	278.5746	285.1706	271.4941	233.2094	181.2681	112.2971	60.3225	39.7843	(83)
Total gains	366.8582	411.3891	462.8477	518.7340	554.4921	545.9456	522.3148	488.8834	444.8416	391.6061	357.6701	350.3762	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	79.5234	79.7616	79.9966	81.1189	81.3324	82.3412	82.3412	82.5308	81.9497	81.3324	80.9017	80.4562	
alpha	6.3016	6.3174	6.3331	6.4079	6.4222	6.4894	6.4894	6.5021	6.4633	6.4222	6.3934	6.3637	
util living area													
	0.9937	0.9862	0.9596	0.8686	0.6957	0.4965	0.3585	0.3992	0.6472	0.9163	0.9852	0.9952	(86)
MIT	20.2717	20.4079	20.6246	20.8575	20.9701	20.9970	20.9997	20.9994	20.9855	20.8239	20.5087	20.2473	(87)
Th 2	20.1903	20.1925	20.1947	20.2050	20.2069	20.2159	20.2159	20.2176	20.2124	20.2069	20.2030	20.1989	(88)
util rest of house													
	0.9919	0.9821	0.9482	0.8379	0.6450	0.4369	0.2948	0.3316	0.5800	0.8883	0.9801	0.9937	(89)
MIT 2	19.2240	19.4224	19.7311	20.0494	20.1805	20.2141	20.2158	20.2173	20.2022	20.0158	19.5775	19.1954	(90)
Living area fraction										fLA = Living area / (4) =		0.4430	(91)
MIT	19.6881	19.8589	20.1269	20.4073	20.5303	20.5609	20.5630	20.5638	20.5492	20.3738	19.9900	19.6614	(92)
Temperature adjustment												0.0000	
adjusted MIT	19.6881	19.8589	20.1269	20.4073	20.5303	20.5609	20.5630	20.5638	20.5492	20.3738	19.9900	19.6614	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9904	0.9800	0.9471	0.8463	0.6662	0.4633	0.3230	0.3616	0.6093	0.8948	0.9784	0.9925	(94)
Useful gains	363.3238	403.1745	438.3670	438.9825	369.3806	252.9293	168.7123	176.7765	271.0567	350.4250	349.9554	347.7364	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	678.6066	657.7110	597.3831	497.4865	380.7495	253.8766	168.7871	176.9289	275.9852	421.4314	558.7585	673.9330	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	234.5704	171.0485	118.3080	42.1229	8.4585	0.0000	0.0000	0.0000	0.0000	52.8288	150.3382	242.6903	(98)
Space heating												1020.3656	(98)
Space heating per m2											(98) / (4) =	20.2053	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												1091.3001	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	234.5704	171.0485	118.3080	42.1229	8.4585	0.0000	0.0000	0.0000	0.0000	52.8288	150.3382	242.6903	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	250.8774	182.9396	126.5326	45.0512	9.0465	0.0000	0.0000	0.0000	0.0000	56.5014	160.7895	259.5618	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	168.4338	148.6468	156.5564	140.9590	138.5817	124.4694	120.1499	131.0004	130.5054	146.1361	153.7489	164.5894	(64)
Efficiency of water heater												79.8000	(216)
(217)m	85.6975	85.1889	84.0788	82.0315	80.3465	79.8000	79.8000	79.8000	79.8000	82.3863	84.7541	85.8482	(217)
Fuel for water heating, kWh/month													
	196.5447	174.4908	186.2021	171.8353	172.4801	155.9767	150.5638	164.1609	163.5406	177.3791	181.4058	191.7215	(219)
Water heating fuel used												2086.3013	(219)
Annual totals kWh/year													
Space heating fuel - main system												1091.3001	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												244.0946	(232)
Total delivered energy for all uses												3496.6960	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1091.3001	0.2160	235.7208	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2086.3013	0.2160	450.6411	(264)
Space and water heating			686.3619	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	244.0946	0.5190	126.6851	(268)
Total CO2, kg/m2/year			851.9720	(272)
Emissions per m2 for space and water heating			13.5913	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.5086	(272b)
Emissions per m2 for pumps and fans			0.7708	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.5913 * 1.55) + 2.5086 + 0.7708, rounded to 2 d.p.			24.3500	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	5 Bed Detached	**Issued on Date**	16/03/2021
Assessment Reference	3	**Prop Type Ref**	
Property	x, Mill Lane, Taplow, Buckinghamshire, SL6		

SAP Rating	86 B	**DER**	12.38	**TER**	22.89
Environmental	88 B	**% DER<TER**	45.92		
CO_2 Emissions (t/year)	2.13	**DFEE**	47.61	**TFEE**	61.01
General Requirements Compliance	Pass	**% DFEE<TFEE**	21.97		

Assessor Details	Mr. Jonathan Peck, Jonathan Peck, Tel: 02036031622, Jonathan@hodkinsonconsultancy.com	**Assessor ID**	T296-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 207 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 22.89 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 12.38 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)61.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)47.6 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
Mitsubishi ECODAN 5kW PUHZ-W50VHA-BS

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage Measured cylinder loss: 1.50 kWh/day
Permitted by DBSCG 1.89 OK
Primary pipework insulated: Yes OK

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.71
Maximum 1.5 OK
MVHR efficiency: 86%
Minimum: 70% OK

---
9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North East: 18.48 m², No overhang
Windows facing South East: 1.56 m², No overhang
Windows facing South West: 15.26 m², No overhang
Windows facing North West: 12.74 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

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10 Key features
Roof U-value 0.10 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.10 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.025 W/m²K
Air permeability 3.0 m³/m²h

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.9000 (1b)	x	2.4500 (2b)	=	195.7550	(1b) - (3b)
First floor	91.2000 (1c)	x	2.8700 (2c)	=	261.7440	(1c) - (3c)
Second floor	35.9000 (1d)	x	2.0500 (2d)	=	73.5950	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	207.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	531.0940	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							0 * 10	=	0.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

				Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =			0.0000 / (5) =	0.0000	(8)
Pressure test				Yes	
Measured/design AP50				3.0000	
Infiltration rate				0.1500	(18)
Number of sides sheltered				2	(19)
Shelter factor			(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor			(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	73.1000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2971	0.2939	0.2907	0.2748	0.2716	0.2556	0.2556	0.2524	0.2620	0.2716	0.2779	0.2843	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.0700	1.0000	2.0700			(26)
Opening Type 2 (Uw = 1.20)			48.0400	1.1450	55.0076			(27)
Opening Type 3 (Uw = 1.20)			6.7500	1.1450	7.7290			(27a)
Floor 1			79.9000	0.1000	7.9900			(28a)
External	286.2000	48.0400	238.1600	0.1500	35.7240			(29a)
Garage	15.4000	2.0700	13.3300	0.1500	1.9995			(29a)
Main Roof	48.3000	4.5000	43.8000	0.1000	4.3800			(30)
Sloped Roof	56.8000	2.2500	54.5500	0.1000	5.4550			(30)
Total net area of external elements Aum(A, m2)			486.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	120.3551			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	12.3737	(36)
Total fabric heat loss (33) + (36) =	132.7289	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	52.0635	51.5048	50.9462	48.1530	47.5943	44.8011	44.8011	44.2425	45.9184	47.5943	48.7116	49.8289	(38)
Heat transfer coeff	184.7923	184.2337	183.6750	180.8818	180.3232	177.5300	177.5300	176.9713	178.6472	180.3232	181.4405	182.5578	(39)
Average = Sum(39)m / 12 =												180.7422	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8927	0.8900	0.8873	0.8738	0.8711	0.8576	0.8576	0.8549	0.8630	0.8711	0.8765	0.8819	(40)
HLP (average)												0.8732	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	3.0110 (42)
Average daily hot water use (litres/day)	105.7119 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	116.2831	112.0546	107.8261	103.5976	99.3692	95.1407	95.1407	99.3692	103.5976	107.8261	112.0546	116.2831	(44)

Energy conte	172.4444	150.8210	155.6337	135.6853	130.1932	112.3469	104.1059	119.4630	120.8898	140.8854	153.7874	167.0032	(45)
Energy content (annual)										Total = Sum(45)m =		1663.2593	(45)
Distribution loss (46)m = 0.15 x (45)m													
	25.8667	22.6231	23.3451	20.3528	19.5290	16.8520	15.6159	17.9195	18.1335	21.1328	23.0681	25.0505	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	220.8168	194.5122	204.0061	182.4973	178.5656	159.1589	152.4783	167.8354	167.7018	189.2578	200.5994	215.3756	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	220.8168	194.5122	204.0061	182.4973	178.5656	159.1589	152.4783	167.8354	167.7018	189.2578	200.5994	215.3756	(64)
									Total per year (kWh/year) = Sum(64)m =			2232.8053	(64)
Heat gains from water heating, kWh/month													
	96.0357	85.1009	90.4461	82.5650	81.9872	74.8049	73.3131	78.4194	77.6455	85.5423	88.5839	94.2265	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	33.6678	29.9034	24.3191	18.4111	13.7625	11.6189	12.5546	16.3190	21.9033	27.8113	32.4599	34.6035	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	377.6504	381.5692	371.6939	350.6705	324.1322	299.1900	282.5271	278.6082	288.4836	309.5070	336.0452	360.9874	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	(71)
Water heating gains (Table 5)													
	129.0802	126.6383	121.5674	114.6735	110.1978	103.8957	98.5392	105.4024	107.8409	114.9762	123.0332	126.6485	(72)
Total internal gains													
	608.5638	606.2763	585.7458	551.9206	516.2580	482.8701	461.7863	468.4950	486.3932	520.4599	559.7037	590.4049	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	18.4800	11.2829	0.4500	0.7000	0.7700	45.5164	(75)
Southeast	1.5600	36.7938	0.4500	0.7000	0.7700	12.5298	(77)
Southwest	15.2600	36.7938	0.4500	0.7000	0.7700	122.5669	(79)
Northwest	12.7400	11.2829	0.4500	0.7000	0.7700	31.3787	(81)
Horizontal	6.7500	26.0000	0.4500	0.7000	1.0000	49.7543	(82)

Solar gains	261.7461	489.9778	780.5713	1140.3010	1426.9288	1480.2312	1400.7886	1178.6968	904.6191	571.9132	321.7184	218.5972	(83)
Total gains	870.3099	1096.2541	1366.3170	1692.2215	1943.1867	1963.1013	1862.5748	1647.1919	1391.0123	1092.3731	881.4221	809.0021	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.7900	78.0259	78.2632	79.4718	79.7180	80.9722	80.9722	81.2279	80.4658	79.7180	79.2271	78.7422	
alpha	6.1860	6.2017	6.2175	6.2981	6.3145	6.3981	6.3981	6.4152	6.3644	6.3145	6.2818	6.2495	
util living area													
	0.9997	0.9987	0.9923	0.9470	0.7923	0.5713	0.4184	0.4915	0.8068	0.9860	0.9991	0.9998	(86)
Tweekday	18.7352	18.9762	19.3685	19.8618	20.1309	20.1992	20.2033	20.2051	20.1571	19.7299	19.1425	18.7095	
Tweekend	20.3181	20.4238	20.5972	20.8190	20.9575	20.9954	20.9995	20.9986	20.9659	20.7533	20.4933	20.3037	
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9	
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	20.1737	20.1760	20.1783	20.1898	20.1921	20.2037	20.2037	20.2060	20.1990	20.1921	20.1875	20.1829	(88)
util rest of house													
	0.9996	0.9982	0.9895	0.9297	0.7431	0.5035	0.3432	0.4081	0.7403	0.9790	0.9988	0.9998	(89)
Tweekday	18.7352	18.9762	19.3685	19.8618	20.1309	20.1992	20.2033	20.2051	20.1571	19.7299	19.1425	18.7095	
Tweekend	18.7352	18.9762	19.3685	19.8618	20.1309	20.1992	20.2033	20.2051	20.1571	19.7299	19.1425	18.7095	
MIT 2	20.1737	20.1760	20.1783	20.1898	20.1921	20.2037	20.2037	20.2060	20.1990	20.1921	20.1875	20.1829	(90)
Living area fraction									fLA = Living area / (4) =			0.3031	(91)
MIT	20.4242	20.4258	20.4274	20.4354	20.4370	20.4451	20.4451	20.4467	20.4418	20.4370	20.4338	20.4306	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.4242	20.4258	20.4274	20.4354	20.4370	20.4451	20.4451	20.4467	20.4418	20.4370	20.4338	20.4306	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Utilisation	0.9997	0.9984	0.9905	0.9355	0.7588	0.5243	0.3661	0.4336	0.7620	0.9815	0.9989	0.9998	(94)
Useful gains	870.0056	1094.4866	1353.2825	1583.0591	1474.4209	1029.3212	681.9110	714.2070	1059.8933	1072.1371	880.4356	808.8258	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	2979.6252	2860.3723	2558.1131	2086.5457	1575.4864	1037.6739	682.6140	716.1456	1132.9526	1773.8419	2419.2913	2963.0204	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1569.5570	1186.6752	896.3939	362.5103	75.1927	0.0000	0.0000	0.0000	0.0000	522.0683	1107.9761	1602.7208	(98)

Space heating 7323.0943 (98)
Space heating per m2 (98) / (4) = 35.3773 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 291.0025 (206)
Efficiency of secondary/supplementary heating system, % 100.0000 (208)
Space heating requirement 2516.5057 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement	1569.5570	1186.6752	896.3939	362.5103	75.1927	0.0000	0.0000	0.0000	0.0000	522.0683	1107.9761	1602.7208	(98)
Space heating efficiency (main heating system 1)	291.0025	291.0025	291.0025	291.0025	291.0025	0.0000	0.0000	0.0000	0.0000	291.0025	291.0025	291.0025	(210)
Space heating fuel (main heating system)	539.3620	407.7887	308.0365	124.5729	25.8392	0.0000	0.0000	0.0000	0.0000	179.4034	380.7445	550.7584	(211)
Water heating requirement	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement	220.8168	194.5122	204.0061	182.4973	178.5656	159.1589	152.4783	167.8354	167.7018	189.2578	200.5994	215.3756	(64)
Efficiency of water heater												178.1250	(216)
(217)m	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	(217)
Fuel for water heating, kWh/month	123.9673	109.1998	114.5298	102.4546	100.2474	89.3524	85.6018	94.2234	94.1484	106.2500	112.6172	120.9126	(219)

Water heating fuel used 1253.5047 (219)
Annual totals kWh/year
Space heating fuel - main system 2516.5057 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.8875)
mechanical ventilation fans (SFP = 0.8875) 575.0420 (230a)
Total electricity for the above, kWh/year 575.0420 (231)
Electricity for lighting (calculated in Appendix L) 594.5840 (232)
Total delivered energy for all uses 4939.6364 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2516.5057	0.5190	1306.0664	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1253.5047	0.5190	650.5690	(264)
Space and water heating			1956.6354	(265)
Pumps and fans	575.0420	0.5190	298.4468	(267)
Energy for lighting	594.5840	0.5190	308.5891	(268)
Total CO2, kg/year			2563.6713	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			12.3800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		12.3800	ZC1
Total Floor Area	TFA	207.0000	
Assumed number of occupants	N	3.0110	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		10.8110	ZC2
CO2 emissions from cooking, equation (L16)		0.9240	ZC3
Total CO2 emissions		24.1150	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		24.1150	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.9000 (1b)	x	2.4500 (2b)	=	195.7550	(1b) - (3b)
First floor	91.2000 (1c)	x	2.8700 (2c)	=	261.7440	(1c) - (3c)
Second floor	35.9000 (1d)	x	2.0500 (2d)	=	73.5950	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	207.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	531.0940	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0753	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3253	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2765	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3526	0.3456	0.3387	0.3042	0.2973	0.2627	0.2627	0.2558	0.2765	0.2973	0.3111	0.3249	(22b)
Effective ac	0.5621	0.5597	0.5574	0.5463	0.5442	0.5345	0.5345	0.5327	0.5382	0.5442	0.5484	0.5528	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0700	1.0000	2.0700			(26)
TER Opening Type (Uw = 1.40)			43.5600	1.3258	57.7500			(27)
TER Room Window (Uw = 1.70)			6.1200	1.5918	9.7416			(27a)
Floor 1			79.9000	0.1300	10.3870			(28a)
External	286.2000	43.5600	242.6400	0.1800	43.6752			(29a)
Garage	15.4000	2.0700	13.3300	0.1800	2.3994			(29a)
Main Roof	48.3000	4.0800	44.2200	0.1300	5.7486			(30)
Sloped Roof	56.8000	2.0400	54.7600	0.1300	7.1188			(30)
Total net area of external elements Aum(A, m2)			486.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	138.8906			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.5445	(36)
Total fabric heat loss					(33) + (36) =		157.4351	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	98.5229	98.1000	97.6854	95.7381	95.3737	93.6777	93.6777	93.3636	94.3310	95.3737	96.1108	96.8813	(38)
Heat transfer coeff	255.9580	255.5351	255.1205	253.1731	252.8088	251.1127	251.1127	250.7987	251.7660	252.8088	253.5459	254.3164	(39)
Average = Sum(39)m / 12 =												253.1714	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2365	1.2345	1.2325	1.2231	1.2213	1.2131	1.2131	1.2116	1.2163	1.2213	1.2249	1.2286	(40)
HLP (average)												1.2231	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		3.0110 (42)
Average daily hot water use (litres/day)		105.7119 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	116.2831	112.0546	107.8261	103.5976	99.3692	95.1407	95.1407	99.3692	103.5976	107.8261	112.0546	116.2831	(44)
Energy conte	172.4444	150.8210	155.6337	135.6853	130.1932	112.3469	104.1059	119.4630	120.8898	140.8854	153.7874	167.0032	(45)
Energy content (annual)										Total = Sum(45)m =		1663.2593	(45)
Distribution loss (46)m = 0.15 x (45)m	25.8667	22.6231	23.3451	20.3528	19.5290	16.8520	15.6159	17.9195	18.1335	21.1328	23.0681	25.0505	(46)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Water storage loss:
Store volume 150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.3938 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7527 (55)
Total storage loss

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)

If cylinder contains dedicated solar storage

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

Total heat required for water heating calculated for each month

	219.0393	192.9067	202.2286	180.7771	176.7882	157.4387	150.7008	166.0579	165.9816	187.4803	198.8793	213.5981 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	219.0393	192.9067	202.2286	180.7771	176.7882	157.4387	150.7008	166.0579	165.9816	187.4803	198.8793	213.5981 (64)

Total per year (kWh/year) = Sum(64)m = 2211.8767 (64)

Heat gains from water heating, kWh/month

	94.6137	83.8166	89.0241	81.1888	80.5652	73.4288	71.8911	76.9974	76.2693	84.1203	87.2078	92.8045 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	33.6678	29.9034	24.3191	18.4111	13.7625	11.6189	12.5546	16.3190	21.9033	27.8113	32.4599	34.6035 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	377.6504	381.5692	371.6939	350.6705	324.1322	299.1900	282.5271	278.6082	288.4836	309.5070	336.0452	360.9874 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410 (71)

Water heating gains (Table 5)

	127.1689	124.7270	119.6561	112.7623	108.2865	101.9845	96.6279	103.4911	105.9296	113.0649	121.1219	124.7372 (72)

Total internal gains

	609.6525	607.3650	586.8345	553.0093	517.3467	483.9588	462.8750	469.5837	487.4819	521.5486	560.7925	591.4936 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	16.7600	11.2829	0.6300	0.7000	0.7700	57.7921	(75)
Southeast	1.4100	36.7938	0.6300	0.7000	0.7700	15.8550	(77)
Southwest	13.8400	36.7938	0.6300	0.7000	0.7700	155.6263	(79)
Northwest	11.5500	11.2829	0.6300	0.7000	0.7700	39.8269	(81)
Horizontal	6.1200	26.0000	0.6300	0.7000	1.0000	63.1547	(82)

Solar gains	332.2549	621.9697	990.8505	1447.4980	1811.3513	1879.0171	1778.1707	1496.2407	1148.3189	725.9789	408.3828	277.4823	(83)
Total gains	941.9074	1229.3348	1577.6850	2000.5073	2328.6980	2362.9759	2241.0456	1965.8245	1635.8009	1247.5275	969.1753	868.9759	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1616	56.2545	56.3459	56.7793	56.8612	57.2452	57.2452	57.3169	57.0967	56.8612	56.6959	56.5241	
alpha	4.7441	4.7503	4.7564	4.7853	4.7907	4.8163	4.8163	4.8211	4.8064	4.7907	4.7797	4.7683	
util living area	0.9994	0.9977	0.9900	0.9507	0.8313	0.6421	0.4846	0.5674	0.8517	0.9850	0.9985	0.9996	(86)
MIT	19.5112	19.7098	20.0446	20.4799	20.8140	20.9597	20.9915	20.9829	20.8458	20.3728	19.8557	19.4774	(87)
Th 2	19.8909	19.8925	19.8941	19.9016	19.9030	19.9095	19.9095	19.9107	19.9070	19.9030	19.9002	19.8972	(88)
util rest of house	0.9992	0.9969	0.9862	0.9322	0.7761	0.5480	0.3689	0.4427	0.7782	0.9769	0.9978	0.9995	(89)
MIT 2	17.8959	18.1873	18.6756	19.2980	19.7282	19.8844	19.9066	19.9040	19.7829	19.1596	18.4065	17.8509	(90)
Living area fraction										fLA = Living area / (4) =		0.3031	(91)
MIT	18.3856	18.6488	19.0906	19.6563	20.0574	20.2104	20.2355	20.2311	20.1051	19.5274	18.8458	18.3439	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3856	18.6488	19.0906	19.6563	20.0574	20.2104	20.2355	20.2311	20.1051	19.5274	18.8458	18.3439	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9956	0.9824	0.9271	0.7848	0.5752	0.4042	0.4807	0.7936	0.9730	0.9968	0.9991	(94)
Useful gains	940.7129	1223.8731	1549.9349	1854.6539	1827.4755	1359.2566	905.7256	945.0077	1298.2270	1213.8460	966.1148	868.2220	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	3605.3183	3513.3119	3212.1268	2723.1959	2112.8146	1408.8312	912.9220	960.8260	1511.8892	2256.9256	2978.1059	3597.0363	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1982.4664	1538.5029	1236.6708	625.3502	212.2924	0.0000	0.0000	0.0000	0.0000	776.0512	1448.6336	2030.2378	(98)
Space heating												9850.2053	(98)
Space heating per m2											(98) / (4) =	47.5855	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												10534.9790	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1982.4664	1538.5029	1236.6708	625.3502	212.2924	0.0000	0.0000	0.0000	0.0000	776.0512	1448.6336	2030.2378	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	2120.2850	1645.4576	1322.6426	668.8238	227.0506	0.0000	0.0000	0.0000	0.0000	830.0013	1549.3408	2171.3773	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.0393	192.9067	202.2286	180.7771	176.7882	157.4387	150.7008	166.0579	165.9816	187.4803	198.8793	213.5981	(64)
Efficiency of water heater												79.8000	(216)
(217)m	89.3085	89.1679	88.8261	87.8582	85.3029	79.8000	79.8000	79.8000	79.8000	88.1989	89.0585	89.3594	(217)
Fuel for water heating, kWh/month													
	245.2613	216.3410	227.6681	205.7601	207.2475	197.2916	188.8481	208.0927	207.9970	212.5653	223.3131	239.0326	(219)
Water heating fuel used												2579.4184	(219)
Annual totals kWh/year													
Space heating fuel - main system												10534.9790	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												594.5840	(232)
Total delivered energy for all uses												13783.9814	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	10534.9790	0.2160	2275.5555	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2579.4184	0.2160	557.1544	(264)
Space and water heating			2832.7098	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	594.5840	0.5190	308.5891	(268)
Total CO2, kg/m2/year			3180.2239	(272)
Emissions per m2 for space and water heating			13.6846	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			1.4908	(272b)
Emissions per m2 for pumps and fans			0.1880	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.6846 * 1.55) + 1.4908 + 0.1880, rounded to 2 d.p.			22.8900	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	5 Bed Detached	**Issued on Date**	16/03/2021
Assessment Reference	2	**Prop Type Ref**	
Property	x, Mill Lane, Taplow, Buckinghamshire, SL6		

SAP Rating	82 B	**DER**	15.59	**TER**	22.89
Environmental	84 B	**% DER<TER**	31.89		
CO_2 Emissions (t/year)	2.74	**DFEE**	57.84	**TFEE**	61.01
General Requirements Compliance	Pass	**% DFEE<TFEE**	5.20		

Assessor Details	Mr. Jonathan Peck, Jonathan Peck, Tel: 02036031622, Jonathan@hodkinsonconsultancy.com	**Assessor ID**	T296-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Detached House, total floor area 207 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 22.89 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.59 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)61.0 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)57.8 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.14 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.39 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 5.00 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
Mitsubishi ECODAN 5kW PUHZ-W50VHA-BS

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: Measured cylinder loss: 1.50 kWh/day
Permitted by DBSCG 1.89: OK
Primary pipework insulated: Yes OK

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North East: 18.48 m², No overhang
Windows facing South East: 1.56 m², No overhang
Windows facing South West: 15.26 m², No overhang
Windows facing North West: 12.74 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

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10 Key features
Roof U-value 0.11 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.039 W/m²K

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.9000 (1b)	x	2.4500 (2b)	=	195.7550	(1b) - (3b)
First floor	91.2000 (1c)	x	2.8700 (2c)	=	261.7440	(1c) - (3c)
Second floor	35.9000 (1d)	x	2.0500 (2d)	=	73.5950	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	207.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	531.0940	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000	/ (5) =	0.0753	(8)
Pressure test			Yes	
Measured/design AP50			5.0000	
Infiltration rate			0.3253	(18)
Number of sides sheltered			2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.2765	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3526	0.3456	0.3387	0.3042	0.2973	0.2627	0.2627	0.2558	0.2765	0.2973	0.3111	0.3249	(22b)
Effective ac	0.5621	0.5597	0.5574	0.5463	0.5442	0.5345	0.5345	0.5327	0.5382	0.5442	0.5484	0.5528	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.0700	1.0000	2.0700			(26)
Opening Type 2 (Uw = 1.40)			48.0400	1.3258	63.6894			(27)
Opening Type 3 (Uw = 1.40)			6.7500	1.3258	8.9489			(27a)
Floor 1			79.9000	0.1600	12.7840			(28a)
External	286.2000	48.0400	238.1600	0.1800	42.8688			(29a)
Garage	15.4000	2.0700	13.3300	0.1700	2.2661			(29a)
Main Roof	48.3000	4.5000	43.8000	0.1100	4.8180			(30)
Sloped Roof	56.8000	2.2500	54.5500	0.1600	8.7280			(30)
Total net area of external elements Aum(A, m2)			486.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	146.1732			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							19.0041	(36)
Total fabric heat loss					(33) + (36) =		165.1773	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	98.5229	98.1000	97.6854	95.7381	95.3737	93.6777	93.6777	93.3636	94.3310	95.3737	96.1108	96.8813	(38)
Heat transfer coeff	263.7002	263.2773	262.8627	260.9154	260.5510	258.8550	258.8550	258.5409	259.5083	260.5510	261.2881	262.0586	(39)
Average = Sum(39)m / 12 =												260.9136	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2739	1.2719	1.2699	1.2605	1.2587	1.2505	1.2505	1.2490	1.2537	1.2587	1.2623	1.2660	(40)
HLP (average)												1.2605	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy												3.0110	(42)
Average daily hot water use (litres/day)												105.7119	(43)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	116.2831	112.0546	107.8261	103.5976	99.3692	95.1407	95.1407	99.3692	103.5976	107.8261	112.0546	116.2831	(44)
Energy conte	172.4444	150.8210	155.6337	135.6853	130.1932	112.3469	104.1059	119.4630	120.8898	140.8854	153.7874	167.0032	(45)
Energy content (annual)										Total = Sum(45)m =		1663.2593	(45)
Distribution loss (46)m = 0.15 x (45)m	25.8667	22.6231	23.3451	20.3528	19.5290	16.8520	15.6159	17.9195	18.1335	21.1328	23.0681	25.0505	(46)

Water storage loss:
Store volume 150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8100 (55)
Total storage loss

	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100 (56)

If cylinder contains dedicated solar storage

	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

Total heat required for water heating calculated for each month

	220.8168	194.5122	204.0061	182.4973	178.5656	159.1589	152.4783	167.8354	167.7018	189.2578	200.5994	215.3756 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	220.8168	194.5122	204.0061	182.4973	178.5656	159.1589	152.4783	167.8354	167.7018	189.2578	200.5994	215.3756 (64)

Total per year (kWh/year) = Sum(64)m = 2232.8053 (64)

Heat gains from water heating, kWh/month

	96.0357	85.1009	90.4461	82.5650	81.9872	74.8049	73.3131	78.4194	77.6455	85.5423	88.5839	94.2265 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	33.6678	29.9034	24.3191	18.4111	13.7625	11.6189	12.5546	16.3190	21.9033	27.8113	32.4599	34.6035	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	377.6504	381.5692	371.6939	350.6705	324.1322	299.1900	282.5271	278.6082	288.4836	309.5070	336.0452	360.9874	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	(71)

Water heating gains (Table 5)

	129.0802	126.6383	121.5674	114.6735	110.1978	103.8957	98.5392	105.4024	107.8409	114.9762	123.0332	126.6485	(72)

Total internal gains

	608.5638	606.2763	585.7458	551.9206	516.2580	482.8701	461.7863	468.4950	486.3932	520.4599	559.7037	590.4049	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	18.4800	11.2829	0.4500	0.7000	0.7700	45.5164	(75)
Southeast	1.5600	36.7938	0.4500	0.7000	0.7700	12.5298	(77)
Southwest	15.2600	36.7938	0.4500	0.7000	0.7700	122.5669	(79)
Northwest	12.7400	11.2829	0.4500	0.7000	0.7700	31.3787	(81)
Horizontal	6.7500	26.0000	0.4500	0.7000	1.0000	49.7543	(82)

Solar gains	261.7461	489.9778	780.5713	1140.3010	1426.9288	1480.2312	1400.7886	1178.6968	904.6191	571.9132	321.7184	218.5972	(83)
Total gains	870.3099	1096.2541	1366.3170	1692.2215	1943.1867	1963.1013	1862.5748	1647.1919	1391.0123	1092.3731	881.4221	809.0021	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.5127	54.6002	54.6863	55.0945	55.1715	55.5330	55.5330	55.6005	55.3932	55.1715	55.0159	54.8541	
alpha	4.6342	4.6400	4.6458	4.6730	4.6781	4.7022	4.7022	4.7067	4.6929	4.6781	4.6677	4.6569	
util living area	0.9996	0.9986	0.9945	0.9741	0.9013	0.7483	0.5865	0.6707	0.9105	0.9914	0.9990	0.9997	(86)
Tweekday	17.7599	18.0133	18.4617	19.0688	19.5738	19.8233	19.8722	19.8650	19.6740	19.0011	18.2707	17.7219	
Tweekend	19.9864	20.0979	20.2960	20.5662	20.8068	20.9459	20.9866	20.9756	20.8491	20.5321	20.2092	19.9677	
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9	
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	19.8613	19.8629	19.8645	19.8719	19.8733	19.8798	19.8798	19.8810	19.8773	19.8733	19.8705	19.8676	(88)
util rest of house	0.9994	0.9981	0.9924	0.9631	0.8594	0.6521	0.4496	0.5315	0.8537	0.9865	0.9985	0.9996	(89)
Tweekday	17.7599	18.0133	18.4617	19.0688	19.5738	19.8233	19.8722	19.8650	19.6740	19.0011	18.2707	17.7219	
Tweekend	17.7599	18.0133	18.4617	19.0688	19.5738	19.8233	19.8722	19.8650	19.6740	19.0011	18.2707	17.7219	
MIT 2	19.8613	19.8629	19.8645	19.8719	19.8733	19.8798	19.8798	19.8810	19.8773	19.8733	19.8705	19.8676	(90)
Living area fraction									fLA = Living area / (4) =			0.3031	(91)
MIT	20.2065	20.2076	20.2087	20.2139	20.2149	20.2194	20.2194	20.2202	20.2176	20.2149	20.2129	20.2109	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.2065	20.2076	20.2087	20.2139	20.2149	20.2194	20.2194	20.2202	20.2176	20.2149	20.2129	20.2109	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9995	0.9983	0.9931	0.9669	0.8737	0.6837	0.4929	0.5768	0.8741	0.9883	0.9987	0.9996	(94)
Useful gains	869.8384	1094.3539	1356.9051	1636.2100	1697.8269	1342.2557	918.1230	950.0369	1215.8579	1079.5723	880.2634	808.6960	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	4194.5485	4030.1496	3603.5121	2951.9697	2218.5572	1454.6051	936.8951	987.6829	1587.5787	2505.1634	3426.2461	4195.7838	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	2473.5844	1972.8547	1671.4756	947.3470	387.4233	0.0000	0.0000	0.0000	0.0000	1060.6397	1833.1076	2519.9933	(98)
Space heating												12866.4256	(98)
Space heating per m2											(98) / (4) =	62.1566	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												294.5306	(206)
Efficiency of secondary/supplementary heating system, %												100.0000	(208)
Space heating requirement												4368.4518	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	2473.5844	1972.8547	1671.4756	947.3470	387.4233	0.0000	0.0000	0.0000	0.0000	1060.6397	1833.1076	2519.9933	(98)
Space heating efficiency (main heating system 1)													
	294.5306	294.5306	294.5306	294.5306	294.5306	0.0000	0.0000	0.0000	0.0000	294.5306	294.5306	294.5306	(210)
Space heating fuel (main heating system)													
	839.8396	669.8302	567.5050	321.6464	131.5393	0.0000	0.0000	0.0000	0.0000	360.1119	622.3828	855.5966	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	220.8168	194.5122	204.0061	182.4973	178.5656	159.1589	152.4783	167.8354	167.7018	189.2578	200.5994	215.3756	(64)
Efficiency of water heater												178.1250	(216)
(217)m	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	(217)
Fuel for water heating, kWh/month													
	123.9673	109.1998	114.5298	102.4546	100.2474	89.3524	85.6018	94.2234	94.1484	106.2500	112.6172	120.9126	(219)
Water heating fuel used												1253.5047	(219)
Annual totals kWh/year													
Space heating fuel - main system												4368.4518	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												594.5840	(232)
Total delivered energy for all uses												6216.5405	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4368.4518	0.5190	2267.2265	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1253.5047	0.5190	650.5690	(264)
Space and water heating			2917.7955	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	594.5840	0.5190	308.5891	(268)
Total CO2, kg/year			3226.3845	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.5900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.5900	ZC1
Total Floor Area	TFA	207.0000	
Assumed number of occupants	N	3.0110	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		10.8110	ZC2
CO2 emissions from cooking, equation (L16)		0.9240	ZC3
Total CO2 emissions		27.3250	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		27.3250	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	79.9000 (1b)	x	2.4500 (2b)	=	195.7550	(1b) - (3b)
First floor	91.2000 (1c)	x	2.8700 (2c)	=	261.7440	(1c) - (3c)
Second floor	35.9000 (1d)	x	2.0500 (2d)	=	73.5950	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	207.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	531.0940	(5)

2. Ventilation rate

	main heating		secondary heating		other		total		m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40	=	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20	=	0.0000	(6b)
Number of intermittent fans							4 * 10	=	40.0000	(7a)
Number of passive vents							0 * 10	=	0.0000	(7b)
Number of flueless gas fires							0 * 40	=	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.0753	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3253	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.2765	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.3526	0.3456	0.3387	0.3042	0.2973	0.2627	0.2627	0.2558	0.2765	0.2973	0.3111	0.3249	(22b)
Effective ac	0.5621	0.5597	0.5574	0.5463	0.5442	0.5345	0.5345	0.5327	0.5382	0.5442	0.5484	0.5528	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.0700	1.0000	2.0700			(26)
TER Opening Type (Uw = 1.40)			43.5600	1.3258	57.7500			(27)
TER Room Window (Uw = 1.70)			6.1200	1.5918	9.7416			(27a)
Floor 1			79.9000	0.1300	10.3870			(28a)
External	286.2000	43.5600	242.6400	0.1800	43.6752			(29a)
Garage	15.4000	2.0700	13.3300	0.1800	2.3994			(29a)
Main Roof	48.3000	4.0800	44.2200	0.1300	5.7486			(30)
Sloped Roof	56.8000	2.0400	54.7600	0.1300	7.1188			(30)
Total net area of external elements Aum(A, m2)			486.6000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	138.8906			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							18.5445	(36)
Total fabric heat loss					(33) + (36) =		157.4351	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	98.5229	98.1000	97.6854	95.7381	95.3737	93.6777	93.6777	93.3636	94.3310	95.3737	96.1108	96.8813	(38)
Heat transfer coeff	255.9580	255.5351	255.1205	253.1731	252.8088	251.1127	251.1127	250.7987	251.7660	252.8088	253.5459	254.3164	(39)
Average = Sum(39)m / 12 =												253.1714	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2365	1.2345	1.2325	1.2231	1.2213	1.2131	1.2131	1.2116	1.2163	1.2213	1.2249	1.2286	(40)
HLP (average)												1.2231	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		3.0110 (42)
Average daily hot water use (litres/day)		105.7119 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	116.2831	112.0546	107.8261	103.5976	99.3692	95.1407	95.1407	99.3692	103.5976	107.8261	112.0546	116.2831	(44)
Energy conte	172.4444	150.8210	155.6337	135.6853	130.1932	112.3469	104.1059	119.4630	120.8898	140.8854	153.7874	167.0032	(45)
Energy content (annual)										Total = Sum(45)m =		1663.2593	(45)
Distribution loss (46)m = 0.15 x (45)m	25.8667	22.6231	23.3451	20.3528	19.5290	16.8520	15.6159	17.9195	18.1335	21.1328	23.0681	25.0505	(46)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Water storage loss:
Store volume 150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day): 1.3938 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7527 (55)
Total storage loss

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (56)

If cylinder contains dedicated solar storage

	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

Total heat required for water heating calculated for each month

	219.0393	192.9067	202.2286	180.7771	176.7882	157.4387	150.7008	166.0579	165.9816	187.4803	198.8793	213.5981 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

	219.0393	192.9067	202.2286	180.7771	176.7882	157.4387	150.7008	166.0579	165.9816	187.4803	198.8793	213.5981 (64)

Total per year (kWh/year) = Sum(64)m = 2211.8767 (64)

Heat gains from water heating, kWh/month

	94.6137	83.8166	89.0241	81.1888	80.5652	73.4288	71.8911	76.9974	76.2693	84.1203	87.2078	92.8045 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	150.5513	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

	33.6678	29.9034	24.3191	18.4111	13.7625	11.6189	12.5546	16.3190	21.9033	27.8113	32.4599	34.6035 (67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

	377.6504	381.5692	371.6939	350.6705	324.1322	299.1900	282.5271	278.6082	288.4836	309.5070	336.0452	360.9874 (68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551	38.0551 (69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000 (70)

Losses e.g. evaporation (negative values) (Table 5)

	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410	-120.4410 (71)

Water heating gains (Table 5)

	127.1689	124.7270	119.6561	112.7623	108.2865	101.9845	96.6279	103.4911	105.9296	113.0649	121.1219	124.7372 (72)

Total internal gains

	609.6525	607.3650	586.8345	553.0093	517.3467	483.9588	462.8750	469.5837	487.4819	521.5486	560.7925	591.4936 (73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
Northeast	16.7600	11.2829	0.6300	0.7000	0.7700	57.7921	(75)
Southeast	1.4100	36.7938	0.6300	0.7000	0.7700	15.8550	(77)
Southwest	13.8400	36.7938	0.6300	0.7000	0.7700	155.6263	(79)
Northwest	11.5500	11.2829	0.6300	0.7000	0.7700	39.8269	(81)
Horizontal	6.1200	26.0000	0.6300	0.7000	1.0000	63.1547	(82)

Solar gains	332.2549	621.9697	990.8505	1447.4980	1811.3513	1879.0171	1778.1707	1496.2407	1148.3189	725.9789	408.3828	277.4823	(83)
Total gains	941.9074	1229.3348	1577.6850	2000.5073	2328.6980	2362.9759	2241.0456	1965.8245	1635.8009	1247.5275	969.1753	868.9759	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	56.1616	56.2545	56.3459	56.7793	56.8612	57.2452	57.2452	57.3169	57.0967	56.8612	56.6959	56.5241	
alpha	4.7441	4.7503	4.7564	4.7853	4.7907	4.8163	4.8163	4.8211	4.8064	4.7907	4.7797	4.7683	
util living area	0.9994	0.9977	0.9900	0.9507	0.8313	0.6421	0.4846	0.5674	0.8517	0.9850	0.9985	0.9996	(86)
MIT	19.5112	19.7098	20.0446	20.4799	20.8140	20.9597	20.9915	20.9829	20.8458	20.3728	19.8557	19.4774	(87)
Th 2	19.8909	19.8925	19.8941	19.9016	19.9030	19.9095	19.9095	19.9107	19.9070	19.9030	19.9002	19.8972	(88)
util rest of house	0.9992	0.9969	0.9862	0.9322	0.7761	0.5480	0.3689	0.4427	0.7782	0.9769	0.9978	0.9995	(89)
MIT 2	17.8959	18.1873	18.6756	19.2980	19.7282	19.8844	19.9066	19.9040	19.7829	19.1596	18.4065	17.8509	(90)
Living area fraction										fLA = Living area / (4) =		0.3031	(91)
MIT	18.3856	18.6488	19.0906	19.6563	20.0574	20.2104	20.2355	20.2311	20.1051	19.5274	18.8458	18.3439	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3856	18.6488	19.0906	19.6563	20.0574	20.2104	20.2355	20.2311	20.1051	19.5274	18.8458	18.3439	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9987	0.9956	0.9824	0.9271	0.7848	0.5752	0.4042	0.4807	0.7936	0.9730	0.9968	0.9991	(94)
Useful gains	940.7129	1223.8731	1549.9349	1854.6539	1827.4755	1359.2566	905.7256	945.0077	1298.2270	1213.8460	966.1148	868.2220	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	3605.3183	3513.3119	3212.1268	2723.1959	2112.8146	1408.8312	912.9220	960.8260	1511.8892	2256.9256	2978.1059	3597.0363	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	1982.4664	1538.5029	1236.6708	625.3502	212.2924	0.0000	0.0000	0.0000	0.0000	776.0512	1448.6336	2030.2378	(98)
Space heating												9850.2053	(98)
Space heating per m2											(98) / (4) =	47.5855	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												10534.9790	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1982.4664	1538.5029	1236.6708	625.3502	212.2924	0.0000	0.0000	0.0000	0.0000	776.0512	1448.6336	2030.2378	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	2120.2850	1645.4576	1322.6426	668.8238	227.0506	0.0000	0.0000	0.0000	0.0000	830.0013	1549.3408	2171.3773	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	219.0393	192.9067	202.2286	180.7771	176.7882	157.4387	150.7008	166.0579	165.9816	187.4803	198.8793	213.5981	(64)
Efficiency of water heater												79.8000	(216)
(217)m	89.3085	89.1679	88.8261	87.8582	85.3029	79.8000	79.8000	79.8000	79.8000	88.1989	89.0585	89.3594	(217)
Fuel for water heating, kWh/month													
	245.2613	216.3410	227.6681	205.7601	207.2475	197.2916	188.8481	208.0927	207.9970	212.5653	223.3131	239.0326	(219)
Water heating fuel used												2579.4184	(219)
Annual totals kWh/year													
Space heating fuel - main system												10534.9790	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												594.5840	(232)
Total delivered energy for all uses												13783.9814	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	10534.9790	0.2160	2275.5555	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2579.4184	0.2160	557.1544	(264)
Space and water heating			2832.7098	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	594.5840	0.5190	308.5891	(268)
Total CO2, kg/m2/year			3180.2239	(272)
Emissions per m2 for space and water heating			13.6846	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			1.4908	(272b)
Emissions per m2 for pumps and fans			0.1880	(272c)
Target Carbon Dioxide Emission Rate (TER) = (13.6846 * 1.55) + 1.4908 + 0.1880, rounded to 2 d.p.			22.8900	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	4 Bed End Terrace	**Issued on Date**	16/03/2021
Assessment Reference	3	**Prop Type Ref**	
Property	Type H, x, Mill Lane, Taplow , Buckinghmashire, SL6		

SAP Rating	86 B	**DER**	13.50	**TER**	22.19
Environmental	88 B	**% DER<TER**	39.17		
CO_2 Emissions (t/year)	1.50	**DFEE**	41.44	**TFEE**	50.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	17.93		

Assessor Details	Mr. Jonathan Peck, Jonathan Peck, Tel: 02036031622, Jonathan@hodkinsonconsultancy.com	**Assessor ID**	T296-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

End-Terrace House, total floor area 131 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 22.19 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 13.50 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)41.4 kWh/m²/yrOK

---
2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.18 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
Mitsubishi ECODAN 5kW PUHZ-W50VHA-BS

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage Measured cylinder loss: 1.50 kWh/day
Permitted by DBSCG 1.89 OK
Primary pipework insulated: Yes OK

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.88
Maximum 1.5 OK
MVHR efficiency: 84%
Minimum: 70% OK

---
9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 4.12 m², No overhang
Windows facing East: 18.88 m², No overhang
Windows facing South: 19.45 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

---
10 Key features

Party wall U-value	0.00 W/m²K
Roof U-value	0.10 W/m²K
Roof U-value	0.10 W/m²K
Roof U-value	0.10 W/m²K
Floor U-value	0.10 W/m²K
Door U-value	1.00 W/m²K
Air permeability	3.0 m³/m²h

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.3000	(1b)	x 2.6500	(2b) =	125.3450	(1b) - (3b)
First floor	47.3000	(1c)	x 2.8500	(2c) =	134.8050	(1c) - (3c)
Second floor	35.9000	(1d)	x 2.0900	(2d) =	75.0310	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		335.1810	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	71.4000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.3056	0.3024	0.2992	0.2833	0.2801	0.2641	0.2641	0.2609	0.2705	0.2801	0.2864	0.2928	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.20)			42.4500	1.1450	48.6069			(27)
Opening Type 6			3.8600	1.0000	3.8600			(26)
Opening Type 11 (Uw = 1.20)			3.0000	1.1450	3.4351			(27a)
Floor 1			47.3200	0.1000	4.7320			(28a)
ext wall	101.3000	46.3100	54.9900	0.1500	8.2485			(29a)
Dwarf wall	36.9000		36.9000	0.1500	5.5350			(29a)
flat roof	29.2000	3.0000	26.2000	0.1000	2.6200			(30)
skeiling	10.2000		10.2000	0.1000	1.0200			(30)
ff ceiling	10.7000		10.7000	0.1000	1.0700			(30)
Total net area of external elements Aum(A, m2)			235.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	79.1275			(33)
Party Wall			14.2000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	11.3844	(36)
Total fabric heat loss (33) + (36) =	90.5119	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	33.7982	33.4456	33.0930	31.3302	30.9776	29.2148	29.2148	28.8622	29.9199	30.9776	31.6828	32.3879	(38)
Heat transfer coeff	124.3100	123.9575	123.6049	121.8421	121.4895	119.7266	119.7266	119.3741	120.4318	121.4895	122.1946	122.8998	(39)
Average = Sum(39)m / 12 =												121.7539	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9526	0.9499	0.9472	0.9337	0.9310	0.9174	0.9174	0.9147	0.9228	0.9310	0.9364	0.9418	(40)
HLP (average)												0.9330	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8963	(42)
Average daily hot water use (litres/day)	102.9865	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

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Daily hot water use
               113.2852   109.1657   105.0462   100.9268    96.8073    92.6879    92.6879    96.8073   100.9268   105.0462   109.1657   113.2852 (44)
Energy conte   167.9986   146.9327   151.6214   132.1872   126.8367   109.4505   101.4219   116.3832   117.7731   137.2533   149.8227   162.6977 (45)
Energy content (annual)                                                                                         Total = Sum(45)m =   1620.3789 (45)
Distribution loss  (46)m = 0.15 x (45)m
                25.1998    22.0399    22.7432    19.8281    19.0255    16.4176    15.2133    17.4575    17.6660    20.5880    22.4734    24.4047 (46)
Water storage loss:
Store volume                                                                                                                         150.0000 (47)
a) If  manufacturer declared loss factor is known  (kWh/day):                                                                          1.5000 (48)
  Temperature factor from Table 2b                                                                                                     0.5400 (49)
Enter (49) or (54) in (55)                                                                                                             0.8100 (55)
Total storage loss
                25.1100    22.6800    25.1100    24.3000    25.1100    24.3000    25.1100    25.1100    24.3000    25.1100    24.3000    25.1100 (56)
If cylinder contains dedicated solar storage
                25.1100    22.6800    25.1100    24.3000    25.1100    24.3000    25.1100    25.1100    24.3000    25.1100    24.3000    25.1100 (57)
Primary loss    23.2624    21.0112    23.2624    22.5120    23.2624    22.5120    23.2624    23.2624    22.5120    23.2624    22.5120    23.2624 (59)
Total heat required for water heating calculated for each month
               216.3710   190.6239   199.9938   178.9992   175.2091   156.2625   149.7943   164.7556   164.5851   185.6257   196.6347   211.0701 (62)
Solar input      0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (63)
                                                                                            Solar input (sum of months) = Sum(63)m =     0.0000 (63)
Output from w/h
               216.3710   190.6239   199.9938   178.9992   175.2091   156.2625   149.7943   164.7556   164.5851   185.6257   196.6347   211.0701 (64)
                                                                                              Total per year (kWh/year) = Sum(64)m =  2189.9249 (64)
Heat gains from water heating, kWh/month
                94.5575    83.8081    89.1120    81.4018    80.8711    73.8419    72.4207    77.3953    76.6092    84.3346    87.2656    92.7949 (65)


----------------------------------------------------------------------------------------------------
5. Internal gains (see Table 5 and 5a)
----------------------------------------------------------------------------------------------------
Metabolic gains (Table 5), Watts
                  Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
(66)m          144.8137   144.8137   144.8137   144.8137   144.8137   144.8137   144.8137   144.8137   144.8137   144.8137   144.8137   144.8137 (66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
                26.5956    23.6220    19.2107    14.5437    10.8716     9.1783     9.9175    12.8911    17.3024    21.9693    25.6415    27.3348 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
               298.3222   301.4178   293.6169   277.0096   256.0459   236.3430   223.1802   220.0845   227.8855   244.4928   265.4565   285.1594 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
                37.4814    37.4814    37.4814    37.4814    37.4814    37.4814    37.4814    37.4814    37.4814    37.4814    37.4814    37.4814 (69)
Pumps, fans      0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000     0.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
              -115.8510  -115.8510  -115.8510  -115.8510  -115.8510  -115.8510  -115.8510  -115.8510  -115.8510  -115.8510  -115.8510  -115.8510 (71)
Water heating gains (Table 5)
               127.0934   124.7144   119.7742   113.0581   108.6978   102.5582    97.3397   104.0260   106.4016   113.3530   121.2023   124.7243 (72)
Total internal gains
               518.4553   516.1983   499.0459   471.0556   442.0594   414.5235   396.8814   403.4457   418.0336   446.2592   478.7443   503.6627 (73)


----------------------------------------------------------------------------------------------------
6. Solar gains
----------------------------------------------------------------------------------------------------

[Jan]                                     Area          Solar flux              g                FF            Access              Gains
                                            m2            Table 6a      Specific data     Specific data        factor                  W
                                                              W/m2        or Table 6b       or Table 6c      Table 6d
----------------------------------------------------------------------------------------------------
North                                   4.1200           10.6334            0.4500            0.7000            0.7700             9.5634 (74)
East                                   18.8800           19.6403            0.4500            0.7000            0.7700            80.9456 (76)
South                                  19.4500           46.7521            0.4500            0.7000            0.7700           198.5017 (78)
Horizontal                              3.0000           26.0000            0.4500            0.7000            1.0000            22.1130 (82)
----------------------------------------------------------------------------------------------------

Solar gains    311.1237   547.6445   787.5910  1025.8198  1184.3188  1188.5425  1140.7624  1022.3763   871.0278   616.4251   376.0860   263.9225 (83)
Total gains    829.5789  1063.8428  1286.6369  1496.8754  1626.3782  1603.0661  1537.6438  1425.8220  1289.0614  1062.6844   854.8303   767.5851 (84)


----------------------------------------------------------------------------------------------------
7. Mean internal temperature (heating season)
----------------------------------------------------------------------------------------------------
Temperature during heating periods in the living area from Table 9, Th1 (C)                                                           21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)
                  Jan        Feb        Mar        Apr        May        Jun        Jul        Aug        Sep        Oct        Nov        Dec
tau             72.9024    73.1098    73.3183    74.3791    74.5949    75.6933    75.6933    75.9168    75.2501    74.5949    74.1645    73.7390
alpha            5.8602     5.8740     5.8879     5.9586     5.9730     6.0462     6.0462     6.0611     6.0167     5.9730     5.9443     5.9159
util living area
                 0.9972     0.9882     0.9554     0.8497     0.6686     0.4751     0.3423     0.3844     0.6275     0.9194     0.9915     0.9982 (86)

Tweekday        18.8761    19.2067    19.6115    19.9759    20.1137    20.1506    20.1526    20.1547    20.1367    19.9082    19.3162    18.8258
Tweekend        20.3974    20.5440    20.7280    20.9020    20.9794    20.9977    20.9997    20.9995    20.9893    20.8612    20.5881    20.3721
24 / 16               9          8          9          8          9          9          9          9          8          9          8          9
24 / 9               22         20         22         22         22         21         22         22         22         22         22         22
16 / 9                0          0          0          0          0          0          0          0          0          0          0          0
MIT             21.0000    21.0000    21.0000    21.0000    21.0000    21.0000    21.0000    21.0000    21.0000    21.0000    21.0000    21.0000 (87)
Th 2            20.1230    20.1253    20.1276    20.1390    20.1413    20.1527    20.1527    20.1550    20.1481    20.1413    20.1367    20.1321 (88)
util rest of house
                 0.9963     0.9847     0.9427     0.8155     0.6151     0.4135     0.2765     0.3142     0.5570     0.8910     0.9884     0.9976 (89)
Tweekday        18.8761    19.2067    19.6115    19.9759    20.1137    20.1506    20.1526    20.1547    20.1367    19.9082    19.3162    18.8258
Tweekend        18.8761    19.2067    19.6115    19.9759    20.1137    20.1506    20.1526    20.1547    20.1367    19.9082    19.3162    18.8258
MIT 2           20.1230    20.1253    20.1276    20.1390    20.1413    20.1527    20.1527    20.1550    20.1481    20.1413    20.1367    20.1321 (90)
Living area fraction                                                                                   fLA = Living area / (4) =      0.2084 (91)
MIT             20.3058    20.3076    20.3094    20.3184    20.3203    20.3293    20.3293    20.3311    20.3257    20.3203    20.3166    20.3130 (92)
Temperature adjustment                                                                                                                 0.0000
adjusted MIT    20.3058    20.3076    20.3094    20.3184    20.3203    20.3293    20.3293    20.3311    20.3257    20.3203    20.3166    20.3130 (93)


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8. Space heating requirement
----------------------------------------------------------------------------------------------------
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CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9965	0.9855	0.9456	0.8232	0.6266	0.4265	0.2903	0.3289	0.5721	0.8976	0.9891	0.9977	(94)
Useful gains	826.7001	1048.4133	1216.6713	1232.1690	1019.0578	683.6278	446.3171	468.8988	737.4589	953.8861	845.5510	765.8562	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1989.6854	1909.8908	1706.9133	1391.2471	1047.2702	685.9498	446.4965	469.2728	749.7695	1180.9087	1615.0027	1980.2881	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	865.2611	578.9129	364.7401	114.5362	20.9901	0.0000	0.0000	0.0000	0.0000	168.9048	554.0052	903.5373	(98)
Space heating												3570.8877	(98)
Space heating per m2											(98) / (4) =	27.3631	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)	0.0000	(201)
Fraction of space heat from main system(s)	1.0000	(202)
Efficiency of main space heating system 1 (in %)	286.7664	(206)
Efficiency of secondary/supplementary heating system, %	100.0000	(208)
Space heating requirement	1245.2252	(211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	865.2611	578.9129	364.7401	114.5362	20.9901	0.0000	0.0000	0.0000	0.0000	168.9048	554.0052	903.5373	(98)
Space heating efficiency (main heating system 1)													
	286.7664	286.7664	286.7664	286.7664	286.7664	0.0000	0.0000	0.0000	0.0000	286.7664	286.7664	286.7664	(210)
Space heating fuel (main heating system)													
	301.7303	201.8761	127.1907	39.9406	7.3196	0.0000	0.0000	0.0000	0.0000	58.8998	193.1904	315.0778	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	216.3710	190.6239	199.9938	178.9992	175.2091	156.2625	149.7943	164.7556	164.5851	185.6257	196.6347	211.0701	(64)
Efficiency of water heater												178.1250	(216)
(217)m	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	(217)
Fuel for water heating, kWh/month													
	121.4715	107.0169	112.2772	100.4908	98.3630	87.7263	84.0951	92.4944	92.3987	104.2109	110.3914	118.4955	(219)
Water heating fuel used												1229.4315	(219)
Annual totals kWh/year													
Space heating fuel - main system												1245.2252	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1000)													
mechanical ventilation fans (SFP = 1.1000)												449.8129	(230a)
Total electricity for the above, kWh/year												449.8129	(231)
Electricity for lighting (calculated in Appendix L)												469.6873	(232)
Total delivered energy for all uses												3394.1569	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1245.2252	0.5190	646.2719	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1229.4315	0.5190	638.0750	(264)
Space and water heating			1284.3469	(265)
Pumps and fans	449.8129	0.5190	233.4529	(267)
Energy for lighting	469.6873	0.5190	243.7677	(268)
Total CO2, kg/year			1761.5675	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			13.5000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		13.5000	ZC1
Total Floor Area	TFA	130.5000	
Assumed number of occupants	N	2.8963	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.5463	ZC2
CO2 emissions from cooking, equation (L16)		1.4445	ZC3
Total CO2 emissions		28.4908	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.4908	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.3000 (1b)	x	2.6500 (2b)	=	125.3450	(1b) - (3b)
First floor	47.3000 (1c)	x	2.8500 (2c)	=	134.8050	(1c) - (3c)
Second floor	35.9000 (1d)	x	2.0900 (2d)	=	75.0310	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	335.1810	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1193	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3693	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3139	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4003	0.3924	0.3846	0.3453	0.3375	0.2982	0.2982	0.2904	0.3139	0.3375	0.3532	0.3689	(22b)
Effective ac	0.5801	0.5770	0.5739	0.5596	0.5569	0.5445	0.5445	0.5422	0.5493	0.5569	0.5624	0.5680	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			3.8600	1.0000	3.8600			(26)
TER Opening Type (Uw = 1.40)			26.8600	1.3258	35.6098			(27)
TER Room Window (Uw = 1.70)			1.8900	1.5918	3.0084			(27a)
Floor 1			47.3200	0.1300	6.1516			(28a)
ext wall	101.3000	30.7200	70.5800	0.1800	12.7044			(29a)
Dwarf wall	36.9000		36.9000	0.1800	6.6420			(29a)
flat roof	29.2000	1.8900	27.3100	0.1300	3.5503			(30)
skeiling	10.2000		10.2000	0.1300	1.3260			(30)
ff ceiling	10.7000		10.7000	0.1300	1.3910			(30)
Total net area of external elements Aum(A, m2)			235.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.2436			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.9800	(36)
Total fabric heat loss (33) + (36) =	89.2236	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.1656	63.8215	63.4843	61.9002	61.6038	60.2241	60.2241	59.9686	60.7555	61.6038	62.2034	62.8302	(38)
Heat transfer coeff	153.3892	153.0451	152.7079	151.1238	150.8274	149.4477	149.4477	149.1922	149.9791	150.8274	151.4270	152.0538	(39)
Average = Sum(39)m / 12 =												151.1223	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1754	1.1728	1.1702	1.1580	1.1558	1.1452	1.1452	1.1432	1.1493	1.1558	1.1604	1.1652	(40)
HLP (average)												1.1580	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8963 (42)
Average daily hot water use (litres/day)	102.9865 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2852	109.1657	105.0462	100.9268	96.8073	92.6879	92.6879	96.8073	100.9268	105.0462	109.1657	113.2852	(44)
Energy conte	167.9986	146.9327	151.6214	132.1872	126.8367	109.4505	101.4219	116.3832	117.7731	137.2533	149.8227	162.6977	(45)
Energy content (annual)										Total = Sum(45)m =		1620.3789	(45)

Distribution loss (46)m = 0.15 x (45)m

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	25.1998	22.0399	22.7432	19.8281	19.0255	16.4176	15.2133	17.4575	17.6660	20.5880	22.4734	24.4047	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	214.5935	189.0184	198.2163	177.2790	173.4316	154.5423	148.0168	162.9781	162.8650	183.8482	194.9145	209.2926	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	214.5935	189.0184	198.2163	177.2790	173.4316	154.5423	148.0168	162.9781	162.8650	183.8482	194.9145	209.2926	(64)
								Total per year (kWh/year) = Sum(64)m =				2168.9963	(64)
Heat gains from water heating, kWh/month													
	93.1355	82.5237	87.6900	80.0257	79.4491	72.4658	70.9987	75.9733	75.2330	82.9126	85.8895	91.3729	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.5949	23.6214	19.2102	14.5433	10.8713	9.1780	9.9172	12.8907	17.3019	21.9688	25.6408	27.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	298.3222	301.4178	293.6169	277.0096	256.0459	236.3430	223.1802	220.0845	227.8855	244.4928	265.4565	285.1594	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	(71)
Water heating gains (Table 5)													
	125.1821	122.8031	117.8629	111.1468	106.7865	100.6469	95.4284	102.1147	104.4903	111.4417	119.2910	122.8130	(72)
Total internal gains													
	519.5433	517.2864	500.1341	472.1439	443.1478	415.6120	397.9699	404.5341	419.1219	447.3473	479.8323	504.7506	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.6100	10.6334	0.6300	0.7000	0.7700	8.4817	(74)
East	11.9600	19.6403	0.6300	0.7000	0.7700	71.7877	(76)
South	12.2900	46.7521	0.6300	0.7000	0.7700	175.6000	(78)
Horizontal	1.8900	26.0000	0.6300	0.7000	1.0000	19.5037	(82)

Solar gains	275.3731	484.7362	697.1637	908.0969	1048.4467	1052.2007	1009.8956	905.0648	771.0411	545.6286	332.8747	233.5931	(83)
Total gains	794.9164	1002.0226	1197.2978	1380.2408	1491.5945	1467.8126	1407.8655	1309.5989	1190.1629	992.9760	812.7070	738.3437	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.0817	59.2146	59.3453	59.9674	60.0852	60.6400	60.6400	60.7438	60.4251	60.0852	59.8473	59.6006	
alpha	4.9388	4.9476	4.9564	4.9978	5.0057	5.0427	5.0427	5.0496	5.0283	5.0057	4.9898	4.9734	
util living area													
	0.9979	0.9930	0.9776	0.9262	0.8069	0.6233	0.4617	0.5143	0.7709	0.9602	0.9947	0.9985	(86)
MIT	19.7332	19.9472	20.2516	20.6046	20.8568	20.9701	20.9945	20.9908	20.9155	20.5578	20.0687	19.6958	(87)
Th 2	19.9397	19.9419	19.9439	19.9537	19.9556	19.9641	19.9641	19.9657	19.9608	19.9556	19.9518	19.9480	(88)
util rest of house													
	0.9971	0.9907	0.9700	0.9018	0.7504	0.5341	0.3558	0.4036	0.6884	0.9419	0.9925	0.9980	(89)
MIT 2	18.2544	18.5674	19.0076	19.5056	19.8230	19.9454	19.9622	19.9621	19.8979	19.4546	18.7530	18.2055	(90)
Living area fraction									fLA = Living area / (4) =			0.2084	(91)
MIT	18.5626	18.8550	19.2669	19.7347	20.0385	20.1590	20.1774	20.1765	20.1100	19.6845	19.0272	18.5161	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5626	18.8550	19.2669	19.7347	20.0385	20.1590	20.1774	20.1765	20.1100	19.6845	19.0272	18.5161	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9873	0.9636	0.8957	0.7553	0.5516	0.3780	0.4267	0.7015	0.9358	0.9897	0.9969	(94)
Useful gains	791.4979	989.3013	1153.6814	1236.2778	1126.6693	809.6606	532.1085	558.8648	834.8499	929.2142	804.3231	736.0858	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2187.7309	2135.7455	1949.5999	1637.3755	1257.6739	830.7795	534.6284	563.4308	901.3748	1370.1979	1806.1062	2176.8224	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1038.7973	770.4105	592.1634	288.7903	97.4674	0.0000	0.0000	0.0000	0.0000	328.0919	721.2838	1071.9080	(98)
Space heating												4908.9126	(98)
Space heating per m2											(98) / (4) =	37.6162	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5250.1739	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1038.7973	770.4105	592.1634	288.7903	97.4674	0.0000	0.0000	0.0000	0.0000	328.0919	721.2838	1071.9080	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	1111.0132	823.9684	633.3298	308.8667	104.2432	0.0000	0.0000	0.0000	0.0000	350.9004	771.4265	1146.4257	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	214.5935	189.0184	198.2163	177.2790	173.4316	154.5423	148.0168	162.9781	162.8650	183.8482	194.9145	209.2926	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.4690	88.1709	87.5558	86.1083	83.3454	79.8000	79.8000	79.8000	79.8000	86.3424	87.9900	88.5602	(217)
Fuel for water heating, kWh/month													
	242.5634	214.3774	226.3885	205.8791	208.0878	193.6620	185.4848	204.2332	204.0915	212.9292	221.5189	236.3281	(219)
Water heating fuel used												2555.5439	(219)
Annual totals kWh/year													
Space heating fuel - main system												5250.1739	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												469.6745	(232)
Total delivered energy for all uses												8350.3923	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5250.1739	0.2160	1134.0376	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2555.5439	0.2160	551.9975	(264)
Space and water heating			1686.0350	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	469.6745	0.5190	243.7611	(268)
Total CO2, kg/m2/year			1968.7211	(272)
Emissions per m2 for space and water heating			12.9198	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			1.8679	(272b)
Emissions per m2 for pumps and fans			0.2983	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.9198 * 1.55) + 1.8679 + 0.2983, rounded to 2 d.p.			22.1900	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	4 Bed End Terrace	**Issued on Date**	16/03/2021
Assessment Reference	2	**Prop Type Ref**	
Property	Type H, x, Mill Lane, Taplow , Buckinghmashire, SL6		

SAP Rating	84 B	**DER**	15.88	**TER**	22.19
Environmental	86 B	**% DER<TER**	28.44		
CO_2 Emissions (t/year)	1.74	**DFEE**	49.98	**TFEE**	50.49
General Requirements Compliance	Pass	**% DFEE<TFEE**	1.01		

Assessor Details	Mr. Jonathan Peck, Jonathan Peck, Tel: 02036031622, Jonathan@hodkinsonconsultancy.com	**Assessor ID**	T296-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

End-Terrace House, total floor area 131 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 22.19 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 15.88 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)50.5 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)50.0 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.16 (max. 0.30)	0.18 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.38 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 5.00 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
Mitsubishi ECODAN 5kW PUHZ-W50VHA-BS

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage: Measured cylinder loss: 1.50 kWh/day
Permitted by DBSCG 1.89 OK
Primary pipework insulated: Yes OK

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Not applicable

---
9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 4.12 m², No overhang
Windows facing East: 18.88 m², No overhang
Windows facing South: 19.45 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: Dark-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
External wall U-value 0.12 W/m²K
Party wall U-value 0.00 W/m²K
Roof U-value 0.11 W/m²K
Roof U-value 0.12 W/m²K

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.3000	(1b)	x 2.6500	(2b) =	125.3450	(1b) - (3b)
First floor	47.3000	(1c)	x 2.8500	(2c) =	134.8050	(1c) - (3c)
Second floor	35.9000	(1d)	x 2.0900	(2d) =	75.0310	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		335.1810	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1193	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3693	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3139	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4003	0.3924	0.3846	0.3453	0.3375	0.2982	0.2982	0.2904	0.3139	0.3375	0.3532	0.3689	(22b)
Effective ac	0.5801	0.5770	0.5739	0.5596	0.5569	0.5445	0.5445	0.5422	0.5493	0.5569	0.5624	0.5680	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1 (Uw = 1.40)			42.4500	1.3258	56.2784			(27)
Opening Type 6			3.8600	1.2000	4.6320			(26)
Opening Type 11 (Uw = 1.40)			3.0000	1.3258	3.9773			(27a)
Floor 1			47.3200	0.1600	7.5712			(28a)
ext wall	101.3000	46.3100	54.9900	0.1800	9.8982			(29a)
Dwarf wall	36.9000		36.9000	0.1200	4.4280			(29a)
flat roof	29.2000	3.0000	26.2000	0.1100	2.8820			(30)
skeiling	10.2000		10.2000	0.1600	1.6320			(30)
ff ceiling	10.7000		10.7000	0.1200	1.2840			(30)
Total net area of external elements Aum(A, m2)			235.6200					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		92.5831			(33)
Party Wall			14.2000	0.0000	0.0000			(32)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	15.3710	(36)
Total fabric heat loss (33) + (36) =	107.9541	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.1656	63.8215	63.4843	61.9002	61.6038	60.2241	60.2241	59.9686	60.7555	61.6038	62.2034	62.8302	(38)
Heat transfer coeff	172.1197	171.7756	171.4383	169.8542	169.5579	168.1782	168.1782	167.9227	168.7096	169.5579	170.1574	170.7843	(39)
Average = Sum(39)m / 12 =												169.8528	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.3189	1.3163	1.3137	1.3016	1.2993	1.2887	1.2887	1.2868	1.2928	1.2993	1.3039	1.3087	(40)
HLP (average)												1.3016	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8963 (42)
Average daily hot water use (litres/day)	102.9865 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2852	109.1657	105.0462	100.9268	96.8073	92.6879	92.6879	96.8073	100.9268	105.0462	109.1657	113.2852	(44)
Energy conte	167.9986	146.9327	151.6214	132.1872	126.8367	109.4505	101.4219	116.3832	117.7731	137.2533	149.8227	162.6977	(45)
Energy content (annual)										Total = Sum(45)m =		1620.3789	(45)

Distribution loss (46)m = 0.15 x (45)m

	25.1998	22.0399	22.7432	19.8281	19.0255	16.4176	15.2133	17.4575	17.6660	20.5880	22.4734	24.4047 (46)

Water storage loss:

Store volume	150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):	1.5000 (48)
Temperature factor from Table 2b	0.5400 (49)
Enter (49) or (54) in (55)	0.8100 (55)

Total storage loss

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100 (56)

If cylinder contains dedicated solar storage

25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100 (57)

Primary loss

23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)

Total heat required for water heating calculated for each month

216.3710	190.6239	199.9938	178.9992	175.2091	156.2625	149.7943	164.7556	164.5851	185.6257	196.6347	211.0701 (62)

Solar input

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)

Solar input (sum of months) = Sum(63)m = 0.0000 (63)

Output from w/h

216.3710	190.6239	199.9938	178.9992	175.2091	156.2625	149.7943	164.7556	164.5851	185.6257	196.6347	211.0701 (64)

Total per year (kWh/year) = Sum(64)m = 2189.9249 (64)

Heat gains from water heating, kWh/month

94.5575	83.8081	89.1120	81.4018	80.8711	73.8419	72.4207	77.3953	76.6092	84.3346	87.2656	92.7949 (65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5

26.5956	23.6220	19.2107	14.5437	10.8716	9.1783	9.9175	12.8911	17.3024	21.9693	25.6415	27.3348	(67)

Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5

298.3222	301.4178	293.6169	277.0096	256.0459	236.3430	223.1802	220.0845	227.8855	244.4928	265.4565	285.1594	(68)

Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5

37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	(69)

Pumps, fans

0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)

Losses e.g. evaporation (negative values) (Table 5)

-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	(71)

Water heating gains (Table 5)

127.0934	124.7144	119.7742	113.0581	108.6978	102.5582	97.3397	104.0260	106.4016	113.3530	121.2023	124.7243	(72)

Total internal gains

518.4553	516.1983	499.0459	471.0556	442.0594	414.5235	396.8814	403.4457	418.0336	446.2592	478.7443	503.6627	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	4.1200	10.6334	0.4500	0.7000	0.7700	9.5634	(74)
East	18.8800	19.6403	0.4500	0.7000	0.7700	80.9456	(76)
South	19.4500	46.7521	0.4500	0.7000	0.7700	198.5017	(78)
Horizontal	3.0000	26.0000	0.4500	0.7000	1.0000	22.1130	(82)

Solar gains	311.1237	547.6445	787.5910	1025.8198	1184.3188	1188.5425	1140.7624	1022.3763	871.0278	616.4251	376.0860	263.9225	(83)
Total gains	829.5789	1063.8428	1286.6369	1496.8754	1626.3782	1603.0661	1537.6438	1425.8220	1289.0614	1062.6844	854.8303	767.5851	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	52.6523	52.7578	52.8616	53.3546	53.4478	53.8863	53.8863	53.9683	53.7166	53.4478	53.2595	53.0640	
alpha	4.5102	4.5172	4.5241	4.5570	4.5632	4.5924	4.5924	4.5979	4.5811	4.5632	4.5506	4.5376	
util living area													
	0.9974	0.9917	0.9748	0.9226	0.8073	0.6317	0.4724	0.5264	0.7766	0.9581	0.9938	0.9982	(86)
Tweekday	17.9387	18.2810	18.7633	19.3096	19.6720	19.8224	19.8465	19.8455	19.7624	19.2565	18.4842	17.8831	
Tweekend	20.0761	20.2276	20.4436	20.6948	20.8805	20.9711	20.9938	20.9901	20.9261	20.6625	20.3141	20.0491	
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9	
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	19.8260	19.8281	19.8301	19.8396	19.8414	19.8497	19.8497	19.8512	19.8465	19.8414	19.8378	19.8340	(88)
util rest of house													
	0.9965	0.9889	0.9661	0.8962	0.7473	0.5342	0.3534	0.4026	0.6886	0.9382	0.9912	0.9975	(89)
Tweekday	17.9387	18.2810	18.7633	19.3096	19.6720	19.8224	19.8465	19.8455	19.7624	19.2565	18.4842	17.8831	
Tweekend	17.9387	18.2810	18.7633	19.3096	19.6720	19.8224	19.8465	19.8455	19.7624	19.2565	18.4842	17.8831	
MIT 2	19.8260	19.8281	19.8301	19.8396	19.8414	19.8497	19.8497	19.8512	19.8465	19.8414	19.8378	19.8340	(90)
Living area fraction									fLA = Living area / (4) =			0.2084	(91)
MIT	20.0707	20.0724	20.0740	20.0815	20.0829	20.0894	20.0894	20.0907	20.0869	20.0829	20.0800	20.0771	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0707	20.0724	20.0740	20.0815	20.0829	20.0894	20.0894	20.0907	20.0869	20.0829	20.0800	20.0771	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9967	0.9896	0.9682	0.9024	0.7610	0.5556	0.3788	0.4293	0.7090	0.9431	0.9918	0.9977	(94)
Useful gains	826.8301	1052.7673	1245.6808	1350.7985	1237.6863	890.6588	582.4763	612.0733	913.8820	1002.1920	847.8227	765.7905	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Heat loss rate W

	2714.4523	2606.2404	2327.0959	1899.2195	1421.3823	923.2037	586.8474	619.7448	1010.0490	1607.8960	2208.6481	2711.5507 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)

Space heating kWh

	1404.3909	1043.9339	804.5728	394.8631	136.6699	0.0000	0.0000	0.0000	0.0000	450.6438	979.7943	1447.6456 (98)

Space heating 6662.5143 (98)
Space heating per m2 (98) / (4) = 51.0537 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 290.4247 (206)
Efficiency of secondary/supplementary heating system, % 100.0000 (208)
Space heating requirement 2294.0590 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1404.3909	1043.9339	804.5728	394.8631	136.6699	0.0000	0.0000	0.0000	0.0000	450.6438	979.7943	1447.6456	(98)
Space heating efficiency (main heating system 1)													
	290.4247	290.4247	290.4247	290.4247	290.4247	0.0000	0.0000	0.0000	0.0000	290.4247	290.4247	290.4247	(210)
Space heating fuel (main heating system)													
	483.5645	359.4508	277.0332	135.9606	47.0586	0.0000	0.0000	0.0000	0.0000	155.1672	337.3660	498.4581	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

	216.3710	190.6239	199.9938	178.9992	175.2091	156.2625	149.7943	164.7556	164.5851	185.6257	196.6347	211.0701 (64)

Efficiency of water heater 178.1250 (216)

(217)m	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250 (217)

Fuel for water heating, kWh/month

	121.4715	107.0169	112.2772	100.4908	98.3630	87.7263	84.0951	92.4944	92.3987	104.2109	110.3914	118.4955 (219)

Water heating fuel used 1229.4315 (219)
Annual totals kWh/year
Space heating fuel - main system 2294.0590 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
Total electricity for the above, kWh/year 0.0000 (231)
Electricity for lighting (calculated in Appendix L) 469.6873 (232)
Total delivered energy for all uses 3993.1778 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2294.0590	0.5190	1190.6166	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1229.4315	0.5190	638.0750	(264)
Space and water heating			1828.6916	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	469.6873	0.5190	243.7677	(268)
Total CO2, kg/year			2072.4593	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			15.8800	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		15.8800	ZC1
Total Floor Area	TFA	130.5000	
Assumed number of occupants	N	2.8963	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.5463	ZC2
CO2 emissions from cooking, equation (L16)		1.4445	ZC3
Total CO2 emissions		30.8708	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		30.8708	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	47.3000 (1b)	x	2.6500 (2b)	=	125.3450	(1b) - (3b)
First floor	47.3000 (1c)	x	2.8500 (2c)	=	134.8050	(1c) - (3c)
Second floor	35.9000 (1d)	x	2.0900 (2d)	=	75.0310	(1d) - (3d)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	130.5000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	335.1810	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1193	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3693	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3139	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4003	0.3924	0.3846	0.3453	0.3375	0.2982	0.2982	0.2904	0.3139	0.3375	0.3532	0.3689	(22b)
Effective ac	0.5801	0.5770	0.5739	0.5596	0.5569	0.5445	0.5445	0.5422	0.5493	0.5569	0.5624	0.5680	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			3.8600	1.0000	3.8600			(26)
TER Opening Type (Uw = 1.40)			26.8600	1.3258	35.6098			(27)
TER Room Window (Uw = 1.70)			1.8900	1.5918	3.0084			(27a)
Floor 1			47.3200	0.1300	6.1516			(28a)
ext wall	101.3000	30.7200	70.5800	0.1800	12.7044			(29a)
Dwarf wall	36.9000		36.9000	0.1800	6.6420			(29a)
flat roof	29.2000	1.8900	27.3100	0.1300	3.5503			(30)
skeiling	10.2000		10.2000	0.1300	1.3260			(30)
ff ceiling	10.7000		10.7000	0.1300	1.3910			(30)
Total net area of external elements Aum(A, m2)			235.6200					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	74.2436			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	14.9800	(36)
Total fabric heat loss (33) + (36) =	89.2236	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	64.1656	63.8215	63.4843	61.9002	61.6038	60.2241	60.2241	59.9686	60.7555	61.6038	62.2034	62.8302	(38)
Heat transfer coeff	153.3892	153.0451	152.7079	151.1238	150.8274	149.4477	149.4477	149.1922	149.9791	150.8274	151.4270	152.0538	(39)
Average = Sum(39)m / 12 =												151.1223	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.1754	1.1728	1.1702	1.1580	1.1558	1.1452	1.1452	1.1432	1.1493	1.1558	1.1604	1.1652	(40)
HLP (average)												1.1580	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.8963 (42)
Average daily hot water use (litres/day)	102.9865 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.2852	109.1657	105.0462	100.9268	96.8073	92.6879	92.6879	96.8073	100.9268	105.0462	109.1657	113.2852	(44)
Energy conte	167.9986	146.9327	151.6214	132.1872	126.8367	109.4505	101.4219	116.3832	117.7731	137.2533	149.8227	162.6977	(45)
Energy content (annual)										Total = Sum(45)m =		1620.3789	(45)

Distribution loss (46)m = 0.15 x (45)m

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

	25.1998	22.0399	22.7432	19.8281	19.0255	16.4176	15.2133	17.4575	17.6660	20.5880	22.4734	24.4047	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.3938	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.7527	(55)
Total storage loss													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(56)
If cylinder contains dedicated solar storage													
	23.3325	21.0745	23.3325	22.5798	23.3325	22.5798	23.3325	23.3325	22.5798	23.3325	22.5798	23.3325	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	214.5935	189.0184	198.2163	177.2790	173.4316	154.5423	148.0168	162.9781	162.8650	183.8482	194.9145	209.2926	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	214.5935	189.0184	198.2163	177.2790	173.4316	154.5423	148.0168	162.9781	162.8650	183.8482	194.9145	209.2926	(64)
								Total per year (kWh/year) = Sum(64)m =				2168.9963	(64)
Heat gains from water heating, kWh/month													
	93.1355	82.5237	87.6900	80.0257	79.4491	72.4658	70.9987	75.9733	75.2330	82.9126	85.8895	91.3729	(65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	144.8137	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	26.5949	23.6214	19.2102	14.5433	10.8713	9.1780	9.9172	12.8907	17.3019	21.9688	25.6408	27.3341	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	298.3222	301.4178	293.6169	277.0096	256.0459	236.3430	223.1802	220.0845	227.8855	244.4928	265.4565	285.1594	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	37.4814	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	-115.8510	(71)
Water heating gains (Table 5)													
	125.1821	122.8031	117.8629	111.1468	106.7865	100.6469	95.4284	102.1147	104.4903	111.4417	119.2910	122.8130	(72)
Total internal gains													
	519.5433	517.2864	500.1341	472.1439	443.1478	415.6120	397.9699	404.5341	419.1219	447.3473	479.8323	504.7506	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	2.6100	10.6334	0.6300	0.7000	0.7700	8.4817	(74)
East	11.9600	19.6403	0.6300	0.7000	0.7700	71.7877	(76)
South	12.2900	46.7521	0.6300	0.7000	0.7700	175.6000	(78)
Horizontal	1.8900	26.0000	0.6300	0.7000	1.0000	19.5037	(82)

Solar gains	275.3731	484.7362	697.1637	908.0969	1048.4467	1052.2007	1009.8956	905.0648	771.0411	545.6286	332.8747	233.5931	(83)
Total gains	794.9164	1002.0226	1197.2978	1380.2408	1491.5945	1467.8126	1407.8655	1309.5989	1190.1629	992.9760	812.7070	738.3437	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	59.0817	59.2146	59.3453	59.9674	60.0852	60.6400	60.6400	60.7438	60.4251	60.0852	59.8473	59.6006	
alpha	4.9388	4.9476	4.9564	4.9978	5.0057	5.0427	5.0427	5.0496	5.0283	5.0057	4.9898	4.9734	
util living area													
	0.9979	0.9930	0.9776	0.9262	0.8069	0.6233	0.4617	0.5143	0.7709	0.9602	0.9947	0.9985	(86)
MIT	19.7332	19.9472	20.2516	20.6046	20.8568	20.9701	20.9945	20.9908	20.9155	20.5578	20.0687	19.6958	(87)
Th 2	19.9397	19.9419	19.9439	19.9537	19.9556	19.9641	19.9641	19.9657	19.9608	19.9556	19.9518	19.9480	(88)
util rest of house													
	0.9971	0.9907	0.9700	0.9018	0.7504	0.5341	0.3558	0.4036	0.6884	0.9419	0.9925	0.9980	(89)
MIT 2	18.2544	18.5674	19.0076	19.5056	19.8230	19.9454	19.9622	19.9621	19.8979	19.4546	18.7530	18.2055	(90)
Living area fraction									fLA = Living area / (4) =			0.2084	(91)
MIT	18.5626	18.8550	19.2669	19.7347	20.0385	20.1590	20.1774	20.1765	20.1100	19.6845	19.0272	18.5161	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.5626	18.8550	19.2669	19.7347	20.0385	20.1590	20.1774	20.1765	20.1100	19.6845	19.0272	18.5161	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9957	0.9873	0.9636	0.8957	0.7553	0.5516	0.3780	0.4267	0.7015	0.9358	0.9897	0.9969	(94)
Useful gains	791.4979	989.3013	1153.6814	1236.2778	1126.6693	809.6606	532.1085	558.8648	834.8499	929.2142	804.3231	736.0858	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2187.7309	2135.7455	1949.5999	1637.3755	1257.6739	830.7795	534.6284	563.4308	901.3748	1370.1979	1806.1062	2176.8224	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1038.7973	770.4105	592.1634	288.7903	97.4674	0.0000	0.0000	0.0000	0.0000	328.0919	721.2838	1071.9080	(98)
Space heating												4908.9126	(98)
Space heating per m2											(98) / (4) =	37.6162	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												5250.1739	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1038.7973	770.4105	592.1634	288.7903	97.4674	0.0000	0.0000	0.0000	0.0000	328.0919	721.2838	1071.9080	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	1111.0132	823.9684	633.3298	308.8667	104.2432	0.0000	0.0000	0.0000	0.0000	350.9004	771.4265	1146.4257	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	214.5935	189.0184	198.2163	177.2790	173.4316	154.5423	148.0168	162.9781	162.8650	183.8482	194.9145	209.2926	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.4690	88.1709	87.5558	86.1083	83.3454	79.8000	79.8000	79.8000	79.8000	86.3424	87.9900	88.5602	(217)
Fuel for water heating, kWh/month													
	242.5634	214.3774	226.3885	205.8791	208.0878	193.6620	185.4848	204.2332	204.0915	212.9292	221.5189	236.3281	(219)
Water heating fuel used												2555.5439	(219)
Annual totals kWh/year													
Space heating fuel - main system												5250.1739	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												469.6745	(232)
Total delivered energy for all uses												8350.3923	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	5250.1739	0.2160	1134.0376	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2555.5439	0.2160	551.9975	(264)
Space and water heating			1686.0350	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	469.6745	0.5190	243.7611	(268)
Total CO2, kg/m2/year			1968.7211	(272)
Emissions per m2 for space and water heating			12.9198	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			1.8679	(272b)
Emissions per m2 for pumps and fans			0.2983	(272c)
Target Carbon Dioxide Emission Rate (TER) = (12.9198 * 1.55) + 1.8679 + 0.2983, rounded to 2 d.p.			22.1900	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	4 Bed Detached	**Issued on Date**	16/03/2021
Assessment Reference	3	**Prop Type Ref**	
Property	Type 9 Det, Stratford-upon-Avon, CV36		

SAP Rating	86 B	**DER**	14.23	**TER**	24.74
Environmental	87 B	**% DER<TER**	42.49		
CO_2 Emissions (t/year)	1.73	**DFEE**	45.63	**TFEE**	60.10
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.07		

Assessor Details	Mr. Jonathan Peck, Jonathan Peck, Tel: 02036031622, Jonathan@hodkinsonconsultancy.com	**Assessor ID**	T296-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 140 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 24.74 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 14.23 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)45.6 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	0.10 (max. 0.20)	0.10 (max. 0.35)	OK
Openings	1.19 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
Mitsubishi ECODAN 5kW PUHZ-W50VHA-BS

Secondary heating system: None

5 Cylinder insulation
Hot water storage Measured cylinder loss: 1.50 kWh/day
Permitted by DBSCG 1.89 OK
Primary pipework insulated: Yes OK

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.88
Maximum 1.5 OK
MVHR efficiency: 84%
Minimum: 70% OK

9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing North: 15.13 m², No overhang
Windows facing East: 4.96 m², No overhang
Windows facing South: 10.50 m², No overhang
Windows facing West: 0.75 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features
Roof U-value 0.10 W/m²K
Roof U-value 0.10 W/m²K
Floor U-value 0.10 W/m²K
Door U-value 1.00 W/m²K
Thermal bridging y-value 0.030 W/m²K
Air permeability 3.0 m³/m²h

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.0000 (1b)	x	2.3900 (2b)	=	179.2500	(1b) - (3b)
First floor	65.0000 (1c)	x	2.6100 (2c)	=	169.6500	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	348.9000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

			Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000	/ (5) =	0.0000	(8)
Pressure test			Yes	
Measured/design AP50			3.0000	
Infiltration rate			0.1500	(18)
Number of sides sheltered			0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =		1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =		0.1500	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1913	0.1875	0.1838	0.1650	0.1613	0.1425	0.1425	0.1388	0.1500	0.1613	0.1688	0.1763	(22b)

Balanced mechanical ventilation with heat recovery
If mechanical ventilation: 0.5000 (23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 71.4000 (23c)

Effective ac	0.3343	0.3305	0.3268	0.3080	0.3043	0.2855	0.2855	0.2818	0.2930	0.3043	0.3118	0.3193	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.20)			31.3400	1.1450	35.8855			(27)
Opening Type 11			2.3100	1.2000	2.7720			(26a)
Ground Floor			75.0000	0.1000	7.5000			(28a)
External Wall	181.0100	35.7700	145.2400	0.1500	21.7860			(29a)
Main Roof	65.0000		65.0000	0.1000	6.5000			(30)
GF Flat Roof	10.0000		10.0000	0.1000	1.0000			(30)
Total net area of external elements Aum(A, m2)			331.0100					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	77.5635			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K 250.0000 (35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K) 9.8224 (36)
Total fabric heat loss (33) + (36) = 87.3859 (37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	38.4845	38.0528	37.6210	35.4622	35.0304	32.8716	32.8716	32.4398	33.7351	35.0304	35.8940	36.7575	(38)
Heat transfer coeff	125.8704	125.4387	125.0069	122.8481	122.4163	120.2575	120.2575	119.8257	121.1210	122.4163	123.2798	124.1434	(39)

Average = Sum(39)m / 12 = 122.7401 (39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.8991	0.8960	0.8929	0.8775	0.8744	0.8590	0.8590	0.8559	0.8652	0.8744	0.8806	0.8867	(40)
HLP (average)												0.8767	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy 2.9171 (42)
Average daily hot water use (litres/day) 103.4808 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.8288	109.6896	105.5504	101.4111	97.2719	93.1327	93.1327	97.2719	101.4111	105.5504	109.6896	113.8288	(44)
Energy conte	168.8049	147.6378	152.3490	132.8216	127.4455	109.9757	101.9087	116.9417	118.3384	137.9119	150.5417	163.4785	(45)
Energy content (annual)										Total = Sum(45)m =		1628.1554	(45)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Distribution loss (46)m = 0.15 x (45)m

	25.3207	22.1457	22.8524	19.9232	19.1168	16.4964	15.2863	17.5413	17.7508	20.6868	22.5813	24.5218 (46)

Water storage loss:

Store volume												150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000 (48)
Temperature factor from Table 2b												0.5400 (49)
Enter (49) or (54) in (55)												0.8100 (55)
Total storage loss												
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100 (56)
If cylinder contains dedicated solar storage												
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100 (57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624 (59)
Total heat required for water heating calculated for each month												
	217.1773	191.3290	200.7214	179.6336	175.8179	156.7877	150.2811	165.3141	165.1504	186.2843	197.3537	211.8509 (62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000 (63)
								Solar input (sum of months) = Sum(63)m =				0.0000 (63)
Output from w/h												
	217.1773	191.3290	200.7214	179.6336	175.8179	156.7877	150.2811	165.3141	165.1504	186.2843	197.3537	211.8509 (64)
									Total per year (kWh/year) = Sum(64)m =			2197.7014 (64)
Heat gains from water heating, kWh/month												
	94.8255	84.0425	89.3540	81.6128	81.0735	74.0165	72.5826	77.5810	76.7971	84.5536	87.5047	93.0545 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.5823	24.4984	19.9234	15.0833	11.2749	9.5188	10.2854	13.3693	17.9443	22.7844	26.5928	28.3489	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	309.4120	312.6228	304.5318	287.3072	265.5642	245.1288	231.4767	228.2660	236.3569	253.5816	275.3246	295.7600	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	(71)
Water heating gains (Table 5)													
	127.4537	125.0633	120.0994	113.3511	108.9698	102.8007	97.5572	104.2756	106.6626	113.6474	121.5343	125.0733	(72)
Total internal gains													
	531.2043	528.9407	511.3109	482.4978	452.5652	424.2046	406.0756	412.6672	427.7202	456.7696	490.2079	515.9384	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	15.1300	10.6334	0.4500	0.7000	0.7700	35.1200	(74)
East	4.9600	19.6403	0.4500	0.7000	0.7700	21.2654	(76)
South	10.5000	46.7521	0.4500	0.7000	0.7700	107.1603	(78)
West	0.7500	19.6403	0.4500	0.7000	0.7700	3.2155	(80)

Solar gains	166.7612	290.5069	416.4715	550.8801	651.0331	661.8661	631.5990	554.1176	462.3792	326.0125	200.8713	142.0060	(83)
Total gains	697.9655	819.4476	927.7824	1033.3780	1103.5983	1086.0708	1037.6746	966.7848	890.0994	782.7821	691.0793	657.9445	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)

Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.2399	77.5058	77.7735	79.1402	79.4193	80.8450	80.8450	81.1363	80.2687	79.4193	78.8630	78.3145	
alpha	6.1493	6.1671	6.1849	6.2760	6.2946	6.3897	6.3897	6.4091	6.3512	6.2946	6.2575	6.2210	
util living area													
	0.9992	0.9977	0.9922	0.9665	0.8760	0.6838	0.5065	0.5633	0.8353	0.9814	0.9980	0.9995	(86)
Tweekday	18.8297	19.0391	19.3579	19.7728	20.0683	20.1896	20.2015	20.2031	20.1439	19.7625	19.2295	18.8102	
Tweekend	20.3617	20.4535	20.5941	20.7775	20.9216	20.9877	20.9984	20.9970	20.9578	20.7695	20.5330	20.3495	
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9	
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	20.1683	20.1709	20.1735	20.1867	20.1893	20.2025	20.2025	20.2051	20.1972	20.1893	20.1840	20.1788	(88)
util rest of house													
	0.9990	0.9970	0.9894	0.9544	0.8357	0.6089	0.4166	0.4696	0.7719	0.9726	0.9972	0.9993	(89)
Tweekday	18.8297	19.0391	19.3579	19.7728	20.0683	20.1896	20.2015	20.2031	20.1439	19.7625	19.2295	18.8102	
Tweekend	18.8297	19.0391	19.3579	19.7728	20.0683	20.1896	20.2015	20.2031	20.1439	19.7625	19.2295	18.8102	
MIT 2	20.1683	20.1709	20.1735	20.1867	20.1893	20.2025	20.2025	20.2051	20.1972	20.1893	20.1840	20.1788	(90)
Living area fraction									fLA = Living area / (4) =			0.1857	(91)
MIT	20.3227	20.3249	20.3270	20.3377	20.3399	20.3506	20.3506	20.3528	20.3463	20.3399	20.3356	20.3313	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3227	20.3249	20.3270	20.3377	20.3399	20.3506	20.3506	20.3528	20.3463	20.3399	20.3356	20.3313	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9990	0.9971	0.9900	0.9569	0.8439	0.6233	0.4335	0.4873	0.7848	0.9745	0.9973	0.9993	(94)
Useful gains	697.2959	817.0811	918.5144	988.8788	931.3260	676.9930	449.7936	471.1353	698.5850	762.8368	689.2325	657.5098	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Heat loss rate W

	2016.7901	1934.8768	1728.4730	1405.1025	1057.6609	691.5542	451.0392	473.6428	756.5596	1192.3189	1631.6804	2002.5938 (97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000 (97a)
Space heating kWh												
	981.7037	751.1587	602.6091	299.6810	93.9932	0.0000	0.0000	0.0000	0.0000	319.5347	678.5625	1000.7424 (98)

Space heating 4727.9854 (98)
Space heating per m2 (98) / (4) = 33.7713 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11) 0.0000 (201)
Fraction of space heat from main system(s) 1.0000 (202)
Efficiency of main space heating system 1 (in %) 286.8678 (206)
Efficiency of secondary/supplementary heating system, % 100.0000 (208)
Space heating requirement 1648.1411 (211)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	981.7037	751.1587	602.6091	299.6810	93.9932	0.0000	0.0000	0.0000	0.0000	319.5347	678.5625	1000.7424	(98)
Space heating efficiency (main heating system 1)													
	286.8678	286.8678	286.8678	286.8678	286.8678	0.0000	0.0000	0.0000	0.0000	286.8678	286.8678	286.8678	(210)
Space heating fuel (main heating system)													
	342.2147	261.8484	210.0651	104.4666	32.7653	0.0000	0.0000	0.0000	0.0000	111.3875	236.5419	348.8515	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)

Water heating
Water heating requirement

	217.1773	191.3290	200.7214	179.6336	175.8179	156.7877	150.2811	165.3141	165.1504	186.2843	197.3537	211.8509	(64)
Efficiency of water heater												178.1250	(216)
(217)m	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	(217)
Fuel for water heating, kWh/month													
	121.9241	107.4128	112.6857	100.8469	98.7048	88.0212	84.3683	92.8079	92.7160	104.5807	110.7950	118.9338	(219)
Water heating fuel used												1233.7973	(219)

Annual totals kWh/year
Space heating fuel - main system 1648.1411 (211)
Space heating fuel - secondary 0.0000 (215)

Electricity for pumps and fans:
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 1.1000)
mechanical ventilation fans (SFP = 1.1000) 468.2238 (230a)
Total electricity for the above, kWh/year 468.2238 (231)
Electricity for lighting (calculated in Appendix L) 487.1124 (232)
Total delivered energy for all uses 3837.2746 (238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1648.1411	0.5190	855.3852	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1233.7973	0.5190	640.3408	(264)
Space and water heating			1495.7260	(265)
Pumps and fans	468.2238	0.5190	243.0082	(267)
Energy for lighting	487.1124	0.5190	252.8113	(268)
Total CO2, kg/year			1991.5455	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			14.2300	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		14.2300	ZC1
Total Floor Area	TFA	140.0000	
Assumed number of occupants	N	2.9171	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.0965	ZC2
CO2 emissions from cooking, equation (L16)		1.3501	ZC3
Total CO2 emissions		28.6766	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		28.6766	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.0000	(1b)	x 2.3900	(2b) =	179.2500	(1b) - (3b)
First floor	65.0000	(1c)	x 2.6100	(2c) =	169.6500	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		348.9000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1146	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3646	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3646	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4649	0.4558	0.4467	0.4011	0.3920	0.3464	0.3464	0.3373	0.3646	0.3920	0.4102	0.4285	(22b)
Effective ac	0.6081	0.6039	0.5998	0.5804	0.5768	0.5600	0.5600	0.5569	0.5665	0.5768	0.5841	0.5918	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Semi-glazed door			2.3100	1.2000	2.7720			(26a)
TER Opening Type (Uw = 1.40)			30.5700	1.3258	40.5284			(27)
Ground Floor			75.0000	0.1300	9.7500			(28a)
External Wall	181.0100	35.0000	146.0100	0.1800	26.2818			(29a)
Main Roof	65.0000		65.0000	0.1300	8.4500			(30)
GF Flat Roof	10.0000		10.0000	0.1300	1.3000			(30)
Total net area of external elements Aum(A, m2)			331.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		91.2022			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.7265	(36)
Total fabric heat loss					(33) + (36) =		106.9287	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	70.0122	69.5290	69.0553	66.8307	66.4145	64.4769	64.4769	64.1180	65.2232	66.4145	67.2565	68.1368	(38)
Heat transfer coeff	176.9409	176.4577	175.9840	173.7594	173.3432	171.4056	171.4056	171.0468	172.1519	173.3432	174.1852	175.0655	(39)
Average = Sum(39)m / 12 =												173.7574	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2639	1.2604	1.2570	1.2411	1.2382	1.2243	1.2243	1.2218	1.2297	1.2382	1.2442	1.2505	(40)
HLP (average)												1.2411	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9171	(42)
Average daily hot water use (litres/day)	103.4808	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.8288	109.6896	105.5504	101.4111	97.2719	93.1327	93.1327	97.2719	101.4111	105.5504	109.6896	113.8288	(44)
Energy conte	168.8049	147.6378	152.3490	132.8216	127.4455	109.9757	101.9087	116.9417	118.3384	137.9119	150.5417	163.4785	(45)
Energy content (annual)										Total = Sum(45)m =		1628.1554	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3207	22.1457	22.8524	19.9232	19.1168	16.4964	15.2863	17.5413	17.7508	20.6868	22.5813	24.5218	(46)
Water storage loss:													
Store volume												150.0000	(47)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day): 1.3938 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7527 (55)
Total storage loss
23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 (56)
If cylinder contains dedicated solar storage
23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
215.3998 189.7235 198.9439 177.9134 174.0404 155.0676 148.5036 163.5366 163.4302 184.5069 195.6335 210.0734 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
215.3998 189.7235 198.9439 177.9134 174.0404 155.0676 148.5036 163.5366 163.4302 184.5069 195.6335 210.0734 (64)
Total per year (kWh/year) = Sum(64)m = 2176.7728 (64)
Heat gains from water heating, kWh/month
93.4035 82.7582 87.9320 80.2366 79.6515 72.6404 71.1606 76.1590 75.4210 83.1316 86.1286 91.6325 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.6011	24.5150	19.9370	15.0936	11.2826	9.5253	10.2924	13.3784	17.9565	22.7999	26.6108	28.3682	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	309.4120	312.6228	304.5318	287.3072	265.5642	245.1288	231.4767	228.2660	236.3569	253.5816	275.3246	295.7600	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	(71)
Water heating gains (Table 5)													
	125.5424	123.1520	118.1881	111.4398	107.0585	100.8895	95.6459	102.3643	104.7514	111.7361	119.6230	123.1620	(72)
Total internal gains													
	532.3118	530.0461	512.4132	483.5968	453.6616	425.2998	407.1713	413.7650	428.8211	457.8738	491.3147	517.0464	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	14.7500	10.6334	0.6300	0.7000	0.7700	47.9331	(74)
East	4.8400	19.6403	0.6300	0.7000	0.7700	29.0512	(76)
South	10.2500	46.7521	0.6300	0.7000	0.7700	146.4524	(78)
West	0.7300	19.6403	0.6300	0.7000	0.7700	4.3817	(80)

Solar gains	227.8184	396.8558	568.8909	752.4204	889.1541	903.9241	862.5980	756.8191	631.5765	445.3480	274.4146	194.0014	(83)
Total gains	760.1302	926.9019	1081.3041	1236.0172	1342.8157	1329.2239	1269.7693	1170.5841	1060.3976	903.2218	765.7294	711.0478	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.9462	55.0966	55.2449	55.9522	56.0866	56.7206	56.7206	56.8396	56.4747	56.0866	55.8154	55.5348	
alpha	4.6631	4.6731	4.6830	4.7301	4.7391	4.7814	4.7814	4.7893	4.7650	4.7391	4.7210	4.7023	
util living area													
	0.9987	0.9964	0.9896	0.9649	0.8919	0.7394	0.5729	0.6356	0.8699	0.9808	0.9970	0.9990	(86)
MIT	19.5569	19.7391	20.0250	20.3996	20.7264	20.9245	20.9823	20.9717	20.8245	20.3946	19.9067	19.5305	(87)
Th 2	19.8692	19.8720	19.8746	19.8872	19.8896	19.9006	19.9006	19.9026	19.8963	19.8896	19.8848	19.8798	(88)
util rest of house													
	0.9982	0.9951	0.9857	0.9508	0.8479	0.6441	0.4403	0.5015	0.8005	0.9706	0.9957	0.9987	(89)
MIT 2	17.9479	18.2158	18.6334	19.1779	19.6178	19.8498	19.8942	19.8909	19.7520	19.1802	18.4702	17.9165	(90)
Living area fraction									fLA = Living area / (4) =			0.1857	(91)
MIT	18.2467	18.4987	18.8919	19.4048	19.8237	20.0493	20.0962	20.0916	19.9512	19.4057	18.7370	18.2162	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2467	18.4987	18.8919	19.4048	19.8237	20.0493	20.0962	20.0916	19.9512	19.4057	18.7370	18.2162	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9928	0.9808	0.9428	0.8448	0.6583	0.4650	0.5261	0.8046	0.9643	0.9937	0.9979	(94)
Useful gains	757.9587	920.1953	1060.5107	1165.3290	1134.3902	874.9706	590.4296	615.8769	853.2456	870.9567	760.9016	709.5545	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2467.7459	2399.5939	2180.7718	1825.3118	1408.1866	934.0488	599.2766	631.4411	1007.2968	1526.4098	2026.9916	2453.7519	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1272.0817	994.1558	833.4742	475.1876	203.7045	0.0000	0.0000	0.0000	0.0000	487.6571	911.5848	1297.6828	(98)
Space heating												6475.5288	(98)
Space heating per m2											(98) / (4) =	46.2538	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6925.6992	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1272.0817	994.1558	833.4742	475.1876	203.7045	0.0000	0.0000	0.0000	0.0000	487.6571	911.5848	1297.6828	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	1360.5152	1063.2683	891.4163	508.2221	217.8658	0.0000	0.0000	0.0000	0.0000	521.5584	974.9570	1387.8961	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	215.3998	189.7235	198.9439	177.9134	174.0404	155.0676	148.5036	163.5366	163.4302	184.5069	195.6335	210.0734	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.7763	88.5962	88.2206	87.3108	85.2344	79.8000	79.8000	79.8000	79.8000	87.2873	88.4055	88.8403	(217)
Fuel for water heating, kWh/month													
	242.6322	214.1440	225.5074	203.7701	204.1903	194.3203	186.0947	204.9331	204.7998	211.3788	221.2910	236.4619	(219)
Water heating fuel used												2549.5234	(219)
Annual totals kWh/year													
Space heating fuel - main system												6925.6992	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												487.4436	(232)
Total delivered energy for all uses												10037.6663	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6925.6992	0.2160	1495.9510	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2549.5234	0.2160	550.6971	(264)
Space and water heating			2046.6481	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	487.4436	0.5190	252.9832	(268)
Total CO2, kg/m2/year			2338.5563	(272)
Emissions per m2 for space and water heating			14.6189	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			1.8070	(272b)
Emissions per m2 for pumps and fans			0.2780	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6189 * 1.55) + 1.8070 + 0.2780, rounded to 2 d.p.			24.7400	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	4 Bed Detached	**Issued on Date**	16/03/2021
Assessment Reference	2	**Prop Type Ref**	
Property	Type 9 Det, Stratford-upon-Avon, CV36		

SAP Rating	82 B	**DER**	17.09	**TER**	24.74
Environmental	84 B	**% DER<TER**	30.93		
CO_2 Emissions (t/year)	2.09	**DFEE**	56.40	**TFEE**	60.10
General Requirements Compliance	Pass	**% DFEE<TFEE**	6.16		

Assessor Details	Mr. Jonathan Peck, Jonathan Peck, Tel: 02036031622, Jonathan@hodkinsonconsultancy.com	**Assessor ID**	T296-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

DWELLING AS DESIGNED

Detached House, total floor area 140 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 24.74 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.09 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)60.1 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)56.4 kWh/m²/yrOK

2 Fabric U-values

Element	Average	Highest	
External wall	0.18 (max. 0.30)	0.18 (max. 0.70)	OK
Floor	0.16 (max. 0.25)	0.16 (max. 0.70)	OK
Roof	0.12 (max. 0.20)	0.16 (max. 0.35)	OK
Openings	1.37 (max. 2.00)	1.40 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

3 Air permeability
Air permeability at 50 pascals: 5.00 (design value)
Maximum 10.0 OK

4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
Mitsubishi ECODAN 5kW PUHZ-W50VHA-BS

Secondary heating system: None

5 Cylinder insulation
Hot water storage: Measured cylinder loss: 1.50 kWh/day
Permitted by DBSCG 1.89: OK
Primary pipework insulated: Yes OK

6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

8 Mechanical ventilation
Not applicable

9 Summertime temperature
Overheating risk (Midlands): Not significant OK
Based on:
Overshading: Average
Windows facing North: 15.13 m², No overhang
Windows facing East: 4.96 m², No overhang
Windows facing South: 10.50 m², No overhang
Windows facing West: 0.75 m², No overhang
Air change rate: 4.00 ach
Blinds/curtains: None

10 Key features
Roof U-value 0.11 W/m²K
Door U-value 1.00 W/m²K

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.0000 (1b)	x	2.3900 (2b)	=	179.2500	(1b) - (3b)
First floor	65.0000 (1c)	x	2.6100 (2c)	=	169.6500	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	348.9000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1146	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3646	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3646	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4649	0.4558	0.4467	0.4011	0.3920	0.3464	0.3464	0.3373	0.3646	0.3920	0.4102	0.4285	(22b)
Effective ac	0.6081	0.6039	0.5998	0.5804	0.5768	0.5600	0.5600	0.5569	0.5665	0.5768	0.5841	0.5918	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.1200	1.0000	2.1200			(26)
Opening Type 2 (Uw = 1.40)			31.3400	1.3258	41.5492			(27)
Opening Type 11			2.3100	1.3000	3.0030			(26a)
Ground Floor			75.0000	0.1600	12.0000			(28a)
External Wall	181.0100	35.7700	145.2400	0.1800	26.1432			(29a)
Main Roof	65.0000		65.0000	0.1100	7.1500			(30)
GF Flat Roof	10.0000		10.0000	0.1600	1.6000			(30)
Total net area of external elements Aum(A, m2)			331.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		93.5654			(33)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	15.2712	(36)
Total fabric heat loss (33) + (36) =	108.8366	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	70.0122	69.5290	69.0553	66.8307	66.4145	64.4769	64.4769	64.1180	65.2232	66.4145	67.2565	68.1368	(38)
Heat transfer coeff	178.8488	178.3656	177.8920	175.6673	175.2511	173.3135	173.3135	172.9547	174.0598	175.2511	176.0931	176.9734	(39)
Average = Sum(39)m / 12 =												175.6653	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2775	1.2740	1.2707	1.2548	1.2518	1.2380	1.2380	1.2354	1.2433	1.2518	1.2578	1.2641	(40)
HLP (average)												1.2548	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9171 (42)
Average daily hot water use (litres/day)	103.4808 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.8288	109.6896	105.5504	101.4111	97.2719	93.1327	93.1327	97.2719	101.4111	105.5504	109.6896	113.8288	(44)
Energy conte	168.8049	147.6378	152.3490	132.8216	127.4455	109.9757	101.9087	116.9417	118.3384	137.9119	150.5417	163.4785	(45)
Energy content (annual)										Total = Sum(45)m =		1628.1554	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3207	22.1457	22.8524	19.9232	19.1168	16.4964	15.2863	17.5413	17.7508	20.6868	22.5813	24.5218	(46)
Water storage loss:													
Store volume												150.0000	(47)

a) If manufacturer declared loss factor is known (kWh/day): 1.5000 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.8100 (55)
Total storage loss
25.1100 22.6800 25.1100 24.3000 25.1100 24.3000 25.1100 25.1100 24.3000 25.1100 24.3000 25.1100 (56)
If cylinder contains dedicated solar storage
25.1100 22.6800 25.1100 24.3000 25.1100 24.3000 25.1100 25.1100 24.3000 25.1100 24.3000 25.1100 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
217.1773 191.3290 200.7214 179.6336 175.8179 156.7877 150.2811 165.3141 165.1504 186.2843 197.3537 211.8509 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
217.1773 191.3290 200.7214 179.6336 175.8179 156.7877 150.2811 165.3141 165.1504 186.2843 197.3537 211.8509 (64)
Total per year (kWh/year) = Sum(64)m = 2197.7014 (64)
Heat gains from water heating, kWh/month
94.8255 84.0425 89.3540 81.6128 81.0735 74.0165 72.5826 77.5810 76.7971 84.5536 87.5047 93.0545 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.5823	24.4984	19.9234	15.0833	11.2749	9.5188	10.2854	13.3693	17.9443	22.7844	26.5928	28.3489	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	309.4120	312.6228	304.5318	287.3072	265.5642	245.1288	231.4767	228.2660	236.3569	253.5816	275.3246	295.7600	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	(71)
Water heating gains (Table 5)													
	127.4537	125.0633	120.0994	113.3511	108.9698	102.8007	97.5572	104.2756	106.6626	113.6474	121.5343	125.0733	(72)
Total internal gains													
	531.2043	528.9407	511.3109	482.4978	452.5652	424.2046	406.0756	412.6672	427.7202	456.7696	490.2079	515.9384	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	15.1300	10.6334	0.4500	0.7000	0.7700	35.1200	(74)
East	4.9600	19.6403	0.4500	0.7000	0.7700	21.2654	(76)
South	10.5000	46.7521	0.4500	0.7000	0.7700	107.1603	(78)
West	0.7500	19.6403	0.4500	0.7000	0.7700	3.2155	(80)

Solar gains	166.7612	290.5069	416.4715	550.8801	651.0331	661.8661	631.5990	554.1176	462.3792	326.0125	200.8713	142.0060	(83)
Total gains	697.9655	819.4476	927.7824	1033.3780	1103.5983	1086.0708	1037.6746	966.7848	890.0994	782.7821	691.0793	657.9445	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.3600	54.5073	54.6524	55.3445	55.4760	56.0962	56.0962	56.2125	55.8556	55.4760	55.2107	54.9361	
alpha	4.6240	4.6338	4.6435	4.6896	4.6984	4.7397	4.7397	4.7475	4.7237	4.6984	4.6807	4.6624	
util living area													
	0.9991	0.9979	0.9944	0.9823	0.9420	0.8344	0.6803	0.7372	0.9233	0.9892	0.9981	0.9993	(86)
Tweekday	17.8559	18.0823	18.4634	18.9882	19.4681	19.7902	19.8747	19.8666	19.6625	19.0525	18.3706	17.8327	
Tweekend	20.0297	20.1289	20.2969	20.5274	20.7487	20.9133	20.9758	20.9646	20.8383	20.5537	20.2523	20.0162	
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9	
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	19.8585	19.8612	19.8639	19.8764	19.8788	19.8898	19.8898	19.8918	19.8855	19.8788	19.8740	19.8691	(88)
util rest of house													
	0.9987	0.9971	0.9922	0.9744	0.9130	0.7494	0.5345	0.5978	0.8721	0.9830	0.9972	0.9991	(89)
Tweekday	17.8559	18.0823	18.4634	18.9882	19.4681	19.7902	19.8747	19.8666	19.6625	19.0525	18.3706	17.8327	
Tweekend	17.8559	18.0823	18.4634	18.9882	19.4681	19.7902	19.8747	19.8666	19.6625	19.0525	18.3706	17.8327	
MIT 2	19.8585	19.8612	19.8639	19.8764	19.8788	19.8898	19.8898	19.8918	19.8855	19.8788	19.8740	19.8691	(90)
Living area fraction										fLA = Living area / (4) =		0.1857	(91)
MIT	20.0705	20.0727	20.0749	20.0851	20.0870	20.0959	20.0959	20.0976	20.0925	20.0870	20.0831	20.0791	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.0705	20.0727	20.0749	20.0851	20.0870	20.0959	20.0959	20.0976	20.0925	20.0870	20.0831	20.0791	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9988	0.9972	0.9927	0.9761	0.9194	0.7676	0.5640	0.6268	0.8838	0.9844	0.9974	0.9991	(94)
Useful gains	697.1412	817.1927	921.0257	1008.6764	1014.6900	833.6616	585.2714	605.9635	786.6440	770.5881	689.2943	657.3656	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2820.5347	2706.2897	2414.8624	1964.8562	1469.8333	952.5215	605.8945	639.5176	1043.0538	1662.6095	2286.2415	2810.1776	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

	1579.8048	1269.4732	1111.4145	688.4495	338.6266	0.0000	0.0000	0.0000	0.0000	663.6639	1149.8020	1601.6922 (98)
Space heating												8402.9267 (98)
Space heating per m2											(98) / (4) =	60.0209 (99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												290.7417	(206)
Efficiency of secondary/supplementary heating system, %												100.0000	(208)
Space heating requirement												2890.1686	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1579.8048	1269.4732	1111.4145	688.4495	338.6266	0.0000	0.0000	0.0000	0.0000	663.6639	1149.8020	1601.6922	(98)
Space heating efficiency (main heating system 1)													
	290.7417	290.7417	290.7417	290.7417	290.7417	0.0000	0.0000	0.0000	0.0000	290.7417	290.7417	290.7417	(210)
Space heating fuel (main heating system)													
	543.3705	436.6326	382.2686	236.7907	116.4699	0.0000	0.0000	0.0000	0.0000	228.2658	395.4719	550.8986	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	217.1773	191.3290	200.7214	179.6336	175.8179	156.7877	150.2811	165.3141	165.1504	186.2843	197.3537	211.8509	(64)
Efficiency of water heater												178.1250	(216)
(217)m	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	(217)
Fuel for water heating, kWh/month													
	121.9241	107.4128	112.6857	100.8469	98.7048	88.0212	84.3683	92.8079	92.7160	104.5807	110.7950	118.9338	(219)
Water heating fuel used												1233.7973	(219)
Annual totals kWh/year													
Space heating fuel - main system												2890.1686	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
Total electricity for the above, kWh/year												0.0000	(231)
Electricity for lighting (calculated in Appendix L)												487.1124	(232)
Total delivered energy for all uses												4611.0782	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	2890.1686	0.5190	1499.9975	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1233.7973	0.5190	640.3408	(264)
Space and water heating			2140.3383	(265)
Pumps and fans	0.0000	0.0000	0.0000	(267)
Energy for lighting	487.1124	0.5190	252.8113	(268)
Total CO2, kg/year			2393.1496	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.0900	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		17.0900	ZC1
Total Floor Area	TFA	140.0000	
Assumed number of occupants	N	2.9171	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		13.0965	ZC2
CO2 emissions from cooking, equation (L16)		1.3501	ZC3
Total CO2 emissions		31.5366	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		31.5366	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	75.0000	(1b)	x 2.3900	(2b) =	179.2500	(1b) - (3b)
First floor	65.0000	(1c)	x 2.6100	(2c) =	169.6500	(1c) - (3c)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	140.0000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n) =		348.9000	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							4 * 10 =	40.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	40.0000 / (5) =	0.1146	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3646	(18)
Number of sides sheltered		0	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	1.0000	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3646	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4649	0.4558	0.4467	0.4011	0.3920	0.3464	0.3464	0.3373	0.3646	0.3920	0.4102	0.4285	(22b)
Effective ac	0.6081	0.6039	0.5998	0.5804	0.5768	0.5600	0.5600	0.5569	0.5665	0.5768	0.5841	0.5918	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.1200	1.0000	2.1200			(26)
TER Semi-glazed door			2.3100	1.2000	2.7720			(26a)
TER Opening Type (Uw = 1.40)			30.5700	1.3258	40.5284			(27)
Ground Floor			75.0000	0.1300	9.7500			(28a)
External Wall	181.0100	35.0000	146.0100	0.1800	26.2818			(29a)
Main Roof	65.0000		65.0000	0.1300	8.4500			(30)
GF Flat Roof	10.0000		10.0000	0.1300	1.3000			(30)
Total net area of external elements Aum(A, m2)			331.0100					(31)
Fabric heat loss, W/K = Sum (A x U)			(26)...(30) + (32) =		91.2022			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							15.7265	(36)
Total fabric heat loss					(33) + (36) =		106.9287	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	70.0122	69.5290	69.0553	66.8307	66.4145	64.4769	64.4769	64.1180	65.2232	66.4145	67.2565	68.1368	(38)
Heat transfer coeff	176.9409	176.4577	175.9840	173.7594	173.3432	171.4056	171.4056	171.0468	172.1519	173.3432	174.1852	175.0655	(39)
Average = Sum(39)m / 12 =												173.7574	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2639	1.2604	1.2570	1.2411	1.2382	1.2243	1.2243	1.2218	1.2297	1.2382	1.2442	1.2505	(40)
HLP (average)												1.2411	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.9171	(42)
Average daily hot water use (litres/day)	103.4808	(43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	113.8288	109.6896	105.5504	101.4111	97.2719	93.1327	93.1327	97.2719	101.4111	105.5504	109.6896	113.8288	(44)
Energy conte	168.8049	147.6378	152.3490	132.8216	127.4455	109.9757	101.9087	116.9417	118.3384	137.9119	150.5417	163.4785	(45)
Energy content (annual)										Total = Sum(45)m =		1628.1554	(45)
Distribution loss (46)m = 0.15 x (45)m	25.3207	22.1457	22.8524	19.9232	19.1168	16.4964	15.2863	17.5413	17.7508	20.6868	22.5813	24.5218	(46)
Water storage loss:													
Store volume												150.0000	(47)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

a) If manufacturer declared loss factor is known (kWh/day): 1.3938 (48)
Temperature factor from Table 2b 0.5400 (49)
Enter (49) or (54) in (55) 0.7527 (55)
Total storage loss
23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 (56)
If cylinder contains dedicated solar storage
23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
215.3998 189.7235 198.9439 177.9134 174.0404 155.0676 148.5036 163.5366 163.4302 184.5069 195.6335 210.0734 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
215.3998 189.7235 198.9439 177.9134 174.0404 155.0676 148.5036 163.5366 163.4302 184.5069 195.6335 210.0734 (64)
Total per year (kWh/year) = Sum(64)m = 2176.7728 (64)
Heat gains from water heating, kWh/month
93.4035 82.7582 87.9320 80.2366 79.6515 72.6404 71.1606 76.1590 75.4210 83.1316 86.1286 91.6325 (65)

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5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	145.8542	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	27.6011	24.5150	19.9370	15.0936	11.2826	9.5253	10.2924	13.3784	17.9565	22.7999	26.6108	28.3682	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	309.4120	312.6228	304.5318	287.3072	265.5642	245.1288	231.4767	228.2660	236.3569	253.5816	275.3246	295.7600	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	37.5854	(69)
Pumps, fans	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	3.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	-116.6834	(71)
Water heating gains (Table 5)													
	125.5424	123.1520	118.1881	111.4398	107.0585	100.8895	95.6459	102.3643	104.7514	111.7361	119.6230	123.1620	(72)
Total internal gains													
	532.3118	530.0461	512.4132	483.5968	453.6616	425.2998	407.1713	413.7650	428.8211	457.8738	491.3147	517.0464	(73)

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6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	14.7500	10.6334	0.6300	0.7000	0.7700	47.9331	(74)
East	4.8400	19.6403	0.6300	0.7000	0.7700	29.0512	(76)
South	10.2500	46.7521	0.6300	0.7000	0.7700	146.4524	(78)
West	0.7300	19.6403	0.6300	0.7000	0.7700	4.3817	(80)

Solar gains	227.8184	396.8558	568.8909	752.4204	889.1541	903.9241	862.5980	756.8191	631.5765	445.3480	274.4146	194.0014	(83)
Total gains	760.1302	926.9019	1081.3041	1236.0172	1342.8157	1329.2239	1269.7693	1170.5841	1060.3976	903.2218	765.7294	711.0478	(84)

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7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.9462	55.0966	55.2449	55.9522	56.0866	56.7206	56.7206	56.8396	56.4747	56.0866	55.8154	55.5348	
alpha	4.6631	4.6731	4.6830	4.7301	4.7391	4.7814	4.7814	4.7893	4.7650	4.7391	4.7210	4.7023	
util living area													
	0.9987	0.9964	0.9896	0.9649	0.8919	0.7394	0.5729	0.6356	0.8699	0.9808	0.9970	0.9990	(86)
MIT	19.5569	19.7391	20.0250	20.3996	20.7264	20.9245	20.9823	20.9717	20.8245	20.3946	19.9067	19.5305	(87)
Th 2	19.8692	19.8720	19.8746	19.8872	19.8896	19.9006	19.9006	19.9026	19.8963	19.8896	19.8848	19.8798	(88)
util rest of house													
	0.9982	0.9951	0.9857	0.9508	0.8479	0.6441	0.4403	0.5015	0.8005	0.9706	0.9957	0.9987	(89)
MIT 2	17.9479	18.2158	18.6334	19.1779	19.6178	19.8498	19.8942	19.8909	19.7520	19.1802	18.4702	17.9165	(90)
Living area fraction									fLA = Living area / (4) =			0.1857	(91)
MIT	18.2467	18.4987	18.8919	19.4048	19.8237	20.0493	20.0962	20.0916	19.9512	19.4057	18.7370	18.2162	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.2467	18.4987	18.8919	19.4048	19.8237	20.0493	20.0962	20.0916	19.9512	19.4057	18.7370	18.2162	(93)

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8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9971	0.9928	0.9808	0.9428	0.8448	0.6583	0.4650	0.5261	0.8046	0.9643	0.9937	0.9979	(94)
Useful gains	757.9587	920.1953	1060.5107	1165.3290	1134.3902	874.9706	590.4296	615.8769	853.2456	870.9567	760.9016	709.5545	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	2467.7459	2399.5939	2180.7718	1825.3118	1408.1866	934.0488	599.2766	631.4411	1007.2968	1526.4098	2026.9916	2453.7519	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh													
	1272.0817	994.1558	833.4742	475.1876	203.7045	0.0000	0.0000	0.0000	0.0000	487.6571	911.5848	1297.6828	(98)
Space heating												6475.5288	(98)
Space heating per m2											(98) / (4) =	46.2538	(99)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												6925.6992	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	1272.0817	994.1558	833.4742	475.1876	203.7045	0.0000	0.0000	0.0000	0.0000	487.6571	911.5848	1297.6828	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	1360.5152	1063.2683	891.4163	508.2221	217.8658	0.0000	0.0000	0.0000	0.0000	521.5584	974.9570	1387.8961	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	215.3998	189.7235	198.9439	177.9134	174.0404	155.0676	148.5036	163.5366	163.4302	184.5069	195.6335	210.0734	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.7763	88.5962	88.2206	87.3108	85.2344	79.8000	79.8000	79.8000	79.8000	87.2873	88.4055	88.8403	(217)
Fuel for water heating, kWh/month													
	242.6322	214.1440	225.5074	203.7701	204.1903	194.3203	186.0947	204.9331	204.7998	211.3788	221.2910	236.4619	(219)
Water heating fuel used												2549.5234	(219)
Annual totals kWh/year													
Space heating fuel - main system												6925.6992	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												487.4436	(232)
Total delivered energy for all uses												10037.6663	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	6925.6992	0.2160	1495.9510	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2549.5234	0.2160	550.6971	(264)
Space and water heating			2046.6481	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	487.4436	0.5190	252.9832	(268)
Total CO2, kg/m2/year			2338.5563	(272)
Emissions per m2 for space and water heating			14.6189	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			1.8070	(272b)
Emissions per m2 for pumps and fans			0.2780	(272c)
Target Carbon Dioxide Emission Rate (TER) = (14.6189 * 1.55) + 1.8070 + 0.2780, rounded to 2 d.p.			24.7400	(273)

FULL SAP CALCULATION PRINTOUT
Calculation Type: New Build (As Designed)

HODKINSON

Property Reference	3B5P GF End	**Issued on Date**	16/03/2021
Assessment Reference	3	**Prop Type Ref**	
Property	x, Balham, SW12 0JH		

SAP Rating	85 B	**DER**	17.00	**TER**	28.53
Environmental	87 B	**% DER<TER**	40.41		
CO_2 Emissions (t/year)	1.18	**DFEE**	46.81	**TFEE**	61.90
General Requirements Compliance	Pass	**% DFEE<TFEE**	24.39		

Assessor Details	Mr. Jonathan Peck, Jonathan Peck, Tel: 02036031622, Jonathan@hodkinsonconsultancy.com	**Assessor ID**	T296-0001
Client			

REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England

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REGULATIONS COMPLIANCE REPORT - Approved Document L1A, 2013 Edition, England
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DWELLING AS DESIGNED

Ground-floor flat, total floor area 87 m²

This report covers items included within the SAP calculations.
It is not a complete report of regulations compliance.

1a TER and DER
Fuel for main heating:Electricity
Fuel factor:1.55 (electricity)
Target Carbon Dioxide Emission Rate (TER) 28.53 kgCO□/m²
Dwelling Carbon Dioxide Emission Rate (DER) 17.00 kgCO□/m²OK

1b TFEE and DFEE
Target Fabric Energy Efficiency (TFEE)61.9 kWh/m²/yr
Dwelling Fabric Energy Efficiency (DFEE)46.8 kWh/m²/yrOK

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2 Fabric U-values

Element	Average	Highest	
External wall	0.15 (max. 0.30)	0.15 (max. 0.70)	OK
Party wall	0.00 (max. 0.20)	-	OK
Floor	0.10 (max. 0.25)	0.10 (max. 0.70)	OK
Roof	(no roof)		
Openings	1.18 (max. 2.00)	1.20 (max. 3.30)	OK

2a Thermal bridging
Thermal bridging calculated from linear thermal transmittances for each junction

---
3 Air permeability
Air permeability at 50 pascals: 3.00 (design value)
Maximum 10.0 OK

---
4 Heating efficiency
Main heating system: Heat pump with radiators or underfloor - Electric
Mitsubishi ECODAN 5kW PUHZ-W50VHA-BS

Secondary heating system: None

---
5 Cylinder insulation
Hot water storage Measured cylinder loss: 1.50 kWh/day
Permitted by DBSCG 1.89 OK
Primary pipework insulated: Yes OK

---
6 Controls
Space heating controls: Time and temperature zone control OK

Hot water controls: Cylinderstat OK
Independent timer for DHW OK

---
7 Low energy lights
Percentage of fixed lights with low-energy fittings:100%
Minimum 75% OK

---
8 Mechanical ventilation
Continuous supply and extract system
Specific fan power: 0.60
Maximum 1.5 OK
MVHR efficiency: 88%
Minimum: 70% OK

---
9 Summertime temperature
Overheating risk (Thames Valley): Slight OK
Based on:
Overshading: Average
Windows facing North: 6.48 m², No overhang
Windows facing North East: 5.51 m², No overhang
Windows facing North West: 7.42 m², No overhang
Air change rate: 3.00 ach
Blinds/curtains: Light-coloured curtain or roller blind, closed 100% of daylight hours

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10 Key features
Party wall U-value 0.00 W/m²K
Floor U-value 0.10 W/m²K
Door U-value 1.00 W/m²K
Air permeability 3.0 m³/m²h

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	86.7000 (1b)	x	2.5000 (2b)	=	216.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	216.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							0 * 10 =	0.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	0.0000 / (5) =	0.0000	(8)
Pressure test		Yes	
Measured/design AP50		3.0000	
Infiltration rate		0.1500	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.1275	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.1626	0.1594	0.1562	0.1403	0.1371	0.1211	0.1211	0.1179	0.1275	0.1371	0.1434	0.1498	(22b)

Balanced mechanical ventilation with heat recovery

If mechanical ventilation:	0.5000	(23a)
If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) =	74.8000	(23c)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Effective ac	0.2886	0.2854	0.2822	0.2663	0.2631	0.2471	0.2471	0.2439	0.2535	0.2631	0.2694	0.2758	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
Opening Type 1			2.2000	1.0000	2.2000			(26)
Opening Type 2 (Uw = 1.20)			19.4100	1.1450	22.2252			(27)
Floor 1			86.7000	0.1000	8.6700			(28a)
External	65.7000	21.6100	44.0900	0.1500	6.6135			(29a)
Sheltered	50.5000		50.5000	0.1500	7.5750			(29a)
Total net area of external elements Aum(A, m2)			202.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	47.2837			(33)
Party			23.7000	0.0000	0.0000			(32)
Party Ceiling 1			86.7000					(32b)

Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K	250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)	10.1320	(36)
Total fabric heat loss (33) + (36) =	57.4157	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	20.6402	20.4122	20.1842	19.0442	18.8162	17.6762	17.6762	17.4482	18.1322	18.8162	19.2722	19.7282	(38)
Heat transfer coeff	78.0558	77.8279	77.5999	76.4599	76.2319	75.0919	75.0919	74.8639	75.5479	76.2319	76.6879	77.1439	(39)
Average = Sum(39)m / 12 =												76.4029	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	0.9003	0.8977	0.8950	0.8819	0.8793	0.8661	0.8661	0.8635	0.8714	0.8793	0.8845	0.8898	(40)
HLP (average)												0.8812	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy	2.5778 (42)
Average daily hot water use (litres/day)	95.4228 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.9651	101.1482	97.3313	93.5144	89.6975	85.8806	85.8806	89.6975	93.5144	97.3313	101.1482	104.9651	(44)
Energy conte	155.6603	136.1415	140.4858	122.4789	117.5214	101.4121	93.9732	107.8356	109.1235	127.1729	138.8192	150.7486	(45)
Energy content (annual)										Total = Sum(45)m =		1501.3730	(45)

Distribution loss (46)m = 0.15 x (45)m

	23.3490	20.4212	21.0729	18.3718	17.6282	15.2118	14.0960	16.1753	16.3685	19.0759	20.8229	22.6123	(46)
Water storage loss:													
Store volume												150.0000	(47)
a) If manufacturer declared loss factor is known (kWh/day):												1.5000	(48)
Temperature factor from Table 2b												0.5400	(49)
Enter (49) or (54) in (55)												0.8100	(55)
Total storage loss													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(56)
If cylinder contains dedicated solar storage													
	25.1100	22.6800	25.1100	24.3000	25.1100	24.3000	25.1100	25.1100	24.3000	25.1100	24.3000	25.1100	(57)
Primary loss	23.2624	21.0112	23.2624	22.5120	23.2624	22.5120	23.2624	23.2624	22.5120	23.2624	22.5120	23.2624	(59)
Total heat required for water heating calculated for each month													
	204.0327	179.8327	188.8582	169.2909	165.8938	148.2241	142.3456	156.2080	155.9355	175.5453	185.6312	199.1210	(62)
Solar input	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(63)
								Solar input (sum of months) = Sum(63)m =				0.0000	(63)
Output from w/h													
	204.0327	179.8327	188.8582	169.2909	165.8938	148.2241	142.3456	156.2080	155.9355	175.5453	185.6312	199.1210	(64)
								Total per year (kWh/year) = Sum(64)m =				2070.9190	(64)
Heat gains from water heating, kWh/month													
	90.4550	80.2200	85.4094	78.1738	77.7738	71.1691	69.9440	74.5533	73.7332	80.9829	83.6070	88.8218	(65)

5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	(66)
Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5													
	20.7609	18.4396	14.9961	11.3530	8.4865	7.1647	7.7417	10.0629	13.5065	17.1495	20.0160	21.3379	(67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5													
	232.8739	235.2904	229.2009	216.2371	199.8726	184.4922	174.2172	171.8007	177.8902	190.8540	207.2186	222.5989	(68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5													
	35.8890	35.8890	35.8890	35.8890	35.8890	35.8890	35.8890	35.8890	35.8890	35.8890	35.8890	35.8890	(69)
Pumps, fans	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(70)
Losses e.g. evaporation (negative values) (Table 5)													
	-103.1122	-103.1122	-103.1122	-103.1122	-103.1122	-103.1122	-103.1122	-103.1122	-103.1122	-103.1122	-103.1122	-103.1122	(71)
Water heating gains (Table 5)													
	121.5792	119.3750	114.7976	108.5748	104.5347	98.8460	94.0108	100.2060	102.4072	108.8480	116.1208	119.3842	(72)
Total internal gains													
	436.8811	434.7721	420.6617	397.8319	374.5608	352.1699	337.6367	343.7367	355.4709	378.5187	405.0225	424.9881	(73)

6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4800	10.6334	0.4500	0.8000	0.7700	17.1903	(74)
Northeast	5.5100	11.2829	0.4500	0.8000	0.7700	15.5099	(75)
Northwest	7.4200	11.2829	0.4500	0.8000	0.7700	20.8863	(81)

Solar gains	53.5865	106.9371	189.3014	308.8759	415.4495	443.4474	414.5966	330.0577	229.7629	129.6439	67.0023	44.0537	(83)
Total gains	490.4676	541.7092	609.9631	706.7079	790.0103	795.6174	752.2333	673.7944	585.2337	508.1625	472.0248	469.0417	(84)

7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C)												21.0000	(85)
Utilisation factor for gains for living area, nil,m (see Table 9a)													
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	77.1349	77.3609	77.5882	78.7450	78.9805	80.1795	80.1795	80.4237	79.6956	78.9805	78.5109	78.0468	
alpha	6.1423	6.1574	6.1725	6.2497	6.2654	6.3453	6.3453	6.3616	6.3130	6.2654	6.2341	6.2031	
util living area													
	0.9985	0.9967	0.9894	0.9489	0.8116	0.5940	0.4379	0.5076	0.8086	0.9770	0.9965	0.9988	(86)
Tweekday	18.9222	19.0902	19.4070	19.8426	20.1122	20.1906	20.1960	20.1975	20.1483	19.7852	19.2914	18.9035	
Tweekend	20.4030	20.4766	20.6169	20.8126	20.9501	20.9941	20.9993	20.9982	20.9646	20.7817	20.5617	20.3917	
24 / 16	9	8	9	8	9	9	9	9	8	9	8	9	
24 / 9	22	20	22	22	22	21	22	22	22	22	22	22	
16 / 9	0	0	0	0	0	0	0	0	0	0	0	0	
MIT	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	21.0000	(87)
Th 2	20.1672	20.1695	20.1717	20.1829	20.1852	20.1964	20.1964	20.1987	20.1919	20.1852	20.1807	20.1762	(88)
util rest of house													
	0.9980	0.9957	0.9858	0.9320	0.7634	0.5238	0.3587	0.4210	0.7419	0.9663	0.9952	0.9985	(89)
Tweekday	18.9222	19.0902	19.4070	19.8426	20.1122	20.1906	20.1960	20.1975	20.1483	19.7852	19.2914	18.9035	
Tweekend	18.9222	19.0902	19.4070	19.8426	20.1122	20.1906	20.1960	20.1975	20.1483	19.7852	19.2914	18.9035	
MIT 2	20.1672	20.1695	20.1717	20.1829	20.1852	20.1964	20.1964	20.1987	20.1919	20.1852	20.1807	20.1762	(90)
Living area fraction									fLA = Living area / (4) =			0.2031	(91)
MIT	20.3364	20.3382	20.3400	20.3489	20.3507	20.3596	20.3596	20.3614	20.3560	20.3507	20.3471	20.3435	(92)
Temperature adjustment												0.0000	
adjusted MIT	20.3364	20.3382	20.3400	20.3489	20.3507	20.3596	20.3596	20.3614	20.3560	20.3507	20.3471	20.3435	(93)

8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9981	0.9959	0.9866	0.9358	0.7739	0.5384	0.3748	0.4388	0.7566	0.9688	0.9955	0.9985	(94)
Useful gains	489.5217	539.4978	601.7998	661.3610	611.3683	428.3269	281.9657	295.6678	442.7787	492.3268	469.8912	468.3568	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W													
	1251.7340	1201.5198	1073.9785	875.3802	659.4569	432.5012	282.3173	296.5672	472.6307	743.3120	1015.8916	1245.3738	(97)

CALCULATION OF DWELLING EMISSIONS FOR REGULATIONS COMPLIANCE 09 Jan 2014

Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	567.0860	444.8788	351.3010	154.0938	35.7779	0.0000	0.0000	0.0000	0.0000	186.7330	393.1202	578.1007	(98)
Space heating												2711.0912	(98)
Space heating per m2											(98) / (4) =	31.2698	(99)

8c. Space cooling requirement

Not applicable

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												243.7071	(206)
Efficiency of secondary/supplementary heating system, %												100.0000	(208)
Space heating requirement												1112.4382	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	567.0860	444.8788	351.3010	154.0938	35.7779	0.0000	0.0000	0.0000	0.0000	186.7330	393.1202	578.1007	(98)
Space heating efficiency (main heating system 1)													
	243.7071	243.7071	243.7071	243.7071	243.7071	0.0000	0.0000	0.0000	0.0000	243.7071	243.7071	243.7071	(210)
Space heating fuel (main heating system)													
	232.6916	182.5465	144.1488	63.2291	14.6807	0.0000	0.0000	0.0000	0.0000	76.6219	161.3085	237.2112	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	204.0327	179.8327	188.8582	169.2909	165.8938	148.2241	142.3456	156.2080	155.9355	175.5453	185.6312	199.1210	(64)
Efficiency of water heater												178.1250	(216)
(217)m	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	178.1250	(217)
Fuel for water heating, kWh/month													
	114.5447	100.9587	106.0256	95.0405	93.1334	83.2135	79.9133	87.6957	87.5427	98.5518	104.2140	111.7873	(219)
Water heating fuel used												1162.6212	(219)
Annual totals kWh/year													
Space heating fuel - main system												1112.4382	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
(BalancedWithHeatRecovery, Database: in-use factor = 1.2500, SFP = 0.7500)													
mechanical ventilation fans (SFP = 0.7500)												198.3263	(230a)
Total electricity for the above, kWh/year												198.3263	(231)
Electricity for lighting (calculated in Appendix L)												366.6436	(232)
Total delivered energy for all uses												2840.0293	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	1112.4382	0.5190	577.3554	(261)
Space heating - secondary	0.0000	0.5190	0.0000	(263)
Water heating (other fuel)	1162.6212	0.5190	603.4004	(264)
Space and water heating			1180.7558	(265)
Pumps and fans	198.3263	0.5190	102.9313	(267)
Energy for lighting	366.6436	0.5190	190.2881	(268)
Total CO2, kg/year			1473.9752	(272)
Dwelling Carbon Dioxide Emission Rate (DER)			17.0000	(273)

16 CO2 EMISSIONS ASSOCIATED WITH APPLIANCES AND COOKING AND SITE-WIDE ELECTRICITY GENERATION TECHNOLOGIES

DER		17.0000	ZC1
Total Floor Area	TFA	86.7000	
Assumed number of occupants	N	2.5778	
CO2 emission factor in Table 12 for electricity displaced from grid	EF	0.5190	
CO2 emissions from appliances, equation (L14)		15.9165	ZC2
CO2 emissions from cooking, equation (L16)		2.0861	ZC3
Total CO2 emissions		35.0026	ZC4
Residual CO2 emissions offset from biofuel CHP		0.0000	ZC5
Additional allowable electricity generation, kWh/m²/year		0.0000	ZC6
Resulting CO2 emissions offset from additional allowable electricity generation		0.0000	ZC7
Net CO2 emissions		35.0026	ZC8

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

SAP 2012 WORKSHEET FOR New Build (As Designed) (Version 9.92, January 2014)
CALCULATION OF TARGET EMISSIONS 09 Jan 2014

1. Overall dwelling dimensions

	Area (m2)		Storey height (m)		Volume (m3)	
Ground floor	86.7000 (1b)	x	2.5000 (2b)	=	216.7500	(1b) - (3b)
Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)...(1n)	86.7000					(4)
Dwelling volume			(3a)+(3b)+(3c)+(3d)+(3e)...(3n)	=	216.7500	(5)

2. Ventilation rate

	main heating		secondary heating		other		total	m3 per hour	
Number of chimneys	0	+	0	+	0	=	0 * 40 =	0.0000	(6a)
Number of open flues	0	+	0	+	0	=	0 * 20 =	0.0000	(6b)
Number of intermittent fans							3 * 10 =	30.0000	(7a)
Number of passive vents							0 * 10 =	0.0000	(7b)
Number of flueless gas fires							0 * 40 =	0.0000	(7c)

		Air changes per hour	
Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) =	30.0000 / (5) =	0.1384	(8)
Pressure test		Yes	
Measured/design AP50		5.0000	
Infiltration rate		0.3884	(18)
Number of sides sheltered		2	(19)
Shelter factor	(20) = 1 - [0.075 x (19)] =	0.8500	(20)
Infiltration rate adjusted to include shelter factor	(21) = (18) x (20) =	0.3301	(21)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Wind speed	5.1000	5.0000	4.9000	4.4000	4.3000	3.8000	3.8000	3.7000	4.0000	4.3000	4.5000	4.7000	(22)
Wind factor	1.2750	1.2500	1.2250	1.1000	1.0750	0.9500	0.9500	0.9250	1.0000	1.0750	1.1250	1.1750	(22a)
Adj infilt rate	0.4209	0.4127	0.4044	0.3632	0.3549	0.3136	0.3136	0.3054	0.3301	0.3549	0.3714	0.3879	(22b)
Effective ac	0.5886	0.5852	0.5818	0.5659	0.5630	0.5492	0.5492	0.5466	0.5545	0.5630	0.5690	0.5752	(25)

3. Heat losses and heat loss parameter

Element	Gross m2	Openings m2	NetArea m2	U-value W/m2K	A x U W/K	K-value kJ/m2K	A x K kJ/K	
TER Opaque door			2.2000	1.0000	2.2000			(26)
TER Opening Type (Uw = 1.40)			19.4100	1.3258	25.7330			(27)
Floor 1			86.7000	0.1300	11.2710			(28a)
External	65.7000	21.6100	44.0900	0.1800	7.9362			(29a)
Sheltered	50.5000		50.5000	0.1800	9.0900			(29a)
Total net area of external elements Aum(A, m2)			202.9000					(31)
Fabric heat loss, W/K = Sum (A x U)				(26)...(30) + (32) =	56.2302			(33)
Thermal mass parameter (TMP = Cm / TFA) in kJ/m2K							250.0000	(35)
Thermal bridges (Sum(L x Psi) calculated using Appendix K)							11.6609	(36)
Total fabric heat loss					(33) + (36) =		67.8911	(37)

Ventilation heat loss calculated monthly (38)m = 0.33 x (25)m x (5)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(38)m	42.1007	41.8546	41.6134	40.4805	40.2685	39.2818	39.2818	39.0991	39.6619	40.2685	40.6973	41.1456	(38)
Heat transfer coeff	109.9917	109.7457	109.5045	108.3716	108.1596	107.1729	107.1729	106.9902	107.5529	108.1596	108.5884	109.0367	(39)
Average = Sum(39)m / 12 =												108.3705	(39)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
HLP	1.2686	1.2658	1.2630	1.2500	1.2475	1.2361	1.2361	1.2340	1.2405	1.2475	1.2525	1.2576	(40)
HLP (average)												1.2499	(40)
Days in month	31	28	31	30	31	30	31	31	30	31	30	31	(41)

4. Water heating energy requirements (kWh/year)

Assumed occupancy		2.5778 (42)
Average daily hot water use (litres/day)		95.4228 (43)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Daily hot water use	104.9651	101.1482	97.3313	93.5144	89.6975	85.8806	85.8806	89.6975	93.5144	97.3313	101.1482	104.9651	(44)
Energy conte	155.6603	136.1415	140.4858	122.4789	117.5214	101.4121	93.9732	107.8356	109.1235	127.1729	138.8192	150.7486	(45)
Energy content (annual)										Total = Sum(45)m =		1501.3730	(45)
Distribution loss (46)m = 0.15 x (45)m	23.3490	20.4212	21.0729	18.3718	17.6282	15.2118	14.0960	16.1753	16.3685	19.0759	20.8229	22.6123	(46)

Water storage loss:		
Store volume		150.0000 (47)
a) If manufacturer declared loss factor is known (kWh/day):		1.3938 (48)
Temperature factor from Table 2b		0.5400 (49)
Enter (49) or (54) in (55)		0.7527 (55)

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

Total storage loss
23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 (56)
If cylinder contains dedicated solar storage
23.3325 21.0745 23.3325 22.5798 23.3325 22.5798 23.3325 23.3325 22.5798 23.3325 22.5798 23.3325 (57)
Primary loss 23.2624 21.0112 23.2624 22.5120 23.2624 22.5120 23.2624 23.2624 22.5120 23.2624 22.5120 23.2624 (59)
Total heat required for water heating calculated for each month
202.2552 178.2272 187.0807 167.5708 164.1163 146.5039 140.5681 154.4305 154.2153 173.7678 183.9110 197.3436 (62)
Solar input 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 (63)
Solar input (sum of months) = Sum(63)m = 0.0000 (63)
Output from w/h
202.2552 178.2272 187.0807 167.5708 164.1163 146.5039 140.5681 154.4305 154.2153 173.7678 183.9110 197.3436 (64)
Total per year (kWh/year) = Sum(64)m = 2049.9904 (64)
Heat gains from water heating, kWh/month
89.0330 78.9356 83.9874 76.7977 76.3518 69.7930 68.5220 73.1313 72.3570 79.5609 82.2309 87.3998 (65)

---
5. Internal gains (see Table 5 and 5a)

Metabolic gains (Table 5), Watts

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
(66)m	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	128.8902	(66)

Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5
20.7594 18.4383 14.9950 11.3522 8.4859 7.1642 7.7411 10.0622 13.5055 17.1483 20.0146 21.3363 (67)
Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5
232.8739 235.2904 229.2009 216.2371 199.8726 184.4922 174.2172 171.8007 177.8902 190.8540 207.2186 222.5989 (68)
Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5
35.8890 35.8890 35.8890 35.8890 35.8890 35.8890 35.8890 35.8890 35.8890 35.8890 35.8890 35.8890 (69)
Pumps, fans 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 3.0000 (70)
Losses e.g. evaporation (negative values) (Table 5)
-103.1122 -103.1122 -103.1122 -103.1122 -103.1122 -103.1122 -103.1122 -103.1122 -103.1122 -103.1122 -103.1122 -103.1122 (71)
Water heating gains (Table 5)
119.6680 117.4637 112.8864 106.6635 102.6234 96.9347 92.0995 98.2947 100.4959 106.9367 114.2095 117.4729 (72)
Total internal gains
437.9683 435.8595 421.7494 398.9198 375.6489 353.2581 338.7248 344.8247 356.5586 379.6061 406.1097 426.0752 (73)

---
6. Solar gains

[Jan]	Area m2	Solar flux Table 6a W/m2	g Specific data or Table 6b	FF Specific data or Table 6c	Access factor Table 6d	Gains W	
North	6.4800	10.6334	0.6300	0.7000	0.7700	21.0581	(74)
Northeast	5.5100	11.2829	0.6300	0.7000	0.7700	18.9997	(75)
Northwest	7.4200	11.2829	0.6300	0.7000	0.7700	25.5857	(81)

Solar gains 65.6435 130.9979 231.8942 378.3730 508.9256 543.2231 507.8808 404.3207 281.4595 158.8138 82.0778 53.9657 (83)
Total gains 503.6118 566.8574 653.6436 777.2928 884.5745 896.4813 846.6056 749.1453 638.0181 538.4199 488.1876 480.0410 (84)

---
7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (C) 21.0000 (85)
Utilisation factor for gains for living area, nil,m (see Table 9a)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
tau	54.7390	54.8617	54.9825	55.5573	55.6662	56.1787	56.1787	56.2746	55.9802	55.6662	55.4464	55.2184	
alpha	4.6493	4.6574	4.6655	4.7038	4.7111	4.7452	4.7452	4.7516	4.7320	4.7111	4.6964	4.6812	
util living area	0.9982	0.9966	0.9906	0.9633	0.8734	0.7009	0.5411	0.6233	0.8816	0.9835	0.9966	0.9986	(86)
MIT	19.5854	19.7249	20.0020	20.4016	20.7517	20.9386	20.9856	20.9731	20.8086	20.3664	19.9123	19.5632	(87)
Th 2	19.8655	19.8677	19.8699	19.8802	19.8822	19.8912	19.8912	19.8929	19.8877	19.8822	19.8783	19.8742	(88)
util rest of house	0.9976	0.9954	0.9870	0.9487	0.8251	0.6041	0.4128	0.4895	0.8152	0.9746	0.9952	0.9981	(89)
MIT 2	17.9869	18.1921	18.5969	19.1751	19.6404	19.8513	19.8861	19.8819	19.7279	19.1352	18.4738	17.9604	(90)
Living area fraction									fLA = Living area / (4) =			0.2031	(91)
MIT	18.3116	18.5034	18.8823	19.4242	19.8661	20.0721	20.1095	20.1036	19.9474	19.3853	18.7660	18.2859	(92)
Temperature adjustment												0.0000	
adjusted MIT	18.3116	18.5034	18.8823	19.4242	19.8661	20.0721	20.1095	20.1036	19.9474	19.3853	18.7660	18.2859	(93)

---
8. Space heating requirement

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Utilisation	0.9963	0.9932	0.9825	0.9409	0.8243	0.6211	0.4390	0.5165	0.8196	0.9690	0.9930	0.9970	(94)
Useful gains	501.7383	562.9746	642.2103	731.3633	729.1360	556.8005	371.6275	386.9553	522.8898	521.7076	484.7660	478.6130	(95)
Ext temp.	4.3000	4.9000	6.5000	8.9000	11.7000	14.6000	16.6000	16.4000	14.1000	10.6000	7.1000	4.2000	(96)
Heat loss rate W	1541.1556	1492.9184	1355.9129	1140.5266	883.2406	586.4640	376.1180	396.2455	628.9094	950.2112	1266.7931	1535.8806	(97)
Month fracti	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	1.0000	(97a)
Space heating kWh	773.3265	624.9222	530.9948	294.5976	114.6538	0.0000	0.0000	0.0000	0.0000	318.8067	563.0595	786.6071	(98)
Space heating												4006.9682	(98)
Space heating per m2											(98) / (4) =	46.2165	(99)

8c. Space cooling requirement

Not applicable

CALCULATION OF TARGET EMISSIONS 09 Jan 2014

9a. Energy requirements - Individual heating systems, including micro-CHP

Fraction of space heat from secondary/supplementary system (Table 11)												0.0000	(201)
Fraction of space heat from main system(s)												1.0000	(202)
Efficiency of main space heating system 1 (in %)												93.5000	(206)
Efficiency of secondary/supplementary heating system, %												0.0000	(208)
Space heating requirement												4285.5275	(211)
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	
Space heating requirement													
	773.3265	624.9222	530.9948	294.5976	114.6538	0.0000	0.0000	0.0000	0.0000	318.8067	563.0595	786.6071	(98)
Space heating efficiency (main heating system 1)													
	93.5000	93.5000	93.5000	93.5000	93.5000	0.0000	0.0000	0.0000	0.0000	93.5000	93.5000	93.5000	(210)
Space heating fuel (main heating system)													
	827.0871	668.3660	567.9088	315.0776	122.6244	0.0000	0.0000	0.0000	0.0000	340.9697	602.2027	841.2910	(211)
Water heating requirement													
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	(215)
Water heating													
Water heating requirement													
	202.2552	178.2272	187.0807	167.5708	164.1163	146.5039	140.5681	154.4305	154.2153	173.7678	183.9110	197.3436	(64)
Efficiency of water heater												79.8000	(216)
(217)m	88.0523	87.8850	87.4452	86.3042	83.8788	79.8000	79.8000	79.8000	79.8000	86.4125	87.6078	88.1300	(217)
Fuel for water heating, kWh/month													
	229.6989	202.7959	213.9404	194.1628	195.6590	183.5889	176.1505	193.5219	193.2523	201.0910	209.9254	223.9233	(219)
Water heating fuel used												2417.7103	(219)
Annual totals kWh/year													
Space heating fuel - main system												4285.5275	(211)
Space heating fuel - secondary												0.0000	(215)
Electricity for pumps and fans:													
central heating pump												30.0000	(230c)
main heating flue fan												45.0000	(230e)
Total electricity for the above, kWh/year												75.0000	(231)
Electricity for lighting (calculated in Appendix L)												366.6167	(232)
Total delivered energy for all uses												7144.8546	(238)

12a. Carbon dioxide emissions - Individual heating systems including micro-CHP

	Energy kWh/year	Emission factor kg CO2/kWh	Emissions kg CO2/year	
Space heating - main system 1	4285.5275	0.2160	925.6739	(261)
Space heating - secondary	0.0000	0.0000	0.0000	(263)
Water heating (other fuel)	2417.7103	0.2160	522.2254	(264)
Space and water heating			1447.8994	(265)
Pumps and fans	75.0000	0.5190	38.9250	(267)
Energy for lighting	366.6167	0.5190	190.2741	(268)
Total CO2, kg/m2/year			1677.0985	(272)
Emissions per m2 for space and water heating			16.7001	(272a)
Fuel factor (electricity)			1.5500	
Emissions per m2 for lighting			2.1946	(272b)
Emissions per m2 for pumps and fans			0.4490	(272c)
Target Carbon Dioxide Emission Rate (TER) = (16.7001 * 1.55) + 2.1946 + 0.4490, rounded to 2 d.p.			28.5300	(273)

Appendix C

SBEM BRUKL Outputs

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

Gym

As designed

Date: Thu Mar 04 10:28:34 2021

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.7

BRUKL compliance check version: v5.6.b.0

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, kgCO_2/m^2.annum	30.2
Target CO_2 emission rate (TER), kgCO_2/m^2.annum	30.2
Building CO_2 emission rate (BER), kgCO_2/m^2.annum	29.7
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	"First Floor 1 - Unit 6 Mezzanine_W_5"
Floor	0.25	0.13	0.13	"000 Ground Floor - Unit 6_S_3"
Roof	0.25	0.16	0.16	"First Floor 1 - Unit 6 Mezzanine_R_4"
Windows***, roof windows, and rooflights	2.2	1.4	1.4	"First Floor 1 - Unit 6 Mezzanine_G_7"
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^{2}K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^{2}K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^{2}K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m^3/(h.m^2) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.25	4	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	4.25	-
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
First Floor 1 - Unit 6 Mezzanine	-	-	-	1.4	-	-	-	-	-	0.85	0.5
000 Ground Floor - Unit 6	-	-	-	1.4	-	-	-	-	-	0.85	0.5

Shell and core configuration

Zone	Assumed shell?
First Floor 1 - Unit 6 Mezzanine	NO
000 Ground Floor - Unit 6	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
First Floor 1 - Unit 6 Mezzanine	-	100	-	306
000 Ground Floor - Unit 6	-	100	-	642

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
First Floor 1 - Unit 6 Mezzanine	NO (-83.7%)	NO
000 Ground Floor - Unit 6	NO (-84.6%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	407.4	407.4
External area [m^2]	995.6	995.6
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	274.56	497.53
Average U-value [W/m^2K]	0.28	0.5
Alpha value* [%]	23.36	16.34

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
100	**D2 General Assembly and Leisure, Night Clubs, and Theatres**
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	1.5	10.48
Cooling	12.64	20.54
Auxiliary	34.7	22.31
Lighting	8.3	6.36
Hot water	0	0
Equipment*	84.6	84.6
TOTAL**	**57.14**	**59.69**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	182.93	357.92
Primary energy* [kWh/m^2]	175.42	178.68
Total emissions [kg/m^2]	29.7	30.2

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	21.4	161.5	1.5	12.6	34.7	3.96	3.55	4.25	5
	Notional	91.7	266.2	10.5	20.5	22.3	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{l\text{-}Typ}$	$U_{l\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.18	"First Floor 1 - Unit 6 Mezzanine_W_5"
Floor	0.2	0.13	"000 Ground Floor - Unit 6_S_3"
Roof	0.15	0.16	"First Floor 1 - Unit 6 Mezzanine_R_4"
Windows, roof windows, and rooflights	1.5	1.4	"First Floor 1 - Unit 6 Mezzanine_G_7"
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{l\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{l\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
$m^3/(h.m^2)$ at 50 Pa	5	5

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

Health Centre

As designed

Date: Thu Mar 04 11:27:20 2021

Administrative information

Building Details

Address: Park View Road, Tottenham Hale, Haringey, , N17 9EX

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.7

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Nimco Ali

Telephone number: 02036031613

Address: Trinity Court Batchworth Island Church Street Rickmansworth, London, WD3 1RT

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, kgCO_2/m^2.annum	19.3
Target CO_2 emission rate (TER), kgCO_2/m^2.annum	19.3
Building CO_2 emission rate (BER), kgCO_2/m^2.annum	12.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	"000 GF Block B and C - Health Centre_P_4"
Floor	0.25	0.13	0.2	"001 First Floor Block B and C - Health Centre_F_4"
Roof	0.25	0.16	0.16	"001 First Floor Block B and C - Health Centre_R_7"
Windows***, roof windows, and rooflights	2.2	1.4	1.4	"000 GF Block B and C - Health Centre_G_7"
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^{2}K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^{2}K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^{2}K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m^3/(h.m^2) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- heat pump heating and cooling

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.25	4	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

1- DHW integrated ASHP

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	4.25	-
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
000 GF Block B and C - Health Centre	-	-	-	1.4	-	-	-	-	-	0.85	0.5
001 First Floor Block B and C - Health Centre	-	-	-	1.4	-	-	-	-	-	0.85	0.5

Shell and core configuration

Zone	Assumed shell?
000 GF Block B and C - Health Centre	NO
001 First Floor Block B and C - Health Centre	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
000 GF Block B and C - Health Centre	100	-	-	5434
001 First Floor Block B and C - Health Centre	100	-	-	5993

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
000 GF Block B and C - Health Centre	NO (-72.4%)	NO
001 First Floor Block B and C - Health Centre	NO (-72.4%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	1711.9	1711.9
External area [m^2]	2724.4	2724.4
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	894.46	1400.96
Average U-value [W/m^2K]	0.33	0.51
Alpha value* [%]	15.96	18.4

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
100	**D1 Non-residential Institutions: Primary Health Care Building**
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	1.32	7.11
Cooling	3.98	9.68
Auxiliary	3.74	2.4
Lighting	14.25	17.64
Hot water	0.82	1.36
Equipment*	36.09	36.09
TOTAL**	**24.11**	**38.19**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	69.7	156.28
Primary energy* [kWh/m^2]	74.02	114.3
Total emissions [kg/m^2]	12.5	19.3

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	18.8	50.9	1.3	4	3.7	3.96	3.55	4.25	5
	Notional	62.2	94.1	7.1	9.7	2.4	2.43	2.7	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{l\text{-}Typ}$	$U_{l\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.18	"000 GF Block B and C - Health Centre_P_4"
Floor	0.2	0.13	"000 GF Block B and C - Health Centre_S_2"
Roof	0.15	0.16	"001 First Floor Block B and C - Health Centre_R_7"
Windows, roof windows, and rooflights	1.5	1.4	"000 GF Block B and C - Health Centre_G_7"
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{l\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{l\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

Retail Unit

As designed

Date: Thu Mar 04 12:04:05 2021

Administrative information

Building Details

Address: Kennington, London, SE11

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.7

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Nimco Ali

Telephone number: 02036031613

Address: The Heights 59-65 Lowlands Road Harrow, London, HA1 3AW

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, kgCO_2/m^2.annum	37.1
Target CO_2 emission rate (TER), kgCO_2/m^2.annum	37.1
Building CO_2 emission rate (BER), kgCO_2/m^2.annum	29
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.28	1.5	"000 GF Block G - Commercial Unit 1_W_13"
Floor	0.25	0.13	0.13	"000 GF Block G - Commercial Unit 1_S_3"
Roof	0.25	0.16	0.16	"000 GF Block G - Commercial Unit 1_R_5"
Windows***, roof windows, and rooflights	2.2	1.4	1.4	"000 GF Block G - Commercial Unit 1_G_12"
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^{2}K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^{2}K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^{2}K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m^3/(h.m^2) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- VRF Heating and Cooling

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.25	4	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

1- Oval DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	4.25	-
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
000 GF Block G - Commercial Unit 1	-	-	-	1.4	-	-	-	-	-	0.85	0.5
000 GF Block G - Commercial Unit 2	-	-	-	1.4	-	-	-	-	-	0.85	0.5
000 GF Block G - Commercial Unit 3	-	-	-	1.4	-	-	-	-	-	0.85	0.5
000 GF Block G - Commercial Unit 4	-	-	-	1.4	-	-	-	-	-	0.85	0.5

Shell and core configuration

Zone	Assumed shell?
000 GF Block G - Commercial Unit 1	NO
000 GF Block G - Commercial Unit 2	NO
000 GF Block G - Commercial Unit 3	NO
000 GF Block G - Commercial Unit 4	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
000 GF Block G - Commercial Unit 1	-	100	75	2578

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
000 GF Block G - Commercial Unit 2	-	100	75	2614
000 GF Block G - Commercial Unit 3	-	100	75	1011
000 GF Block G - Commercial Unit 4	-	100	75	940

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
000 GF Block G - Commercial Unit 1	NO (-54.3%)	NO
000 GF Block G - Commercial Unit 2	NO (-57.1%)	NO
000 GF Block G - Commercial Unit 3	NO (-84%)	NO
000 GF Block G - Commercial Unit 4	NO (-70.6%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	780	780
External area [m^2]	1550.2	1550.2
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	490.82	714.88
Average U-value [W/m^2K]	0.32	0.46
Alpha value* [%]	109.87	15.23

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	6.06	3.47
Cooling	6.8	17.31
Auxiliary	6.57	3.78
Lighting	36.02	48.02
Hot water	0.4	0.66
Equipment*	20.26	20.26
TOTAL**	**55.85**	**73.23**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	173.25	254.62
Primary energy* [kWh/m^2]	171.46	219.19
Total emissions [kg/m^2]	29	37.1

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	86.4	86.9	6.1	6.8	6.6	3.96	3.55	4.25	5
	Notional	30.3	224.3	3.5	17.3	3.8	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.18	"000 GF Block G - Commercial Unit 1_W_8"
Floor	0.2	0.13	"000 GF Block G - Commercial Unit 1_S_3"
Roof	0.15	0.16	"000 GF Block G - Commercial Unit 1_R_5"
Windows, roof windows, and rooflights	1.5	1.4	"000 GF Block G - Commercial Unit 1_G_12"
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

Nursery

As designed

Date: Thu Mar 04 12:20:59 2021

Administrative information

Building Details

Address: Leven Rd, Poplar, London, E14 0LL

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.7

BRUKL compliance check version: v5.6.b.0

Certifier details

Name: Nimco Ali

Telephone number: 02036031613

Address: Trinity Court Batchworth Island Church Street
Rickmansworth, London, WD3 1RT

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, kgCO_2/m^2.annum	13.9
Target CO_2 emission rate (TER), kgCO_2/m^2.annum	13.9
Building CO_2 emission rate (BER), kgCO_2/m^2.annum	12.7
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	"000 Nursery - Creche - Unit 0_P_6"
Floor	0.25	0.13	0.13	"000 Nursery - Creche - Unit 0_S_3"
Roof	0.25	-	-	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	1.4	1.4	"000 Nursery - Creche - Unit 0_G_9"
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^{2}K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^{2}K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^{2}K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m^3/(h.m^2) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.25	4	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

1- ASHP DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	4.25	-
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
000 Nursery - Creche - Unit 0	-	-	-	1.4	-	-	-	-	-	0.85	0.5

Shell and core configuration

Zone	Assumed shell?
000 Nursery - Creche - Unit 0	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
000 Nursery - Creche - Unit 0	100	-	-	1562

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
000 Nursery - Creche - Unit 0	NO (-73.1%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	375.7	375.7
External area [m^2]	561.4	561.4
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	126.07	230.47
Average U-value [W/m^2K]	0.22	0.41
Alpha value* [%]	15.8	13.5

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
100	**D1 Non-residential Institutions: Education**
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	0.04	0.98
Cooling	5.26	6.61
Auxiliary	6.93	4.45
Lighting	9.09	10.23
Hot water	3.09	5.13
Equipment*	13.87	13.87
TOTAL**	**24.41**	**27.4**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	67.73	94.28
Primary energy* [kWh/m^2]	74.95	82.02
Total emissions [kg/m^2]	12.7	13.9

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	0.6	67.2	0	5.3	6.9	3.96	3.55	4.25	5
	Notional	8.6	85.7	1	6.6	4.5	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{l\text{-}Typ}$	$U_{l\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.18	"000 Nursery - Creche - Unit 0_P_6"
Floor	0.2	0.13	"000 Nursery - Creche - Unit 0_S_3"
Roof	0.15	-	"No heat loss roofs"
Windows, roof windows, and rooflights	1.5	1.4	"000 Nursery - Creche - Unit 0_G_9"
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{l\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{l\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

Office

As designed

Date: Thu Mar 04 12:51:22 2021

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.7

BRUKL compliance check version: v5.6.b.0

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, kgCO_2/m^2.annum	19
Target CO_2 emission rate (TER), kgCO_2/m^2.annum	19
Building CO_2 emission rate (BER), kgCO_2/m^2.annum	14.5
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	"First Floor 1 - Unit 6 Mezzanine_W_5"
Floor	0.25	0.13	0.13	"000 Ground Floor - Unit 7_S_3"
Roof	0.25	0.16	0.16	"First Floor 1 - Unit 6 Mezzanine_R_4"
Windows***, roof windows, and rooflights	2.2	1.4	1.4	"First Floor 1 - Unit 6 Mezzanine_G_7"
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^{2}K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^{2}K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^{2}K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m^3/(h.m^2) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.25	4	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	4.25	-
Standard value	2*	N/A

* Standard shown is for all types except absorption and gas engine heat pumps.

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
First Floor 1 - Unit 6 Mezzanine	-	-	-	1.4	-	-	-	-	-	0.85	0.5
000 Ground Floor - Unit 7	-	-	-	1.4	-	-	-	-	-	0.85	0.5
000 Ground Floor - Unit 6	-	-	-	1.4	-	-	-	-	-	0.85	0.5
000 Ground Floor - Unit 8	-	-	-	1.4	-	-	-	-	-	0.85	0.5

Shell and core configuration

Zone	Assumed shell?
First Floor 1 - Unit 6 Mezzanine	NO
000 Ground Floor - Unit 7	NO
000 Ground Floor - Unit 6	NO
000 Ground Floor - Unit 8	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
First Floor 1 - Unit 6 Mezzanine	100	-	-	815

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
000 Ground Floor - Unit 7	100	-	-	995
000 Ground Floor - Unit 6	100	-	-	1711
000 Ground Floor - Unit 8	100	-	-	703

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
First Floor 1 - Unit 6 Mezzanine	NO (-83.7%)	NO
000 Ground Floor - Unit 7	NO (-67.6%)	NO
000 Ground Floor - Unit 6	NO (-84.6%)	NO
000 Ground Floor - Unit 8	NO (-84.2%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	662.8	662.8
External area [m^2]	1706.7	1706.7
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	496.91	853.23
Average U-value [W/m^2K]	0.29	0.5
Alpha value* [%]	24.52	17.47

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
100	**B1 Offices and Workshop businesses**
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	4.86	10.24
Cooling	5.41	10.38
Auxiliary	4.2	2.7
Lighting	12.84	13.07
Hot water	0.68	1.12
Equipment*	42.19	42.19
TOTAL**	**27.98**	**37.51**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	138.35	224.07
Primary energy* [kWh/m^2]	85.9	112.27
Total emissions [kg/m^2]	14.5	19

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	69.2	69.1	4.9	5.4	4.2	3.96	3.55	4.25	5
	Notional	89.6	134.5	10.2	10.4	2.7	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{l\text{-}Typ}$	$U_{l\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.18	"First Floor 1 - Unit 6 Mezzanine_W_5"
Floor	0.2	0.13	"000 Ground Floor - Unit 7_S_3"
Roof	0.15	0.16	"First Floor 1 - Unit 6 Mezzanine_R_4"
Windows, roof windows, and rooflights	1.5	1.4	"First Floor 1 - Unit 6 Mezzanine_G_7"
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{l\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{l\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
$m^3/(h.m^2)$ at 50 Pa	5	5

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

Pub

As designed

Date: Thu Mar 04 12:56:10 2021

Administrative information

Building Details

Address:

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.7

BRUKL compliance check version: v5.6.b.0

Certifier details

Name

Telephone number:

Address:

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, kgCO_2/m^2.annum	70.1
Target CO_2 emission rate (TER), kgCO_2/m^2.annum	70.1
Building CO_2 emission rate (BER), kgCO_2/m^2.annum	47.2
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	"001 Pub Unit 1 - Pub lift and stair to cellar_P_10"
Floor	0.25	0.16	0.18	"001 Pub Unit 1 - Pub lift and stair to cellar_F_3"
Roof	0.25	-	-	"No heat loss roofs"
Windows***, roof windows, and rooflights	2.2	1.4	1.4	"001 Pub Unit 1 - Pub entrance_G_11"
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^{2}K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^{2}K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^{2}K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m^3/(h.m^2) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- Heating only ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.25	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

2- ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.25	4	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

1- DHW Pub Cafe gym with storage

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	0.001
Standard value	N/A	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
001 Pub Unit 1 - Pub entrance	-	-	-	1.4	-	-	-	-	-	0.85	0.5
001 Pub Unit 1 - Pub	-	-	-	1.4	-	-	-	-	-	0.85	0.5

Shell and core configuration

Zone	Assumed shell?
001 Pub Unit 1 - Pub lift and stair to cellar	NO
001 Pub Unit 1 - Pub entrance	NO
001 Pub Unit 1 - Pub	NO

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
001 Pub Unit 1 - Pub lift and stair to cellar	-	100	-	54
001 Pub Unit 1 - Pub entrance	-	100	75	101
001 Pub Unit 1 - Pub	-	100	75	754

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
001 Pub Unit 1 - Pub entrance	NO (-82.3%)	NO
001 Pub Unit 1 - Pub	NO (-21.6%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	360.5	360.5
External area [m^2]	776.9	776.9
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	320.78	372.75
Average U-value [W/m^2K]	0.41	0.48
Alpha value* [%]	11.85	13.09

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
100	**A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways**
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	2.57	8.43
Cooling	22.35	30.69
Auxiliary	11.3	7.2
Lighting	25.71	47.23
Hot water	28.94	44.89
Equipment*	110.43	110.43
TOTAL**	**90.88**	**138.44**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	335.91	511.35
Primary energy* [kWh/m^2]	279	414.37
Total emissions [kg/m^2]	47.2	70.1

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Natural Gas										
	Actual	137.4	134.6	10.1	0	10.4	3.79	0	4.25	0
	Notional	216.9	376.9	24.8	0	6.1	2.43	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	24	319.5	1.7	25	11.4	3.96	3.55	4.25	5
	Notional	56.8	444.8	6.5	34.3	7.3	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{l\text{-}Typ}$	$U_{l\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.18	"001 Pub Unit 1 - Pub lift and stair to cellar_P_10"
Floor	0.2	0.13	"001 Pub Unit 1 - Pub_S_3"
Roof	0.15	-	"No heat loss roofs"
Windows, roof windows, and rooflights	1.5	1.4	"001 Pub Unit 1 - Pub entrance_G_11"
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{l\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{l\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name **Shell and Core**

Retail

As designed

Date: Thu Mar 04 14:18:02 2021

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.7

BRUKL compliance check version: v5.6.b.0

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, kgCO_2/m^2.annum	37.9
Target CO_2 emission rate (TER), kgCO_2/m^2.annum	37.9
Building CO_2 emission rate (BER), kgCO_2/m^2.annum	25.1
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	"000 Ground Floor - Unit 7_W_8"
Floor	0.25	0.13	0.13	"000 Ground Floor - Unit 7_S_3"
Roof	0.25	0.16	0.16	"000 Ground Floor - Unit 7_R_30"
Windows***, roof windows, and rooflights	2.2	1.4	1.4	"000 Ground Floor - Unit 7_G_9"
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^{2}K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^{2}K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^{2}K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m^3/(h.m^2) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	NO
Whole building electric power factor achieved by power factor correction	<0.9

1- ASHP

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.25	4	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	1	-
Standard value	1	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
000 Ground Floor - Unit 7	-	-	-	1.4	-	-	-	-	-	0.85	0.5
000 Ground Floor - Unit 8	-	-	-	1.4	-	-	-	-	-	0.85	0.5

Shell and core configuration

Zone	Assumed shell?
000 Ground Floor - Unit 7	NO
000 Ground Floor - Unit 8	NO

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			
	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
000 Ground Floor - Unit 7	-	100	75	1492
000 Ground Floor - Unit 8	-	100	75	1055

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
000 Ground Floor - Unit 7	NO (-67.6%)	NO
000 Ground Floor - Unit 8	NO (-84.2%)	NO

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	255.4	255.4
External area [m^2]	711.1	711.1
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	5	3
Average conductance [W/K]	222.35	355.71
Average U-value [W/m^2K]	0.31	0.5
Alpha value* [%]	27.1	19.51

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
100	**A1/A2 Retail/Financial and Professional services**
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
	D1 Non-residential Institutions: Education
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	4.39	8.49
Cooling	9.67	18.92
Auxiliary	5.88	3.78
Lighting	26.76	42.45
Hot water	1.7	1.96
Equipment*	20.26	20.26
TOTAL**	**48.39**	**75.6**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	186.17	319.48
Primary energy* [kWh/m^2]	148.56	222.59
Total emissions [kg/m^2]	25.1	37.9

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	62.6	123.6	4.4	9.7	5.9	3.96	3.55	4.25	5
	Notional	74.3	245.2	8.5	18.9	3.8	2.43	3.6	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{l\text{-}Typ}$	$U_{l\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.18	"000 Ground Floor - Unit 7_W_8"
Floor	0.2	0.13	"000 Ground Floor - Unit 7_S_3"
Roof	0.15	0.16	"000 Ground Floor - Unit 7_R_30"
Windows, roof windows, and rooflights	1.5	1.4	"000 Ground Floor - Unit 7_G_9"
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{l\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{l\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

School

As designed

Date: Thu Mar 04 16:05:35 2021

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.7

BRUKL compliance check version: v5.6.b.0

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, kgCO_2/m^2.annum	12
Target CO_2 emission rate (TER), kgCO_2/m^2.annum	12
Building CO_2 emission rate (BER), kgCO_2/m^2.annum	8.4
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.18	0.18	"00_Ground Floor 1 - Stairs1_W_6"
Floor	0.25	0.11	0.16	"02_Second Floor 2 - Circulation_F_3"
Roof	0.25	0.16	0.16	"02_Second Floor 3 - Circulation_R_5"
Windows***, roof windows, and rooflights	2.2	1.4	1.4	"00_Ground Floor 1 - Stairs1_G_7"
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m^{2}K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m^{2}K)]
$U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m^{2}K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m^3/(h.m^2) at 50 Pa	10	5

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- heating only

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.25	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

2- air heating

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.25	-	-	1.4	0.85
Standard value	2.5*	N/A	N/A	1.5^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

3- School Cooling Server

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.25	4	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

4- School HVAC heating only

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.25	-	-	1.4	0.85
Standard value	2.5*	N/A	N/A	1.5^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	-
Standard value	N/A	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
00_Ground Floor 1 - Store Nursery Cloak	0.3	-	-	-	-	-	-	-	-	-	N/A
02_Second Floor 1 - Store Cleaner	0.3	-	-	-	-	-	-	-	-	-	N/A
02_Second Floor 5 - Store Cleaner	0.3	-	-	-	-	-	-	-	-	-	N/A
00_Ground Floor 1 - Kitchen	-	0.2	-	-	-	-	-	-	1	-	N/A
01_First Floor 1 - Classroom Reception C2	-	-	-	0.2	-	-	-	-	-	0.85	0.5
01_First Floor 1 - Circulation1	-	-	-	0.2	-	-	-	-	-	0.85	0.5
01_First Floor 1 - Toilet Boys	0.3	-	-	-	-	-	-	-	-	-	N/A
01_First Floor 1 - Office Group Space	-	-	-	0.2	-	-	-	-	-	0.85	0.5
01_First Floor 1 - Toilet Girls	0.3	-	-	-	-	-	-	-	-	-	N/A
01_First Floor 1 - Toilet Staff	0.3	-	-	-	-	-	-	-	-	-	N/A
01_First Floor 1 - Classroom Y1 C2	-	-	-	0.2	-	-	-	-	-	0.85	0.5
01_First Floor 1 - Classroom Y1 C1	-	-	-	0.2	-	-	-	-	-	0.85	0.5
01_First Floor 1 - Classroom Reception C1	-	-	-	0.2	-	-	-	-	-	0.85	0.5
01_First Floor 1 - Office Meeting Room	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 1 - Toilet Staff	0.3	-	-	-	-	-	-	-	-	-	N/A
02_Second Floor 1 - Toilet Boys	0.3	-	-	-	-	-	-	-	-	-	N/A
02_Second Floor 1 - Office Group Space2	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 1 - Classroom Y2 C1	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 1 - Office Group Space1	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 1 - Toilet Girls	0.3	-	-	-	-	-	-	-	-	-	N/A
02_Second Floor 1 - Classroom Y4 C1	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 1 - Classroom Y4 C2	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 1 - Classroom Y3 C1	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 1 - Office Staff Work Sink	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 1 - Classroom Y3 C2	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 1 - Classroom Y2 C2	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 2 - Toilet Boys	0.3	-	-	-	-	-	-	-	-	-	N/A
02_Second Floor 2 - Classroom Y2 C1	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 2 - Classroom Y4 C1	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 2 - Classroom Y4 C2	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 2 - Classroom Y3 C1	-	-	-	0.2	-	-	-	-	-	0.85	0.5

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
02_Second Floor 2 - Classroom Y3 C2	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 2 - Classroom Y2 C2	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 3 - Toilet Staff	0.3	-	-	-	-	-	-	-	-	-	N/A
02_Second Floor 3 - Office Group Space1	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 3 - Toilet Girls	0.3	-	-	-	-	-	-	-	-	-	N/A
02_Second Floor 3 - Classroom Y4 C1	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 3 - Classroom Y4 C2	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 3 - Classroom Y3 C1	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 3 - Office Staff Work Sink	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 3 - Classroom Y3 C2	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 5 - Toilet Boys	0.3	-	-	-	-	-	-	-	-	-	N/A
02_Second Floor 5 - Office Group Space2	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 5 - Classroom Y2 C1	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 5 - Classroom Y2 C2	-	-	-	0.2	-	-	-	-	-	0.85	0.5
02_Second Floor 5 - Classroom Y3 C2	-	-	-	0.2	-	-	-	-	-	0.85	0.5
00_Ground Floor 1 - Toilet Staff	-	-	0.5	-	-	-	-	-	-	-	N/A
00_Ground Floor 1 - Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
00_Ground Floor 1 - WC	-	-	0.5	-	-	-	-	-	-	-	N/A
00_Ground Floor 1 - Hygiene Room	-	-	0.3	0.2	-	-	-	-	-	0.85	0.5
00_Ground Floor 1 - Store Reprographics	-	0.2	-	-	-	-	-	-	-	-	N/A
00_Ground Floor 1 - Toilets Nursery	-	-	0.5	-	-	-	-	-	-	-	N/A

General lighting and display lighting

Zone name	Luminous efficacy [lm/W]			General lighting [W]
	Luminaire	Lamp	Display lamp	
Standard value	60	60	22	
00_Ground Floor 1 - Store Nursery Cloak	100	-	-	16
00_Ground Floor 1 - Store kitchen Staff Dry	100	-	-	16
00_Ground Floor 1 - Store PE	100	-	-	20
00_Ground Floor 1 - Store General	100	-	-	13
00_Ground Floor 1 - Store Chair	100	-	-	17
01_First Floor 1 - Plant	100	-	-	205
01_First Floor 1 - Store Cleaner	100	-	-	8
01_First Floor 1 - Store Y1 C1	100	-	-	8
01_First Floor 1 - Store RC1	100	-	-	8
01_First Floor 1 - Store RC2	100	-	-	8
02_Second Floor 1 - Store Cleaner	100	-	-	8
02_Second Floor 1 - Store Y2 C1	100	-	-	5
02_Second Floor 1 - Store Y4 C2	100	-	-	9
02_Second Floor 1 - Store Y3 C1	100	-	-	8
02_Second Floor 1 - Store Y3 C2	100	-	-	8
02_Second Floor 1 - Store Y2 C2	100	-	-	9
02_Second Floor 2 - Store Y2 C1	100	-	-	5
02_Second Floor 2 - Store Y2 C2	100	-	-	9

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
02_Second Floor 3 - Store Y4 C2	100	-	-	9
02_Second Floor 3 - Store Y3 C1	100	-	-	8
02_Second Floor 3 - Store Y3 C2	100	-	-	8
02_Second Floor 5 - Store Cleaner	100	-	-	8
02_Second Floor 5 - Store Y2 C1	100	-	-	5
02_Second Floor 5 - Store Y2 C2	100	-	-	9
00_Ground Floor 1 - Stairs1	-	100	-	58
00_Ground Floor 1 - Kitchen	-	100	-	513
01_First Floor 1 - Classroom Reception C2	100	-	-	282
01_First Floor 1 - Circulation1	-	100	-	141
01_First Floor 1 - Stairs2	-	100	-	58
01_First Floor 1 - Toilet Boys	-	100	-	73
01_First Floor 1 - Office Group Space	100	-	-	80
01_First Floor 1 - Stairs1	-	100	-	58
01_First Floor 1 - Toilet Girls	-	100	-	73
01_First Floor 1 - Toilet Staff	-	100	-	31
01_First Floor 1 - Classroom Y1 C2	100	-	-	292
01_First Floor 1 - Classroom Y1 C1	100	-	-	293
01_First Floor 1 - Classroom Reception C1	100	-	-	280
01_First Floor 1 - Office Meeting Room	100	-	-	106
02_Second Floor 1 - Circulation	-	100	-	163
02_Second Floor 1 - Toilet Staff	-	100	-	32
02_Second Floor 1 - Toilet Boys	-	100	-	73
02_Second Floor 1 - Stairs2	-	100	-	58
02_Second Floor 1 - Office Group Space2	100	-	-	79
02_Second Floor 1 - Classroom Y2 C1	100	-	-	292
02_Second Floor 1 - Office Group Space1	100	-	-	79
02_Second Floor 1 - Stairs1	-	100	-	58
02_Second Floor 1 - Toilet Girls	-	100	-	73
02_Second Floor 1 - Classroom Y4 C1	100	-	-	292
02_Second Floor 1 - Cloak Y4 C1	100	-	-	5
02_Second Floor 1 - Classroom Y4 C2	100	-	-	292
02_Second Floor 1 - Classroom Y3 C1	100	-	-	284
02_Second Floor 1 - Office Staff Work Sink	100	-	-	106
02_Second Floor 1 - Classroom Y3 C2	100	-	-	283
02_Second Floor 1 - Cloak Y2 C2	100	-	-	7
02_Second Floor 1 - Classroom Y2 C2	100	-	-	283
02_Second Floor 1 - Cloak Y4 C2	100	-	-	5
02_Second Floor 2 - Circulation	-	100	-	163
02_Second Floor 2 - Toilet Boys	-	100	-	73
02_Second Floor 2 - Stairs2	-	100	-	58
02_Second Floor 2 - Classroom Y2 C1	100	-	-	292
02_Second Floor 2 - Stairs1	-	100	-	58

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
02_Second Floor 2 - Classroom Y4 C1	100	-	-	292
02_Second Floor 2 - Cloak Y4 C1	100	-	-	5
02_Second Floor 2 - Classroom Y4 C2	100	-	-	292
02_Second Floor 2 - Classroom Y3 C1	100	-	-	284
02_Second Floor 2 - Classroom Y3 C2	100	-	-	283
02_Second Floor 2 - Cloak Y2 C2	100	-	-	7
02_Second Floor 2 - Classroom Y2 C2	100	-	-	283
02_Second Floor 2 - Cloak Y4 C2	100	-	-	5
02_Second Floor 3 - Circulation	-	100	-	163
02_Second Floor 3 - Toilet Staff	-	100	-	32
02_Second Floor 3 - Office Group Space1	100	-	-	79
02_Second Floor 3 - Stairs1	-	100	-	58
02_Second Floor 3 - Toilet Girls	-	100	-	73
02_Second Floor 3 - Classroom Y4 C1	100	-	-	292
02_Second Floor 3 - Cloak Y4 C1	100	-	-	5
02_Second Floor 3 - Classroom Y4 C2	100	-	-	292
02_Second Floor 3 - Classroom Y3 C1	100	-	-	284
02_Second Floor 3 - Office Staff Work Sink	100	-	-	106
02_Second Floor 3 - Classroom Y3 C2	100	-	-	283
02_Second Floor 3 - Cloak Y4 C2	100	-	-	5
02_Second Floor 4 - Circulation	-	100	-	163
02_Second Floor 4 - Stairs1	-	100	-	58
02_Second Floor 5 - Toilet Boys	-	100	-	73
02_Second Floor 5 - Stairs2	-	100	-	58
02_Second Floor 5 - Office Group Space2	100	-	-	79
02_Second Floor 5 - Classroom Y2 C1	100	-	-	292
02_Second Floor 5 - Cloak Y2 C2	100	-	-	7
02_Second Floor 5 - Classroom Y2 C2	100	-	-	283
02_Second Floor 5 - Circulation	-	100	-	73
02_Second Floor 5 - Classroom Y3 C2	100	-	-	257
00_Ground Floor 1 - Studio	-	100	-	319
01_First Floor 1 - Server Room	100	-	-	33
00_Ground Floor 1 - Toilet Staff	-	100	-	35
00_Ground Floor 1 - Toilets	-	100	-	61
00_Ground Floor 1 - WC	-	100	-	33
00_Ground Floor 1 - Hygiene Room	100	-	-	13
00_Ground Floor 1 - Store Reprographics	100	-	-	15
01_First Floor 1 - Cloak Y1 C2	100	-	-	5
01_First Floor 1 - Cloak Y1 C1	100	-	-	5
00_Ground Floor 1 - Nursery	100	-	-	292
00_Ground Floor 1 - Office Staff Work	100	-	-	145
00_Ground Floor 1 - Office Heads	100	-	-	152
00_Ground Floor 1 - Stairs2	-	100	-	58

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	**Luminaire**	**Lamp**	**Display lamp**	**General lighting [W]**
Standard value	60	60	22	
00_Ground Floor 1 - Toilets Nursery	-	100	-	61
00_Ground Floor 1 - Circulation1	-	100	-	156
00_Ground Floor 1 - Nursery Small Group	100	-	-	78
00_Ground Floor 1 - Hall Internal	100	-	-	382
00_Ground Floor 1 - Hall Dimming	100	-	-	418
00_Ground Floor 1 - Office Interview	100	-	-	87
00_Ground Floor 1 - Entrance	-	100	75	70
00_Ground Floor 1 - Office General	100	-	-	175
00_Ground Floor 1 - Sick Bay	100	-	-	53

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01_First Floor 1 - Classroom Reception C2	NO (-85.3%)	NO
01_First Floor 1 - Office Group Space	N/A	N/A
01_First Floor 1 - Classroom Y1 C2	NO (-62.7%)	NO
01_First Floor 1 - Classroom Y1 C1	NO (-77.6%)	NO
01_First Floor 1 - Classroom Reception C1	NO (-71.3%)	NO
01_First Floor 1 - Office Meeting Room	N/A	N/A
02_Second Floor 1 - Office Group Space2	N/A	N/A
02_Second Floor 1 - Classroom Y2 C1	NO (-71.1%)	NO
02_Second Floor 1 - Office Group Space1	N/A	N/A
02_Second Floor 1 - Classroom Y4 C1	NO (-62.7%)	NO
02_Second Floor 1 - Classroom Y4 C2	NO (-77.6%)	NO
02_Second Floor 1 - Classroom Y3 C1	NO (-72%)	NO
02_Second Floor 1 - Office Staff Work Sink	N/A	N/A
02_Second Floor 1 - Classroom Y3 C2	NO (-71.9%)	NO
02_Second Floor 1 - Classroom Y2 C2	NO (-83.1%)	NO
02_Second Floor 2 - Classroom Y2 C1	NO (-71.1%)	NO
02_Second Floor 2 - Classroom Y4 C1	NO (-62.7%)	NO
02_Second Floor 2 - Classroom Y4 C2	NO (-77.6%)	NO
02_Second Floor 2 - Classroom Y3 C1	NO (-72%)	NO
02_Second Floor 2 - Classroom Y3 C2	NO (-71.9%)	NO
02_Second Floor 2 - Classroom Y2 C2	NO (-83.1%)	NO
02_Second Floor 3 - Office Group Space1	N/A	N/A
02_Second Floor 3 - Classroom Y4 C1	NO (-62.7%)	NO
02_Second Floor 3 - Classroom Y4 C2	NO (-77.6%)	NO
02_Second Floor 3 - Classroom Y3 C1	NO (-72%)	NO
02_Second Floor 3 - Office Staff Work Sink	N/A	N/A
02_Second Floor 3 - Classroom Y3 C2	NO (-71.9%)	NO
02_Second Floor 5 - Office Group Space2	N/A	N/A
02_Second Floor 5 - Classroom Y2 C1	NO (-71.1%)	NO
02_Second Floor 5 - Classroom Y2 C2	NO (-83.1%)	NO
02_Second Floor 5 - Classroom Y3 C2	NO (-84.2%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00_Ground Floor 1 - Studio	N/A	N/A
01_First Floor 1 - Server Room	N/A	N/A
00_Ground Floor 1 - Nursery	NO (-51.5%)	NO
00_Ground Floor 1 - Office Staff Work	NO (-82.1%)	NO
00_Ground Floor 1 - Office Heads	NO (-86.6%)	NO
00_Ground Floor 1 - Nursery Small Group	N/A	N/A
00_Ground Floor 1 - Hall Internal	N/A	N/A
00_Ground Floor 1 - Hall Dimming	NO (-65.7%)	NO
00_Ground Floor 1 - Office Interview	N/A	N/A
00_Ground Floor 1 - Entrance	YES (+59.3%)	NO
00_Ground Floor 1 - Office General	NO (-87.3%)	NO
00_Ground Floor 1 - Sick Bay	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m²]	3943.9	3943.9
External area [m²]	6709.1	6709.1
Weather	LON	LON
Infiltration [m³/hm²@ 50Pa]	5	3
Average conductance [W/K]	1714.31	3147.85
Average U-value [W/m²K]	0.26	0.47
Alpha value* [%]	15.48	11.78

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
100	**D1 Non-residential Institutions: Education**
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m²]

	Actual	Notional
Heating	1.13	2.91
Cooling	0.35	0.35
Auxiliary	5.22	5.43
Lighting	7.68	12.27
Hot water	1.76	2.77
Equipment*	18.54	18.54
TOTAL**	**16.13**	**23.73**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m²]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m²]	74.08	137.26
Primary energy* [kWh/m²]	49.52	71.03
Total emissions [kg/m²]	8.4	12

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] No Heating or Cooling										
	Actual	123.2	0.7	0	0	0.3	0	0	0	0
	Notional	141.3	1.7	0	0	0.5	0	0	----	----
[ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Natural Gas										
	Actual	14.6	51.5	1.1	0	3.6	3.79	0	4.25	0
	Notional	22.3	111.3	2.5	0	4.9	2.43	0	----	----
[ST] Central heating using air distribution, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Natural Gas										
	Actual	1.5	11.9	0.1	0	11.3	3.96	0	4.25	0
	Notional	15.5	14.1	1.8	0	6.6	2.43	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	0	1510.2	0	112.3	0	0	3.74	0	5
	Notional	0	1466.2	0	113.1	0	0	3.6	----	----
[ST] No Heating or Cooling										
	Actual	89.4	11.2	0	0	8	0	0	0	0
	Notional	112.3	37.4	0	0	11.7	0	0	----	----
[ST] Central heating using air distribution, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Natural Gas										
	Actual	36.2	29.6	2.5	0	18.5	3.96	0	4.25	0
	Notional	68.6	68.1	7.8	0	11.8	2.43	0	----	----

Key to terms

Heat dem [MJ/m2]	= Heating energy demand
Cool dem [MJ/m2]	= Cooling energy demand
Heat con [kWh/m2]	= Heating energy consumption
Cool con [kWh/m2]	= Cooling energy consumption
Aux con [kWh/m2]	= Auxiliary energy consumption
Heat SSEFF	= Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER	= Cooling system seasonal energy efficiency ratio
Heat gen SSEFF	= Heating generator seasonal efficiency
Cool gen SSEER	= Cooling generator seasonal energy efficiency ratio
ST	= System type
HS	= Heat source
HFT	= Heating fuel type
CFT	= Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.18	"00_Ground Floor 1 - Stairs1_W_6"
Floor	0.2	0.09	"00_Ground Floor 1 - Toilets Nursery_S_3"
Roof	0.15	0.16	"02_Second Floor 3 - Circulation_R_5"
Windows, roof windows, and rooflights	1.5	1.4	"00_Ground Floor 1 - Stairs1_G_7"
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]

* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	5

BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

Project name

Future School

As designed

Date: Thu Mar 04 15:53:03 2021

Administrative information

Building Details

Address: ,

Certification tool

Calculation engine: SBEM

Calculation engine version: v5.6.b.0

Interface to calculation engine: DesignBuilder SBEM

Interface to calculation engine version: v6.1.7

BRUKL compliance check version: v5.6.b.0

Certifier details

Name:

Telephone number:

Address: , ,

Criterion 1: The calculated CO_2 emission rate for the building must not exceed the target

CO_2 emission rate from the notional building, kgCO_2/m².annum	12
Target CO_2 emission rate (TER), kgCO_2/m².annum	12
Building CO_2 emission rate (BER), kgCO_2/m².annum	7.1
Are emissions from the building less than or equal to the target?	BER =< TER
Are as built details the same as used in the BER calculations?	Separate submission

Criterion 2: The performance of the building fabric and fixed building services should achieve reasonable overall standards of energy efficiency

Values which do not achieve the standards in the Non-Domestic Building Services Compliance Guide and Part L are displayed in red.

Building fabric

Element	$U_{a\text{-}Limit}$	$U_{a\text{-}Calc}$	$U_{i\text{-}Calc}$	Surface where the maximum value occurs*
Wall**	0.35	0.12	0.12	"00_Ground Floor 1 - Stairs1_W_6"
Floor	0.25	0.09	0.1	"00_Ground Floor 1 - Kitchen_F_4"
Roof	0.25	0.1	0.1	"02_Second Floor 3 - Circulation_R_5"
Windows***, roof windows, and rooflights	2.2	1.1	1.1	"00_Ground Floor 1 - Stairs1_G_7"
Personnel doors	2.2	-	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	-	"No external vehicle access doors"
High usage entrance doors	3.5	-	-	"No external high usage entrance doors"

$U_{a\text{-}Limit}$ = Limiting area-weighted average U-values [W/(m²K)]
$U_{a\text{-}Calc}$ = Calculated area-weighted average U-values [W/(m²K)] $U_{i\text{-}Calc}$ = Calculated maximum individual element U-values [W/(m²K)]

* There might be more than one surface where the maximum U-value occurs.
** Automatic U-value check by the tool does not apply to curtain walls whose limiting standard is similar to that for windows.
*** Display windows and similar glazing are excluded from the U-value check.
N.B.: Neither roof ventilators (inc. smoke vents) nor swimming pool basins are modelled or checked against the limiting standards by the tool.

Air Permeability	Worst acceptable standard	This building
m³/(h.m²) at 50 Pa	10	2

Building services

The standard values listed below are minimum values for efficiencies and maximum values for SFPs. Refer to the Non-Domestic Building Services Compliance Guide for details.

Whole building lighting automatic monitoring & targeting with alarms for out-of-range values	YES
Whole building electric power factor achieved by power factor correction	<0.9

1- heating only

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.25	-	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					NO

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

2- air heating

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.25	-	-	1.2	0.9
Standard value	2.5*	N/A	N/A	1.5^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

3- School Cooling Server

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.25	4	-	-	-
Standard value	2.5*	N/A	N/A	N/A	N/A
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

4- School HVAC heating only

	Heating efficiency	Cooling efficiency	Radiant efficiency	SFP [W/(l/s)]	HR efficiency
This system	4.25	-	-	1.2	0.9
Standard value	2.5*	N/A	N/A	1.5^	0.5
Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system					YES

* Standard shown is for all types >12 kW output, except absorption and gas engine heat pumps. For types <=12 kW output, refer to EN 14825 for limiting standards.

^ Limiting SFP may be extended by the amounts specified in the Non-Domestic Building Services Compliance Guide if the system includes additional components as listed in the Guide.

1- Project DHW

	Water heating efficiency	Storage loss factor [kWh/litre per day]
This building	Hot water provided by HVAC system	-
Standard value	N/A	N/A

Local mechanical ventilation, exhaust, and terminal units

ID	System type in Non-domestic Building Services Compliance Guide
A	Local supply or extract ventilation units serving a single area
B	Zonal supply system where the fan is remote from the zone
C	Zonal extract system where the fan is remote from the zone
D	Zonal supply and extract ventilation units serving a single room or zone with heating and heat recovery
E	Local supply and extract ventilation system serving a single area with heating and heat recovery
F	Other local ventilation units
G	Fan-assisted terminal VAV unit
H	Fan coil units
I	Zonal extract system where the fan is remote from the zone with grease filter

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
00_Ground Floor 1 - Store Nursery Cloak	0.3	-	-	-	-	-	-	-	-	-	N/A
02_Second Floor 1 - Store Cleaner	0.3	-	-	-	-	-	-	-	-	-	N/A
02_Second Floor 5 - Store Cleaner	0.3	-	-	-	-	-	-	-	-	-	N/A
00_Ground Floor 1 - Kitchen	-	0.2	-	-	-	-	-	-	1	-	N/A
01_First Floor 1 - Classroom Reception C2	-	-	-	0.2	-	-	-	-	-	0.9	0.5
01_First Floor 1 - Circulation1	-	-	-	0.2	-	-	-	-	-	0.9	0.5
01_First Floor 1 - Toilet Boys	0.3	-	-	-	-	-	-	-	-	-	N/A
01_First Floor 1 - Office Group Space	-	-	-	0.2	-	-	-	-	-	0.9	0.5
01_First Floor 1 - Toilet Girls	0.3	-	-	-	-	-	-	-	-	-	N/A
01_First Floor 1 - Toilet Staff	0.3	-	-	-	-	-	-	-	-	-	N/A
01_First Floor 1 - Classroom Y1 C2	-	-	-	0.2	-	-	-	-	-	0.9	0.5
01_First Floor 1 - Classroom Y1 C1	-	-	-	0.2	-	-	-	-	-	0.9	0.5
01_First Floor 1 - Classroom Reception C1	-	-	-	0.2	-	-	-	-	-	0.9	0.5
01_First Floor 1 - Office Meeting Room	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 1 - Toilet Staff	0.3	-	-	-	-	-	-	-	-	-	N/A
02_Second Floor 1 - Toilet Boys	0.3	-	-	-	-	-	-	-	-	-	N/A
02_Second Floor 1 - Office Group Space2	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 1 - Classroom Y2 C1	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 1 - Office Group Space1	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 1 - Toilet Girls	0.3	-	-	-	-	-	-	-	-	-	N/A
02_Second Floor 1 - Classroom Y4 C1	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 1 - Classroom Y4 C2	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 1 - Classroom Y3 C1	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 1 - Office Staff Work Sink	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 1 - Classroom Y3 C2	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 1 - Classroom Y2 C2	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 2 - Toilet Boys	0.3	-	-	-	-	-	-	-	-	-	N/A
02_Second Floor 2 - Classroom Y2 C1	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 2 - Classroom Y4 C1	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 2 - Classroom Y4 C2	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 2 - Classroom Y3 C1	-	-	-	0.2	-	-	-	-	-	0.9	0.5

Zone name	SFP [W/(l/s)]									HR efficiency	
ID of system type	A	B	C	D	E	F	G	H	I		
Standard value	0.3	1.1	0.5	1.9	1.6	0.5	1.1	0.5	1	Zone	Standard
02_Second Floor 2 - Classroom Y3 C2	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 2 - Classroom Y2 C2	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 3 - Toilet Staff	0.3	-	-	-	-	-	-	-	-	-	N/A
02_Second Floor 3 - Office Group Spaee	1	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 3 - Toilet Girls	0.3	-	-	-	-	-	-	-	-	-	N/A
02_Second Floor 3 - Classroom Y4 C1	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 3 - Classroom Y4 C2	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 3 - Classroom Y3 C1	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 3 - Office Staff Work Sink	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 3 - Classroom Y3 C2	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 5 - Toilet Boys	0.3	-	-	-	-	-	-	-	-	-	N/A
02_Second Floor 5 - Office Group Spaee	2	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 5 - Classroom Y2 C1	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 5 - Classroom Y2 C2	-	-	-	0.2	-	-	-	-	-	0.9	0.5
02_Second Floor 5 - Classroom Y3 C2	-	-	-	0.2	-	-	-	-	-	0.9	0.5
00_Ground Floor 1 - Toilet Staff	-	-	0.5	-	-	-	-	-	-	-	N/A
00_Ground Floor 1 - Toilets	-	-	0.5	-	-	-	-	-	-	-	N/A
00_Ground Floor 1 - WC	-	-	0.5	-	-	-	-	-	-	-	N/A
00_Ground Floor 1 - Hygiene Room	-	-	0.3	0.2	-	-	-	-	-	0.9	0.5
00_Ground Floor 1 - Store Reprographics	-	-	0.2	-	-	-	-	-	-	-	N/A
00_Ground Floor 1 - Toilets Nursery	-	-	0.5	-	-	-	-	-	-	-	N/A

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
00_Ground Floor 1 - Store Nursery Cloak	120	-	-	14
00_Ground Floor 1 - Store kitchen Staff Dry	120	-	-	14
00_Ground Floor 1 - Store PE	120	-	-	17
00_Ground Floor 1 - Store General	120	-	-	11
00_Ground Floor 1 - Store Chair	120	-	-	14
01_First Floor 1 - Plant	120	-	-	171
01_First Floor 1 - Store Cleaner	120	-	-	6
01_First Floor 1 - Store Y1 C1	120	-	-	7
01_First Floor 1 - Store RC1	120	-	-	7
01_First Floor 1 - Store RC2	120	-	-	7
02_Second Floor 1 - Store Cleaner	120	-	-	6
02_Second Floor 1 - Store Y2 C1	120	-	-	4
02_Second Floor 1 - Store Y4 C2	120	-	-	8
02_Second Floor 1 - Store Y3 C1	120	-	-	6
02_Second Floor 1 - Store Y3 C2	120	-	-	6
02_Second Floor 1 - Store Y2 C2	120	-	-	8
02_Second Floor 2 - Store Y2 C1	120	-	-	4
02_Second Floor 2 - Store Y2 C2	120	-	-	8

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
02_Second Floor 3 - Store Y4 C2	120	-	-	8
02_Second Floor 3 - Store Y3 C1	120	-	-	6
02_Second Floor 3 - Store Y3 C2	120	-	-	6
02_Second Floor 5 - Store Cleaner	120	-	-	6
02_Second Floor 5 - Store Y2 C1	120	-	-	4
02_Second Floor 5 - Store Y2 C2	120	-	-	8
00_Ground Floor 1 - Stairs1	-	120	-	48
00_Ground Floor 1 - Kitchen	-	120	-	427
01_First Floor 1 - Classroom Reception C2	120	-	-	235
01_First Floor 1 - Circulation1	-	120	-	117
01_First Floor 1 - Stairs2	-	120	-	48
01_First Floor 1 - Toilet Boys	-	120	-	61
01_First Floor 1 - Office Group Space	120	-	-	67
01_First Floor 1 - Stairs1	-	120	-	48
01_First Floor 1 - Toilet Girls	-	120	-	61
01_First Floor 1 - Toilet Staff	-	120	-	26
01_First Floor 1 - Classroom Y1 C2	120	-	-	244
01_First Floor 1 - Classroom Y1 C1	120	-	-	244
01_First Floor 1 - Classroom Reception C1	120	-	-	233
01_First Floor 1 - Office Meeting Room	120	-	-	89
02_Second Floor 1 - Circulation	-	120	-	136
02_Second Floor 1 - Toilet Staff	-	120	-	27
02_Second Floor 1 - Toilet Boys	-	120	-	61
02_Second Floor 1 - Stairs2	-	120	-	48
02_Second Floor 1 - Office Group Space2	120	-	-	66
02_Second Floor 1 - Classroom Y2 C1	120	-	-	244
02_Second Floor 1 - Office Group Space1	120	-	-	66
02_Second Floor 1 - Stairs1	-	120	-	49
02_Second Floor 1 - Toilet Girls	-	120	-	61
02_Second Floor 1 - Classroom Y4 C1	120	-	-	244
02_Second Floor 1 - Cloak Y4 C1	120	-	-	4
02_Second Floor 1 - Classroom Y4 C2	120	-	-	244
02_Second Floor 1 - Classroom Y3 C1	120	-	-	236
02_Second Floor 1 - Office Staff Work Sink	120	-	-	89
02_Second Floor 1 - Classroom Y3 C2	120	-	-	236
02_Second Floor 1 - Cloak Y2 C2	120	-	-	6
02_Second Floor 1 - Classroom Y2 C2	120	-	-	236
02_Second Floor 1 - Cloak Y4 C2	120	-	-	4
02_Second Floor 2 - Circulation	-	120	-	136
02_Second Floor 2 - Toilet Boys	-	120	-	61
02_Second Floor 2 - Stairs2	-	120	-	48
02_Second Floor 2 - Classroom Y2 C1	120	-	-	244
02_Second Floor 2 - Stairs1	-	120	-	49

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
02_Second Floor 2 - Classroom Y4 C1	120	-	-	244
02_Second Floor 2 - Cloak Y4 C1	120	-	-	4
02_Second Floor 2 - Classroom Y4 C2	120	-	-	244
02_Second Floor 2 - Classroom Y3 C1	120	-	-	236
02_Second Floor 2 - Classroom Y3 C2	120	-	-	236
02_Second Floor 2 - Cloak Y2 C2	120	-	-	6
02_Second Floor 2 - Classroom Y2 C2	120	-	-	236
02_Second Floor 2 - Cloak Y4 C2	120	-	-	4
02_Second Floor 3 - Circulation	-	120	-	136
02_Second Floor 3 - Toilet Staff	-	120	-	27
02_Second Floor 3 - Office Group Space1	120	-	-	66
02_Second Floor 3 - Stairs1	-	120	-	49
02_Second Floor 3 - Toilet Girls	-	120	-	61
02_Second Floor 3 - Classroom Y4 C1	120	-	-	244
02_Second Floor 3 - Cloak Y4 C1	120	-	-	4
02_Second Floor 3 - Classroom Y4 C2	120	-	-	244
02_Second Floor 3 - Classroom Y3 C1	120	-	-	236
02_Second Floor 3 - Office Staff Work Sink	120	-	-	89
02_Second Floor 3 - Classroom Y3 C2	120	-	-	236
02_Second Floor 3 - Cloak Y4 C2	120	-	-	4
02_Second Floor 4 - Circulation	-	120	-	136
02_Second Floor 4 - Stairs1	-	120	-	49
02_Second Floor 5 - Toilet Boys	-	120	-	61
02_Second Floor 5 - Stairs2	-	120	-	48
02_Second Floor 5 - Office Group Space2	120	-	-	66
02_Second Floor 5 - Classroom Y2 C1	120	-	-	244
02_Second Floor 5 - Cloak Y2 C2	120	-	-	6
02_Second Floor 5 - Classroom Y2 C2	120	-	-	236
02_Second Floor 5 - Circulation	-	120	-	61
02_Second Floor 5 - Classroom Y3 C2	120	-	-	215
00_Ground Floor 1 - Studio	-	120	-	266
01_First Floor 1 - Server Room	120	-	-	27
00_Ground Floor 1 - Toilet Staff	-	120	-	29
00_Ground Floor 1 - Toilets	-	120	-	51
00_Ground Floor 1 - WC	-	120	-	27
00_Ground Floor 1 - Hygiene Room	120	-	-	11
00_Ground Floor 1 - Store Reprographics	120	-	-	13
01_First Floor 1 - Cloak Y1 C2	120	-	-	4
01_First Floor 1 - Cloak Y1 C1	120	-	-	4
00_Ground Floor 1 - Nursery	120	-	-	243
00_Ground Floor 1 - Office Staff Work	120	-	-	121
00_Ground Floor 1 - Office Heads	120	-	-	127
00_Ground Floor 1 - Stairs2	-	120	-	48

General lighting and display lighting	Luminous efficacy [lm/W]			
Zone name	Luminaire	Lamp	Display lamp	General lighting [W]
Standard value	60	60	22	
00_Ground Floor 1 - Toilets Nursery	-	120	-	51
00_Ground Floor 1 - Circulation1	-	120	-	130
00_Ground Floor 1 - Nursery Small Group	120	-	-	65
00_Ground Floor 1 - Hall Internal	120	-	-	318
00_Ground Floor 1 - Hall Dimming	120	-	-	348
00_Ground Floor 1 - Office Interview	120	-	-	72
00_Ground Floor 1 - Entrance	-	120	90	59
00_Ground Floor 1 - Office General	120	-	-	146
00_Ground Floor 1 - Sick Bay	120	-	-	45

Criterion 3: The spaces in the building should have appropriate passive control measures to limit solar gains

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
01_First Floor 1 - Classroom Reception C2	NO (-85.3%)	NO
01_First Floor 1 - Office Group Space	N/A	N/A
01_First Floor 1 - Classroom Y1 C2	NO (-62.7%)	NO
01_First Floor 1 - Classroom Y1 C1	NO (-77.6%)	NO
01_First Floor 1 - Classroom Reception C1	NO (-71.3%)	NO
01_First Floor 1 - Office Meeting Room	N/A	N/A
02_Second Floor 1 - Office Group Space2	N/A	N/A
02_Second Floor 1 - Classroom Y2 C1	NO (-71.1%)	NO
02_Second Floor 1 - Office Group Space1	N/A	N/A
02_Second Floor 1 - Classroom Y4 C1	NO (-62.7%)	NO
02_Second Floor 1 - Classroom Y4 C2	NO (-77.6%)	NO
02_Second Floor 1 - Classroom Y3 C1	NO (-72%)	NO
02_Second Floor 1 - Office Staff Work Sink	N/A	N/A
02_Second Floor 1 - Classroom Y3 C2	NO (-71.9%)	NO
02_Second Floor 1 - Classroom Y2 C2	NO (-83.1%)	NO
02_Second Floor 2 - Classroom Y2 C1	NO (-71.1%)	NO
02_Second Floor 2 - Classroom Y4 C1	NO (-62.7%)	NO
02_Second Floor 2 - Classroom Y4 C2	NO (-77.6%)	NO
02_Second Floor 2 - Classroom Y3 C1	NO (-72%)	NO
02_Second Floor 2 - Classroom Y3 C2	NO (-71.9%)	NO
02_Second Floor 2 - Classroom Y2 C2	NO (-83.1%)	NO
02_Second Floor 3 - Office Group Space1	N/A	N/A
02_Second Floor 3 - Classroom Y4 C1	NO (-62.7%)	NO
02_Second Floor 3 - Classroom Y4 C2	NO (-77.6%)	NO
02_Second Floor 3 - Classroom Y3 C1	NO (-72%)	NO
02_Second Floor 3 - Office Staff Work Sink	N/A	N/A
02_Second Floor 3 - Classroom Y3 C2	NO (-71.9%)	NO
02_Second Floor 5 - Office Group Space2	N/A	N/A
02_Second Floor 5 - Classroom Y2 C1	NO (-71.1%)	NO
02_Second Floor 5 - Classroom Y2 C2	NO (-83.1%)	NO
02_Second Floor 5 - Classroom Y3 C2	NO (-84.2%)	NO

Zone	Solar gain limit exceeded? (%)	Internal blinds used?
00_Ground Floor 1 - Studio	N/A	N/A
01_First Floor 1 - Server Room	N/A	N/A
00_Ground Floor 1 - Nursery	NO (-51.5%)	NO
00_Ground Floor 1 - Office Staff Work	NO (-82.1%)	NO
00_Ground Floor 1 - Office Heads	NO (-86.6%)	NO
00_Ground Floor 1 - Nursery Small Group	N/A	N/A
00_Ground Floor 1 - Hall Internal	N/A	N/A
00_Ground Floor 1 - Hall Dimming	NO (-65.7%)	NO
00_Ground Floor 1 - Office Interview	N/A	N/A
00_Ground Floor 1 - Entrance	YES (+59.3%)	NO
00_Ground Floor 1 - Office General	NO (-87.3%)	NO
00_Ground Floor 1 - Sick Bay	N/A	N/A

Criterion 4: The performance of the building, as built, should be consistent with the calculated BER

Separate submission

Criterion 5: The necessary provisions for enabling energy-efficient operation of the building should be in place

Separate submission

EPBD (Recast): Consideration of alternative energy systems

Were alternative energy systems considered and analysed as part of the design process?	NO
Is evidence of such assessment available as a separate submission?	NO
Are any such measures included in the proposed design?	NO

Technical Data Sheet (Actual vs. Notional Building)

Building Global Parameters

	Actual	Notional
Area [m^2]	3943.9	3943.9
External area [m^2]	6709.1	6709.1
Weather	LON	LON
Infiltration [m^3/hm^2@ 50Pa]	2	3
Average conductance [W/K]	1236.13	3147.85
Average U-value [W/m^2K]	0.18	0.47
Alpha value* [%]	21.47	11.78

* Percentage of the building's average heat transfer coefficient which is due to thermal bridging

Building Use

% Area	Building Type
	A1/A2 Retail/Financial and Professional services
	A3/A4/A5 Restaurants and Cafes/Drinking Est./Takeaways
	B1 Offices and Workshop businesses
	B2 to B7 General Industrial and Special Industrial Groups
	B8 Storage or Distribution
	C1 Hotels
	C2 Residential Institutions: Hospitals and Care Homes
	C2 Residential Institutions: Residential schools
	C2 Residential Institutions: Universities and colleges
	C2A Secure Residential Institutions
	Residential spaces
	D1 Non-residential Institutions: Community/Day Centre
	D1 Non-residential Institutions: Libraries, Museums, and Galleries
100	**D1 Non-residential Institutions: Education**
	D1 Non-residential Institutions: Primary Health Care Building
	D1 Non-residential Institutions: Crown and County Courts
	D2 General Assembly and Leisure, Night Clubs, and Theatres
	Others: Passenger terminals
	Others: Emergency services
	Others: Miscellaneous 24hr activities
	Others: Car Parks 24 hrs
	Others: Stand alone utility block

Energy Consumption by End Use [kWh/m^2]

	Actual	Notional
Heating	0.62	2.91
Cooling	0.2	0.35
Auxiliary	4.36	5.43
Lighting	6.68	12.27
Hot water	1.76	2.77
Equipment*	18.54	18.54
TOTAL**	**13.61**	**23.73**

* Energy used by equipment does not count towards the total for consumption or calculating emissions.
** Total is net of any electrical energy displaced by CHP generators, if applicable.

Energy Production by Technology [kWh/m^2]

	Actual	Notional
Photovoltaic systems	0	0
Wind turbines	0	0
CHP generators	0	0
Solar thermal systems	0	0

Energy & CO_2 Emissions Summary

	Actual	Notional
Heating + cooling demand [MJ/m^2]	71.83	137.26
Primary energy* [kWh/m^2]	41.77	71.03
Total emissions [kg/m^2]	7.1	12

* Primary energy is net of any electrical energy displaced by CHP generators, if applicable.

HVAC Systems Performance

System Type		Heat dem MJ/m2	Cool dem MJ/m2	Heat con kWh/m2	Cool con kWh/m2	Aux con kWh/m2	Heat SSEEF	Cool SSEER	Heat gen SEFF	Cool gen SEER
[ST] No Heating or Cooling										
	Actual	90	0.8	0	0	0.3	0	0	0	0
	Notional	141.3	1.7	0	0	0.5	0	0	----	----
[ST] Central heating using water: radiators, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Natural Gas										
	Actual	8.4	58	0.6	0	3.6	3.79	0	4.25	0
	Notional	22.3	111.3	2.5	0	4.9	2.43	0	----	----
[ST] Central heating using air distribution, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Natural Gas										
	Actual	0	20.3	0	0	6.9	3.85	0	4.25	0
	Notional	15.5	14.1	1.8	0	6.6	2.43	0	----	----
[ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity										
	Actual	0	1535.2	0	63.4	0	0	6.73	0	9
	Notional	0	1466.2	0	113.1	0	0	3.6	----	----
[ST] No Heating or Cooling										
	Actual	62.7	11.3	0	0	8	0	0	0	0
	Notional	112.3	37.4	0	0	11.7	0	0	----	----
[ST] Central heating using air distribution, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Natural Gas										
	Actual	16.3	48.5	1.2	0	11.4	3.85	0	4.25	0
	Notional	68.6	68.1	7.8	0	11.8	2.43	0	----	----

Key to terms

Heat dem [MJ/m2] = Heating energy demand
Cool dem [MJ/m2] = Cooling energy demand
Heat con [kWh/m2] = Heating energy consumption
Cool con [kWh/m2] = Cooling energy consumption
Aux con [kWh/m2] = Auxiliary energy consumption
Heat SSEFF = Heating system seasonal efficiency (for notional building, value depends on activity glazing class)
Cool SSEER = Cooling system seasonal energy efficiency ratio
Heat gen SSEFF = Heating generator seasonal efficiency
Cool gen SSEER = Cooling generator seasonal energy efficiency ratio
ST = System type
HS = Heat source
HFT = Heating fuel type
CFT = Cooling fuel type

Key Features

The Building Control Body is advised to give particular attention to items whose specifications are better than typically expected.

Building fabric

Element	$U_{i\text{-}Typ}$	$U_{i\text{-}Min}$	Surface where the minimum value occurs*
Wall	0.23	0.12	"00_Ground Floor 1 - Stairs1_W_6"
Floor	0.2	0.08	"00_Ground Floor 1 - Toilets Nursery_S_3"
Roof	0.15	0.1	"02_Second Floor 3 - Circulation_R_5"
Windows, roof windows, and rooflights	1.5	1.1	"00_Ground Floor 1 - Stairs1_G_7"
Personnel doors	1.5	-	"No external personnel doors"
Vehicle access & similar large doors	1.5	-	"No external vehicle access doors"
High usage entrance doors	1.5	-	"No external high usage entrance doors"

$U_{i\text{-}Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i\text{-}Min}$ = Minimum individual element U-values [W/(m²K)]
* There might be more than one surface where the minimum U-value occurs.

Air Permeability	Typical value	This building
m³/(h.m²) at 50 Pa	5	2