Document

# Energy Strategy Report

Project

## Highgate Newtown Residential and Community Centre Redevelopment

Client

## London Borough of Camden

Date

## November 2018


Contact

Giuseppe Siracusa

gsiracusa@mcbains.co.uk

020 7786 7900

5th Fl, 26 Finsbury Square

London EC2A 1DS

+44 (0)20 7786 7900

mcbains.co.uk


| DOCUMENT REFERENCE | | | | | | | | STATUS | |
|---|---|---|---|---|---|---|---|---|---|
| 59776 | HNCC | MCB | XX | XX | RP | V | 0001 | D5 | P3 |
| MCB NO. | PROJ. IDEN | ORIGINATOR | ZONE | LEVEL | TYPE | DISCIPLINE | NUMBER | SUITABILITY | REVISION |

# DOCUMENT LOCATION

Ensure that this document is current. Printed documents and locally copied files may become obsolete due to changes to the master document.

The source of the master document can be found on the following:

HNCC-MCB-XX-ZZ-RP-V-0001 D5-P3 Energy Strategy.docx

# REVISION HISTORY

| Suitability | Revision | Version Date | Summary of Changes | Changes marked |
|---|---|---|---|---|
| D5 | P1 | 30-10-2018 | Draft for comment | |
| D5 | P2 | 09-11-2018 | With updated calculations | |
| D5 | P3 | 29-01-2019 | Update for revised scheme | |

# DISTRIBUTION

This document has been distributed to:

| Name | Company |
|---|---|
| Lewis Westhoff | Iceni |
| | |

# APPROVALS

This document requires the following approvals:

| Name | Title |
|---|---|
| Rolfe Jackson | Director |
| | |

# CONTENTS

# 1.0 EXECUTIVE SUMMARY

This Energy Strategy has been prepared by McBains Ltd for the revised scheme at Highgate Newtown Community Centre in support of the Section 73 Application. The scheme comprises 39 new private dwellings, 2 houses within the refurbished Gospel Hall, and a new community centre. This document supersedes the previous Energy Strategy (VZdV, Rev 3, 28th Oct 2016).

It has been prepared as part of a series of documents to support the application, in conjunction with which it should be read, and addresses requirements related to energy use and carbon dioxide emissions reduction in accordance with local and national policy. The main policy and guidance context of the responses includes:

- London Borough of Camden – Local Plan (July 2017)
- The London Plan - Minor Alterations to the London Plan (MALP) (March 2016)

This document sets out how the expected energy demands of the proposed development have been analysed and forms the site-wide energy strategy in accordance with the Mayor's energy hierarchy, maximising the contribution at each step. A summary of key outcomes is provided below.

The reduction of regulated carbon dioxide emissions of the proposed scheme has been estimated as 45.1% across the residential and commercial elements from a Part L 2013 compliant baseline by maximising the contribution at each step of the energy hierarchy. This is split down as table 1 below. Having minimised energy demand, a Combined Heat and Power unit will be specified and, finally, a PV array of 24.8kWp is proposed.

LEAN:

Energy demand has been minimised through a highly efficient building envelope and systems in terms of U-values and air-tightness, inverter driven pumps, reduced thermal bridges, the inclusion of high efficiency lighting throughout coupled with PIR sensors, occupancy detectors and dimmers. High efficiency heat recovery in the mechanical ventilation system will also be specified. The challenging Target Fabric Energy Efficiency criterion introduced in Part L1A 2013 is complied with across the residential elements of the development.

The overall contribution of lean measures across the site is a 0.85% increase in carbon dioxide emissions. This is broken down as follows:
New Build Residential – 5.7% saving
New Build Commercial – 15.4% increase

CLEAN:

Further reductions have been achieved through the use of a Combined Heat and Power (CHP) unit. To ensure efficient operation throughout the year, the CHP unit will be sized to meet approximately 60% of the annual space heating and domestic hot water load of the site wide load. The remaining heating load will be met by high efficiency gas boilers, with individual combi boilers for the 2 no. houses (Block C).

The overall contribution of clean measures across the site is a further 34.3% reduction in carbon dioxide emissions. This is broken down as follows:
New Build Residential – 31.5% saving
New Build Commercial – 39.3% saving

Residential Refurb – 34.8% saving

GREEN:

To further reduce the carbon dioxide emissions of the proposed development, an assessment of potential low and zero carbon technologies has been undertaken. The preferred option would be to install a PV array (24.8kWp) to contribute towards the electrical load of the development.

The overall contribution of green measures across the site is a further 17.1% reduction in carbon dioxide emissions. This is broken down as follows:
New Build Residential – 22.2% saving
New Build Commercial – 6.4% saving

It is expected that the proposed development will achieve a reduction of an estimated 45.1% in regulated $CO_2$ reductions compared to Building Regulations Part L 2013.

The expected $CO_2$ savings are as follows for each stage of the energy hierarchy:

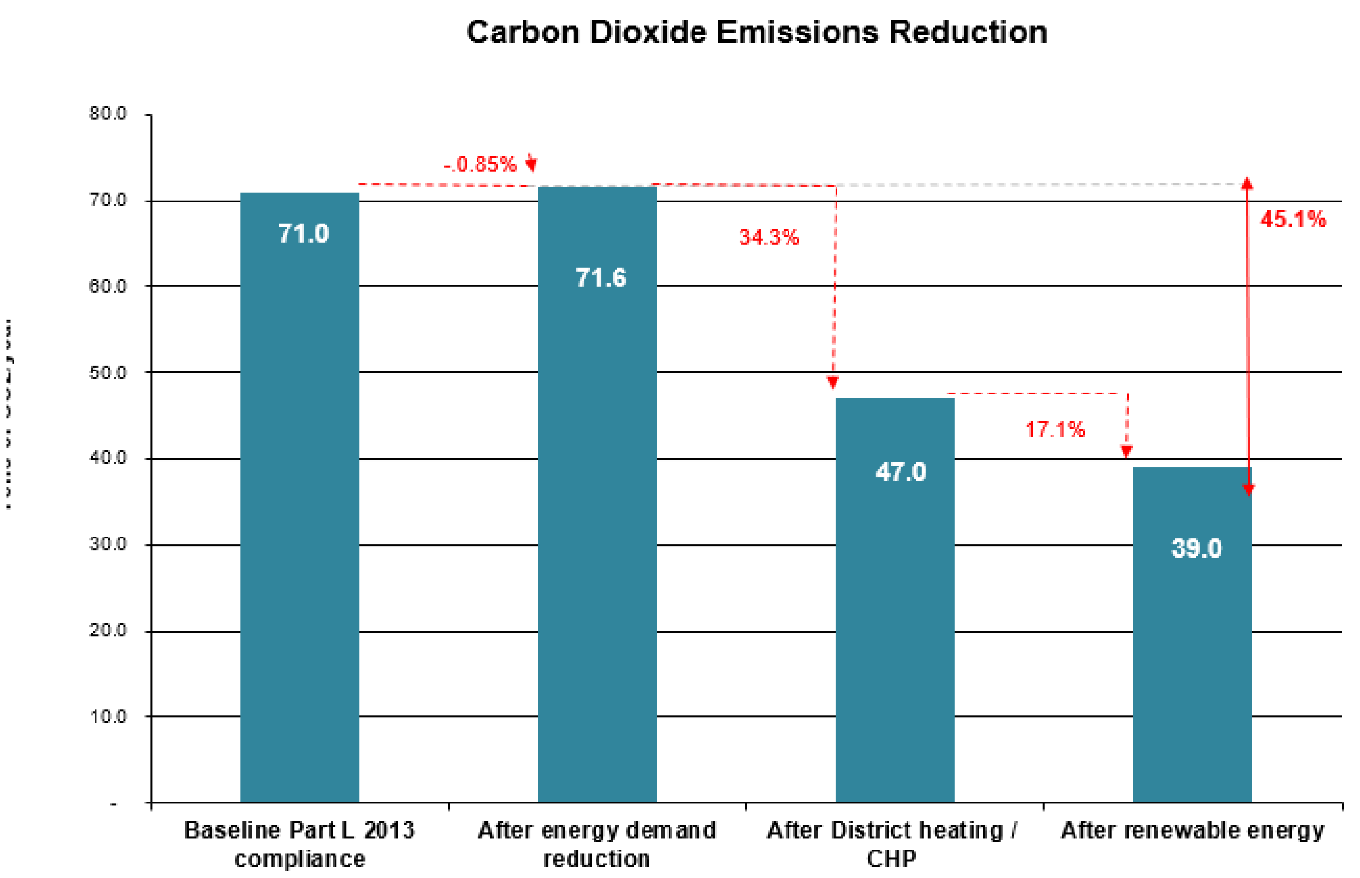
**Table 1:** Site wide $CO_2$ Emissions after each stage of the Energy Hierarchy are broken down as follows:

| Approved Energy Statement | New build residential | | | New build commercial | | | Resi refurb | | |
|---|---|---|---|---|---|---|---|---|---|
| | Total tCO2 | Stage reduction, tCO2 | Stage reduction, % | Total tCO2 | Stage reduction, tCO2 | Stage reduction, % | Total tCO2 | Stage reduction, tCO2 | Stage reduction, % |
| **Baseline** | 48.98 | N/A | N/A | 22 | N/A | N/A | *13.76* | N/A | N/A |
| **Be Lean** | 46.19 | 2.79 | 5.7% | 25.4 | -3.4 | -15.4% | N/A | N/A | N/A |
| **Be Clean** | 31.61 | 14.58 | 31.5% | 15.4 | 10.0 | 39.3% | *8.97* | *4.79* | *34.8%* |
| **Be Green** | 24.58 | 7.03 | 22.2% | 14.4 | 1.00 | 6.4% | N/A | N/A | N/A |
| **TOTAL** | **24.58** | **24.4** | **49.81%** | **14.4** | **7.6** | **35%** | ***8.97*** | ***4.79*** | ***34.8%*** |
| *Target* | N/A | *48.98* | *100.0%* | N/A | *7.6* | *35.0%* | N/A | N/A | N/A |
| **Shortfall** | N/A | 24.58 | 50.19% | N/A | - | - | N/A | N/A | N/A |
| Offset payment | £44,244.00 | | | | | | - | | |

| Approved Energy Statement | SITEWIDE COMBINED | | |
|---|---|---|---|
| | Total tCO2 | Stage reduction, tCO2 | Stage reduction, % |
| **Baseline** | 70.98 | N/A | N/A |
| **Be Lean** | 71.59 | -0.61 | -0.85% |
| **Be Clean** | 47.01 | 24.58 | 34.3% |
| **Be Green** | 38.98 | 8.03 | 17.1% |
| **TOTAL** | **38.98** | **32.0** | **45.1%** |

The above tables exclude the savings to the residential refurb (Gospel Hall).

The development is expected to achieve regulated $CO_2$ reductions of an estimated 45.1% compared with Part L1A 2013 as shown below.




In the Gospel Hall refurbished property, by improving U Values to walls and windows and installing high efficiency boilers provides a reduction in CO2 emissions of 34.8%is achieved against its current emissions.

# 2.0 METHODOLOGY

## 2.1 The Accredited Software

In order to determine the baseline consumption and improvements in the private residential dwellings, a series of Standard Assessment Procedure (SAP) assessments were carried out. A representative sample of 11 dwellings (25% of the development) was selected to show a range of compliance strategies and potential improvements. For this exercise the Stroma FSAP 2012 Calculator Version 1.0.4.16 was used, which is a government accredited software package (checked by BRE on behalf of DECC, CLG, SBS and DFPNI).

In order to develop the Simplified Building Energy Model (SBEM) for the non-domestic elements of the development, for this calculation Tas v9.4.3 has been used. This is a Dynamic Simulation Modeller which gives a highly accurate representation of the building energy use, calculating the building demand, consumption and $CO_2$ emissions for every hour of the year. This version of the software has been accredited by the CLG for Part L2a & production of EPC certificates for all levels of buildings.

## 2.2 The Approach

Once the Part L 2013 calculations had been set up according to the information from the rest of the design team, the energy hierarchy was applied as described in London Plan Policy 5.2 Minimising carbon dioxide emissions;

- Be lean: Use less energy
- Be clean: Supply energy efficiently
- Be green: Use renewable energy

The Baseline: The Building/Dwelling Emission Rate (BER/DER) of the development and the Target Emission Rates (TER) of the corresponding notional buildings were calculated using SBEM and SAP in accordance with Building Regulations Part L 2013. For the residential element of the development, SAP calculations were undertaken in order to establish an overall figure for the Dwelling Emission Rate (DER) across the residential element of the development. Similarly, full SBEM simulations were carried out for the community centre to estimate the associated energy demand and regulated carbon dioxide emissions.

The Energy Hierarchy: Once the baselines were determined, the energy hierarchy was applied to maximise the reduction of carbon dioxide emissions; energy efficiency measures first, followed by an assessment of the options for meeting the remaining energy demand efficiently and finally an assessment of the options to further reduce carbon dioxide emissions from renewable energy generated onsite.

Following preliminary calculations it is expected that overall regulated carbon dioxide emissions will be reduced by at least 41.5% across the development compared to Part L 2013 through the Lean, Clean and Green measures.

# 3.0 THE BASELINE

To assess the performance of the residential element of the development, the following parameters summarised in Table 3 were applied to the representative sample dwellings.

**Table 3: NEW RESIDENTIAL - Fabric and services parameters**

| Element or system | Units | Highgate Newtown | Notional building (Part L1A 2013) | Limiting Values (Part 1a 2013) |
|---|---|---|---|---|
| FABRIC PERFORMANCE | | | | |
| Ground Floor - U value | $W/m^2K$ | 0.11 | 0.13 | 0.25 |
| External Walls - U value | $W/m^2K$ | Block A 0.15<br>Block D 0.18 | 0.18 | 0.3 |
| Party walls - U value | $W/m^2K$ | 0 | 0 | 0.2 |
| Roof - U value | $W/m^2K$ | Block A 0.11<br>Block D 0.13 | 0.13 | 0.25 |
| Windows, rooflights, glazed doors | | | | |
| U value | $W/m^2K$ | 1.4 | 1.4 | 2 |
| g value | | 0.37 - 0.558 - Flats | 0.63 | - |
| frame factor | | 0.7 | | |
| External Doors | | 1.4 | 1 | |
| Air tightness | $m^3/hr/m^2$ | 3 | 5 | 10 |
| Thermal bridging (y factor) | | Accredited Construction | | |
| BUILDING SERVICES | | | | |
| CHP heat efficiency (fraction of | % | 51% (0.60) | | |
| CHP electrical efficiency | % | 33 | | |
| Boiler efficiency (fraction of | % | 91% (0.40) | 89.5% | |
| Energy efficient lighting | % | 100 | 100 | 100 |
| Mechanical ventilation & heat recovery:<br>Specific Fan Power (SFP) / heat | W / L / s | SFP = 0.53 / 94% | | |
| Mechanical cooling SEER | | None | | |

**Table 3: EXISTING BUILDING RESIDENTIAL - Fabric and services parameters**

| Element or system | Units | Existing Building (Part L1B 2013) | Improved U Values |
|---|---|---|---|
| FABRIC PERFORMANCE | | | |
| Ground Floor - U value | $W/m^2K$ | 0.6 | 0.6 |
| External Walls - U value | $W/m^2K$ | 2.2 | 1.8 |
| Party walls - U value | $W/m^2K$ | 0 | 0 |
| Roof - U value | $W/m^2K$ | 2.5 | 0.18 |
| Windows, rooflights, glazed doors | | | |
| U value | $W/m^2K$ | 5.6 | 1.4 |
| g value | | | 0.44 - 0.558 |
| Air tightness | $m^3/hr/m^2$ | 15 | 10 |
| BUILDING SERVICES | | | |
| Boiler efficiency | % | n/a | 91%) |
| Energy efficient lighting | % | n/a | 100 |
| Mechanical ventilation & heat recovery: Specific Fan Power (SFP) / heat | W / L / s | n/a | SFP = 0.53 / 94% |
| Mechanical cooling SEER | | None | None |

**Table 4: NON DOMESTIC - Fabric and services parameters**

| Element or system | Units | Highgate Newtown | Notional building (Part L2A 2013) | Limiting Values (Part 1a 2013) |
|---|---|---|---|---|
| FABRIC PERFORMANCE | | | | |
| External Walls - U value | W/m²K | 0.22 | 0.26 | 0.35 |
| Floor - U value | W/m²K | 0.18 | 0.22 | 0.25 |
| Roof - U value | W/m²K | 0.14 | 0.22 | 0.25 |
| Windows, rooflights, glazed doors | | | | |
| U value | W/m²K | 1.4 | 1.4 | 2.2 |
| g value | | 0.488 - 0.512 | 0.63 | - |
| frame factor | | 0.8 | | |
| External Doors | | 1.63 | | |
| Air tightness | $m^3/hr/m^2$ | 3 | 3 | 10 |
| BUILDING SERVICES | | | | |
| CHP heat efficiency (fraction of | % | 51% (0.60) | | |
| CHP electrical efficiency | % | 33 | | |
| Boiler efficiency (fraction of | % | 91% (0.40) | 91% | |
| Lighting (lm/W) | % | 100 | 60 | 60 |
| Mechanical ventilation & heat recovery: Specific Fan Power (SFP) / heat recovery efficiency | W / L / s | SFP = 1.6 / 70% | | |
| Mechanical cooling SEER | | | 4.5/3.6 | |

## 3.1 Percentage of Glazed Area of the Façade

The percentage of glazing to the façade of each building is detailed as below:

| | |
|---|---|
| Building A New Build Residential | 29.5% |
| Building B New Build Community Centre | 15.4% |
| Building C Existing Building | 17.3% |
| Building D New Build Residential | 24% |

# 4.0 IMPROVEMENTS FROM REDUCING ENERGY DEMAND ('BE LEAN')

Reducing carbon emissions from the total energy needs (heating, cooling and power) of the development is one of the fundamental aims of any development adopting the principles of sustainable design in order to mitigate the effects of climate change and help conserve fossil fuel resources.

The first step in the energy hierarchy is to use passive design and energy efficiency measures to reduce the energy demand of the building. From preliminary calculations, it is estimated that a regulated carbon dioxide emissions reduction of 6% over Part L 2013 across the development as a whole through lean measures alone can be achieved. It is worth noting that the challenging Target Fabric Energy Efficiency criterion has been achieved in all of the sample dwellings and on a block basis this criterion is passed.

## A. Building Fabric Improvements and Overheating

The glazed areas in the residential element of the scheme are a key component. The proportion of glazing to façade area was assessed with careful consideration of beneficial heat gain, winter heat losses, daylight and aesthetic appeal of the building. Windows with a U-value of 1.40 W/m$^2$K are proposed. This will help to minimise excessive heat loss in winter and solar gain in the summer, reducing the associated heating load in winter and the risk of overheating in summer. Furthermore, external wall U-values of 0.15 – 0.22 W/m$^2$K have been selected for the new residential & commercial buildings.

## B. Air Tightness Improvements

An improvement upon the minimum requirements of the Part L 2013 will be targeted with 3m$^3$/m$^2$hour at 50 Pa pressure. The Design Team and Contractor will incorporate suitable construction details into the design and adopt best practice construction practices in order to achieve these figures.

## C. Thermal Bridging

Thermal bridging will be carefully considered to improve upon the minimum default y value of 0.15. Thermal bridges at all window junctions (sills, jambs and lintels) will be designed with Accredited Construction Details to ensure that heat transferred through to the building is reduced. Particular attention will also be paid to the balconies, which are one of the highest risk areas to cause thermal bridging due to construction methods and detailing.

## D. Luminaires and Controls

Low energy lighting has become an essential feature of building design. Advances in lamp and ballast design have led to higher efficiency luminaires with control measures having become standard in most new developments in order to respond to changes to standards such as Part L of the Building Regulations and sustainability assessment methods such as BREEAM and the Code for Sustainable Homes.

Lighting controls can consist of simple presence detection which when combined with daylight control can switch luminaires on/off automatically or regulate the lighting levels in accordance with the outside conditions. These systems are proposed for use in conjunction with each other for the most energy efficient installation. Daylight control is intended for use to control external lighting.

Energy efficient light fittings will be provided throughout the development to reduce the electrical load. Daylight sensors and timers will be installed to all external lighting (not including security lighting). High efficiency lamps will be installed in communal areas managed by the landlord. These will be controlled by a combination of infrared occupancy control.

## E. Ventilation

Due to the high performance of the building fabric and the development, relying solely on natural ventilation for the residential dwellings is not considered an appropriate strategy and a balanced mechanical ventilation strategy with mechanical extract is proposed. This will ensure minimum fresh air requirements, moisture and odour removal from the kitchen and toilet areas and allow for a boost / purge facility to increase the volume of air flow controlled. In order to optimise the energy performance of the system, each unit will incorporate heat recovery.

For the community centre, a natural ventilation strategy is proposed. Given that the building is on multiple floors and based around a central atrium with large open spaces, the opportunity exists to adopt this operational strategy.

## F. Comfort Cooling

The controlled ventilation strategies and high performance fabric within both the residential dwellings and community centre assume that comfort cooling will not be required. Likewise, both buildings will be provided with openable windows, and a summertime boost function on the MVHR (mechanical ventilation unit) will allow the occupants choice as to how to regulate the internal comfort within the apartment blocks.

It should be noted that no internal blinds are assumed for all dwellings.

The table below demonstrates how the development has addressed the issue of cooling in line with Cooling Hierarchy as included within Policy 5.2 of the Minor Alterations to the London Plan (MALP) (March 2016).

| Cooling hierarchy | Proposed Development |
|---|---|
| **1 minimise internal heat generation through energy efficient design** | Selection of high performance glazing units with U values and g- values that exceed Part L 2013 requirements. |
| **2 reduce the amount of heat entering a building in summer through orientation, shading, albedo, fenestration, insulation and green roofs and walls** | In terms of external shading, window reveals and a significant quantum of logias (recessed balconies) substantially reduce excessive solar gains.<br><br>Areas of green roofs are also being considered in combination with the roof mounted PV arrays. |
| **3 manage the heat within the building through exposed internal thermal mass and high ceilings** | An ample floor –ceiling height of 2.5m is provided. A nighttime cooling strategy via openable windows or rooflights is proposed to allow the structure of the buildings to cool down Community Centre only. |
| **4 passive ventilation** | Openable windows are provided to all dwellings and the community centre allow users control over their environment |
| **5 mechanical ventilation** | Mechanical ventilation with heat recovery is to be installed in all dwellings, with a summertime boost function. |
| **6 active cooling systems (ensuring they are the lowest carbon options).** | A in depth overheating analysis has been undertaken for both the community centre and the residential buildings which has highlighted the following issues<br><br>Residential - TM59<br>There are a number of south facing bedrooms and living rooms currently failing the TM59 assessment. Currently the analysis has been carried out excluding blinds and the analysis will be run using blinds to confirm any overheating areas.<br><br>A review is ongoing on how these issues can be mitigated and resolved, trying to avoid any cooling being installed.<br><br>Commercial - TM52<br>The community centre currently passes the TM52 analysis as detailed in the results shown in appendix D.<br><br>During the stage 4 design the scheme, looking at window openings and louvre openings.<br><br>The results of the TM52 and TM59 thermal models can be seen in Appendix D. |

# 5.0 IMPROVEMENT FROM SUPPLYING ENERGY EFFICIENTLY ('BE CLEAN')

## 5.1 District Heating Network

The London Plan shows great support for district heating networks and all developments are required to assess the feasibility of connecting to existing or planned networks, and also the integration with nearby proposed development.

Although not indicated on the London Heat Map below, existing heating networks exist in close proximity and are under London Borough of Camden's ownership. These are Highgate Newtown and Brookfield. However, it is our understanding that these networks are both refurbishments and the respective plant rooms do not include sufficient capacity to extend the networks to service the Highgate Newtown Community Centre.

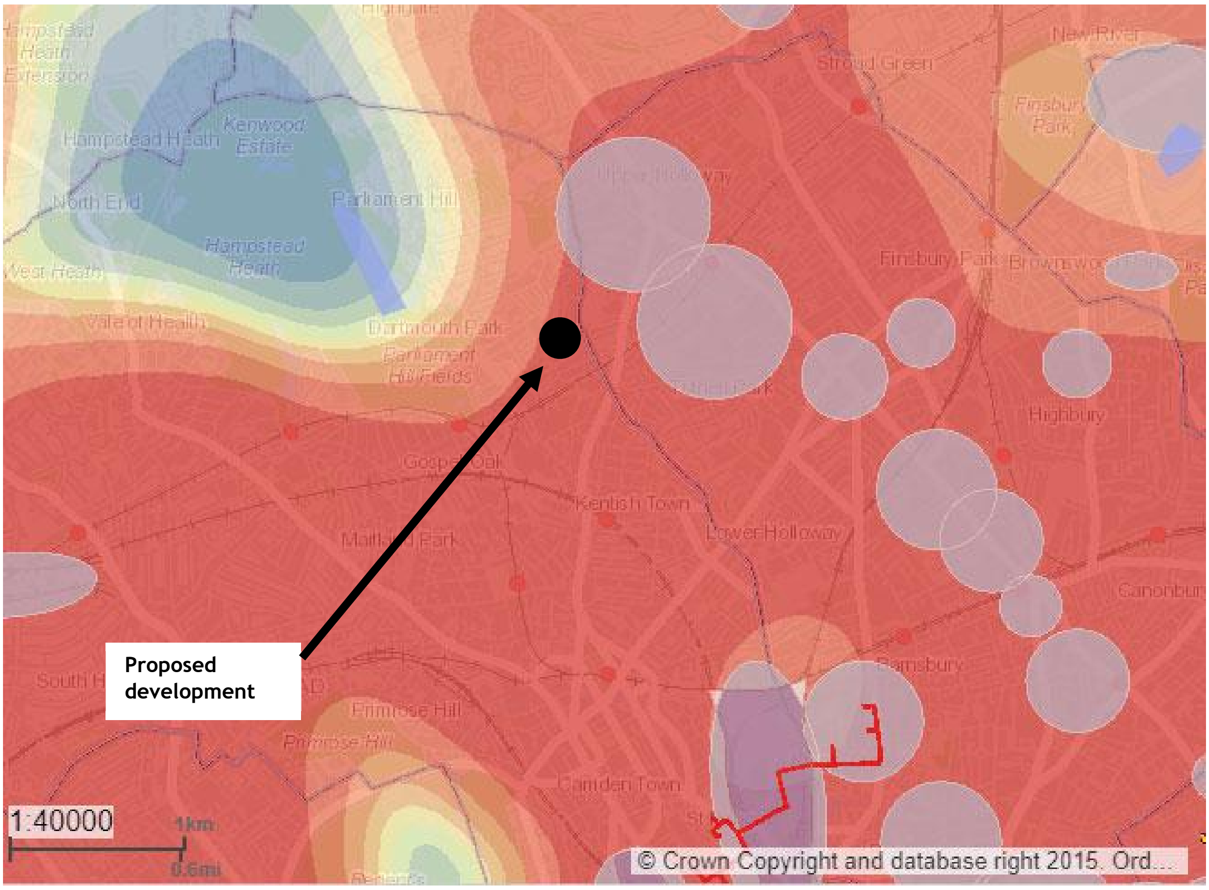



**Figure 1:** London Heat Map showing heat loads and district heating networks in the vicinity of the proposed development.

- Heat mapping decentralised energy potential
- Potential District Heating Networks
- Rivers, lakes or sea
- Existing District Heating Networks

### 5.2 Combined Heat and Power (CHP)

Connecting to a district heating network was the first option assessed. As no suitable heat network currently exists, nor plans confirmed in terms of future network routes, the next priority in Policy 5.6 of the London Plan (MALP) 2016 to be assessed is to install a Combined Heat and Power (CHP) unit. As the plant would be installed onsite, the transmission losses associated with larger district networks would be far reduced. Furthermore, for every unit of electricity generated, the heat can be captured and used for 'free' to contribute to a thermal base load. These two main advantages lead to significant carbon dioxide emissions reductions.

The residential led nature of the scheme is particularly suited to CHP given the large, consistent thermal loads, which allow the CHP unit to run constantly for long periods. This allows it to run most efficiently and maximises its working life. It is assumed that the CHP will be sized to meet around 60% of the total heat demand in the development and it will have community boilers as back up. Detailed calculations load profile calculations will be carried out at Detailed Design.

The inclusion of the community centre within the site wide energy network also complements CHP. The electricity generated whilst the CHP runs during the daytime will directly correspondence with electrical load of the community centre.

In order to estimate the size for the CHP unit, the main considerations are twofold:

1. To ensure the unit would run at the rated output for at least 10 hours per day and 329 days a year (to account for maintenance 10% downtime); and
2. Avoid the need to export electricity or heat

At this stage, it is proposed that a CHP unit of approximately 20 – 25 kWe capacity is installed with thermal stores in order to maximise running hours. The unit selected will be fitted with a scrubber to ensure that the NOx emissions are less than 40mg/kWh.

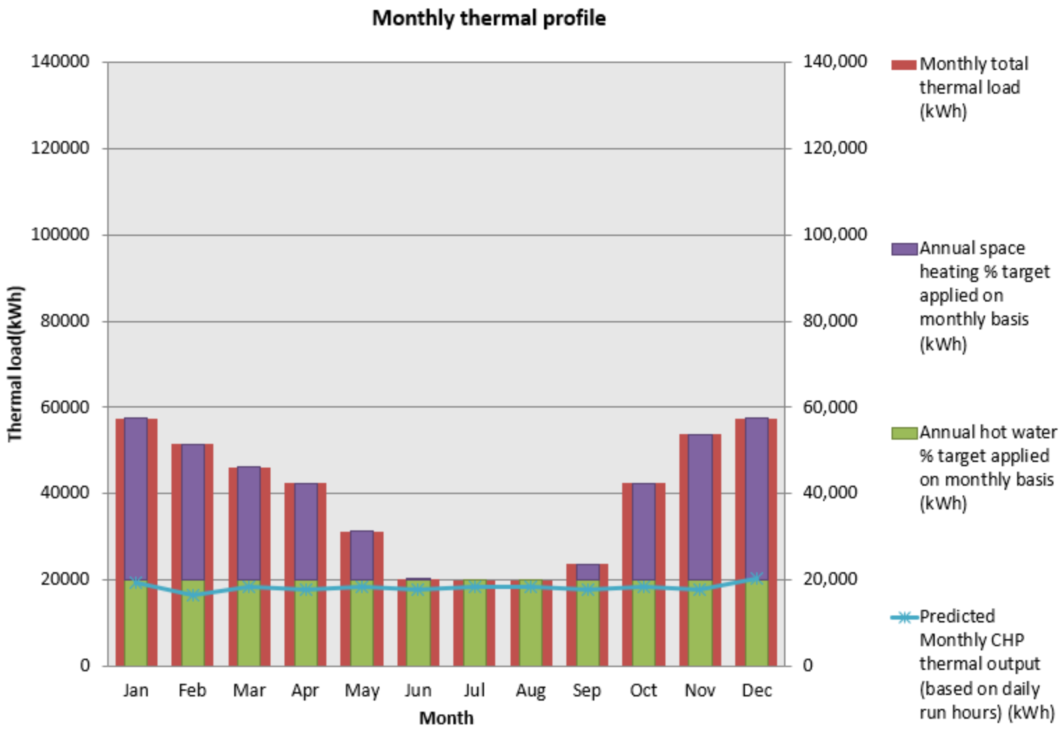
A potential CHP unit for installation is as follows:

<u>XRGI 20 (SAV Systems)</u>

- Electrical rated output (kWe) [efficiency] : 20
- Thermal rated output (kWth) [efficiency]: 38.7
- Overall efficiency 96%

This need to run the CHP as much as possible makes the building load of prime importance when reviewing the viability of such schemes, The main issue is the summer time heat load profile. The CHP therefore needs to be sized to meet the base heat load in the summer time to ensure maximum efficiency.

The below monthly load profile has been produced from the estimated energy consumption of the development.



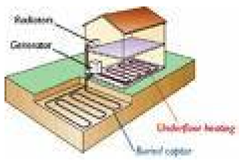

All electricity from the CHP will be fed into the main switch panel to serve Landlords services, such as communal lighting and lifts.

# 6.0 IMPROVEMENT FROM INTRODUCING RENEWABLE ENERGY TECHNOLOGIES ('BE GREEN')

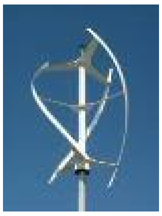
## 6.1 Initial feasibility

A renewable and low carbon technology feasibility study has been carried out to investigate the contribution that on-site generation from renewable energy technologies could make to further reduce the carbon dioxide emissions in the proposed development. The following technologies have been assessed in terms of their technical feasibility and potential $CO_2$ emissions savings:

- Solar thermal water heating;
- Photovoltaics;
- Biomass heating;
- Building mounted and stand-alone wind turbines;
- Ground source heat pumps (GSHP); and
- Air source heat pumps (ASHP).

| Technology | Feasibility | Comments |
|---|---|---|
| **Ground or Air Source Heat Pumps**   | ✗ | Heat Pumps typically meet a proportion of the heating and cooling loads and can be incorporated into the piles of a building structure. However, given that the CHP will provide a significant portion of the thermal demand, it is considered that ground and air source heat pumps being installed in addition would be duplication. |
| **Photovoltaics**  | ✓ | The proposed development has a large area of flat or south facing roof and thus with the appropriate mounting systems can be very favourable for the installation of Photovoltaic panels. Photovoltaic cells would contribute to a proportion of the electrical load of the scheme and also benefit from the Feed in Tariff. |

| Technology | Feasibility | Comments |
|---|---|---|
| **Solar Hot Water Systems**  | ✗ | The hot water load is substantial in any residential scheme. In this case this has been addressed at the second step of the energy hierarchy through the Combined Heat and Power plant; therefore the solar thermal technology would not make a further contribution to the carbon dioxide emissions reduction and will not be considered further. |
| **Biomass Heating**  | ✗ | A communal biomass boiler would be unsuitable for the development due to its central London location and the associated implications of fuel deliveries. Furthermore, given the restricted space between buildings and regular pedestrian movements related to the Community Centre, fuel deliveries from large vehicles would be deemed to pose a significant safety risk. This will not be further considered. |
| **Wind (roof mounted)**  | ✗ | Roof mounted wind turbines are not recommended for this site due to noise, flicker and vibration implications on the residential/non-domestic areas. Numerous inner city wind turbine trials have shown that such turbines' energy yields are significantly lower than manufacturers' estimations. This will not be further considered. |

| Technology | Feasibility | Comments |
|---|---|---|
| **Wind (standalone)**  | ✕ | Small-scale (10m mast), standalone turbines are not suitable for this development due to lack of space on the site and relatively low wind speeds that would be achieved in this very urban environment. This will not be further considered. |

## 6.2 Preferred Options for Renewables

As the proposed development will not include structural piles, a ground source heat pump system is not proposed. The significant roof area is suitable for solar technology, and due to the presence of the CHP unit within the energy strategy, it is considered that a PV array is most suitable.

It is proposed that a 99 panel PV array is installed which will equate to 24.75 kWp, with active area of approximately 160m$^2$. Please refer to Appendix A for an indicative PV layout.

Indicative details of the PV panels are listed below:

| Solar PV Information Required | | Units |
|---|---|---|
| Model | Sanyo HIT-H250E01 | |
| Efficiency | 18 | % |
| Number of PV panels | 99 | |
| Area of PV panels | 160 | m$^2$ |
| Total Capacity (Installed Power) | 24.75 | kWp |
| Total Energy Output | 17,325 | kWh/year |
| $CO_2$ Offset | 8.9 | kg$CO_2$ |
| Emissions Reductions | 17.1 | % |
| Additionally, FiT information can be provided | It should be noted that on 19th July 2018 the Department of Business Energy and Industrial Strategy (BEIS) published a consultation in which they state their intention to close the FIT scheme to new applicants from 1 April 2019. | |

# APPENDIX A - PROPOSED PV LAYOUT

**Proposed PV Layout**

# APPENDIX B1 - SAP OUTPUTS FOR SAMPLE UNITS "LEAN"

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:36:01*

## Project Information:

| | | | |
|---|---|---|---|
| **Assessed By:** | () | **Building Type:** | Flat |

## Dwelling Details:

| | | | |
|---|---|---|---|
| **NEW DWELLING DESIGN STAGE** | | Total Floor Area: 100.24m² | |
| **Site Reference :** | Bertram Street | **Plot Reference:** | 06-18-69419 A-0-06 |
| **Address :** | A-0-06, Bertram Street, London | | |

## Client Details:

| | |
|---|---|
| **Name:** | McBains |
| **Address :** | 26 Finsbury Square, London, EC2A 1DS |

**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 system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 15.23 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 14.10 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 43.7 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 39.2 kWh/m² | |
| | | OK |

## 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 | 0.11 (max. 0.25) | 0.11 (max. 0.70) | OK |
| Roof | (no roof) | | |
| Openings | 1.40 (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: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |

Based on:

| | |
|---|---|
| Overshading: | Average or unknown |
| Windows facing: South | 12.15m² |
| Windows facing: South East | 7.63m² |
| Ventilation rate: | 2.00 |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Floors U-value | 0.11 W/m²K |
| Community heating, heat from boilers – mains gas | |

# Predicted Energy Assessment

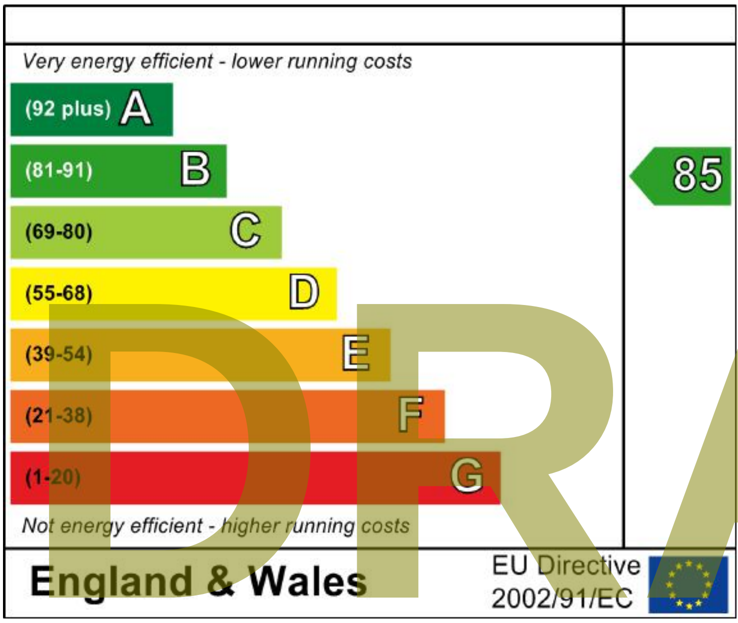
A-0-06
Bertram Street
London

Dwelling type: Ground floor Flat
Date of assessment: 22 January 2019
Produced by: Stroma Certification
Total floor area: 100.24 m²

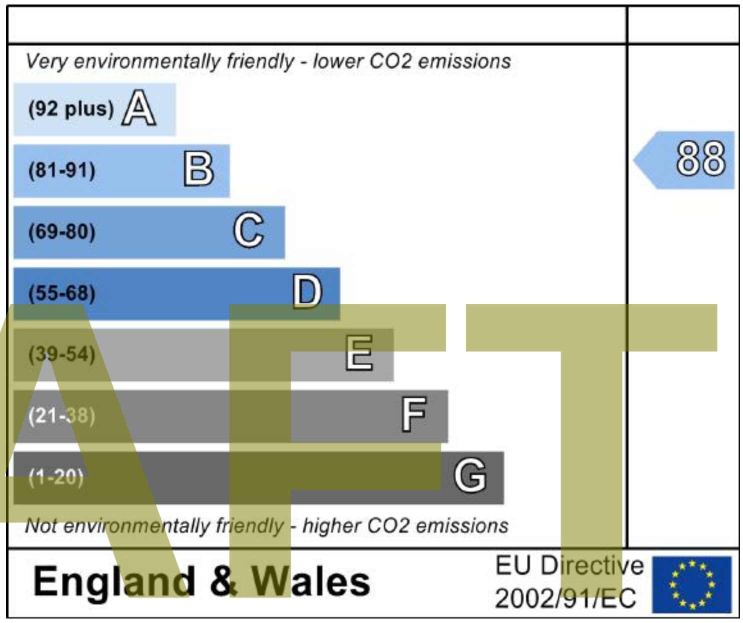
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-0-06

| | |
|---|---|
| Address: | A-0-06, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 166.49 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 100.24 m² | 2.4 m |
| Living area: | 37.51 m² (fraction 0.374) | |
| Front of dwelling faces: | North | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.44 | 1.4 | 12.15 | 1 |
| Side | 16mm or more | 0.7 | 0.44 | 1.4 | 7.63 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | North | 0 | 0 |
| Rear | | External Wall | South | 0 | 0 |
| Side | | External Wall | South East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 77.99 | 21.88 | 56.11 | 0.15 | 0 | False | 14 |
| Corridor Wall | 3.6 | 0 | 3.6 | 0.15 | 0.43 | False | 14 |
| Riser Wall | 4.8 | 0 | 4.8 | 0.15 | 0 | False | 14 |
| Ground Floor | 100.24 | | | 0.11 | | | 110 |
| Internal Elements | | | | | | | |
| Stud Walls | 144 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 22.8 | | | | | | 20 |
| Party Ceiling | 100.24 | | | | | | 30 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0654

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 23.4 | 0.05 | E4 | Jamb |
| [Approved] | 35.99 | 0.16 | E5 | Ground floor (normal) |
| [Approved] | 35.99 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 9.5 | 0.16 | P1 | Ground floor |
| | 9.5 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, Rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 3

## Main heating system:

Main heating system: Community heating schemes
Heat source: Community boilers
heat from boilers – mains gas, heat fraction 1, efficiency 89.5
Piping>=1991, pre-insulated, low temp, variable flow

## Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and TRVs
Control code: 2306

## Secondary heating system:

Secondary heating system: None

## Water heating:

Water heating: From main heating system
Water code: 901
Fuel :heat from boilers – mains gas
No hot water cylinder
Solar panel: False

## Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Dense urban
EPC language: English
Wind turbine: No
Photovoltaics: None
Assess Zero Carbon Home: No

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | | **Stroma Number:** | |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

## Property Address: 06-18-69419 A-0-06

**Address :** A-0-06, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 100.24 | (1a) x | 2.4 | (2a) = | 240.58 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 100.24 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 240.58 | (5) |

## 2. Ventilation rate:

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



| | | | Air changes per hour | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |



## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 12.15 | x1/[1/( 1.4 )+ 0.04] | | = | 16.11 | | | (27) |
| Windows Type 2 | | | 7.63 | x1/[1/( 1.4 )+ 0.04] | | = | 10.12 | | | (27) |
| Floor | | | 100.24 | x | 0.11 | = | 11.0264 | 110 | 11026.4 | (28) |
| Walls Type1 | 77.99 | 21.88 | 56.11 | x | 0.15 | = | 8.42 | 14 | 785.54 | (29) |
| Walls Type2 | 3.6 | 0 | 3.6 | x | 0.14 | = | 0.51 | 14 | 50.4 | (29) |
| Walls Type3 | 4.8 | 0 | 4.8 | x | 0.15 | = | 0.72 | 14 | 67.2 | (29) |
| Total area of elements, m² | | | 186.63 | | | | | | | (31) |
| Party wall | | | 22.8 | x | 0 | = | 0 | 20 | 456 | (32) |
| Party ceiling | | | 100.24 | | | | | 30 | 3007.2 | (32b) |
| Internal wall ** | | | 144 | | | | | 9 | 1296 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 49.83 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 16688.74 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 166.49 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 12.2 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 62.04 (37)

# SAP WorkSheet: New dwelling design stage

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 20.88 | 20.63 | 20.38 | 19.11 | 18.86 | 17.59 | 17.59 | 17.34 | 18.1 | 18.86 | 19.37 | 19.87 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 82.92 | 82.67 | 82.42 | 81.15 | 80.9 | 79.63 | 79.63 | 79.38 | 80.14 | 80.9 | 81.4 | 81.91 | |

Average = $Sum(39)_{1...12}$ /12= 81.09 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.83 | 0.82 | 0.82 | 0.81 | 0.81 | 0.79 | 0.79 | 0.79 | 0.8 | 0.81 | 0.81 | 0.82 | |

Average = $Sum(40)_{1...12}$ /12= 0.81 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.74 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.32 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

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

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 109.25 | 105.28 | 101.3 | 97.33 | 93.36 | 89.38 | 89.38 | 93.36 | 97.33 | 101.3 | 105.28 | 109.25 | |

Total = $Sum(44)_{1...12}$ = 1191.79 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 162.01 | 141.7 | 146.22 | 127.48 | 122.32 | 105.55 | 97.81 | 112.24 | 113.58 | 132.36 | 144.48 | 156.9 | |

Total = $Sum(45)_{1...12}$ = 1562.63 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 24.3 | 21.25 | 21.93 | 19.12 | 18.35 | 15.83 | 14.67 | 16.84 | 17.04 | 19.85 | 21.67 | 23.53 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 217.29 | 191.62 | 201.49 | 180.97 | 177.59 | 159.04 | 153.08 | 167.51 | 167.07 | 187.64 | 197.98 | 212.18 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 217.29 | 191.62 | 201.49 | 180.97 | 177.59 | 159.04 | 153.08 | 167.51 | 167.07 | 187.64 | 197.98 | 212.18 |

Output from water heater (annual)$_{1...12}$ | 2213.47 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 98.09 | 87.06 | 92.84 | 85.18 | 84.89 | 77.89 | 76.74 | 81.54 | 80.56 | 88.23 | 90.84 | 96.39 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 57.7 | 51.25 | 41.68 | 31.55 | 23.59 | 19.91 | 21.52 | 27.97 | 37.54 | 47.67 | 55.63 | 59.31 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 383.16 | 387.13 | 377.11 | 355.78 | 328.86 | 303.55 | 286.65 | 282.67 | 292.69 | 314.02 | 340.95 | 366.25 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 131.84 | 129.55 | 124.78 | 118.31 | 114.1 | 108.18 | 103.15 | 109.6 | 111.89 | 118.59 | 126.16 | 129.56 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 681.73 | 676.96 | 652.6 | 614.67 | 575.57 | 540.67 | 520.34 | 529.26 | 551.14 | 589.3 | 631.77 | 664.14 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | Access Factor Table 6d | Area m² | Flux Table 6a | g_ Table 6b | FF Table 6c | Gains (W) |
|---|---|---|---|---|---|---|

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 36.79 | x | 0.44 | x | 0.7 | = | 59.92 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 62.67 | x | 0.44 | x | 0.7 | = | 102.07 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 85.75 | x | 0.44 | x | 0.7 | = | 139.65 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 106.25 | x | 0.44 | x | 0.7 | = | 173.04 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 119.01 | x | 0.44 | x | 0.7 | = | 193.82 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 118.15 | x | 0.44 | x | 0.7 | = | 192.42 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 113.91 | x | 0.44 | x | 0.7 | = | 185.51 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 104.39 | x | 0.44 | x | 0.7 | = | 170.01 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 92.85 | x | 0.44 | x | 0.7 | = | 151.22 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 69.27 | x | 0.44 | x | 0.7 | = | 112.81 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 44.07 | x | 0.44 | x | 0.7 | = | 71.77 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 31.49 | x | 0.44 | x | 0.7 | = | 51.28 | (77) |
| South | 0.9x | 0.77 | x | 12.15 | x | 46.75 | x | 0.44 | x | 0.7 | = | 121.24 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 76.57 | x | 0.44 | x | 0.7 | = | 198.57 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 97.53 | x | 0.44 | x | 0.7 | = | 252.94 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 110.23 | x | 0.44 | x | 0.7 | = | 285.88 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 114.87 | x | 0.44 | x | 0.7 | = | 297.9 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 110.55 | x | 0.44 | x | 0.7 | = | 286.69 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 108.01 | x | 0.44 | x | 0.7 | = | 280.11 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 104.89 | x | 0.44 | x | 0.7 | = | 272.03 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 101.89 | x | 0.44 | x | 0.7 | = | 264.22 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 82.59 | x | 0.44 | x | 0.7 | = | 214.17 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 55.42 | x | 0.44 | x | 0.7 | = | 143.72 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 40.4 | x | 0.44 | x | 0.7 | = | 104.77 | (78) |



Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 181.17 | 300.64 | 392.59 | 458.91 | 491.72 | 479.11 | 465.62 | 442.04 | 415.44 | 326.98 | 215.49 | 156.05 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 862.89 | 977.59 | 1045.2 | 1073.59 | 1067.29 | 1019.78 | 985.96 | 971.3 | 966.59 | 916.28 | 847.25 | 820.19 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.96 | 0.93 | 0.88 | 0.79 | 0.66 | 0.49 | 0.35 | 0.37 | 0.56 | 0.79 | 0.92 | 0.96 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.23 | 20.41 | 20.61 | 20.81 | 20.93 | 20.99 | 21 | 21 | 20.98 | 20.84 | 20.51 | 20.19 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.23 | 20.23 | 20.23 | 20.25 | 20.25 | 20.26 | 20.26 | 20.26 | 20.25 | 20.25 | 20.24 | 20.24 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.95 | 0.91 | 0.86 | 0.76 | 0.62 | 0.44 | 0.29 | 0.31 | 0.5 | 0.76 | 0.91 | 0.96 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.21 | 19.47 | 19.76 | 20.03 | 20.18 | 20.25 | 20.26 | 20.26 | 20.23 | 20.07 | 19.63 | 19.16 | (90) |

fLA = Living area ÷ (4) = 0.37 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.59 | 19.82 | 20.08 | 20.32 | 20.46 | 20.53 | 20.53 | 20.54 | 20.51 | 20.36 | 19.96 | 19.55 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.59 | 19.82 | 20.08 | 20.32 | 20.46 | 20.53 | 20.53 | 20.54 | 20.51 | 20.36 | 19.96 | 19.55 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.94 | 0.91 | 0.85 | 0.76 | 0.63 | 0.46 | 0.32 | 0.34 | 0.52 | 0.76 | 0.9 | 0.95 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 812.67 | 886.16 | 891.54 | 818.05 | 672.39 | 465.88 | 312.5 | 327.17 | 502.41 | 697.44 | 764.41 | 779.61 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 1268.05 | 1233.74 | 1118.92 | 926.91 | 708.88 | 471.83 | 313.3 | 328.25 | 513.89 | 789.25 | 1047.02 | 1257.12 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 338.8 | 233.57 | 169.17 | 78.39 | 27.15 | 0 | 0 | 0 | 0 | 68.31 | 203.47 | 355.27 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1474.12 (98)

Space heating requirement in kWh/m²/year 14.71 (99)



## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | |
|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1474.12 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1547.83 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2213.47 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2324.14 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 38.72 | (313) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 194.45 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 194.45 | (331) |
| Energy for lighting (calculated in Appendix L) | | 407.62 | (332) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 4.24 | x 0.01 = | 65.63 | (340a) |
| Water heating from CHP | (310a) x | 4.24 | x 0.01 = | 98.54 | (342a) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 25.65 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 53.77 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 363.58 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.05 | (357) |
| **SAP rating (section12)** | | 85.33 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | **Energy** kWh/year | **Emission factor** kg CO2/kWh | | **Emissions** kg CO2/year | |
|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP)<br>Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 89.5 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | 0.22 | = | 934.47 | (367) |
| Electrical energy for heat distribution | [(313) x | 0.52 | = | 20.1 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 954.56 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 954.56 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 100.92 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 211.56 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 1267.03 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 12.64 | (384) |

## EI rating (section 14)

| | | | | | |
|---|---|---|---|---|---|
| **EI rating (section 14)** | | | | 88.31 | (385) |

### 13b. Primary Energy – Community heating scheme

| | | **Energy kWh/year** | **Primary factor** | | **P.Energy kWh/year** | |
|---|---|---|---|---|---|---|
| Energy from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| Energy associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 1.22 | = | 5278 | (367) |
| Electrical energy for heat distribution | [(313) x | | | = | 118.87 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | = | 5396.87 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | 5396.87 | (373) |
| Energy associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | 5396.87 | (376) |
| Energy associated with space cooling | (315) x | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | 3.07 | = | 596.95 | (378) |
| Energy associated with electricity for lighting | (332))) x | | 3.07 | = | 1251.4 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | 7245.22 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 A-0-06

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | North |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 166.49 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 2 ( Windows open half the time) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 158.78 | **(P1)** |
| **Transmission heat loss coefficient:** | 62 | |
| **Summer heat loss coefficient:** | 220.82 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| South (Rear) | 0 | 1 |
| South East (Side) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| South (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| South East (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| South (Rear) | 0.9 x | 12.15 | 112.21 | 0.44 | 0.7 | 0.76 | 289.1 | |
| South East (Side) | 0.9 x | 7.63 | 119.92 | 0.44 | 0.7 | 0.76 | 194.03 | |
| | | | | | | **Total** | 483.13 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 540.67 | 520.34 | 529.26 | |
| Total summer gains | 1044.04 | 1003.47 | 995.51 | **(P5)** |
| Summer gain/loss ratio | 4.73 | 4.54 | 4.51 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 0.83 | 0.83 | 0.83 | |
| Threshold temperature | 21.56 | 23.28 | 23.14 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:35:58*

## Project Information:

**Assessed By:** ()　　**Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE**　　Total Floor Area: 70.75m²

**Site Reference :** Bertram Street　　**Plot Reference:** 06-18-69419 A-1-01

**Address :** A-1-01, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 15.86 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 14.61 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 38.8 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 34.4 kWh/m² | |
| | | OK |



## 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 | 1.40 (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: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |

Based on:

| | |
|---|---|
| Overshading: | Average or unknown |
| Windows facing: North | 1.92m² |
| Windows facing: West | 15.96m² |
| Ventilation rate: | 4.00 |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

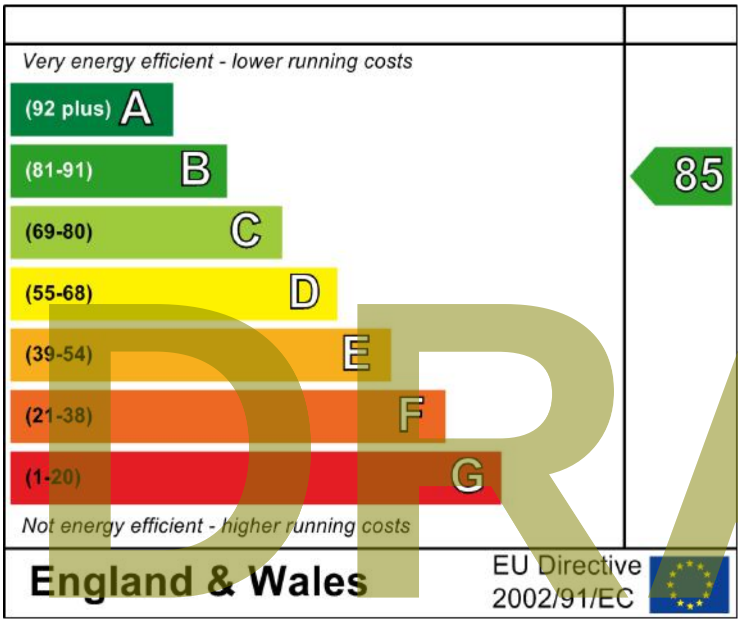
# Predicted Energy Assessment

| | | | |
|---|---|---|---|
| A-1-01 | | Dwelling type: | Mid floor Flat |
| Bertram Street | | Date of assessment: | 22 January 2019 |
| London | | Produced by: | Stroma Certification |
| | | Total floor area: | 70.75 m² |

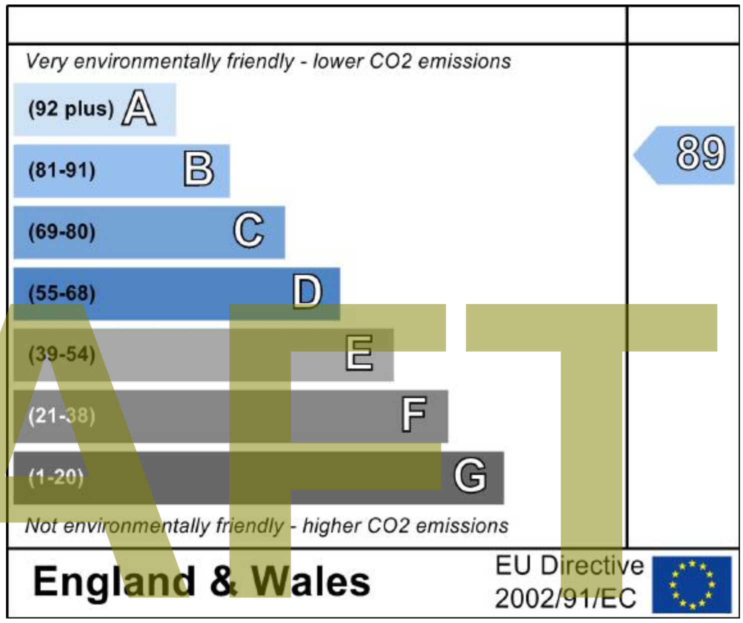
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating






The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-1-01

| | |
|---|---|
| Address: | A-1-01, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 99.4 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 70.75 m² | 2.4 m |
| Living area: | 25.03 m² (fraction 0.354) | |
| Front of dwelling faces: | South | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 1.92 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 15.96 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | South | 0 | 0 |
| Rear | | External Wall | North | 0 | 0 |
| Side | | External Wall | West | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 47.64 | 19.98 | 27.66 | 0.15 | 0 | False | 14 |
| Corridor Wall | 8.02 | 0 | 8.02 | 0.15 | 0.43 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 105.6 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 31.51 | | | | | | 20 |
| Party Ceiling | 70.75 | | | | | | 30 |
| Party Floor | 70.75 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0964

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 23.4 | 0.05 | E4 | Jamb |
| [Approved] | 46.38 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 4.8 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 7.2 | 0.06 | E18 | Party wall between dwellings |
| | 26.26 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, Rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 3

## Main heating system:

Main heating system: Community heating schemes
Heat source: Community boilers
heat from boilers – mains gas, heat fraction 1, efficiency 89.5
Piping>=1991, pre-insulated, low temp, variable flow

## Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and TRVs
Control code: 2306

## Secondary heating system:

Secondary heating system: None

## Water heating:

Water heating: From main heating system
Water code: 901
Fuel :heat from CHP
No hot water cylinder
Solar panel: False

## Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Dense urban
EPC language: English
Wind turbine: No
Photovoltaics: None
Assess Zero Carbon Home: No

# SAP WorkSheet: New dwelling design stage

**User Details:**

| | | | |
|---|---|---|---|
| **Assessor Name:** | | **Stroma Number:** | |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

**Property Address: 06-18-69419 A-1-01**

**Address :** A-1-01, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 70.75 | (1a) x | 2.4 | (2a) = | 169.8 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 70.75 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 169.8 | (5) |

## 2. Ventilation rate:

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

| | | | | Air changes per hour | |
|---|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = | (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |
| *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | | |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 1.92 | x1/[1/( 1.4 )+ 0.04] | | = | 2.55 | | | (27) |
| Windows Type 2 | | | 15.96 | x1/[1/( 1.4 )+ 0.04] | | = | 21.16 | | | (27) |
| Walls Type1 | 47.64 | 19.98 | 27.66 | x | 0.15 | = | 4.15 | 14 | 387.24 | (29) |
| Walls Type2 | 8.02 | 0 | 8.02 | x | 0.14 | = | 1.13 | 14 | 112.28 | (29) |
| Total area of elements, m² | | | 55.66 | | | | | | | (31) |
| Party wall | | | 31.51 | x | 0 | = | 0 | 20 | 630.2 | (32) |
| Party floor | | | 70.75 | | | | | 40 | 2830 | (32a) |
| Party ceiling | | | 70.75 | | | | | 30 | 2122.5 | (32b) |
| Internal wall ** | | | 105.6 | | | | | 9 | 950.4 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.92 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 7032.62 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 99.4 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 5.36 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 37.29 (37)

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 14.74 | 14.56 | 14.38 | 13.49 | 13.31 | 12.42 | 12.42 | 12.24 | 12.78 | 13.31 | 13.67 | 14.03 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 52.03 | 51.85 | 51.67 | 50.78 | 50.6 | 49.71 | 49.71 | 49.53 | 50.06 | 50.6 | 50.96 | 51.31 |

Average = Sum(39)$_{1…12}$ /12= 50.73 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.74 | 0.73 | 0.73 | 0.72 | 0.72 | 0.7 | 0.7 | 0.7 | 0.71 | 0.72 | 0.72 | 0.73 |

Average = Sum(40)$_{1…12}$ /12= 0.72 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.26 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.97 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 96.77 | 93.25 | 89.73 | 86.22 | 82.7 | 79.18 | 79.18 | 82.7 | 86.22 | 89.73 | 93.25 | 96.77 |

Total = Sum(44)$_{1…12}$ = 1055.7 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 143.51 | 125.51 | 129.52 | 112.92 | 108.35 | 93.5 | 86.64 | 99.42 | 100.61 | 117.25 | 127.98 | 138.98 |

Total = Sum(45)$_{1…12}$ = 1384.18 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 21.53 | 18.83 | 19.43 | 16.94 | 16.25 | 14.02 | 13 | 14.91 | 15.09 | 17.59 | 19.2 | 20.85 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Primary circuit loss (annual) from Table 3 | | | | | | | | | | | | 0 | (58) |

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 198.79 | 175.44 | 184.8 | 166.41 | 163.63 | 146.99 | 141.91 | 154.7 | 154.1 | 172.52 | 181.48 | 194.26 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 198.79 | 175.44 | 184.8 | 166.41 | 163.63 | 146.99 | 141.91 | 154.7 | 154.1 | 172.52 | 181.48 | 194.26 | |

Output from water heater (annual)$_{1...12}$ 2035.02 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 91.94 | 81.68 | 87.29 | 80.34 | 80.25 | 73.88 | 73.03 | 77.28 | 76.25 | 83.21 | 85.35 | 90.43 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating



## 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= | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | | | | | | | | | | | | | |
| (67)m= | 44.36 | 39.4 | 32.04 | 24.26 | 18.13 | 15.31 | 16.54 | 21.5 | 28.86 | 36.64 | 42.77 | 45.59 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | | | | | | | | | | | | | |
| (68)m= | 297.08 | 300.16 | 292.39 | 275.85 | 254.98 | 235.36 | 222.25 | 219.17 | 226.93 | 243.47 | 264.35 | 283.97 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | | | | | | | | | | | | | |
| (69)m= | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | (69) |
| Pumps and fans gains (Table 5a) | | | | | | | | | | | | | |
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |
| Losses e.g. evaporation (negative values) (Table 5) | | | | | | | | | | | | | |
| (71)m= | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | (71) |
| Water heating gains (Table 5) | | | | | | | | | | | | | |
| (72)m= | 123.57 | 121.54 | 117.32 | 111.58 | 107.86 | 102.61 | 98.16 | 103.87 | 105.9 | 111.84 | 118.54 | 121.55 | (72) |
| **Total internal gains =** | | | | | | (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m | | | | | | | |
| (73)m= | 561.14 | 557.24 | 537.89 | 507.83 | 477.1 | 449.41 | 433.08 | 440.67 | 457.83 | 488.09 | 521.79 | 547.25 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 1.92 | x | 10.63 | x | 0.558 | x | 0.7 | = | 5.53 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 20.32 | x | 0.558 | x | 0.7 | = | 10.56 | (74) |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 1.92 | x | 34.53 | x | 0.558 | x | 0.7 | = | 17.95 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 55.46 | x | 0.558 | x | 0.7 | = | 28.83 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 74.72 | x | 0.558 | x | 0.7 | = | 38.83 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 79.99 | x | 0.558 | x | 0.7 | = | 41.57 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 74.68 | x | 0.558 | x | 0.7 | = | 38.81 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 59.25 | x | 0.558 | x | 0.7 | = | 30.79 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 41.52 | x | 0.558 | x | 0.7 | = | 21.58 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 24.19 | x | 0.558 | x | 0.7 | = | 12.57 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 13.12 | x | 0.558 | x | 0.7 | = | 6.82 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 8.86 | x | 0.558 | x | 0.7 | = | 4.61 | (74) |
| West | 0.9x | 0.77 | x | 15.96 | x | 19.64 | x | 0.56 | x | 0.7 | = | 84.85 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 38.42 | x | 0.56 | x | 0.7 | = | 165.98 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 63.27 | x | 0.56 | x | 0.7 | = | 273.35 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 92.28 | x | 0.56 | x | 0.7 | = | 398.66 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 113.09 | x | 0.56 | x | 0.7 | = | 488.58 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 115.77 | x | 0.56 | x | 0.7 | = | 500.15 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 110.22 | x | 0.56 | x | 0.7 | = | 476.16 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 94.68 | x | 0.56 | x | 0.7 | = | 409.01 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 73.59 | x | 0.56 | x | 0.7 | = | 317.92 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 45.59 | x | 0.56 | x | 0.7 | = | 196.95 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 24.49 | x | 0.56 | x | 0.7 | = | 105.8 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 16.15 | x | 0.56 | x | 0.7 | = | 69.78 | (80) |



Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 90.38 | 176.54 | 291.3 | 427.49 | 527.41 | 541.72 | 514.97 | 439.8 | 339.49 | 209.52 | 112.61 | 74.38 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 651.52 | 733.78 | 829.18 | 935.32 | 1004.51 | 991.13 | 948.05 | 880.47 | 797.32 | 697.61 | 634.41 | 621.63 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.87 | 0.83 | 0.74 | 0.6 | 0.45 | 0.32 | 0.23 | 0.26 | 0.42 | 0.66 | 0.82 | 0.89 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.11 | 20.32 | 20.59 | 20.84 | 20.95 | 20.99 | 21 | 21 | 20.97 | 20.81 | 20.44 | 20.08 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.31 | 20.31 | 20.31 | 20.33 | 20.33 | 20.34 | 20.34 | 20.34 | 20.33 | 20.33 | 20.32 | 20.32 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.86 | 0.81 | 0.72 | 0.57 | 0.42 | 0.29 | 0.2 | 0.22 | 0.38 | 0.63 | 0.8 | 0.88 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.13 | 19.42 | 19.8 | 20.13 | 20.27 | 20.33 | 20.34 | 20.34 | 20.31 | 20.1 | 19.61 | 19.09 | (90) |

fLA = Living area ÷ (4) = | 0.35 | (91)

# SAP WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.48 | 19.74 | 20.08 | 20.38 | 20.51 | 20.56 | 20.57 | 20.57 | 20.54 | 20.35 | 19.9 | 19.44 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.48 | 19.74 | 20.08 | 20.38 | 20.51 | 20.56 | 20.57 | 20.57 | 20.54 | 20.35 | 19.9 | 19.44 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.85 | 0.8 | 0.71 | 0.57 | 0.43 | 0.3 | 0.21 | 0.23 | 0.4 | 0.63 | 0.79 | 0.86 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 551.26 | 584.45 | 588.51 | 536.83 | 431.89 | 293.74 | 196.83 | 205.75 | 314.96 | 440.63 | 501.98 | 534.12 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 789.82 | 769.53 | 701.59 | 582.83 | 445.83 | 296.37 | 197.36 | 206.57 | 322.44 | 493.29 | 652.36 | 781.84 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 177.49 | 124.37 | 84.13 | 33.12 | 10.37 | 0 | 0 | 0 | 0 | 39.18 | 108.28 | 184.3 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 761.25 (98)

Space heating requirement in kWh/m²/year 10.76 (99)



## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 761.25 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 799.32 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2035.02 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2136.77 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 29.36 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Electricity for pumps and fans within dwelling (Table 4f): | | | |
| mechanical ventilation - balanced, extract or positive input from outside | | 137.24 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 137.24 | (331) |
| Energy for lighting (calculated in Appendix L) | | 313.38 | (332) |

## 10b. Fuel costs – Community heating scheme

| | Fuel kWh/year | | Fuel Price (Table 12) | | Fuel Cost £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 4.24 | x 0.01 = | 33.89 | (340a) |
| Water heating from CHP | (310a) | x | 4.24 | x 0.01 = | 90.6 | (342a) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 18.1 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 41.33 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 303.93 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.1 | (357) |
| **SAP rating (section12)** | | 84.62 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 708.6 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 15.24 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 723.84 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 723.84 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 71.23 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 162.64 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 957.71 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 13.54 | (384) |
| **EI rating (section 14)** | | | | | 88.91 | (385) |

## 13b. Primary Energy – Community heating scheme

| Energy kWh/year | Primary factor | P.Energy kWh/year |
|---|---|---|

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Energy from other sources of space and water heating (not CHP) | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 89.5 | (367a) |
| Energy associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | 1.22 | = | 4002.27 | (367) |
| Electrical energy for heat distribution | [(313) x | | = | 90.14 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | = | 4092.41 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | 4092.41 | (373) |
| Energy associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | 4092.41 | (376) |
| Energy associated with space cooling | (315) x | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | 3.07 | = | 421.33 | (378) |
| Energy associated with electricity for lighting | (332))) x | 3.07 | = | 962.07 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | 5475.8 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 A-1-01

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | South |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 99.4 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 224.14 | **(P1)** |
| **Transmission heat loss coefficient:** | 37.3 | |
| **Summer heat loss coefficient:** | 261.42 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| North (Rear) | 0 | 1 |
| West (Side) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| North (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| West (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| North (Rear) | 0.9 x | 1.92 | 81.19 | 0.56 | 0.7 | 0.76 | 41.92 | |
| West (Side) | 0.9 x | 15.96 | 117.51 | 0.56 | 0.7 | 0.76 | 504.35 | |
| | | | | | | **Total** | 546.27 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 449.41 | 433.08 | 440.67 | |
| Total summer gains | 1030.15 | 979.35 | 918.46 | **(P5)** |
| Summer gain/loss ratio | 3.94 | 3.75 | 3.51 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.3 | 1.3 | 1.3 | |
| Threshold temperature | 21.24 | 22.95 | 22.62 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:35:55*



## Project Information:

**Assessed By:** ()    **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE**    Total Floor Area: 53.39m²

**Site Reference :** Bertram Street    **Plot Reference:** 06-18-69419 A-1-07

**Address :** A-1-07, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 21.9 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 22.06 kg/m² | **Fail** |

Excess emissions = 0.16 kg/m² (0.7 %)

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 62.0 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 59.4 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.14 (max. 0.30) | 0.15 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | 0.20 (max. 0.25) | 0.20 (max. 0.70) | **OK** |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | **OK** |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | OK |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | OK |
| MVHR efficiency: | 94% | |
| Minimum | 70% | OK |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | OK |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: East | 15.96m² | |
| Windows facing: North | 2.4m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| External Walls U-value | 0.13 W/m²K |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# Predicted Energy Assessment

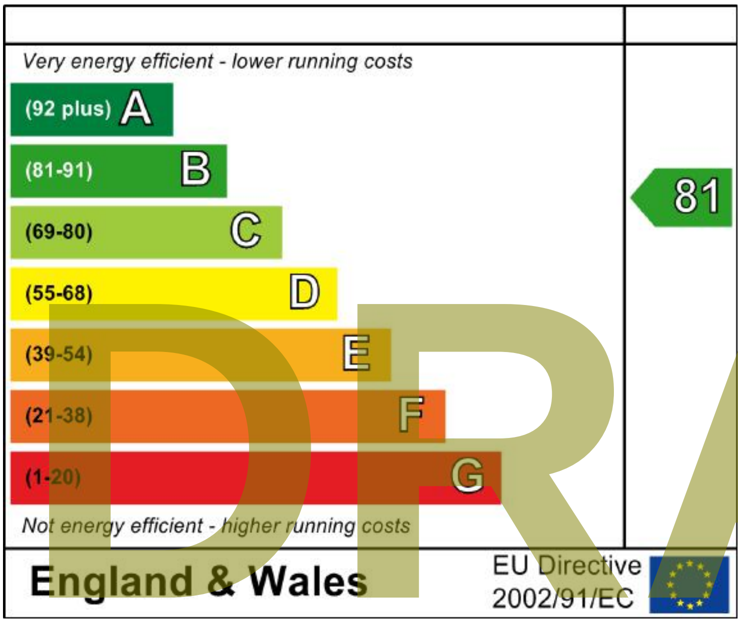
A-1-07
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Mid floor Flat |
| Date of assessment: | 22 January 2019 |
| Produced by: | Stroma Certification |
| Total floor area: | 53.39 m² |

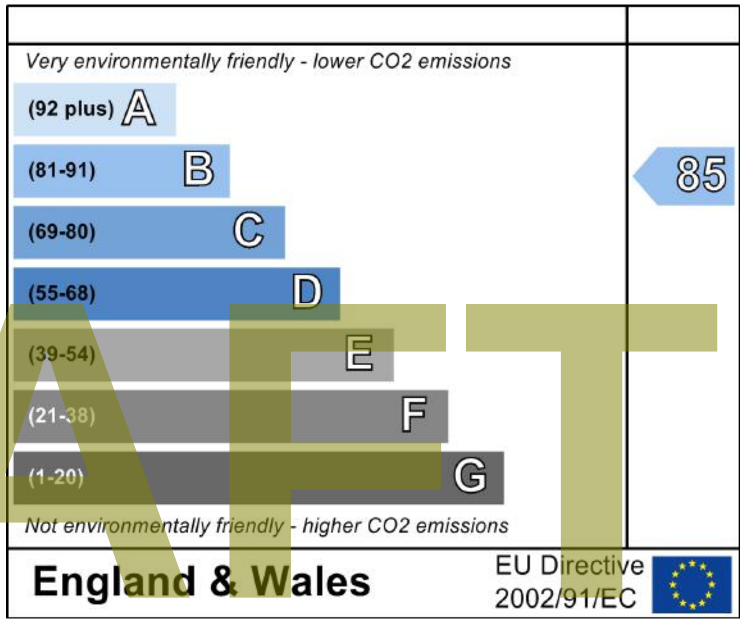
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating






The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input



## Property Details: 06-18-69419 A-1-07

| | |
|---|---|
| Address: | A-1-07, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 136.43 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 53.39 m² | 2.4 m |
| Living area: | 24.42 m² (fraction 0.457) | |
| Front of dwelling faces: | West | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 15.96 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 2.4 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | West | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |
| Side | | External Wall | North | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| <u>External Elements</u> | | | | | | | |
| External Wall | 27.89 | 20.46 | 7.43 | 0.15 | 0 | False | 14 |
| Corridor Wall | 15.07 | 0 | 15.07 | 0.15 | 0.43 | False | 14 |
| Lift Wall | 14.57 | 0 | 14.57 | 0.15 | 0 | False | 14 |
| Stair Wall | 7.03 | 0 | 7.03 | 0.15 | 0.9 | False | 14 |
| Exposed Floor | 53.39 | | | 0.2 | | | 75 |
| <u>Internal Elements</u> | | | | | | | |
| Stud Walls | 81.6 | | | | | | 9 |
| <u>Party Elements</u> | | | | | | | |
| Party Wall | 16.32 | | | | | | 20 |
| Party Ceiling | 53.39 | | | | | | 30 |

# SAP Input

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1167

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 23.4 | 0.05 | E4 | Jamb |
| [Approved] | 26.9 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 4.8 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 26.9 | 0.32 | E20 | Exposed floor (normal) |
| | 6.8 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 6.8 | 0.16 | P7 | Exposed floor (normal) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 3 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 1, efficiency 89.5<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

**Assessor Name:** | **Stroma Number:**
**Software Name:** Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.16

## Property Address: 06-18-69419 A-1-07

**Address :** A-1-07, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 53.39 | (1a) x | 2.4 | (2a) = | 128.14 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 53.39 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 128.14 | (5) |

## 2. Ventilation rate:

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

DRAFT

| | | | Air changes per hour | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = | (6a)+(6b)+(7a)+(7b)+(7c) = | 0 ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 3 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.78 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.12 | (21) |

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.15 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.12 | 0.12 | 0.13 | 0.14 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 15.96 | x1/[1/( 1.4 )+ 0.04] | | = | 21.16 | | | (27) |
| Windows Type 2 | | | 2.4 | x1/[1/( 1.4 )+ 0.04] | | = | 3.18 | | | (27) |
| Floor | | | 53.39 | x | 0.2 | = | 10.678 | 75 | 4004.25 | (28) |
| Walls Type1 | 27.89 | 20.46 | 7.43 | x | 0.15 | = | 1.11 | 14 | 104.02 | (29) |
| Walls Type2 | 15.07 | 0 | 15.07 | x | 0.14 | = | 2.12 | 14 | 210.98 | (29) |
| Walls Type3 | 14.57 | 0 | 14.57 | x | 0.15 | = | 2.19 | 14 | 203.98 | (29) |
| Walls Type4 | 7.03 | 0 | 7.03 | x | 0.13 | = | 0.93 | 14 | 98.42 | (29) |
| Total area of elements, m² | | | 117.95 | | | | | | | (31) |
| Party wall | | | 16.32 | x | 0 | = | 0 | 20 | 326.4 | (32) |
| Party ceiling | | | 53.39 | | | | | 30 | 1601.7 | (32b) |
| Internal wall ** | | | 81.6 | | | | | 9 | 734.4 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 44.31 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 7284.15 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 136.43 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 13.77 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

# SAP WorkSheet: New dwelling design stage

Total fabric heat loss (33) + (36) = 58.08 (37)

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.52 | 10.39 | 10.27 | 9.66 | 9.53 | 8.92 | 8.92 | 8.8 | 9.17 | 9.53 | 9.78 | 10.03 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 68.6 | 68.47 | 68.35 | 67.74 | 67.61 | 67 | 67 | 66.88 | 67.25 | 67.61 | 67.86 | 68.11 | |

Average = Sum(39)1…12 /12= 67.71 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.28 | 1.28 | 1.28 | 1.27 | 1.27 | 1.25 | 1.25 | 1.25 | 1.26 | 1.27 | 1.27 | 1.28 | |

Average = Sum(40)1…12 /12= 1.27 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.79 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.71 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

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

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 84.39 | 81.32 | 78.25 | 75.18 | 72.11 | 69.04 | 69.04 | 72.11 | 75.18 | 78.25 | 81.32 | 84.39 | |

Total = Sum(44)1…12 = 920.56 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 125.14 | 109.45 | 112.94 | 98.47 | 94.48 | 81.53 | 75.55 | 86.69 | 87.73 | 102.24 | 111.6 | 121.19 | |

Total = Sum(45)1…12 = 1207.01 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.77 | 16.42 | 16.94 | 14.77 | 14.17 | 12.23 | 11.33 | 13 | 13.16 | 15.34 | 16.74 | 18.18 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

# SAP WorkSheet: New dwelling design stage



Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 180.42 | 159.38 | 168.22 | 151.96 | 149.76 | 135.02 | 130.83 | 141.97 | 141.22 | 157.52 | 165.1 | 176.47 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 180.42 | 159.38 | 168.22 | 151.96 | 149.76 | 135.02 | 130.83 | 141.97 | 141.22 | 157.52 | 165.1 | 176.47 | |

Output from water heater (annual)$_{1...12}$ | 1857.85 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 85.83 | 76.33 | 81.77 | 75.53 | 75.64 | 69.9 | 69.34 | 73.05 | 71.96 | 78.22 | 79.9 | 84.52 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 34.77 | 30.89 | 25.12 | 19.02 | 14.22 | 12 | 12.97 | 16.86 | 22.62 | 28.73 | 33.53 | 35.74 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 232.88 | 235.29 | 229.2 | 216.24 | 199.87 | 184.49 | 174.22 | 171.8 | 177.89 | 190.86 | 207.22 | 222.6 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 115.36 | 113.59 | 109.91 | 104.91 | 101.66 | 97.09 | 93.2 | 98.18 | 99.95 | 105.13 | 110.98 | 113.6 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 466.35 | 463.1 | 447.57 | 423.5 | 399.08 | 376.91 | 363.72 | 370.17 | 383.8 | 408.04 | 435.06 | 455.27 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

# SAP WorkSheet: New dwelling design stage

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 2.4 | x | 10.63 | x | 0.558 | x | 0.7 | = | 6.91 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 20.32 | x | 0.558 | x | 0.7 | = | 13.2 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 34.53 | x | 0.558 | x | 0.7 | = | 22.43 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 55.46 | x | 0.558 | x | 0.7 | = | 36.03 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 74.72 | x | 0.558 | x | 0.7 | = | 48.54 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 79.99 | x | 0.558 | x | 0.7 | = | 51.96 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 74.68 | x | 0.558 | x | 0.7 | = | 48.51 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 59.25 | x | 0.558 | x | 0.7 | = | 38.49 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 41.52 | x | 0.558 | x | 0.7 | = | 26.97 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 24.19 | x | 0.558 | x | 0.7 | = | 15.71 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 13.12 | x | 0.558 | x | 0.7 | = | 8.52 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 8.86 | x | 0.558 | x | 0.7 | = | 5.76 | (74) |
| East | 0.9x | 1 | x | 15.96 | x | 19.64 | x | 0.56 | x | 0.7 | = | 84.85 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 38.42 | x | 0.56 | x | 0.7 | = | 165.98 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 63.27 | x | 0.56 | x | 0.7 | = | 273.35 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 92.28 | x | 0.56 | x | 0.7 | = | 398.66 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 113.09 | x | 0.56 | x | 0.7 | = | 488.58 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 115.77 | x | 0.56 | x | 0.7 | = | 500.15 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 110.22 | x | 0.56 | x | 0.7 | = | 476.16 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 94.68 | x | 0.56 | x | 0.7 | = | 409.01 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 73.59 | x | 0.56 | x | 0.7 | = | 317.92 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 45.59 | x | 0.56 | x | 0.7 | = | 196.95 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 24.49 | x | 0.56 | x | 0.7 | = | 105.8 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 16.15 | x | 0.56 | x | 0.7 | = | 69.78 | (76) |



Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 91.76 | 179.18 | 295.78 | 434.7 | 537.12 | 552.11 | 524.67 | 447.5 | 344.89 | 212.67 | 114.32 | 75.53 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 558.1 | 642.29 | 743.35 | 858.19 | 936.2 | 929.02 | 888.39 | 817.67 | 728.69 | 620.71 | 549.37 | 530.81 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.94 | 0.9 | 0.84 | 0.73 | 0.59 | 0.44 | 0.32 | 0.36 | 0.57 | 0.79 | 0.91 | 0.94 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.35 | 19.62 | 20.04 | 20.49 | 20.79 | 20.94 | 20.98 | 20.97 | 20.86 | 20.44 | 19.82 | 19.29 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 19.85 | 19.85 | 19.86 | 19.87 | 19.87 | 19.88 | 19.88 | 19.88 | 19.87 | 19.87 | 19.86 | 19.86 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.92 | 0.89 | 0.82 | 0.69 | 0.53 | 0.37 | 0.24 | 0.28 | 0.49 | 0.75 | 0.89 | 0.93 | (89) |

# SAP WorkSheet: New dwelling design stage

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 17.72 | 18.1 | 18.68 | 19.29 | 19.66 | 19.83 | 19.87 | 19.86 | 19.76 | 19.25 | 18.39 | 17.64 | (90) |

fLA = Living area ÷ (4) = 0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.47 | 18.8 | 19.3 | 19.84 | 20.18 | 20.34 | 20.38 | 20.37 | 20.26 | 19.79 | 19.04 | 18.4 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.47 | 18.8 | 19.3 | 19.84 | 20.18 | 20.34 | 20.38 | 20.37 | 20.26 | 19.79 | 19.04 | 18.4 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.91 | 0.87 | 0.81 | 0.69 | 0.55 | 0.4 | 0.28 | 0.32 | 0.52 | 0.75 | 0.87 | 0.92 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 506.54 | 560.05 | 598.89 | 593.94 | 513.69 | 368.07 | 248.88 | 259.46 | 377.81 | 465.69 | 479.1 | 486.69 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 971.77 | 951.53 | 874.89 | 741.02 | 573.21 | 384.3 | 253.01 | 265.55 | 414.39 | 621.66 | 810.58 | 966.98 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 346.13 | 263.07 | 205.35 | 105.89 | 44.29 | 0 | 0 | 0 | 0 | 116.04 | 238.67 | 357.33 | |

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 1676.77 (98)

Space heating requirement in kWh/m²/year 31.41 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1676.77 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1760.61 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |

**Water heating**

Annual water heating requirement 1857.85

If DHW from community scheme:

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1950.74 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 37.11 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 103.57 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 103.57 | (331) |
| Energy for lighting (calculated in Appendix L) | | 245.65 | (332) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 4.24 | x 0.01 = | 74.65 | (340a) |
| Water heating from CHP | (310a) | x | 4.24 | x 0.01 = | 82.71 | (342a) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 13.66 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 32.4 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 323.42 | (355) |



## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.38 | (357) |
| **SAP rating (section12)** | | 80.74 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | **Energy** kWh/year | **Emission factor** kg CO2/kWh | | **Emissions** kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 895.7 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 19.26 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 914.96 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 914.96 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 53.75 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 127.49 | (379) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 1096.21 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 20.53 | (384) |
| **EI rating (section 14)** | | | | 85.07 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | Energy kWh/year | Primary factor | | P.Energy kWh/year | |
|---|---|---|---|---|---|---|
| Energy from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| Energy associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 1.22 | = | 5059.04 | (367) |
| Electrical energy for heat distribution | [(313) x | | | = | 113.94 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | = | 5172.98 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | 5172.98 | (373) |
| Energy associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | 5172.98 | (376) |
| Energy associated with space cooling | (315) x | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | 3.07 | = | 317.95 | (378) |
| Energy associated with electricity for lighting | (332))) x | | 3.07 | = | 754.16 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | 6245.08 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 A-1-07

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | West |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 136.43 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 169.14 | **(P1)** |
| **Transmission heat loss coefficient:** | 58.1 | |
| **Summer heat loss coefficient:** | 227.22 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| East (Rear) | 0 | 1 |
| North (Side) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| North (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| East (Rear) | 0.9 x | 15.96 | 117.51 | 0.56 | 0.7 | 0.76 | 504.35 | |
| North (Side) | 0.9 x | 2.4 | 81.19 | 0.56 | 0.7 | 0.76 | 52.4 | |
| | | | | | | **Total** | 556.75 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 376.91 | 363.72 | 370.17 | |
| Total summer gains | 968.99 | 920.47 | 856.49 | **(P5)** |
| Summer gain/loss ratio | 4.26 | 4.05 | 3.77 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.04 | 1.04 | 1.04 | |
| Threshold temperature | 21.31 | 23 | 22.61 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:35:52*

## Project Information:

**Assessed By:** () **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 50.87m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 A-2-04

**Address :** A-2-04, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 18.94 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 17.75 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 45.1 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 40.2 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.14 (max. 0.30) | 0.15 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

DRAFT

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: East | 12.17m² | |
| Windows facing: North | 1.68m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| External Walls U-value | 0.13 W/m²K |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# Predicted Energy Assessment



A-2-04
Bertram Street
London

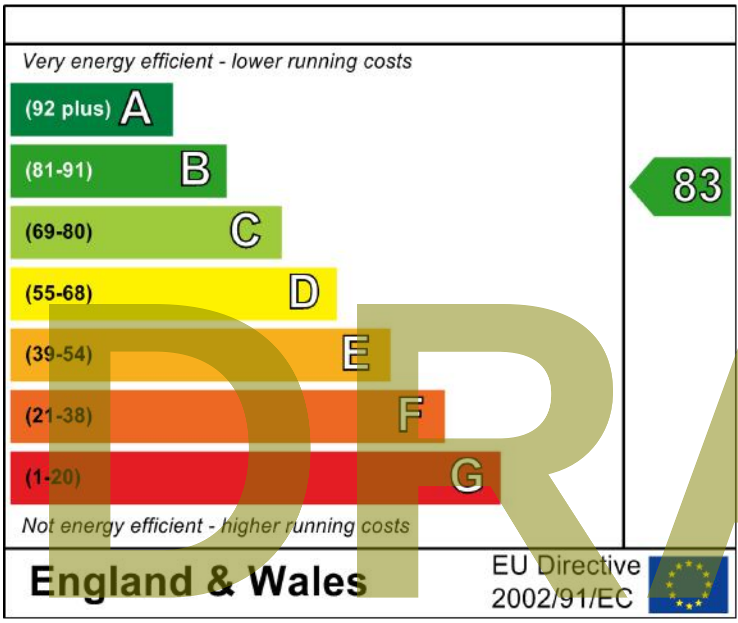
Dwelling type: Mid floor Flat
Date of assessment: 22 January 2019
Produced by: Stroma Certification
Total floor area: 50.87 m²

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

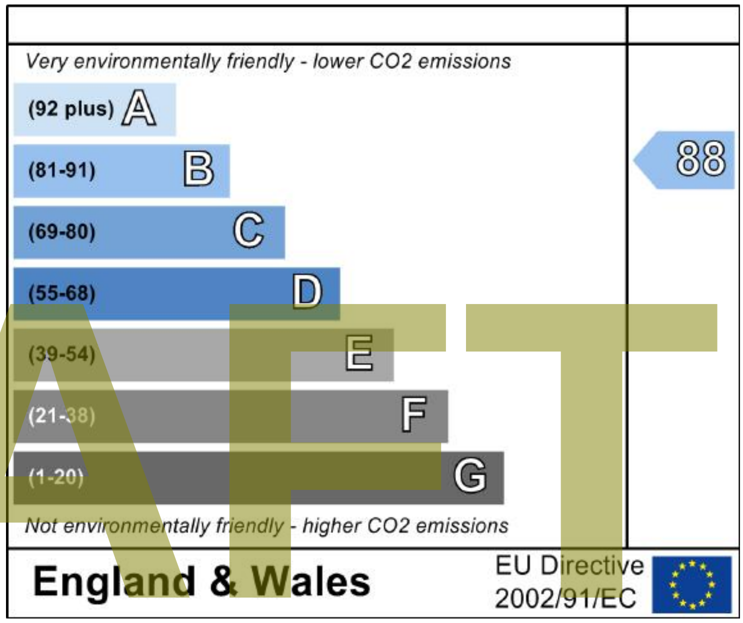
Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.



## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-2-04

| | |
|---|---|
| Address: | A-2-04, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 98.75 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 50.87 m² | 2.4 m |
| Living area: | 26.6 m² (fraction 0.523) | |
| Front of dwelling faces: | West | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 12.17 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 1.68 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | West | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |
| Side | | External Wall | North | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 27.03 | 15.95 | 11.08 | 0.15 | 0 | False | 14 |
| Corridor Wall | 24.7 | 0 | 24.7 | 0.15 | 0.43 | False | 14 |
| Stair Wall | 12.64 | 0 | 12.64 | 0.15 | 0.9 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 62.4 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 11.16 | | | | | | 20 |
| Party Ceiling | 50.87 | | | | | | 30 |
| Party Floor | 50.87 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0897

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 18.6 | 0.05 | E4 | Jamb |
| [Approved] | 53.64 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 2.4 | 0.06 | E18 | Party wall between dwellings |
| | 9.3 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, Rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 3

## Main heating system:

Main heating system: Community heating schemes
Heat source: Community boilers
heat from boilers – mains gas, heat fraction 1, efficiency 89.5
Piping>=1991, pre-insulated, low temp, variable flow

## Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and TRVs
Control code: 2306

## Secondary heating system:

Secondary heating system: None

## Water heating:

Water heating: From main heating system
Water code: 901
Fuel :heat from CHP
No hot water cylinder
Solar panel: False

## Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Dense urban
EPC language: English
Wind turbine: No
Photovoltaics: None
Assess Zero Carbon Home: No

# SAP WorkSheet: New dwelling design stage

User Details:

**Assessor Name:** | **Stroma Number:**
**Software Name:** Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.16

Property Address: 06-18-69419 A-2-04

**Address :** A-2-04, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 50.87 | (1a) x | 2.4 | (2a) = | 122.09 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 50.87 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 122.09 | (5) |

## 2. Ventilation rate:

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

DRAFT

| | | | Air changes per hour | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |
| *If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)* | | | | |
| Number of storeys in the dwelling (ns) | | | 0 | (9) |
| Additional infiltration | | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | | 0 | (11) |
| *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | | | |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | | 0 | (13) |
| Percentage of windows and doors draught stripped | | | 0 | (14) |
| Window infiltration | | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | | 3 | (17) |
| If based on air permeability value, then (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | | | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | | |
| Number of sides sheltered | | | 3 | (19) |
| Shelter factor | | (20) = 1 - [0.075 x (19)] = | 0.78 | (20) |
| Infiltration rate incorporating shelter factor | | (21) = (18) x (20) = | 0.12 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.15 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.12 | 0.12 | 0.13 | 0.14 |

*Calculate effective air change rate for the applicable case*

| | | |
|---|---|---|
| If mechanical ventilation: | 0.5 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0.5 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 79.9 | (23c) |

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (25) |



## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 12.17 | x1/[1/( 1.4 )+ 0.04] | | = | 16.13 | | | (27) |
| Windows Type 2 | | | 1.68 | x1/[1/( 1.4 )+ 0.04] | | = | 2.23 | | | (27) |
| Walls Type1 | 27.03 | 15.95 | 11.08 | x | 0.15 | = | 1.66 | 14 | 155.12 | (29) |
| Walls Type2 | 24.7 | 0 | 24.7 | x | 0.14 | = | 3.48 | 14 | 345.8 | (29) |
| Walls Type3 | 12.64 | 0 | 12.64 | x | 0.13 | = | 1.67 | 14 | 176.96 | (29) |
| Total area of elements, m² | | | 64.37 | | | | | | | (31) |
| Party wall | | | 11.16 | x | 0 | = | 0 | 20 | 223.2 | (32) |
| Party floor | | | 50.87 | | | | | 40 | 2034.8 | (32a) |
| Party ceiling | | | 50.87 | | | | | 30 | 1526.1 | (32b) |
| Internal wall ** | | | 62.4 | | | | | 9 | 561.6 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

| | | | |
|---|---|---|---|
| Fabric heat loss, W/K = S (A x U) | (26)…(30) + (32) = | 28.11 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 5023.58 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 98.75 | (35) |

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

| | | | |
|---|---|---|---|
| Thermal bridges : S (L x Y) calculated using Appendix K | | 5.78 | (36) |

*if details of thermal bridging are not known (36) = 0.15 x (31)*

| | | | |
|---|---|---|---|
| Total fabric heat loss | (33) + (36) = | 33.89 | (37) |

# SAP WorkSheet: New dwelling design stage

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.02 | 9.9 | 9.79 | 9.2 | 9.08 | 8.5 | 8.5 | 8.38 | 8.73 | 9.08 | 9.32 | 9.55 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 43.91 | 43.8 | 43.68 | 43.09 | 42.98 | 42.39 | 42.39 | 42.27 | 42.62 | 42.98 | 43.21 | 43.44 | |

Average = $Sum(39)_{1...12}$ /12= 43.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.86 | 0.86 | 0.86 | 0.85 | 0.84 | 0.83 | 0.83 | 0.83 | 0.84 | 0.84 | 0.85 | 0.85 | |

Average = $Sum(40)_{1...12}$ /12= 0.85 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.72 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.95 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)* | | | | | | | | | | | | | |
| (44)m= | 82.44 | 79.45 | 76.45 | 73.45 | 70.45 | 67.45 | 67.45 | 70.45 | 73.45 | 76.45 | 79.45 | 82.44 | |

Total = $Sum(44)_{1...12}$ = 899.39 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 122.26 | 106.93 | 110.34 | 96.2 | 92.31 | 79.65 | 73.81 | 84.7 | 85.71 | 99.89 | 109.03 | 118.4 | |

Total = $Sum(45)_{1...12}$ = 1179.24 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.34 | 16.04 | 16.55 | 14.43 | 13.85 | 11.95 | 11.07 | 12.7 | 12.86 | 14.98 | 16.36 | 17.76 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

# SAP WorkSheet: New dwelling design stage

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 177.54 | 156.86 | 165.62 | 149.69 | 147.58 | 133.15 | 129.09 | 139.98 | 139.2 | 155.16 | 162.53 | 173.68 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 177.54 | 156.86 | 165.62 | 149.69 | 147.58 | 133.15 | 129.09 | 139.98 | 139.2 | 155.16 | 162.53 | 173.68 |

Output from water heater (annual)$_{1...12}$ | 1830.08 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.87 | 75.5 | 80.91 | 74.78 | 74.91 | 69.28 | 68.76 | 72.38 | 71.29 | 77.43 | 79.05 | 83.59 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 33.32 | 29.59 | 24.07 | 18.22 | 13.62 | 11.5 | 12.42 | 16.15 | 21.68 | 27.52 | 32.12 | 34.24 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 223.12 | 225.44 | 219.61 | 207.18 | 191.5 | 176.77 | 166.92 | 164.61 | 170.44 | 182.86 | 198.54 | 213.28 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 114.08 | 112.35 | 108.75 | 103.86 | 100.69 | 96.22 | 92.42 | 97.29 | 99.02 | 104.08 | 109.79 | 112.35 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 451.84 | 448.7 | 433.75 | 410.59 | 387.14 | 365.81 | 353.1 | 359.37 | 372.46 | 395.79 | 421.78 | 441.2 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | Access Factor Table 6d | Area m² | Flux Table 6a | g_ Table 6b | FF Table 6c | Gains (W) |
|---|---|---|---|---|---|---|

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 1.68 | x | 10.63 | x | 0.558 | x | 0.7 | = | 4.84 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 20.32 | x | 0.558 | x | 0.7 | = | 9.24 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 34.53 | x | 0.558 | x | 0.7 | = | 15.7 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 55.46 | x | 0.558 | x | 0.7 | = | 25.22 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 74.72 | x | 0.558 | x | 0.7 | = | 33.98 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 79.99 | x | 0.558 | x | 0.7 | = | 36.37 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 74.68 | x | 0.558 | x | 0.7 | = | 33.96 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 59.25 | x | 0.558 | x | 0.7 | = | 26.94 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 41.52 | x | 0.558 | x | 0.7 | = | 18.88 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 24.19 | x | 0.558 | x | 0.7 | = | 11 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 13.12 | x | 0.558 | x | 0.7 | = | 5.97 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 8.86 | x | 0.558 | x | 0.7 | = | 4.03 | (74) |
| East | 0.9x | 1 | x | 12.17 | x | 19.64 | x | 0.56 | x | 0.7 | = | 64.7 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 38.42 | x | 0.56 | x | 0.7 | = | 126.57 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 63.27 | x | 0.56 | x | 0.7 | = | 208.44 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 92.28 | x | 0.56 | x | 0.7 | = | 303.99 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 113.09 | x | 0.56 | x | 0.7 | = | 372.56 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 115.77 | x | 0.56 | x | 0.7 | = | 381.38 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 110.22 | x | 0.56 | x | 0.7 | = | 363.09 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 94.68 | x | 0.56 | x | 0.7 | = | 311.89 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 73.59 | x | 0.56 | x | 0.7 | = | 242.42 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 45.59 | x | 0.56 | x | 0.7 | = | 150.18 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 24.49 | x | 0.56 | x | 0.7 | = | 80.67 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 16.15 | x | 0.56 | x | 0.7 | = | 53.21 | (76) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 69.54 | 135.81 | 224.14 | 329.22 | 406.53 | 417.75 | 397.05 | 338.83 | 261.3 | 161.18 | 86.64 | 57.24 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 521.38 | 584.51 | 657.89 | 739.81 | 793.67 | 783.56 | 750.14 | 698.2 | 633.76 | 556.97 | 508.42 | 498.44 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.87 | 0.82 | 0.74 | 0.61 | 0.47 | 0.34 | 0.25 | 0.28 | 0.44 | 0.67 | 0.82 | 0.88 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.9 | 20.12 | 20.43 | 20.74 | 20.9 | 20.98 | 20.99 | 20.99 | 20.94 | 20.71 | 20.27 | 19.85 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.2 | 20.2 | 20.2 | 20.21 | 20.21 | 20.22 | 20.22 | 20.23 | 20.22 | 20.21 | 20.21 | 20.21 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.85 | 0.81 | 0.72 | 0.59 | 0.44 | 0.3 | 0.2 | 0.23 | 0.4 | 0.64 | 0.8 | 0.87 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.74 | 19.06 | 19.49 | 19.9 | 20.11 | 20.2 | 20.22 | 20.22 | 20.17 | 19.88 | 19.28 | 18.69 | (90) |

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.35 | 19.61 | 19.98 | 20.34 | 20.53 | 20.61 | 20.62 | 20.62 | 20.57 | 20.31 | 19.8 | 19.29 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.35 | 19.61 | 19.98 | 20.34 | 20.53 | 20.61 | 20.62 | 20.62 | 20.57 | 20.31 | 19.8 | 19.29 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.84 | 0.79 | 0.71 | 0.59 | 0.45 | 0.32 | 0.23 | 0.25 | 0.42 | 0.64 | 0.79 | 0.85 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 437.05 | 463.55 | 469.93 | 436.93 | 359.25 | 249.86 | 169.43 | 176.82 | 264.5 | 357.36 | 400.29 | 424.03 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 660.7 | 644.3 | 588.79 | 492.86 | 379.33 | 254.64 | 170.6 | 178.51 | 275.89 | 417.39 | 548.69 | 655.75 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 166.39 | 121.46 | 88.43 | 40.27 | 14.93 | 0 | 0 | 0 | 0 | 44.66 | 106.85 | 172.4 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 755.41 (98)

Space heating requirement in kWh/m²/year 14.85 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 755.41 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 793.18 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1830.08 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1921.58 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 27.15 | (313) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 98.68 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 98.68 | (331) |
| Energy for lighting (calculated in Appendix L) | | 235.37 | (332) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 4.24 | x 0.01 = | 33.63 | (340a) |
| Water heating from CHP | (310a) x | 4.24 | x 0.01 = | 81.47 | (342a) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 13.02 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 31.04 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 279.17 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.22 | (357) |
| **SAP rating (section12)** | | 82.94 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | **Energy** kWh/year | **Emission factor** kg CO2/kWh | | **Emissions** kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP)<br>Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 655.18 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 14.09 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 669.27 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 669.27 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 51.21 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 122.16 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 842.64 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 16.56 | (384) |

# SAP WorkSheet: New dwelling design stage

## EI rating (section 14)

| | | | | |
|---|---|---|---|---|
| EI rating (section 14) | | | 88.22 | (385) |

13b. Primary Energy – Community heating scheme

| | | Energy kWh/year | Primary factor | | P.Energy kWh/year | |
|---|---|---|---|---|---|---|
| Energy from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| Energy associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 1.22 | = | 3700.56 | (367) |
| Electrical energy for heat distribution | [(313) x | | | = | 83.34 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | = | 3783.91 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | 3783.91 | (373) |
| Energy associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | 3783.91 | (376) |
| Energy associated with space cooling | (315) x | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | 3.07 | = | 302.94 | (378) |
| Energy associated with electricity for lighting | (332))) x | | 3.07 | = | 722.58 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | 4809.42 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 A-2-04

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | West |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 98.75 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 161.16 | **(P1)** |
| **Transmission heat loss coefficient:** | 33.9 | |
| **Summer heat loss coefficient:** | 195.05 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| East (Rear) | 0 | 1 |
| North (Side) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| North (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| East (Rear) | 0.9 x | 12.17 | 117.51 | 0.56 | 0.7 | 0.76 | 384.58 | |
| North (Side) | 0.9 x | 1.68 | 81.19 | 0.56 | 0.7 | 0.76 | 36.68 | |
| | | | | | | **Total** | 421.26 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 365.81 | 353.1 | 359.37 | |
| Total summer gains | 813.74 | 774.36 | 727.54 | **(P5)** |
| Summer gain/loss ratio | 4.17 | 3.97 | 3.73 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.31 | 1.31 | 1.31 | |
| Threshold temperature | 21.48 | 23.18 | 22.84 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:35:48*

## Project Information:

**Assessed By:** () **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 81.07m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 A-2-05

**Address :** A-2-05, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 15.58 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 14.30 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 40.9 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 35.9 kWh/m² | |
| | | OK |

DRAFT

## 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 | 1.40 (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: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |

Based on:

| | |
|---|---|
| Overshading: | Average or unknown |
| Windows facing: West | 20.76m² |
| Ventilation rate: | 4.00 |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

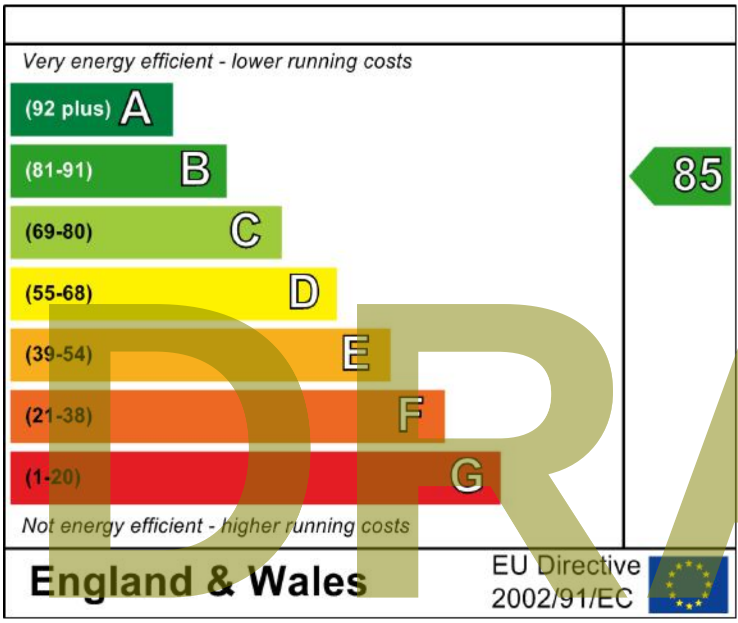
# Predicted Energy Assessment

| | | |
|---|---|---|
| A-2-05 | Dwelling type: | Mid floor Flat |
| Bertram Street | Date of assessment: | 22 January 2019 |
| London | Produced by: | Stroma Certification |
| | Total floor area: | 81.07 m² |

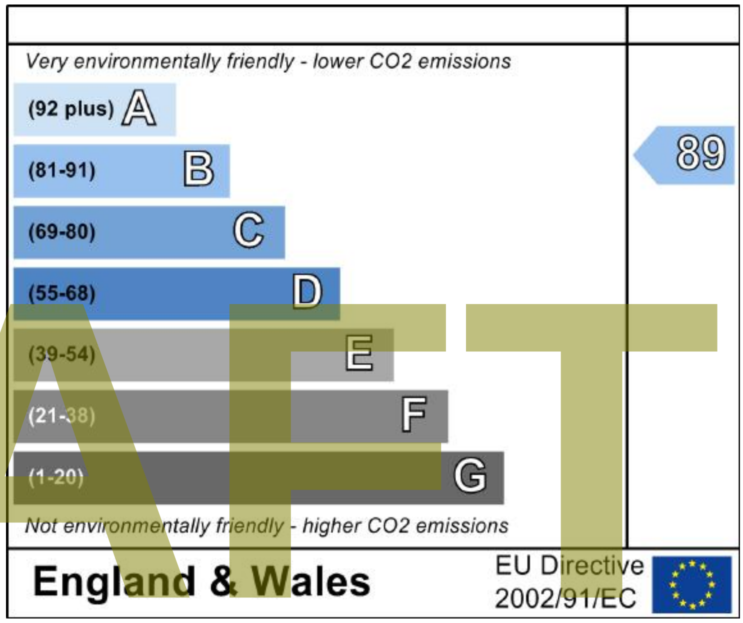
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating






The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-2-05

| | |
|---|---|
| Address: | A-2-05, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 100.03 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 81.07 m² | 2.4 m |
| Living area: | 34.57 m² (fraction 0.426) | |
| Front of dwelling faces: | East | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 20.76 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | East | 0 | 0 |
| Rear | | External Wall | West | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 45.29 | 22.86 | 22.43 | 0.15 | 0 | False | 14 |
| Corridor Wall | 10.7 | 0 | 10.7 | 0.15 | 0.43 | False | 14 |
| Riser Wall | 24.31 | 0 | 24.31 | 0.15 | 0 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 120 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 27.5 | | | | | | 20 |
| Party Ceiling | 81.07 | | | | | | 30 |
| Party Floor | 81.07 | | | | | | 40 |

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.082

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |

# SAP Input

| | | | | |
|---|---|---|---|---|
| [Approved] | 23.4 | 0.05 | E4 | Jamb |
| [Approved] | 66.92 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 9.6 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 7.2 | 0.06 | E18 | Party wall between dwellings |
| | 22.92 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 2<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 3 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 1, efficiency 89.5<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | | **Stroma Number:** | |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

## Property Address: 06-18-69419 A-2-05

**Address :** A-2-05, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 81.07 | (1a) x | 2.4 | (2a) = | 194.57 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 81.07 | (4) | | | | |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | 194.57 | (5) |

## 2. Ventilation rate:

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



| | | | | Air changes per hour | |
|---|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = | (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |
| *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | | |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 3 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.78 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.12 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.15 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.12 | 0.12 | 0.13 | 0.14 |

*Calculate effective air change rate for the applicable case*

| | | |
|---|---|---|
| If mechanical ventilation: | 0.5 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0.5 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 79.9 | (23c) |

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (25) |



## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows | | | 20.76 | x1/[1/( 1.4 )+ 0.04] | | = | 27.52 | | | (27) |
| Walls Type1 | 45.29 | 22.86 | 22.43 | x | 0.15 | = | 3.36 | 14 | 314.02 | (29) |
| Walls Type2 | 10.7 | 0 | 10.7 | x | 0.14 | = | 1.51 | 14 | 149.8 | (29) |
| Walls Type3 | 24.31 | 0 | 24.31 | x | 0.15 | = | 3.65 | 14 | 340.34 | (29) |
| Total area of elements, m² | | | 80.3 | | | | | | | (31) |
| Party wall | | | 27.5 | x | 0 | = | 0 | 20 | 550 | (32) |
| Party floor | | | 81.07 | | | | | 40 | 3242.8 | (32a) |
| Party ceiling | | | 81.07 | | | | | 30 | 2432.1 | (32b) |
| Internal wall ** | | | 120 | | | | | 9 | 1080 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

| | | | |
|---|---|---|---|
| Fabric heat loss, W/K = S (A x U) | (26)…(30) + (32) = | 38.98 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 8109.06 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 100.03 | (35) |

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

| | | | |
|---|---|---|---|
| Thermal bridges : S (L x Y) calculated using Appendix K | | 6.59 | (36) |

*if details of thermal bridging are not known (36) = 0.15 x (31)*

| | | | |
|---|---|---|---|
| Total fabric heat loss | (33) + (36) = | 45.57 | (37) |

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

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 15.97 | 15.78 | 15.6 | 14.66 | 14.48 | 13.54 | 13.54 | 13.36 | 13.92 | 14.48 | 14.85 | 15.22 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 61.54 | 61.35 | 61.16 | 60.23 | 60.04 | 59.11 | 59.11 | 58.93 | 59.48 | 60.04 | 60.42 | 60.79 | |

Average = Sum(39)$_{1\ldots12}$ /12= 60.18 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.76 | 0.76 | 0.75 | 0.74 | 0.74 | 0.73 | 0.73 | 0.73 | 0.73 | 0.74 | 0.75 | 0.75 |

Average = Sum(40)$_{1\ldots12}$ /12= 0.74 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.17 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

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

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 102.48 | 98.76 | 95.03 | 91.3 | 87.58 | 83.85 | 83.85 | 87.58 | 91.3 | 95.03 | 98.76 | 102.48 |

Total = Sum(44)$_{1\ldots12}$ = 1118.01 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 151.98 | 132.92 | 137.17 | 119.58 | 114.74 | 99.02 | 91.75 | 105.29 | 106.54 | 124.17 | 135.54 | 147.19 |

Total = Sum(45)$_{1\ldots12}$ = 1465.89 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 22.8 | 19.94 | 20.57 | 17.94 | 17.21 | 14.85 | 13.76 | 15.79 | 15.98 | 18.63 | 20.33 | 22.08 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 207.26 | 182.85 | 192.44 | 173.08 | 170.02 | 152.51 | 147.03 | 160.56 | 160.04 | 179.44 | 189.03 | 202.46 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 207.26 | 182.85 | 192.44 | 173.08 | 170.02 | 152.51 | 147.03 | 160.56 | 160.04 | 179.44 | 189.03 | 202.46 | |

Output from water heater (annual)$_{1...12}$ | 2116.73 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 94.76 | 84.14 | 89.83 | 82.56 | 82.37 | 75.72 | 74.73 | 79.23 | 78.22 | 85.51 | 87.86 | 93.16 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 49.4 | 43.88 | 35.69 | 27.02 | 20.19 | 17.05 | 18.42 | 23.95 | 32.14 | 40.81 | 47.63 | 50.78 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 330.84 | 334.27 | 325.62 | 307.2 | 283.95 | 262.1 | 247.51 | 244.07 | 252.72 | 271.14 | 294.39 | 316.24 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 127.36 | 125.21 | 120.74 | 114.66 | 110.72 | 105.16 | 100.44 | 106.49 | 108.64 | 114.93 | 122.03 | 125.22 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 609.64 | 605.4 | 584.08 | 550.92 | 516.9 | 486.35 | 468.41 | 476.55 | 495.54 | 528.92 | 566.09 | 594.27 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 0.9x | 0.77 | x | 20.76 | x | 19.64 | x | 0.56 | x | 0.7 | = | 110.37 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 38.42 | x | 0.56 | x | 0.7 | = | 215.9 | (80) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 0.9x | 0.77 | x | 20.76 | x | 63.27 | x | 0.56 | x | 0.7 | = | 355.56 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 92.28 | x | 0.56 | x | 0.7 | = | 518.56 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 113.09 | x | 0.56 | x | 0.7 | = | 635.52 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 115.77 | x | 0.56 | x | 0.7 | = | 650.57 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 110.22 | x | 0.56 | x | 0.7 | = | 619.36 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 94.68 | x | 0.56 | x | 0.7 | = | 532.03 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 73.59 | x | 0.56 | x | 0.7 | = | 413.53 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 45.59 | x | 0.56 | x | 0.7 | = | 256.19 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 24.49 | x | 0.56 | x | 0.7 | = | 137.61 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 16.15 | x | 0.56 | x | 0.7 | = | 90.76 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 110.37 | 215.9 | 355.56 | 518.56 | 635.52 | 650.57 | 619.36 | 532.03 | 413.53 | 256.19 | 137.61 | 90.76 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 720.01 | 821.3 | 939.64 | 1069.48 | 1152.42 | 1136.92 | 1087.77 | 1008.57 | 909.07 | 785.1 | 703.7 | 685.03 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.89 | 0.84 | 0.75 | 0.61 | 0.46 | 0.33 | 0.24 | 0.27 | 0.44 | 0.68 | 0.84 | 0.9 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.01 | 20.24 | 20.54 | 20.81 | 20.94 | 20.99 | 21 | 21 | 20.96 | 20.77 | 20.36 | 19.97 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.29 | 20.29 | 20.29 | 20.3 | 20.31 | 20.32 | 20.32 | 20.32 | 20.31 | 20.31 | 20.3 | 20.3 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.88 | 0.83 | 0.73 | 0.59 | 0.43 | 0.29 | 0.2 | 0.23 | 0.4 | 0.65 | 0.82 | 0.89 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.98 | 19.3 | 19.71 | 20.08 | 20.24 | 20.3 | 20.31 | 20.31 | 20.28 | 20.04 | 19.48 | 18.92 | (90) |

fLA = Living area ÷ (4) = 0.43 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.42 | 19.7 | 20.06 | 20.39 | 20.54 | 20.59 | 20.6 | 20.6 | 20.57 | 20.35 | 19.86 | 19.36 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.42 | 19.7 | 20.06 | 20.39 | 20.54 | 20.59 | 20.6 | 20.6 | 20.57 | 20.35 | 19.86 | 19.36 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.86 | 0.81 | 0.73 | 0.59 | 0.44 | 0.31 | 0.22 | 0.24 | 0.41 | 0.65 | 0.81 | 0.88 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 620.81 | 667.19 | 681.29 | 629.81 | 511.09 | 350.39 | 235.87 | 246.45 | 373.87 | 512.71 | 570.71 | 599.57 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |

# SAP WorkSheet: New dwelling design stage

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (97)m= | 930.31 | 907.99 | 829.68 | 691.98 | 530.64 | 354.34 | 236.71 | 247.73 | 384.82 | 585.39 | 770.76 | 921.87 | (97) |

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (98)m= | 230.27 | 161.82 | 110.4 | 44.76 | 14.54 | 0 | 0 | 0 | 0 | 54.07 | 144.04 | 239.79 |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 999.69 (98)

Space heating requirement in kWh/m²/year 12.33 (99)

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme.<br>Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 999.69 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1049.68 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2116.73 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2222.57 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 32.72 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 157.26 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 157.26 | (331) |
| Energy for lighting (calculated in Appendix L) | | 348.99 | (332) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 4.24 | x 0.01 = | 44.51 | (340a) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Water heating from CHP | (310a) x | 4.24 | x 0.01 = | 94.24 | (342a) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 20.74 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 46.03 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 325.52 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.08 | (357) |
| **SAP rating (section12)** | | 84.87 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 789.73 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 16.98 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 806.71 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 806.71 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 81.62 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 181.13 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1069.45 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 13.19 | (384) |
| **EI rating (section 14)** | | | | | 88.63 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | Energy kWh/year | Primary factor | | P.Energy kWh/year | |
|---|---|---|---|---|---|---|
| Energy from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| Energy associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 1.22 | = | 4460.49 | (367) |
| Electrical energy for heat distribution | [(313) x | | | = | 100.46 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | = | 4560.94 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | 4560.94 | (373) |
| Energy associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | 1.22 | = | 0 | (375) |

DRAFT

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | 4560.94 | (376) |
| Energy associated with space cooling | (315) x | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | 3.07 | = | 482.79 | (378) |
| Energy associated with electricity for lighting | (332))) x | 3.07 | = | 1071.4 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | 6115.14 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 A-2-05

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | East |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 100.03 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 256.83 | **(P1)** |
| **Transmission heat loss coefficient:** | 45.6 | |
| **Summer heat loss coefficient:** | 302.4 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Rear) | 0.9 x | 20.76 | 117.51 | 0.56 | 0.7 | 0.76 | 656.04 | |
| | | | | | | **Total** | 656.04 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 486.35 | 468.41 | 476.55 | |
| Total summer gains | 1182.75 | 1124.44 | 1053.7 | **(P5)** |
| Summer gain/loss ratio | 3.91 | 3.72 | 3.48 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.3 | 1.3 | 1.3 | |
| Threshold temperature | 21.21 | 22.92 | 22.58 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:35:45*

## Project Information:

**Assessed By:** ()

**Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE**

Total Floor Area: 57.93m²

**Site Reference :** Bertram Street

**Plot Reference:** 06-18-69419 A-3-03

**Address :** A-3-03, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 17.4 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.87 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 41.2 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 35.0 kWh/m² | |
| | | OK |



## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.14 (max. 0.30) | 0.15 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (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: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: West | 12.15m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party  Walls U-value | 0 W/m²K | |
| Community heating, heat from boilers – mains gas | | |

# Predicted Energy Assessment

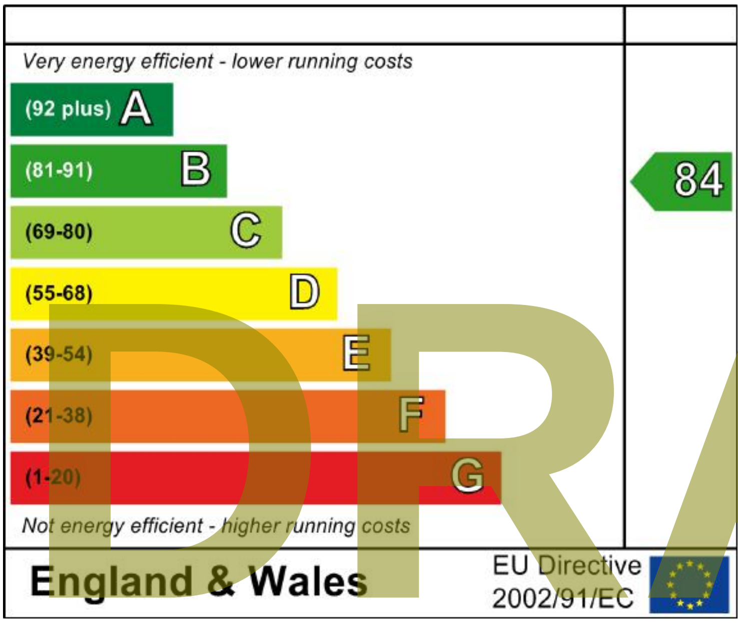
A-3-03
Bertram Street
London

Dwelling type: Mid floor Flat
Date of assessment: 22 January 2019
Produced by: Stroma Certification
Total floor area: 57.93 m²

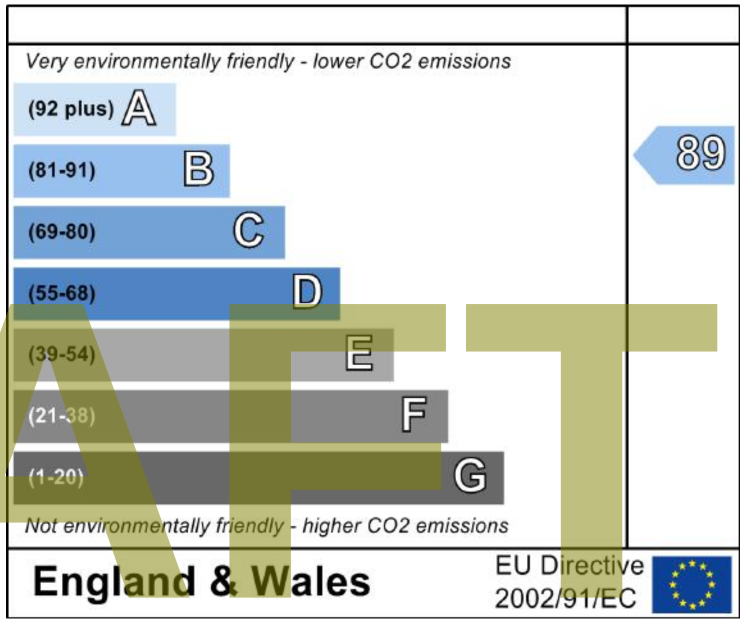
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating






The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-3-03

| | |
|---|---|
| Address: | A-3-03, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 98.76 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 57.93 m² | 2.4 m |
| Living area: | 27.94 m² (fraction 0.482) | |
| Front of dwelling faces: | East | |



## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 12.15 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | East | 0 | 0 |
| Rear | | External Wall | West | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 35.93 | 14.25 | 21.68 | 0.15 | 0 | False | 14 |
| Corridor Wall | 24.82 | 0 | 24.82 | 0.15 | 0.43 | False | 14 |
| Riser Wall | 2.23 | 0 | 2.23 | 0.15 | 0 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 72 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 16.8 | | | | | | 20 |
| Party Ceiling | 57.93 | | | | | | 30 |
| Party Floor | 57.93 | | | | | | 40 |

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0866

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |

# SAP Input

| | | | | |
|---|---|---|---|---|
| [Approved] | 13.8 | 0.05 | E4 | Jamb |
| [Approved] | 52.48 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 2.4 | 0.06 | E18 | Party wall between dwellings |
| | 14 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 3 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 1, efficiency 89.5<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | | **Stroma Number:** | |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

## Property Address: 06-18-69419 A-3-03

**Address :** A-3-03, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 57.93 | (1a) | x | 2.4 | (2a) | = | 139.03 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 57.93 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 139.03 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 3 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.78 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.12 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.15 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.12 | 0.12 | 0.13 | 0.14 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (25) |



## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows | | | 12.15 | x1/[1/( 1.4 )+ 0.04] | | = | 16.11 | | | (27) |
| Walls Type1 | 35.93 | 14.25 | 21.68 | x | 0.15 | = | 3.25 | 14 | 303.52 | (29) |
| Walls Type2 | 24.82 | 0 | 24.82 | x | 0.14 | = | 3.5 | 14 | 347.48 | (29) |
| Walls Type3 | 2.23 | 0 | 2.23 | x | 0.15 | = | 0.33 | 14 | 31.22 | (29) |
| Total area of elements, m² | | | 62.98 | | | | | | | (31) |
| Party wall | | | 16.8 | x | 0 | = | 0 | 20 | 336 | (32) |
| Party floor | | | 57.93 | | | | | 40 | 2317.2 | (32a) |
| Party ceiling | | | 57.93 | | | | | 30 | 1737.9 | (32b) |
| Internal wall ** | | | 72 | | | | | 9 | 648 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.13 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 5721.32 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 98.76 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 5.46 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 31.59 (37)

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 11.41 | 11.28 | 11.14 | 10.48 | 10.34 | 9.68 | 9.68 | 9.54 | 9.94 | 10.34 | 10.61 | 10.88 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 43 | 42.87 | 42.73 | 42.07 | 41.93 | 41.27 | 41.27 | 41.13 | 41.53 | 41.93 | 42.2 | 42.47 | |

Average = $\text{Sum}(39)_{1\ldots12}$ /12= 42.03 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.74 | 0.74 | 0.74 | 0.73 | 0.72 | 0.71 | 0.71 | 0.71 | 0.72 | 0.72 | 0.73 | 0.73 | |

Average = $\text{Sum}(40)_{1\ldots12}$ /12= 0.73 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.92 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 79.86 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 87.85 | 84.65 | 81.46 | 78.26 | 75.07 | 71.87 | 71.87 | 75.07 | 78.26 | 81.46 | 84.65 | 87.85 | |

Total = $\text{Sum}(44)_{1\ldots12}$ = 958.32 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 130.27 | 113.94 | 117.57 | 102.5 | 98.35 | 84.87 | 78.65 | 90.25 | 91.33 | 106.43 | 116.18 | 126.16 | |

Total = $\text{Sum}(45)_{1\ldots12}$ = 1256.52 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 19.54 | 17.09 | 17.64 | 15.38 | 14.75 | 12.73 | 11.8 | 13.54 | 13.7 | 15.96 | 17.43 | 18.92 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 185.55 | 163.87 | 172.85 | 156 | 153.63 | 138.37 | 133.92 | 145.53 | 144.82 | 161.71 | 169.67 | 181.44 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 185.55 | 163.87 | 172.85 | 156 | 153.63 | 138.37 | 133.92 | 145.53 | 144.82 | 161.71 | 169.67 | 181.44 |

Output from water heater (annual)$_{1...12}$ | 1907.35 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 87.54 | 77.83 | 83.31 | 76.88 | 76.92 | 71.02 | 70.37 | 74.23 | 73.16 | 79.61 | 81.42 | 86.17 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 37.48 | 33.29 | 27.07 | 20.5 | 15.32 | 12.94 | 13.98 | 18.17 | 24.38 | 30.96 | 36.14 | 38.52 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 250.3 | 252.89 | 246.35 | 232.41 | 214.83 | 198.29 | 187.25 | 184.65 | 191.2 | 205.13 | 222.72 | 239.25 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 117.66 | 115.81 | 111.98 | 106.77 | 103.39 | 98.63 | 94.59 | 99.77 | 101.61 | 107 | 113.09 | 115.82 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 492.34 | 488.91 | 472.31 | 446.59 | 420.45 | 396.77 | 382.72 | 389.5 | 404.1 | 430.01 | 458.86 | 480.5 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 0.9x | 0.77 | x | 12.15 | x | 19.64 | x | 0.56 | x | 0.7 | = | 64.59 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 38.42 | x | 0.56 | x | 0.7 | = | 126.36 | (80) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 0.9x | 0.77 | x | 12.15 | x | 63.27 | x | 0.56 | x | 0.7 | = | 208.09 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 92.28 | x | 0.56 | x | 0.7 | = | 303.49 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 113.09 | x | 0.56 | x | 0.7 | = | 371.94 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 115.77 | x | 0.56 | x | 0.7 | = | 380.75 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 110.22 | x | 0.56 | x | 0.7 | = | 362.49 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 94.68 | x | 0.56 | x | 0.7 | = | 311.37 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 73.59 | x | 0.56 | x | 0.7 | = | 242.02 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 45.59 | x | 0.56 | x | 0.7 | = | 149.94 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 24.49 | x | 0.56 | x | 0.7 | = | 80.54 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 16.15 | x | 0.56 | x | 0.7 | = | 53.12 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 64.59 | 126.36 | 208.09 | 303.49 | 371.94 | 380.75 | 362.49 | 311.37 | 242.02 | 149.94 | 80.54 | 53.12 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 556.94 | 615.26 | 680.41 | 750.09 | 792.39 | 777.52 | 745.21 | 700.87 | 646.13 | 579.94 | 539.4 | 533.62 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.86 | 0.82 | 0.74 | 0.61 | 0.47 | 0.33 | 0.24 | 0.27 | 0.43 | 0.66 | 0.81 | 0.87 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.14 | 20.32 | 20.58 | 20.82 | 20.94 | 20.99 | 21 | 21 | 20.97 | 20.8 | 20.45 | 20.1 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.3 | 20.31 | 20.31 | 20.32 | 20.32 | 20.33 | 20.33 | 20.33 | 20.33 | 20.32 | 20.32 | 20.31 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.85 | 0.8 | 0.72 | 0.58 | 0.44 | 0.3 | 0.21 | 0.23 | 0.39 | 0.63 | 0.79 | 0.86 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.16 | 19.42 | 19.77 | 20.1 | 20.25 | 20.32 | 20.33 | 20.33 | 20.29 | 20.09 | 19.62 | 19.12 | (90) |

fLA = Living area ÷ (4) = 0.48 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.63 | 19.86 | 20.16 | 20.44 | 20.58 | 20.64 | 20.65 | 20.65 | 20.62 | 20.43 | 20.02 | 19.59 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.63 | 19.86 | 20.16 | 20.44 | 20.58 | 20.64 | 20.65 | 20.65 | 20.62 | 20.43 | 20.02 | 19.59 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.84 | 0.79 | 0.71 | 0.59 | 0.45 | 0.32 | 0.22 | 0.25 | 0.41 | 0.63 | 0.78 | 0.85 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 465.87 | 487.34 | 485.72 | 442.45 | 358.24 | 246.3 | 166.51 | 173.9 | 263.41 | 366.76 | 422.07 | 453.04 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |

# SAP WorkSheet: New dwelling design stage

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (97)m= | 659.37 | 641.15 | 583.67 | 485.56 | 372.48 | 249.24 | 167.14 | 174.81 | 270.71 | 412.22 | 545.24 | 653.71 | (97) |

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (98)m= | 143.97 | 103.36 | 72.87 | 31.04 | 10.6 | 0 | 0 | 0 | 0 | 33.82 | 88.68 | 149.3 |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 633.64 (98)

Space heating requirement in kWh/m²/year 10.94 (99)

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme.<br>Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 633.64 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 665.33 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1907.35 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2002.72 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 26.68 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 112.37 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 112.37 | (331) |
| Energy for lighting (calculated in Appendix L) | | 264.78 | (332) |

DRAFT

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 4.24 | x 0.01 = | 28.21 | (340a) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Water heating from CHP | (310a) x | 4.24 | x 0.01 = | 84.92 | (342a) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 14.82 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 34.92 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 282.87 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.15 | (357) |
| **SAP rating (section12)** | | 83.9 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 643.91 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 13.85 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 657.76 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 657.76 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 58.32 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 137.42 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 853.5 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 14.73 | (384) |
| **EI rating (section 14)** | | | | | 88.89 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | Energy kWh/year | Primary factor | | P.Energy kWh/year | |
|---|---|---|---|---|---|---|
| Energy from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| Energy associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 1.22 | = | 3636.89 | (367) |
| Electrical energy for heat distribution | [(313) x | | | = | 81.91 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | = | 3718.8 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | 3718.8 | (373) |
| Energy associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | 1.22 | = | 0 | (375) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | 3718.8 | (376) |
| Energy associated with space cooling | (315) x | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | 3.07 | = | 344.98 | (378) |
| Energy associated with electricity for lighting | (332))) x | 3.07 | = | 812.86 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | 4876.65 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 A-3-03

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | East |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 98.76 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 183.52 | **(P1)** |
| **Transmission heat loss coefficient:** | 31.6 | |
| **Summer heat loss coefficient:** | 215.11 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Rear) | 0.9 x | 12.15 | 117.51 | 0.56 | 0.7 | 0.76 | 383.95 | |
| | | | | | | **Total** | 383.95 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 396.77 | 382.72 | 389.5 | |
| Total summer gains | 804.34 | 766.67 | 727.29 | **(P5)** |
| Summer gain/loss ratio | 3.74 | 3.56 | 3.38 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.31 | 1.31 | 1.31 | |
| Threshold temperature | 21.05 | 22.77 | 22.49 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:35:42*

## Project Information:

**Assessed By:** () **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 66.7m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 A-3-06

**Address :** A-3-06, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 15.45 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 14.94 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 34.8 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 33.8 kWh/m² | |
| | | OK |

## 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 | 1.40 (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: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| 7 Low energy lights | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

| 8 Mechanical ventilation | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

| 9 Summertime temperature | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South | 3.82m² | |
| Windows facing: West | 8.35m² | |
| Windows facing: South East | 7.63m² | |
| Ventilation rate: | 6.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

| 10 Key features | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# Predicted Energy Assessment

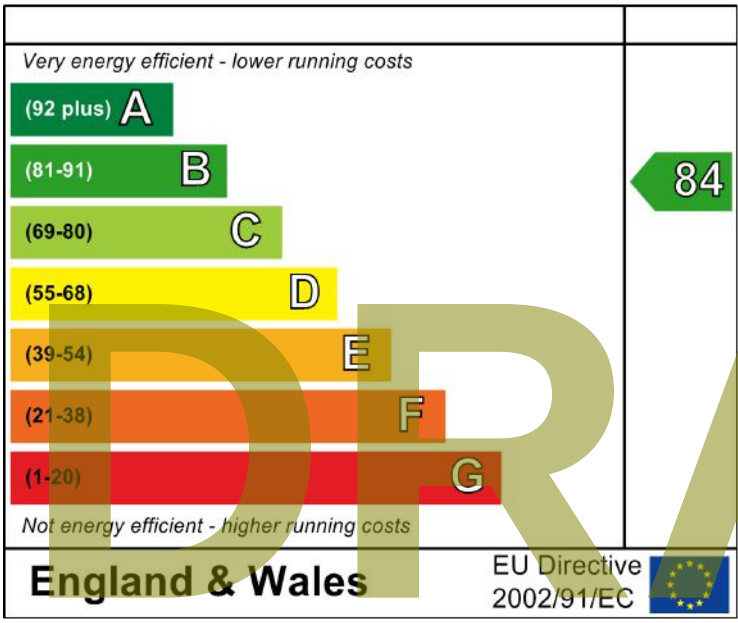
A-3-06
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Mid floor Flat |
| Date of assessment: | 22 January 2019 |
| Produced by: | Stroma Certification |
| Total floor area: | 66.7 m² |

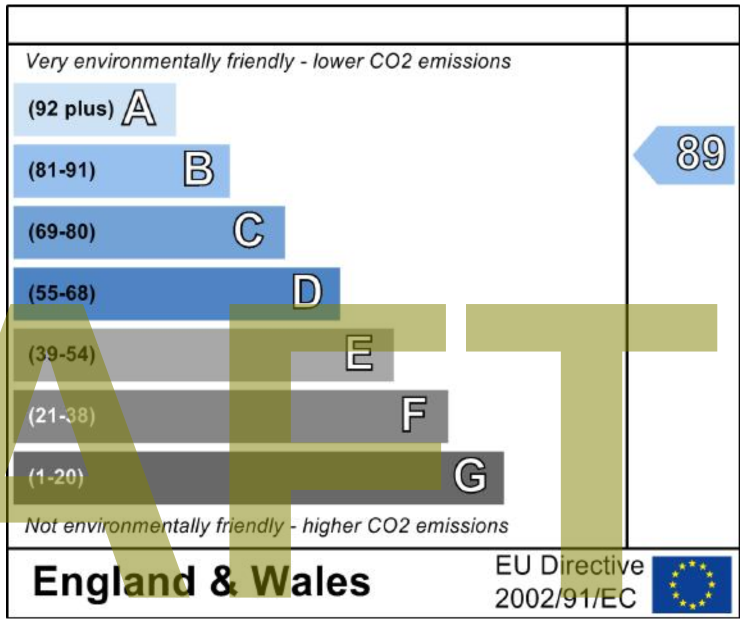
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating






The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-3-06

| | |
|---|---|
| Address: | A-3-06, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 98.32 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | |
|---|---|
| Dwelling type: | Flat |
| Detachment: | |
| Year Completed: | 2018 |

| Floor Location: | Floor area: | Storey height: |
|---|---|---|
| Floor 0 | 66.7 m² | 2.4 m |

| | |
|---|---|
| Living area: | 30.23 m² (fraction 0.453) |
| Front of dwelling faces: | North |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 3.82 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 8.35 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 7.63 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | North | 0 | 0 |
| Rear | | External Wall | South | 0 | 0 |
| Side | | External Wall | West | 0 | 0 |
| Side | | External Wall | South East | 0 | 0 |

| | |
|---|---|
| Overshading: | Average or unknown |

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| <u>External Elements</u> | | | | | | | |
| External Wall | 52.8 | 21.9 | 30.9 | 0.15 | 0 | False | 14 |
| Corridor Wall | 4.32 | 0 | 4.32 | 0.15 | 0.43 | False | 14 |
| <u>Internal Elements</u> | | | | | | | |
| Stud Walls | 96 | | | | | | 9 |
| <u>Party Elements</u> | | | | | | | |
| Party Wall | 26.6 | | | | | | 20 |
| Party Ceiling | 66.7 | | | | | | 30 |

# SAP Input

| | | |
|---|---|---|
| Party Floor | 66.7 | 40 |

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0948

| | **Length** | **Psi-value** | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 23.4 | 0.05 | E4 | Jamb |
| [Approved] | 44 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 4.8 | 0.09 | E16 | Corner (normal) |
| [Approved] | 7.2 | 0.06 | E18 | Party wall between dwellings |
| | 25.76 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 1, efficiency 89.5<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | | **Stroma Number:** | |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 A-3-06

**Address :** A-3-06, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 66.7 | (1a) x | 2.4 | (2a) = | 160.08 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 66.7 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 160.08 | (5) |

## 2. Ventilation rate:

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

DRAFT

| | | | Air changes per hour | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |
| *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | | |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

| | | |
|---|---|---|
| If mechanical ventilation: | 0.5 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0.5 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 79.9 | (23c) |

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 3.82 | x1/[1/( 1.4 )+ 0.04] | | = | 5.06 | | | (27) |
| Windows Type 2 | | | 8.35 | x1/[1/( 1.4 )+ 0.04] | | = | 11.07 | | | (27) |
| Windows Type 3 | | | 7.63 | x1/[1/( 1.4 )+ 0.04] | | = | 10.12 | | | (27) |
| Walls Type1 | 52.8 | 21.9 | 30.9 | x | 0.15 | = | 4.64 | 14 | 432.6 | (29) |
| Walls Type2 | 4.32 | 0 | 4.32 | x | 0.14 | = | 0.61 | 14 | 60.48 | (29) |
| Total area of elements, m² | | | 57.12 | | | | | | | (31) |
| Party wall | | | 26.6 | x | 0 | = | 0 | 20 | 532 | (32) |
| Party floor | | | 66.7 | | | | | 40 | 2668 | (32a) |
| Party ceiling | | | 66.7 | | | | | 30 | 2001 | (32b) |
| Internal wall ** | | | 96 | | | | | 9 | 864 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

| | | | |
|---|---|---|---|
| Fabric heat loss, W/K = S (A x U) | (26)…(30) + (32) = | 34.43 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 6558.08 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 98.32 | (35) |

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

| | | | |
|---|---|---|---|
| Thermal bridges : S (L x Y) calculated using Appendix K | | 5.41 | (36) |

*if details of thermal bridging are not known (36) = 0.15 x (31)*

| | | | |
|---|---|---|---|
| Total fabric heat loss | (33) + (36) = | 39.85 | (37) |

# SAP WorkSheet: New dwelling design stage

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 13.9 | 13.73 | 13.56 | 12.72 | 12.55 | 11.71 | 11.71 | 11.54 | 12.04 | 12.55 | 12.89 | 13.22 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 53.74 | 53.58 | 53.41 | 52.57 | 52.4 | 51.56 | 51.56 | 51.39 | 51.89 | 52.4 | 52.73 | 53.07 | |

Average = Sum(39)1…12 /12= 52.52 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.81 | 0.8 | 0.8 | 0.79 | 0.79 | 0.77 | 0.77 | 0.77 | 0.78 | 0.79 | 0.79 | 0.8 | |

Average = Sum(40)1…12 /12= 0.79 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.16 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 85.58 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*



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

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 94.14 | 90.72 | 87.29 | 83.87 | 80.45 | 77.02 | 77.02 | 80.45 | 83.87 | 87.29 | 90.72 | 94.14 | |

Total = Sum(44)1…12 = 1026.98 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 139.61 | 122.1 | 126 | 109.85 | 105.4 | 90.95 | 84.28 | 96.71 | 97.87 | 114.06 | 124.5 | 135.2 | |

Total = Sum(45)1…12 = 1346.53 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 20.94 | 18.32 | 18.9 | 16.48 | 15.81 | 13.64 | 12.64 | 14.51 | 14.68 | 17.11 | 18.68 | 20.28 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 194.88 | 172.03 | 181.27 | 163.34 | 160.68 | 144.45 | 139.56 | 151.99 | 151.36 | 169.33 | 178 | 190.48 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 194.88 | 172.03 | 181.27 | 163.34 | 160.68 | 144.45 | 139.56 | 151.99 | 151.36 | 169.33 | 178 | 190.48 |

Output from water heater (annual)$_{1\ldots12}$ — 1997.37 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 90.64 | 80.54 | 86.12 | 79.32 | 79.27 | 73.04 | 72.24 | 76.38 | 75.34 | 82.15 | 84.19 | 89.18 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating



## 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= | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 42.23 | 37.51 | 30.5 | 23.09 | 17.26 | 14.57 | 15.75 | 20.47 | 27.47 | 34.88 | 40.71 | 43.4 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 282.8 | 285.73 | 278.34 | 262.6 | 242.72 | 224.05 | 211.57 | 208.63 | 216.03 | 231.77 | 251.64 | 270.32 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 121.83 | 119.85 | 115.75 | 110.17 | 106.54 | 101.44 | 97.1 | 102.66 | 104.63 | 110.41 | 116.93 | 119.86 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 540.27 | 536.51 | 518 | 489.27 | 459.94 | 433.47 | 417.83 | 425.17 | 441.55 | 470.48 | 502.7 | 527 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | Access Factor Table 6d | Area m² | Flux Table 6a | g_ Table 6b | FF Table 6c | Gains (W) |
|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 36.79 | x | 0.56 | x | 0.7 | = | 75.99 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 62.67 | x | 0.56 | x | 0.7 | = | 129.44 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 85.75 | x | 0.56 | x | 0.7 | = | 177.11 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 106.25 | x | 0.56 | x | 0.7 | = | 219.44 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 119.01 | x | 0.56 | x | 0.7 | = | 245.8 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 118.15 | x | 0.56 | x | 0.7 | = | 244.02 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 113.91 | x | 0.56 | x | 0.7 | = | 235.26 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 104.39 | x | 0.56 | x | 0.7 | = | 215.6 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 92.85 | x | 0.56 | x | 0.7 | = | 191.77 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 69.27 | x | 0.56 | x | 0.7 | = | 143.06 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 44.07 | x | 0.56 | x | 0.7 | = | 91.02 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 31.49 | x | 0.56 | x | 0.7 | = | 65.03 | (77) |
| South | 0.9x | 0.77 | x | 3.82 | x | 46.75 | x | 0.56 | x | 0.7 | = | 48.34 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 76.57 | x | 0.56 | x | 0.7 | = | 79.17 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 97.53 | x | 0.56 | x | 0.7 | = | 100.85 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 110.23 | x | 0.56 | x | 0.7 | = | 113.98 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 114.87 | x | 0.56 | x | 0.7 | = | 118.78 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 110.55 | x | 0.56 | x | 0.7 | = | 114.31 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 108.01 | x | 0.56 | x | 0.7 | = | 111.69 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 104.89 | x | 0.56 | x | 0.7 | = | 108.46 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 101.89 | x | 0.56 | x | 0.7 | = | 105.35 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 82.59 | x | 0.56 | x | 0.7 | = | 85.4 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 55.42 | x | 0.56 | x | 0.7 | = | 57.3 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 40.4 | x | 0.56 | x | 0.7 | = | 41.77 | (78) |
| West | 0.9x | 0.77 | x | 8.35 | x | 19.64 | x | 0.56 | x | 0.7 | = | 44.39 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 38.42 | x | 0.56 | x | 0.7 | = | 86.84 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 63.27 | x | 0.56 | x | 0.7 | = | 143.01 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 92.28 | x | 0.56 | x | 0.7 | = | 208.57 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 113.09 | x | 0.56 | x | 0.7 | = | 255.62 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 115.77 | x | 0.56 | x | 0.7 | = | 261.67 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 110.22 | x | 0.56 | x | 0.7 | = | 249.12 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 94.68 | x | 0.56 | x | 0.7 | = | 213.99 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 73.59 | x | 0.56 | x | 0.7 | = | 166.33 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 45.59 | x | 0.56 | x | 0.7 | = | 103.04 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 24.49 | x | 0.56 | x | 0.7 | = | 55.35 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 16.15 | x | 0.56 | x | 0.7 | = | 36.51 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 168.73 | 295.45 | 420.97 | 542 | 620.19 | 620 | 596.07 | 538.05 | 463.45 | 331.5 | 203.67 | 143.31 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 709 | 831.96 | 938.97 | 1031.27 | 1080.13 | 1053.47 | 1013.9 | 963.23 | 905 | 801.98 | 706.38 | 670.31 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.85 | 0.78 | 0.69 | 0.56 | 0.43 | 0.31 | 0.22 | 0.24 | 0.38 | 0.61 | 0.78 | 0.86 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.08 | 20.34 | 20.6 | 20.83 | 20.94 | 20.99 | 21 | 21 | 20.97 | 20.81 | 20.44 | 20.03 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.25 | 20.25 | 20.25 | 20.26 | 20.27 | 20.28 | 20.28 | 20.28 | 20.27 | 20.27 | 20.26 | 20.26 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.83 | 0.76 | 0.66 | 0.54 | 0.4 | 0.28 | 0.19 | 0.21 | 0.35 | 0.57 | 0.76 | 0.85 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.04 | 19.4 | 19.76 | 20.06 | 20.2 | 20.26 | 20.27 | 20.28 | 20.24 | 20.05 | 19.55 | 18.98 | (90) |

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.52 | 19.82 | 20.14 | 20.41 | 20.53 | 20.59 | 20.6 | 20.6 | 20.57 | 20.4 | 19.95 | 19.45 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.52 | 19.82 | 20.14 | 20.41 | 20.53 | 20.59 | 20.6 | 20.6 | 20.57 | 20.4 | 19.95 | 19.45 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.82 | 0.75 | 0.66 | 0.54 | 0.41 | 0.29 | 0.2 | 0.22 | 0.36 | 0.58 | 0.75 | 0.83 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 579 | 624.16 | 621.02 | 557.28 | 446.59 | 305.29 | 205.52 | 214.81 | 328.03 | 464.14 | 530.87 | 558.62 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 817.77 | 799.61 | 728.46 | 604.79 | 462.92 | 308.86 | 206.3 | 215.91 | 335.84 | 513.37 | 677.85 | 809.59 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 177.64 | 117.9 | 79.94 | 34.21 | 12.15 | 0 | 0 | 0 | 0 | 36.63 | 105.83 | 186.73 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 751.01 (98)

Space heating requirement in kWh/m²/year 11.26 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |

| | |
|---|---|
| **Space heating** | **kWh/year** |
| Annual space heating requirement | 751.01 |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 788.57 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |

**Water heating**

| | | | |
|---|---|---|---|
| Annual water heating requirement | | 1997.37 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2097.24 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 28.86 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 129.38 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 129.38 | (331) |
| Energy for lighting (calculated in Appendix L) | | 298.32 | (332) |

## 10b. Fuel costs – Community heating scheme

| | Fuel kWh/year | | Fuel Price (Table 12) | | Fuel Cost £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 4.24 | x 0.01 = | 33.44 | (340a) |
| Water heating from CHP | (310a) | x | 4.24 | x 0.01 = | 88.92 | (342a) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 17.07 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 39.35 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 298.77 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.12 | (357) |
| **SAP rating (section12)** | | 84.33 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP)<br>Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 696.46 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 14.98 | (372) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 711.44 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 711.44 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 67.15 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 154.83 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 933.42 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 13.99 | (384) |
| **EI rating (section 14)** | | | | 88.8 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | Energy kWh/year | Primary factor | | P.Energy kWh/year | |
|---|---|---|---|---|---|---|
| Energy from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| Energy associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 1.22 | = | 3933.72 | (367) |
| Electrical energy for heat distribution | [(313) x | | | = | 88.59 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | = | 4022.31 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | 4022.31 | (373) |
| Energy associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | 4022.31 | (376) |
| Energy associated with space cooling | (315) x | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | 3.07 | = | 397.21 | (378) |
| Energy associated with electricity for lighting | (332))) x | | 3.07 | = | 915.83 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | 5335.35 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 A-3-06

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | Yes |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | North |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 98.32 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 6 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 316.96 | **(P1)** |
| **Transmission heat loss coefficient:** | 39.8 | |
| **Summer heat loss coefficient:** | 356.81 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| South (Rear) | 0 | 1 |
| West (Side) | 0 | 1 |
| South East (Side) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| South (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| West (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| South East (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| South (Rear) | 0.9 x | 3.82 | 112.21 | 0.56 | 0.7 | 0.76 | 115.27 | |
| West (Side) | 0.9 x | 8.35 | 117.51 | 0.56 | 0.7 | 0.76 | 263.87 | |
| South East (Side) | 0.9 x | 7.63 | 119.92 | 0.56 | 0.7 | 0.76 | 246.07 | |
| | | | | | | **Total** | 625.21 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 433.47 | 417.83 | 425.17 | |
| Total summer gains | 1091.38 | 1043.04 | 1000.6 | **(P5)** |
| Summer gain/loss ratio | 3.06 | 2.92 | 2.8 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.31 | 1.31 | 1.31 | |
| Threshold temperature | 20.37 | 22.14 | 21.92 | **(P7)** |
| **Likelihood of high internal temperature** | **Not significant** | **Medium** | **Slight** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:35:38*

## Project Information:

**Assessed By:** ()

**Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE**

Total Floor Area: 86.19m²

**Site Reference :** Bertram Street

**Plot Reference:** 06-18-69419 A-4-01

**Address :** A-4-01, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 18.24 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.97 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 56.1 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 43.1 kWh/m² | |
| | | OK |

DRAFT

## 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 | 0.11 (max. 0.20) | 0.11 (max. 0.35) | OK |
| Openings | 1.40 (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: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |

Based on:

| | |
|---|---|
| Overshading: | Average or unknown |
| Windows facing: West | 17.05m² |
| Windows facing: North | 6m² |
| Ventilation rate: | 4.00 |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Roofs U-value | 0.11 W/m²K |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# Predicted Energy Assessment

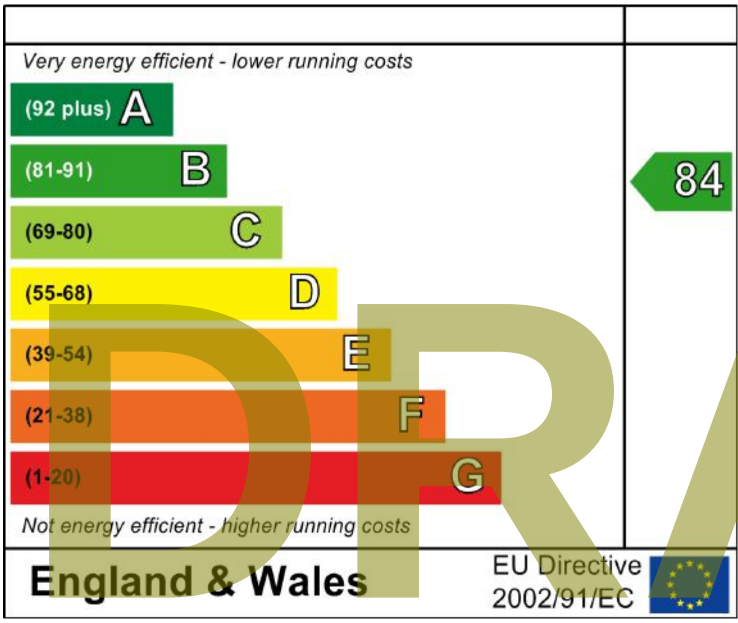
A-4-01
Bertram Street
London

Dwelling type: Top floor Flat
Date of assessment: 22 January 2019
Produced by: Stroma Certification
Total floor area: 86.19 m²

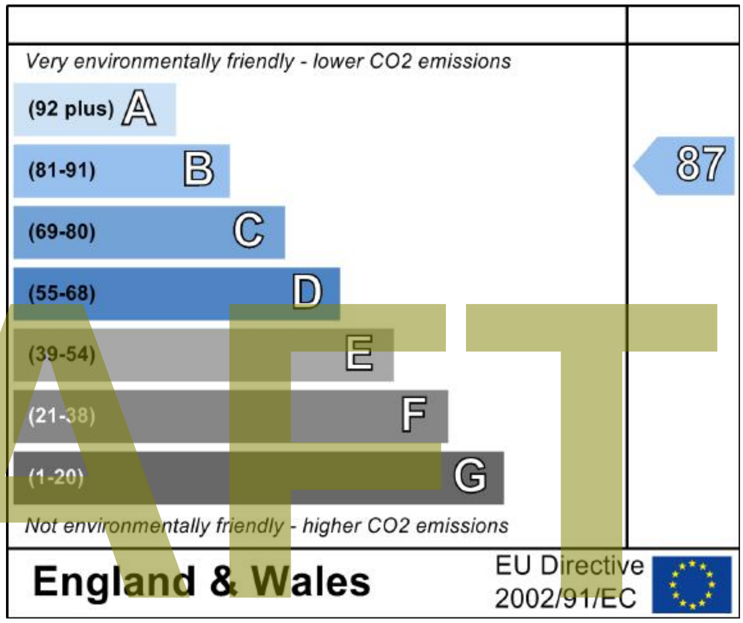
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-4-01

| | |
|---|---|
| Address: | A-4-01, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 81.19 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 86.19 m² | 2.4 m |
| Living area: | 24.1 m² (fraction 0.278) | |
| Front of dwelling faces: | South | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 17.05 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 6 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | South | 0 | 0 |
| Side | | External Wall | West | 0 | 0 |
| Rear | | External Wall | North | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 55.68 | 25.15 | 30.53 | 0.15 | 0 | False | 14 |
| Corridor Wall | 8.9 | 0 | 8.9 | 0.15 | 0.43 | False | 14 |
| Roof | 86.19 | 0 | 86.19 | 0.11 | 0 | | 9 |
| Internal Elements | | | | | | | |
| Stud Walls | 163.2 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 37.7 | | | | | | 20 |
| Party Floor | 86.19 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 28.2 | 0.05 | E4 | Jamb |
| [Approved] | 26.91 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 4.8 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 7.2 | 0.06 | E18 | Party wall between dwellings |
| | 5.6 | 0.04 | E14 | Flat roof |
| | 21.31 | 0.28 | E15 | Flat roof with parapet |
| | 15.71 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 15.71 | 0.12 | P4 | Roof (insulation at ceiling level) |

## Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, Rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 3

## Main heating system:

Main heating system: Community heating schemes
Heat source: Community boilers
heat from boilers – mains gas, heat fraction 1, efficiency 89.5
Piping>=1991, pre-insulated, low temp, variable flow

## Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and TRVs
Control code: 2306

## Secondary heating system:

Secondary heating system: None

## Water heating:

Water heating: From main heating system
Water code: 901
Fuel :heat from CHP
No hot water cylinder
Solar panel: False

## Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Dense urban
EPC language: English
Wind turbine: No
Photovoltaics: None
Assess Zero Carbon Home: No

# SAP WorkSheet: New dwelling design stage

User Details:

**Assessor Name:** | **Stroma Number:**
**Software Name:** Stroma FSAP 2012 | **Software Version:** Version: 1.0.4.16

Property Address: 06-18-69419 A-4-01

**Address :** A-4-01, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 86.19 | (1a) x | 2.4 | (2a) = | 206.86 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 86.19 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 206.86 | (5) |

## 2. Ventilation rate:

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



| | | | Air changes per hour | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:



| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 17.05 | x1/[1/( 1.4 )+ 0.04] | | = | 22.6 | | | (27) |
| Windows Type 2 | | | 6 | x1/[1/( 1.4 )+ 0.04] | | = | 7.95 | | | (27) |
| Walls Type1 | 55.68 | 25.15 | 30.53 | x | 0.15 | = | 4.58 | 14 | 427.42 | (29) |
| Walls Type2 | 8.9 | 0 | 8.9 | x | 0.14 | = | 1.25 | 14 | 124.6 | (29) |
| Roof | 86.19 | 0 | 86.19 | x | 0.11 | = | 9.48 | 9 | 775.71 | (30) |
| Total area of elements, m² | | | 150.77 | | | | | | | (31) |
| Party wall | | | 37.7 | x | 0 | = | 0 | 20 | 754 | (32) |
| Party floor | | | 86.19 | | | | | 40 | 3447.6 | (32a) |
| Internal wall ** | | | 163.2 | | | | | 9 | 1468.8 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 48.81 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 6998.13 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 81.19 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 12.32 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 61.13 (37)

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 17.96 | 17.74 | 17.52 | 16.43 | 16.22 | 15.13 | 15.13 | 14.91 | 15.56 | 16.22 | 16.65 | 17.09 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 79.09 | 78.87 | 78.65 | 77.57 | 77.35 | 76.26 | 76.26 | 76.04 | 76.69 | 77.35 | 77.78 | 78.22 | |

Average = Sum(39)$_{1…12}$ /12= 77.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.92 | 0.92 | 0.91 | 0.9 | 0.9 | 0.88 | 0.88 | 0.88 | 0.89 | 0.9 | 0.9 | 0.91 | |

Average = Sum(40)$_{1…12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.24 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)* | | | | | | | | | | | | | |
| (44)m= | 104.76 | 100.95 | 97.14 | 93.33 | 89.52 | 85.71 | 85.71 | 89.52 | 93.33 | 97.14 | 100.95 | 104.76 | |

Total = Sum(44)$_{1…12}$ = 1142.82 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 155.35 | 135.87 | 140.21 | 122.24 | 117.29 | 101.21 | 93.79 | 107.62 | 108.91 | 126.92 | 138.55 | 150.45 | |

Total = Sum(45)$_{1…12}$ = 1498.42 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 23.3 | 20.38 | 21.03 | 18.34 | 17.59 | 15.18 | 14.07 | 16.14 | 16.34 | 19.04 | 20.78 | 22.57 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 210.63 | 185.8 | 195.49 | 175.73 | 172.57 | 154.71 | 149.07 | 162.9 | 162.4 | 182.2 | 192.04 | 205.73 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 210.63 | 185.8 | 195.49 | 175.73 | 172.57 | 154.71 | 149.07 | 162.9 | 162.4 | 182.2 | 192.04 | 205.73 |

Output from water heater (annual)$_{1...12}$ | 2149.26 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 95.88 | 85.12 | 90.84 | 83.44 | 83.22 | 76.45 | 75.41 | 80.01 | 79.01 | 86.42 | 88.86 | 94.25 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 51.68 | 45.9 | 37.33 | 28.26 | 21.13 | 17.84 | 19.27 | 25.05 | 33.62 | 42.69 | 49.83 | 53.12 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 346.11 | 349.7 | 340.65 | 321.38 | 297.06 | 274.2 | 258.93 | 255.34 | 264.39 | 283.65 | 307.98 | 330.84 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 128.87 | 126.67 | 122.1 | 115.89 | 111.86 | 106.18 | 101.35 | 107.54 | 109.73 | 116.16 | 123.42 | 126.68 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 631.04 | 626.66 | 604.46 | 569.92 | 534.43 | 502.6 | 483.94 | 492.31 | 512.13 | 546.9 | 585.61 | 615.02 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 6 | x | 10.63 | x | 0.558 | x | 0.7 | = | 17.27 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 20.32 | x | 0.558 | x | 0.7 | = | 33 | (74) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 6 | x | 34.53 | x | 0.558 | x | 0.7 | = | 56.08 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 55.46 | x | 0.558 | x | 0.7 | = | 90.08 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 74.72 | x | 0.558 | x | 0.7 | = | 121.35 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 79.99 | x | 0.558 | x | 0.7 | = | 129.91 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 74.68 | x | 0.558 | x | 0.7 | = | 121.28 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 59.25 | x | 0.558 | x | 0.7 | = | 96.22 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 41.52 | x | 0.558 | x | 0.7 | = | 67.43 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 24.19 | x | 0.558 | x | 0.7 | = | 39.29 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 13.12 | x | 0.558 | x | 0.7 | = | 21.3 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 8.86 | x | 0.558 | x | 0.7 | = | 14.4 | (74) |
| West | 0.9x | 0.77 | x | 17.05 | x | 19.64 | x | 0.56 | x | 0.7 | = | 90.64 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 38.42 | x | 0.56 | x | 0.7 | = | 177.32 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 63.27 | x | 0.56 | x | 0.7 | = | 292.02 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 92.28 | x | 0.56 | x | 0.7 | = | 425.89 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 113.09 | x | 0.56 | x | 0.7 | = | 521.94 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 115.77 | x | 0.56 | x | 0.7 | = | 534.3 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 110.22 | x | 0.56 | x | 0.7 | = | 508.68 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 94.68 | x | 0.56 | x | 0.7 | = | 436.95 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 73.59 | x | 0.56 | x | 0.7 | = | 339.63 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 45.59 | x | 0.56 | x | 0.7 | = | 210.4 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 24.49 | x | 0.56 | x | 0.7 | = | 113.02 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 16.15 | x | 0.56 | x | 0.7 | = | 74.54 | (80) |



Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 107.91 | 210.32 | 348.1 | 515.97 | 643.29 | 664.21 | 629.96 | 533.17 | 407.06 | 249.69 | 134.33 | 88.94 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 738.96 | 836.98 | 952.56 | 1085.89 | 1177.72 | 1166.81 | 1113.9 | 1025.48 | 919.19 | 796.58 | 719.94 | 703.96 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.89 | 0.85 | 0.79 | 0.67 | 0.53 | 0.39 | 0.29 | 0.33 | 0.51 | 0.73 | 0.85 | 0.9 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.3 | 19.57 | 19.99 | 20.46 | 20.77 | 20.93 | 20.98 | 20.97 | 20.85 | 20.43 | 19.79 | 19.25 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.15 | 20.15 | 20.16 | 20.17 | 20.17 | 20.18 | 20.18 | 20.18 | 20.18 | 20.17 | 20.17 | 20.16 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.88 | 0.84 | 0.77 | 0.64 | 0.5 | 0.35 | 0.24 | 0.27 | 0.46 | 0.7 | 0.84 | 0.89 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 17.88 | 18.27 | 18.86 | 19.51 | 19.91 | 20.11 | 20.16 | 20.16 | 20.02 | 19.48 | 18.6 | 17.81 | (90) |

fLA = Living area ÷ (4) = | 0.28 | (91)

# SAP WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.28 | 18.64 | 19.18 | 19.77 | 20.15 | 20.34 | 20.39 | 20.38 | 20.25 | 19.74 | 18.93 | 18.21 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.28 | 18.64 | 19.18 | 19.77 | 20.15 | 20.34 | 20.39 | 20.38 | 20.25 | 19.74 | 18.93 | 18.21 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.85 | 0.81 | 0.74 | 0.63 | 0.5 | 0.36 | 0.25 | 0.29 | 0.47 | 0.68 | 0.81 | 0.86 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 628.91 | 679.06 | 707.09 | 684.8 | 585.58 | 417.75 | 283.38 | 294.92 | 430.15 | 544.31 | 582.74 | 607.12 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 1105.55 | 1083.42 | 997.32 | 843.47 | 653.56 | 437.66 | 289.02 | 302.9 | 471.94 | 707.19 | 920.47 | 1096.13 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 354.62 | 271.73 | 215.93 | 114.24 | 50.58 | 0 | 0 | 0 | 0 | 121.18 | 243.16 | 363.83 | |

Total per year (kWh/year) = $\text{Sum}(98)_{1...5,9...12}$ = 1735.28 (98)

Space heating requirement in kWh/m²/year 20.13 (99)



## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1735.28 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1822.04 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2149.26 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2256.72 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 40.79 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 167.19 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 167.19 | (331) |
| Energy for lighting (calculated in Appendix L) | | 365.1 | (332) |

## 10b. Fuel costs – Community heating scheme

| | Fuel kWh/year | Fuel Price (Table 12) | | Fuel Cost £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 4.24 | x 0.01 = | 77.25 | (340a) |
| Water heating from CHP | (310a) x | 4.24 | x 0.01 = | 95.68 | (342a) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 22.05 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 48.16 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 363.15 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.16 | (357) |
| **SAP rating (section12)** | | 83.78 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 984.37 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 21.17 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 1005.54 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 1005.54 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 86.77 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 189.49 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1281.8 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 14.87 | (384) |
| **EI rating (section 14)** | | | | | 86.91 | (385) |

## 13b. Primary Energy – Community heating scheme

| Energy kWh/year | Primary factor | P.Energy kWh/year |
|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Energy from other sources of space and water heating (not CHP) | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 89.5 | (367a) |
| Energy associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | 1.22 | = | 5559.88 | (367) |
| Electrical energy for heat distribution | [(313) x | | = | 125.22 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | = | 5685.09 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | 5685.09 | (373) |
| Energy associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | 5685.09 | (376) |
| Energy associated with space cooling | (315) x | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | 3.07 | = | 513.28 | (378) |
| Energy associated with electricity for lighting | (332))) x | 3.07 | = | 1120.85 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | 7319.22 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 A-4-01

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | South |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 81.19 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 273.05 | **(P1)** |
| **Transmission heat loss coefficient:** | 61.1 | |
| **Summer heat loss coefficient:** | 334.18 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Side) | 0 | 1 |
| North (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| North (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Side) | 0.9 x | 17.05 | 117.51 | 0.56 | 0.7 | 0.76 | 538.8 | |
| North (Rear) | 0.9 x | 6 | 81.19 | 0.56 | 0.7 | 0.76 | 131 | |
| | | | | | | **Total** | 669.79 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 502.6 | 483.94 | 492.31 | |
| Total summer gains | 1216.27 | 1153.73 | 1072.84 | **(P5)** |
| Summer gain/loss ratio | 3.64 | 3.45 | 3.21 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.43 | 1.43 | 1.43 | |
| Threshold temperature | 21.07 | 22.78 | 22.44 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** <u>Medium</u>

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:35:35*

## Project Information:

**Assessed By:** ()  **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE**  Total Floor Area: 88.69m²

**Site Reference :** Bertram Street  **Plot Reference:** 06-18-69419 A-4-02

**Address :** A-4-02, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 17.96 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.66 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 55.4 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 42.3 kWh/m² | |
| | | OK |

## 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 | 0.11 (max. 0.20) | 0.11 (max. 0.35) | OK |
| Openings | 1.40 (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: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |

Based on:

| | |
|---|---|
| Overshading: | Average or unknown |
| Windows facing: East | 17.05m² |
| Windows facing: North | 6m² |
| Ventilation rate: | 4.00 |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Roofs U-value | 0.11 W/m²K |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# Predicted Energy Assessment

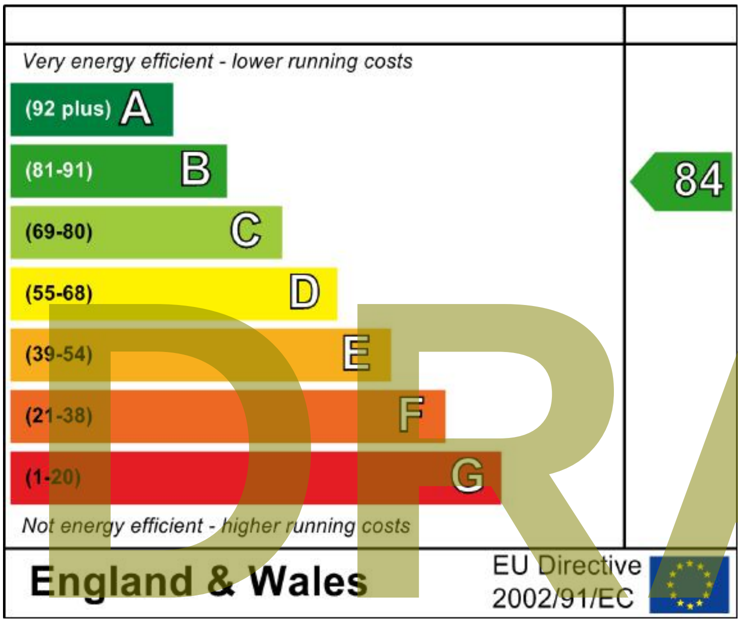
A-4-02
Bertram Street
London

Dwelling type: Top floor Flat
Date of assessment: 22 January 2019
Produced by: Stroma Certification
Total floor area: 88.69 m²

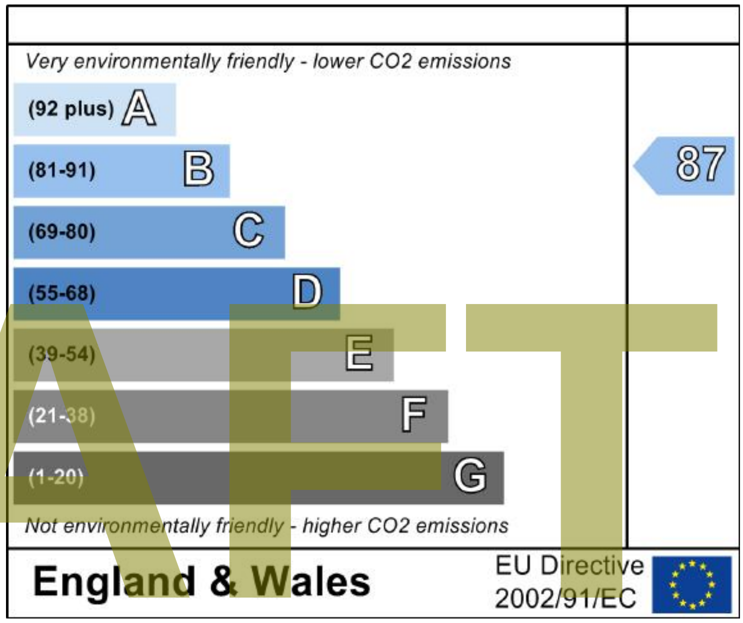
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating






The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-4-02

| | |
|---|---|
| Address: | A-4-02, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 78.39 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 88.69 m² | 2.4 m |
| Living area: | 25.61 m² (fraction 0.289) | |
| Front of dwelling faces: | South | |

DRAFT

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 17.05 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 6 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | South | 0 | 0 |
| Side | | External Wall | East | 0 | 0 |
| Rear | | External Wall | North | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 51.58 | 25.15 | 26.43 | 0.15 | 0 | False | 14 |
| Corridor Wall | 9.22 | 0 | 9.22 | 0.15 | 0.43 | False | 14 |
| Roof | 88.69 | 0 | 88.69 | 0.11 | 0 | | 9 |
| Internal Elements | | | | | | | |
| Stud Walls | 163.2 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 31.94 | | | | | | 20 |
| Party Floor | 88.69 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0833

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 28.2 | 0.05 | E4 | Jamb |
| [Approved] | 29.67 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 8.18 | 0.04 | E14 | Flat roof |
| | 21.49 | 0.28 | E15 | Flat roof with parapet |
| | 13.31 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 13.31 | 0.12 | P4 | Roof (insulation at ceiling level) |

## Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, Rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 3

## Main heating system:

Main heating system: Community heating schemes
Heat source: Community boilers
heat from boilers – mains gas, heat fraction 1, efficiency 89.5
Piping>=1991, pre-insulated, low temp, variable flow

## Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and TRVs
Control code: 2306

## Secondary heating system:

Secondary heating system: None

## Water heating:

Water heating: From main heating system
Water code: 901
Fuel :heat from CHP
No hot water cylinder
Solar panel: False

## Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Dense urban
EPC language: English
Wind turbine: No
Photovoltaics: None
Assess Zero Carbon Home: No

# SAP WorkSheet: New dwelling design stage

User Details:

**Assessor Name:** 
**Stroma Number:** 
**Software Name:** Stroma FSAP 2012
**Software Version:** Version: 1.0.4.16

Property Address: 06-18-69419 A-4-02

**Address :** A-4-02, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 88.69 | (1a) x | 2.4 | (2a) = | 212.86 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 88.69 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 212.86 | (5) |

## 2. Ventilation rate:

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

| | | | Air changes per hour | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |
| *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | | |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Monthly average wind speed from Table 7** | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| **Wind Factor (22a)m = (22)m ÷ 4** | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |



## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 17.05 | x1/[1/( 1.4 )+ 0.04] | | = | 22.6 | | | (27) |
| Windows Type 2 | | | 6 | x1/[1/( 1.4 )+ 0.04] | | = | 7.95 | | | (27) |
| Walls Type1 | 51.58 | 25.15 | 26.43 | x | 0.15 | = | 3.96 | 14 | 370.02 | (29) |
| Walls Type2 | 9.22 | 0 | 9.22 | x | 0.14 | = | 1.3 | 14 | 129.08 | (29) |
| Roof | 88.69 | 0 | 88.69 | x | 0.11 | = | 9.76 | 9 | 798.21 | (30) |
| Total area of elements, m² | | | 149.49 | | | | | | | (31) |
| Party wall | | | 31.94 | x | 0 | = | 0 | 20 | 638.8 | (32) |
| Party floor | | | 88.69 | | | | | 40 | 3547.6 | (32a) |
| Internal wall ** | | | 163.2 | | | | | 9 | 1468.8 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 48.52 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 6952.51 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 78.39 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 12.45 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 60.97 (37)

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

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

# SAP WorkSheet: New dwelling design stage

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 18.48 | 18.25 | 18.03 | 16.91 | 16.69 | 15.57 | 15.57 | 15.34 | 16.02 | 16.69 | 17.13 | 17.58 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 79.44 | 79.22 | 79 | 77.88 | 77.65 | 76.53 | 76.53 | 76.31 | 76.98 | 77.65 | 78.1 | 78.55 |

Average = Sum(39)$_{1...12}$ /12= 77.82 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.9 | 0.89 | 0.89 | 0.88 | 0.88 | 0.86 | 0.86 | 0.86 | 0.87 | 0.88 | 0.88 | 0.89 |

Average = Sum(40)$_{1...12}$ /12= 0.88 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.61 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.12 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*



*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 105.74 | 101.89 | 98.05 | 94.2 | 90.36 | 86.51 | 86.51 | 90.36 | 94.2 | 98.05 | 101.89 | 105.74 |

Total = Sum(44)$_{1...12}$ = 1153.5 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 156.81 | 137.14 | 141.52 | 123.38 | 118.39 | 102.16 | 94.66 | 108.63 | 109.93 | 128.11 | 139.84 | 151.86 |

Total = Sum(45)$_{1...12}$ = 1512.42 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 23.52 | 20.57 | 21.23 | 18.51 | 17.76 | 15.32 | 14.2 | 16.29 | 16.49 | 19.22 | 20.98 | 22.78 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# SAP WorkSheet: New dwelling design stage

| | | |
|---|---|---|
| Primary circuit loss (annual) from Table 3 | 0 | (58) |

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 212.08 | 187.07 | 196.8 | 176.87 | 173.66 | 155.65 | 149.94 | 163.91 | 163.42 | 183.39 | 193.33 | 207.13 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 212.08 | 187.07 | 196.8 | 176.87 | 173.66 | 155.65 | 149.94 | 163.91 | 163.42 | 183.39 | 193.33 | 207.13 | |

| | | |
|---|---|---|
| Output from water heater (annual)$_{1...12}$ | 2163.26 | (64) |

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 96.36 | 85.54 | 91.28 | 83.82 | 83.58 | 76.76 | 75.7 | 80.34 | 79.35 | 86.82 | 89.29 | 94.71 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating



## 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= | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 52.74 | 46.85 | 38.1 | 28.84 | 21.56 | 18.2 | 19.67 | 25.56 | 34.31 | 43.57 | 50.85 | 54.21 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 353.2 | 356.87 | 347.63 | 327.97 | 303.15 | 279.82 | 264.24 | 260.57 | 269.81 | 289.47 | 314.29 | 337.62 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 129.52 | 127.29 | 122.68 | 116.41 | 112.35 | 106.61 | 101.74 | 107.98 | 110.2 | 116.69 | 124.02 | 127.3 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 640.86 | 636.41 | 613.81 | 578.63 | 542.45 | 510.04 | 491.05 | 499.52 | 519.72 | 555.13 | 594.56 | 624.53 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 6 | x | 10.63 | x | 0.558 | x | 0.7 | = | 17.27 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 20.32 | x | 0.558 | x | 0.7 | = | 33 | (74) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 6 | x | 34.53 | x | 0.558 | x | 0.7 | = | 56.08 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 55.46 | x | 0.558 | x | 0.7 | = | 90.08 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 74.72 | x | 0.558 | x | 0.7 | = | 121.35 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 79.99 | x | 0.558 | x | 0.7 | = | 129.91 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 74.68 | x | 0.558 | x | 0.7 | = | 121.28 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 59.25 | x | 0.558 | x | 0.7 | = | 96.22 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 41.52 | x | 0.558 | x | 0.7 | = | 67.43 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 24.19 | x | 0.558 | x | 0.7 | = | 39.29 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 13.12 | x | 0.558 | x | 0.7 | = | 21.3 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 8.86 | x | 0.558 | x | 0.7 | = | 14.4 | (74) |
| East | 0.9x | 1 | x | 17.05 | x | 19.64 | x | 0.56 | x | 0.7 | = | 90.64 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 38.42 | x | 0.56 | x | 0.7 | = | 177.32 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 63.27 | x | 0.56 | x | 0.7 | = | 292.02 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 92.28 | x | 0.56 | x | 0.7 | = | 425.89 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 113.09 | x | 0.56 | x | 0.7 | = | 521.94 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 115.77 | x | 0.56 | x | 0.7 | = | 534.3 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 110.22 | x | 0.56 | x | 0.7 | = | 508.68 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 94.68 | x | 0.56 | x | 0.7 | = | 436.95 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 73.59 | x | 0.56 | x | 0.7 | = | 339.63 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 45.59 | x | 0.56 | x | 0.7 | = | 210.4 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 24.49 | x | 0.56 | x | 0.7 | = | 113.02 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 16.15 | x | 0.56 | x | 0.7 | = | 74.54 | (76) |



Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 107.91 | 210.32 | 348.1 | 515.97 | 643.29 | 664.21 | 629.96 | 533.17 | 407.06 | 249.69 | 134.33 | 88.94 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 748.77 | 846.73 | 961.91 | 1094.6 | 1185.75 | 1174.25 | 1121.01 | 1032.69 | 926.78 | 804.82 | 728.89 | 713.47 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.89 | 0.85 | 0.78 | 0.67 | 0.53 | 0.39 | 0.29 | 0.33 | 0.51 | 0.73 | 0.85 | 0.9 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.3 | 19.57 | 19.99 | 20.46 | 20.77 | 20.93 | 20.98 | 20.97 | 20.85 | 20.42 | 19.79 | 19.24 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.17 | 20.17 | 20.18 | 20.19 | 20.19 | 20.2 | 20.2 | 20.2 | 20.19 | 20.19 | 20.18 | 20.18 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.88 | 0.84 | 0.77 | 0.64 | 0.5 | 0.35 | 0.24 | 0.27 | 0.46 | 0.7 | 0.83 | 0.89 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 17.89 | 18.28 | 18.87 | 19.52 | 19.92 | 20.13 | 20.18 | 20.17 | 20.04 | 19.49 | 18.61 | 17.83 | (90) |

fLA = Living area ÷ (4) = | 0.29 | (91)

# SAP WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.3 | 18.65 | 19.2 | 19.79 | 20.17 | 20.36 | 20.41 | 20.4 | 20.27 | 19.76 | 18.95 | 18.23 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.3 | 18.65 | 19.2 | 19.79 | 20.17 | 20.36 | 20.41 | 20.4 | 20.27 | 19.76 | 18.95 | 18.23 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.85 | 0.81 | 0.74 | 0.63 | 0.5 | 0.36 | 0.25 | 0.29 | 0.47 | 0.68 | 0.81 | 0.86 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 634.81 | 684.27 | 711.29 | 688.01 | 588.38 | 420.26 | 285.73 | 297.24 | 432.64 | 547.61 | 587.51 | 613.01 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 1112.12 | 1089.66 | 1002.94 | 848.08 | 657.45 | 440.68 | 291.6 | 305.48 | 475.12 | 711.37 | 925.79 | 1102.43 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 355.12 | 272.42 | 216.98 | 115.25 | 51.39 | 0 | 0 | 0 | 0 | 121.84 | 243.56 | 364.12 | |

Total per year (kWh/year) = Sum(98)1…5,9…12 = 1740.69 (98)

Space heating requirement in kWh/m²/year 19.63 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1740.69 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1827.73 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2163.26 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 2271.42 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 40.99 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 172.04 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 172.04 | (331) |
| Energy for lighting (calculated in Appendix L) | | 372.58 | (332) |

## 10b. Fuel costs – Community heating scheme

| | Fuel kWh/year | Fuel Price (Table 12) | | Fuel Cost £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 4.24 | x 0.01 = | 77.5 | (340a) |
| Water heating from CHP | (310a) x | 4.24 | x 0.01 = | 96.31 | (342a) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 22.69 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 49.14 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 365.64 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.15 | (357) |
| **SAP rating (section12)** | | 83.98 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 989.29 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 21.27 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 1010.57 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 1010.57 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 89.29 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 193.37 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1293.23 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 14.58 | (384) |
| **EI rating (section 14)** | | | | | 87.04 | (385) |

## 13b. Primary Energy – Community heating scheme

| Energy kWh/year | Primary factor | P.Energy kWh/year |
|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Energy from other sources of space and water heating (not CHP) | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 89.5 | (367a) |
| Energy associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | 1.22 | = | 5587.66 | (367) |
| Electrical energy for heat distribution | [(313) x | | = | 125.84 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | = | 5713.51 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | 5713.51 | (373) |
| Energy associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | 5713.51 | (376) |
| Energy associated with space cooling | (315) x | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | 3.07 | = | 528.17 | (378) |
| Energy associated with electricity for lighting | (332))) x | 3.07 | = | 1143.83 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | 7385.51 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 A-4-02

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | South |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 78.39 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 280.97 | **(P1)** |
| **Transmission heat loss coefficient:** | 61 | |
| **Summer heat loss coefficient:** | 341.94 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| East (Side) | 0 | 1 |
| North (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| East (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| North (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| East (Side) | 0.9 x | 17.05 | 117.51 | 0.56 | 0.7 | 0.76 | 538.8 | |
| North (Rear) | 0.9 x | 6 | 81.19 | 0.56 | 0.7 | 0.76 | 131 | |
| | | | | | | **Total** | 669.79 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 510.04 | 491.05 | 499.52 | |
| Total summer gains | 1223.71 | 1160.84 | 1080.05 | **(P5)** |
| Summer gain/loss ratio | 3.58 | 3.39 | 3.16 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.45 | 1.45 | 1.45 | |
| Threshold temperature | 21.03 | 22.75 | 22.41 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:35:32*

## Project Information:

**Assessed By:** () **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 44.29m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 D-0-01

**Address :** D-0-01, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 24.05 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 22.58 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 64.4 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 56.9 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | OK |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | OK |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | OK |
| MVHR efficiency: | 94% | |
| Minimum | 70% | OK |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | OK |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: West | 7.63m² | |
| Ventilation rate: | 2.00 | |
| Blinds/curtains: | Light-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Community heating, heat from boilers – mains gas | |

# Predicted Energy Assessment

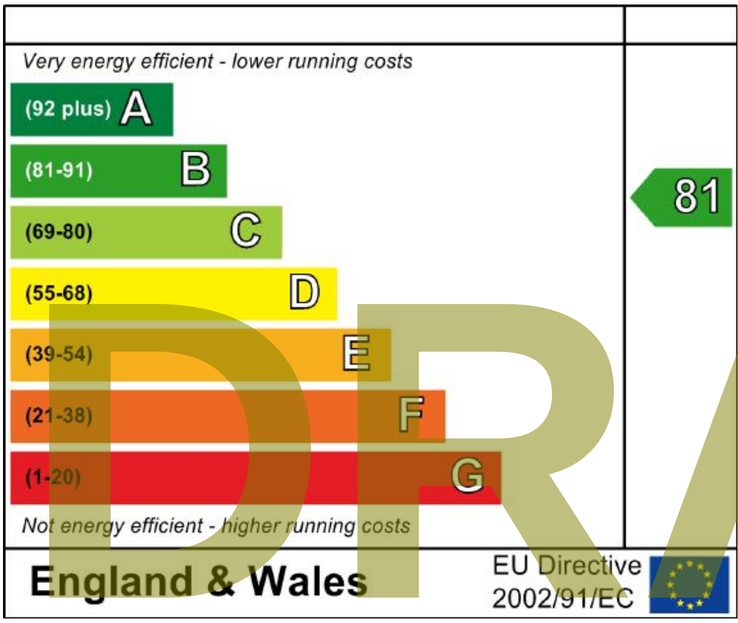
D-0-01
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Ground floor Flat |
| Date of assessment: | 24 January 2019 |
| Produced by: | Stroma Certification |
| Total floor area: | 44.29 m² |

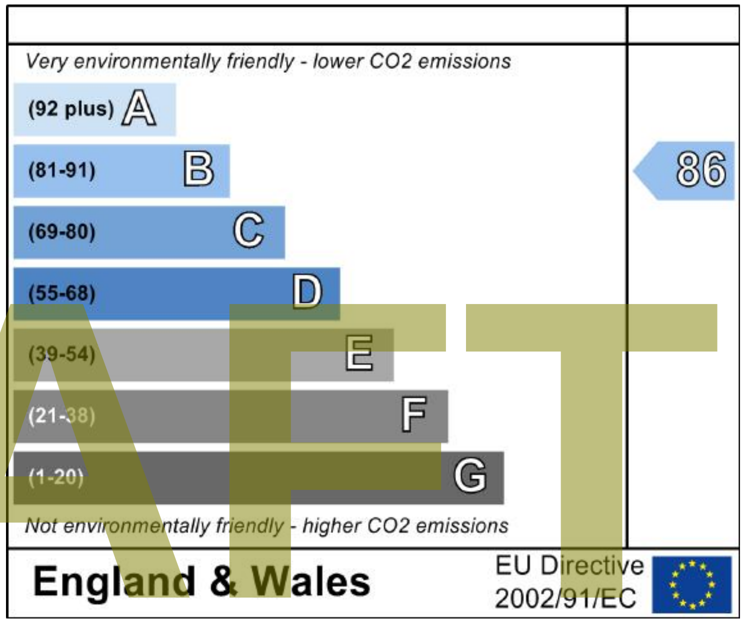
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-0-01

| | |
|---|---|
| Address: | D-0-01, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 24 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 163.84 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 44.29 m² | 2.4 m |
| Living area: | 37.16 m² (fraction 0.839) | |
| Front of dwelling faces: | West | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Front | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Front | 16mm or more | 0.7 | 0.558 | 1.4 | 7.63 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | West | 0 | 0 |
| Front | | External Wall | West | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 65.09 | 9.73 | 55.36 | 0.18 | 0 | False | 14 |
| Ground Floor | 44.29 | | | 0.13 | | | 110 |
| Internal Elements | | | | | | | |
| Stud Walls | 31.2 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Ceiling | 44.29 | | | | | | 30 |

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0966

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 13.8 | 0.05 | E4 | Jamb |
| [Approved] | 27.12 | 0.16 | E5 | Ground floor (normal) |

# SAP Input

| | | | | |
|---|---|---|---|---|
| [Approved] | 27.12 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| | 15.47 | 0.16 | P1 | Ground floor |
| | 15.47 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 1, efficiency 89.5<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from boilers – mains gas<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | | **Stroma Number:** | |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

## Property Address: 06-18-69419 D-0-01

**Address :** D-0-01, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 44.29 | (1a) | x | 2.4 | (2a) | = | 106.3 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 44.29 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 106.3 | (5) |

## 2. Ventilation rate:

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

DRAFT

**Air changes per hour**

Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0 ÷ (5) = 0 (8)

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |



## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows | | | 7.63 | x1/[1/( 1.4 )+ 0.04] | | = | 10.12 | | | (27) |
| Floor | | | 44.29 | x | 0.13 | = | 5.7577 | 110 | 4871.9 | (28) |
| Walls | 65.09 | 9.73 | 55.36 | x | 0.18 | = | 9.96 | 14 | 775.04 | (29) |
| Total area of elements, m² | | | 109.38 | | | | | | | (31) |
| Party ceiling | | | 44.29 | | | | | 30 | 1328.7 | (32b) |
| Internal wall ** | | | 31.2 | | | | | 9 | 280.8 | (32c) |

* *for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

** *include the areas on both sides of internal walls and partitions*

| | | | |
|---|---|---|---|
| Fabric heat loss, W/K = S (A x U) | (26)…(30) + (32) = | 28.78 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 7256.44 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 163.84 | (35) |

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 10.57 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 39.34 (37)

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 9.23 | 9.12 | 9 | 8.44 | 8.33 | 7.77 | 7.77 | 7.66 | 8 | 8.33 | 8.56 | 8.78 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 48.57 | 48.46 | 48.35 | 47.79 | 47.68 | 47.12 | 47.12 | 47.01 | 47.34 | 47.68 | 47.9 | 48.13 | |

Average = Sum(39)$_{1…12}$ /12= 47.76 (39)

# SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.1 | 1.09 | 1.09 | 1.08 | 1.08 | 1.06 | 1.06 | 1.06 | 1.07 | 1.08 | 1.08 | 1.09 |

Average = Sum(40)$_{1…12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.52 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 70.41 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

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

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 77.45 | 74.63 | 71.81 | 69 | 66.18 | 63.37 | 63.37 | 66.18 | 69 | 71.81 | 74.63 | 77.45 |

Total = Sum(44)$_{1…12}$ = 844.87 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 114.85 | 100.45 | 103.65 | 90.37 | 86.71 | 74.82 | 69.34 | 79.56 | 80.51 | 93.83 | 102.42 | 111.23 |

Total = Sum(45)$_{1…12}$ = 1107.75 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 17.23 | 15.07 | 15.55 | 13.56 | 13.01 | 11.22 | 10.4 | 11.93 | 12.08 | 14.07 | 15.36 | 16.68 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# SAP WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 170.13 | 150.38 | 158.93 | 143.86 | 141.99 | 128.32 | 124.61 | 134.84 | 134.01 | 149.11 | 155.92 | 166.5 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 170.13 | 150.38 | 158.93 | 143.86 | 141.99 | 128.32 | 124.61 | 134.84 | 134.01 | 149.11 | 155.92 | 166.5 | |

Output from water heater (annual)$_{1...12}$ 1758.59 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 82.41 | 73.34 | 78.69 | 72.84 | 73.05 | 67.67 | 67.28 | 70.68 | 69.57 | 75.42 | 76.85 | 81.2 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | | | | | | | | | | | | | |
| (67)m= | 30.37 | 26.98 | 21.94 | 16.61 | 12.42 | 10.48 | 11.33 | 14.72 | 19.76 | 25.09 | 29.28 | 31.22 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | | | | | | | | | | | | | |
| (68)m= | 197.69 | 199.74 | 194.57 | 183.57 | 169.68 | 156.62 | 147.9 | 145.85 | 151.01 | 162.02 | 175.91 | 188.97 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | | | | | | | | | | | | | |
| (69)m= | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | (69) |
| Pumps and fans gains (Table 5a) | | | | | | | | | | | | | |
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |
| Losses e.g. evaporation (negative values) (Table 5) | | | | | | | | | | | | | |
| (71)m= | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | (71) |
| Water heating gains (Table 5) | | | | | | | | | | | | | |
| (72)m= | 110.77 | 109.14 | 105.76 | 101.17 | 98.19 | 93.99 | 90.42 | 95 | 96.62 | 101.37 | 106.74 | 109.15 | (72) |
| **Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m | | | | | | | | | | | | | |
| (73)m= | 414.99 | 412.02 | 398.44 | 377.51 | 356.44 | 337.25 | 325.81 | 331.72 | 343.56 | 364.64 | 388.09 | 405.49 | (73) |



## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 0.9x | 0.77 | x | 7.63 | x | 19.64 | x | 0.56 | x | 0.7 | = | 40.56 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 38.42 | x | 0.56 | x | 0.7 | = | 79.35 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 63.27 | x | 0.56 | x | 0.7 | = | 130.68 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 92.28 | x | 0.56 | x | 0.7 | = | 190.59 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 113.09 | x | 0.56 | x | 0.7 | = | 233.57 | (80) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 0.9x | 0.77 | x | 7.63 | x | 115.77 | x | 0.56 | x | 0.7 | = | 239.1 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 110.22 | x | 0.56 | x | 0.7 | = | 227.64 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 94.68 | x | 0.56 | x | 0.7 | = | 195.54 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 73.59 | x | 0.56 | x | 0.7 | = | 151.99 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 45.59 | x | 0.56 | x | 0.7 | = | 94.16 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 24.49 | x | 0.56 | x | 0.7 | = | 50.58 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 16.15 | x | 0.56 | x | 0.7 | = | 33.36 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 40.56 | 79.35 | 130.68 | 190.59 | 233.57 | 239.1 | 227.64 | 195.54 | 151.99 | 94.16 | 50.58 | 33.36 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 455.55 | 491.37 | 529.12 | 568.1 | 590.02 | 576.36 | 553.44 | 527.26 | 495.54 | 458.8 | 438.67 | 438.85 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.95 | 0.93 | 0.89 | 0.8 | 0.67 | 0.5 | 0.37 | 0.4 | 0.61 | 0.82 | 0.92 | 0.95 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.88 | 20.04 | 20.31 | 20.63 | 20.85 | 20.96 | 20.99 | 20.99 | 20.92 | 20.65 | 20.22 | 19.84 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20 | 20.01 | 20.01 | 20.02 | 20.02 | 20.03 | 20.03 | 20.03 | 20.03 | 20.02 | 20.02 | 20.01 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.94 | 0.91 | 0.86 | 0.76 | 0.62 | 0.43 | 0.29 | 0.32 | 0.54 | 0.78 | 0.9 | 0.94 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.55 | 18.78 | 19.16 | 19.6 | 19.87 | 20 | 20.03 | 20.03 | 19.96 | 19.63 | 19.05 | 18.51 | (90) |

fLA = Living area ÷ (4) = 0.84 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.66 | 19.84 | 20.13 | 20.46 | 20.7 | 20.81 | 20.84 | 20.83 | 20.77 | 20.48 | 20.03 | 19.63 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.66 | 19.84 | 20.13 | 20.46 | 20.7 | 20.81 | 20.84 | 20.83 | 20.77 | 20.48 | 20.03 | 19.63 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.93 | 0.91 | 0.87 | 0.78 | 0.65 | 0.49 | 0.36 | 0.39 | 0.59 | 0.8 | 0.9 | 0.94 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 425 | 447.95 | 459.07 | 443.77 | 384.74 | 281.56 | 197.06 | 204.83 | 292.81 | 368.39 | 396.14 | 412.28 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 746.27 | 723.9 | 658.84 | 552.68 | 428.88 | 292.54 | 199.58 | 208.37 | 315.69 | 471.25 | 619.5 | 742.49 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 239.03 | 185.44 | 148.63 | 78.42 | 32.84 | 0 | 0 | 0 | 0 | 76.53 | 160.82 | 245.67 | |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = Sum(98)1...5,9...12 = | 1167.37 | (98) |
| Space heating requirement in kWh/m²/year | | 26.36 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1167.37 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1225.74 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1758.59 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1846.52 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 30.72 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 85.91 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 85.91 | (331) |
| Energy for lighting (calculated in Appendix L) | | 214.57 | (332) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 4.24 | x 0.01 = | 51.97 | (340a) |
| Water heating from CHP | (310a) | x | 4.24 | x 0.01 = | 78.29 | (342a) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 11.33 | (349) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Energy for lighting | (332) | 13.19 | x 0.01 = | 28.3 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 289.9 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.36 | (357) |
| **SAP rating (section12)** | | 80.98 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | **Energy kWh/year** | **Emission factor kg CO2/kWh** | | **Emissions kg CO2/year** | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 741.46 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 15.95 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 757.41 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 757.41 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 44.59 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 111.36 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 913.36 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 20.62 | (384) |
| **EI rating (section 14)** | | | | | 86.29 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | **Energy kWh/year** | **Primary factor** | | **P.Energy kWh/year** | |
|---|---|---|---|---|---|---|
| Energy from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| Energy associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 1.22 | = | 4187.89 | (367) |
| Electrical energy for heat distribution | [(313) x | | | = | 94.32 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | = | 4282.21 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | 4282.21 | (373) |
| Energy associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | 4282.21 | (376) |
| Energy associated with space cooling | (315) x | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | 3.07 | = | 263.76 | (378) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Energy associated with electricity for lighting | (332))) x | 3.07 | = | 658.73 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | 5204.7 | (383) |

DRAFT

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 D-0-01

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | West |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 163.84 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Light-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 2 ( Windows open half the time) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 70.16 | **(P1)** |
| **Transmission heat loss coefficient:** | 39.3 | |
| **Summer heat loss coefficient:** | 109.5 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Front) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Front) | 0.6 | 0.9 | 1 | 0.54 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Front) | 0.9 x | 7.63 | 117.51 | 0.56 | 0.7 | 0.54 | 170.2 | |
| | | | | | | **Total** | 170.2 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 337.25 | 325.81 | 331.72 | |
| Total summer gains | 517.92 | 496.01 | 481.46 | **(P5)** |
| Summer gain/loss ratio | 4.73 | 4.53 | 4.4 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 0.85 | 0.85 | 0.85 | |
| Threshold temperature | 21.58 | 23.28 | 23.05 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:35:29*

## Project Information:

**Assessed By:** ()

**Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE**

Total Floor Area: 51.14m²

**Site Reference :** Bertram Street

**Plot Reference:** 06-18-69419 D-1-01

**Address :** D-1-01, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 20.04 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 19.48 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 51.1 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 47.4 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | OK |
| Roof | (no roof) | | |
| Openings | 1.40 (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: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |

Based on:

| | |
|---|---|
| Overshading: | Average or unknown |
| Windows facing: West | 7.63m² |
| Windows facing: East | 8.4m² |
| Ventilation rate: | 6.00 |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# Predicted Energy Assessment

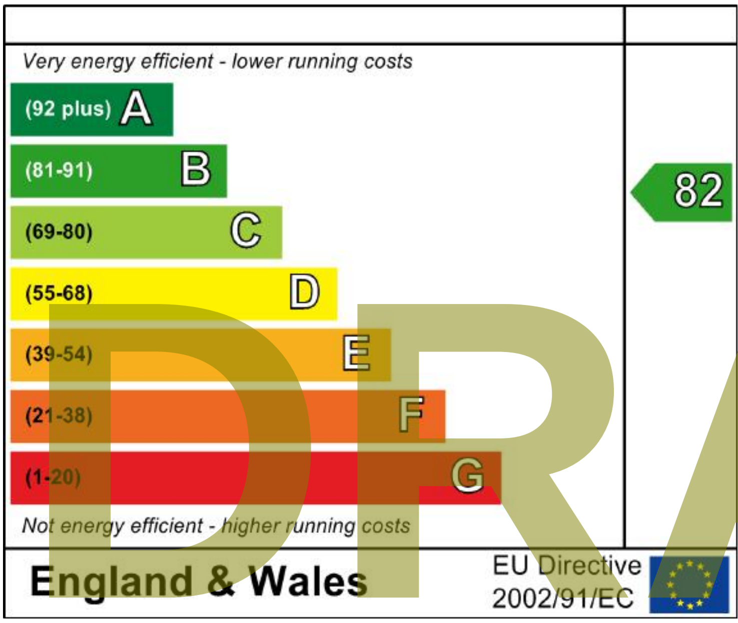


| | | | |
|---|---|---|---|
| D-1-01 | | Dwelling type: | Mid floor Flat |
| Bertram Street | | Date of assessment: | 24 January 2019 |
| London | | Produced by: | Stroma Certification |
| | | Total floor area: | 51.14 m² |

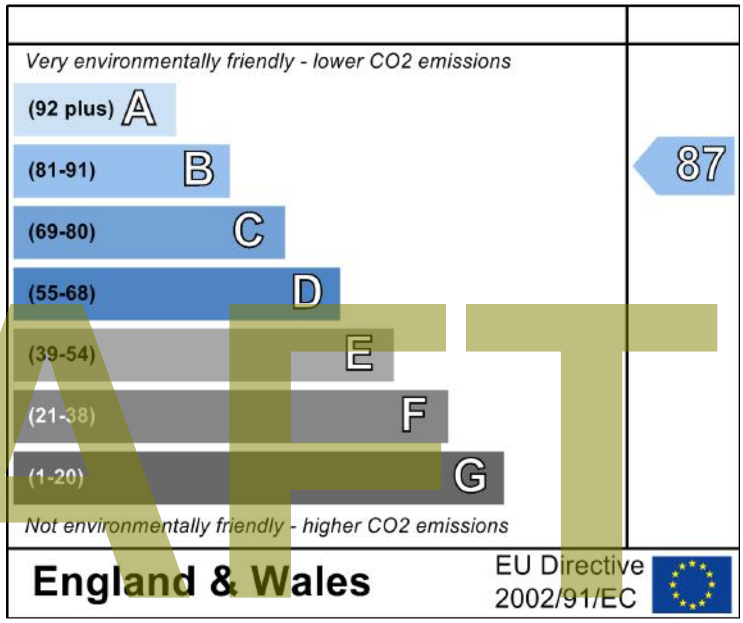
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating






The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-1-01

| | |
|---|---|
| Address: | D-1-01, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 24 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 102.37 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 51.14 m² | 2.4 m |
| Living area: | 24.52 m² (fraction 0.479) | |
| Front of dwelling faces: | South | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Front | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Front | 16mm or more | 0.7 | 0.558 | 1.4 | 7.63 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 8.4 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | Stair Wall | South | 0 | 0 |
| Front | | External Wall | West | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 53.01 | 16.03 | 36.98 | 0.18 | 0 | False | 14 |
| Stair Wall | 20.97 | 2.1 | 18.87 | 0.18 | 0.9 | False | 14 |
| Exposed Floor | 6.3 | | | 0.13 | | | 75 |
| Internal Elements | | | | | | | |
| Stud Walls | 60 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 5.64 | | | | | | 20 |
| Party Ceiling | 51.14 | | | | | | 30 |
| Party Floor | 44.84 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1004

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 18.6 | 0.05 | E4 | Jamb |
| [Approved] | 55.98 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 5.67 | 0.32 | E20 | Exposed floor (normal) |
| | 2.35 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 2.35 | 0.16 | P7 | Exposed floor (normal) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 1, efficiency 89.5<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

User Details:

**Assessor Name:** 
**Stroma Number:** 
**Software Name:** Stroma FSAP 2012
**Software Version:** Version: 1.0.4.16

Property Address: 06-18-69419 D-1-01

**Address :** D-1-01, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 51.14 | (1a) x | 2.4 | (2a) = | 122.74 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 51.14 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 122.74 | (5) |

## 2. Ventilation rate:

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

DRAFT

| | | Air changes per hour | |
|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |
| *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | | |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

| | | |
|---|---|---|
| If mechanical ventilation: | 0.5 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0.5 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 79.9 | (23c) |

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 7.63 | x1/[1/( 1.4 )+ 0.04] | | = | 10.12 | | | (27) |
| Windows Type 2 | | | 8.4 | x1/[1/( 1.4 )+ 0.04] | | = | 11.14 | | | (27) |
| Floor | | | 6.3 | x | 0.13 | = | 0.819 | 75 | 472.5 | (28) |
| Walls Type1 | 53.01 | 16.03 | 36.98 | x | 0.18 | = | 6.66 | 14 | 517.72 | (29) |
| Walls Type2 | 20.97 | 2.1 | 18.87 | x | 0.15 | = | 2.92 | 14 | 264.18 | (29) |
| Total area of elements, m² | | | 80.28 | | | | | | | (31) |
| Party wall | | | 5.64 | x | 0 | = | 0 | 20 | 112.8 | (32) |
| Party floor | | | 44.84 | | | | | 40 | 1793.6 | (32a) |
| Party ceiling | | | 51.14 | | | | | 30 | 1534.2 | (32b) |
| Internal wall ** | | | 60 | | | | | 9 | 540 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

| | | | |
|---|---|---|---|
| Fabric heat loss, W/K = S (A x U) | (26)…(30) + (32) = | 34.59 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 5235 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 102.37 | (35) |

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

| | | | |
|---|---|---|---|
| Thermal bridges : S (L x Y) calculated using Appendix K | | 8.06 | (36) |

*if details of thermal bridging are not known (36) = 0.15 x (31)*

| | | | |
|---|---|---|---|
| Total fabric heat loss | (33) + (36) = | 42.65 | (37) |

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.65 | 10.53 | 10.4 | 9.75 | 9.62 | 8.98 | 8.98 | 8.85 | 9.23 | 9.62 | 9.88 | 10.14 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 53.3 | 53.18 | 53.05 | 52.4 | 52.27 | 51.63 | 51.63 | 51.5 | 51.88 | 52.27 | 52.53 | 52.79 | | |
| | | | | | | | | | | Average = $\text{Sum}(39)_{1...12}$ /12= | | | 52.37 | (39) |

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.04 | 1.04 | 1.04 | 1.02 | 1.02 | 1.01 | 1.01 | 1.01 | 1.01 | 1.02 | 1.03 | 1.03 | | |
| | | | | | | | | | | Average = $\text{Sum}(40)_{1...12}$ /12= | | | 1.02 | (40) |

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.72 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.14 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*



*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 82.65 | 79.65 | 76.64 | 73.64 | 70.63 | 67.62 | 67.62 | 70.63 | 73.64 | 76.64 | 79.65 | 82.65 | | |
| | | | | | | | | | | Total = $\text{Sum}(44)_{1...12}$ = | | | 901.65 | (44) |

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 122.57 | 107.2 | 110.62 | 96.44 | 92.54 | 79.85 | 74 | 84.91 | 85.93 | 100.14 | 109.31 | 118.7 | | |
| | | | | | | | | | | Total = $\text{Sum}(45)_{1...12}$ = | | | 1182.21 | (45) |

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.39 | 16.08 | 16.59 | 14.47 | 13.88 | 11.98 | 11.1 | 12.74 | 12.89 | 15.02 | 16.4 | 17.81 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 177.85 | 157.13 | 165.9 | 149.94 | 147.82 | 133.35 | 129.27 | 140.19 | 139.42 | 155.42 | 162.8 | 173.98 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 177.85 | 157.13 | 165.9 | 149.94 | 147.82 | 133.35 | 129.27 | 140.19 | 139.42 | 155.42 | 162.8 | 173.98 |

Output from water heater (annual)$_{1...12}$ | 1833.05 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.98 | 75.59 | 81 | 74.86 | 74.99 | 69.35 | 68.83 | 72.45 | 71.37 | 77.52 | 79.14 | 83.69 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 33.47 | 29.73 | 24.18 | 18.31 | 13.68 | 11.55 | 12.48 | 16.23 | 21.78 | 27.65 | 32.27 | 34.41 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 224.17 | 226.5 | 220.63 | 208.16 | 192.4 | 177.6 | 167.71 | 165.38 | 171.24 | 183.72 | 199.47 | 214.28 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 114.22 | 112.48 | 108.88 | 103.98 | 100.79 | 96.31 | 92.51 | 97.39 | 99.12 | 104.19 | 109.92 | 112.49 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 453.4 | 450.25 | 435.23 | 411.98 | 388.42 | 367 | 354.24 | 360.53 | 373.68 | 397.1 | 423.2 | 442.71 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | Access Factor Table 6d | Area m² | Flux Table 6a | g_ Table 6b | FF Table 6c | Gains (W) |
|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 8.4 | x | 19.64 | x | 0.56 | x | 0.7 | = | 44.66 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 38.42 | x | 0.56 | x | 0.7 | = | 87.36 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 63.27 | x | 0.56 | x | 0.7 | = | 143.87 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 92.28 | x | 0.56 | x | 0.7 | = | 209.82 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 113.09 | x | 0.56 | x | 0.7 | = | 257.15 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 115.77 | x | 0.56 | x | 0.7 | = | 263.23 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 110.22 | x | 0.56 | x | 0.7 | = | 250.61 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 94.68 | x | 0.56 | x | 0.7 | = | 215.27 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 73.59 | x | 0.56 | x | 0.7 | = | 167.32 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 45.59 | x | 0.56 | x | 0.7 | = | 103.66 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 24.49 | x | 0.56 | x | 0.7 | = | 55.68 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 16.15 | x | 0.56 | x | 0.7 | = | 36.72 | (76) |
| West | 0.9x | 0.77 | x | 7.63 | x | 19.64 | x | 0.56 | x | 0.7 | = | 40.56 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 38.42 | x | 0.56 | x | 0.7 | = | 79.35 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 63.27 | x | 0.56 | x | 0.7 | = | 130.68 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 92.28 | x | 0.56 | x | 0.7 | = | 190.59 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 113.09 | x | 0.56 | x | 0.7 | = | 233.57 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 115.77 | x | 0.56 | x | 0.7 | = | 239.1 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 110.22 | x | 0.56 | x | 0.7 | = | 227.64 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 94.68 | x | 0.56 | x | 0.7 | = | 195.54 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 73.59 | x | 0.56 | x | 0.7 | = | 151.99 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 45.59 | x | 0.56 | x | 0.7 | = | 94.16 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 24.49 | x | 0.56 | x | 0.7 | = | 50.58 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 16.15 | x | 0.56 | x | 0.7 | = | 33.36 | (80) |



Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 85.22 | 166.71 | 274.55 | 400.41 | 490.72 | 502.34 | 478.25 | 410.81 | 319.31 | 197.82 | 106.26 | 70.08 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 538.62 | 616.96 | 709.78 | 812.39 | 879.14 | 869.34 | 832.48 | 771.34 | 692.99 | 594.92 | 529.47 | 512.79 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.89 | 0.84 | 0.77 | 0.64 | 0.5 | 0.37 | 0.27 | 0.3 | 0.48 | 0.71 | 0.84 | 0.9 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.53 | 19.8 | 20.2 | 20.6 | 20.84 | 20.95 | 20.99 | 20.98 | 20.9 | 20.56 | 19.98 | 19.47 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.05 | 20.05 | 20.05 | 20.06 | 20.06 | 20.08 | 20.08 | 20.08 | 20.07 | 20.06 | 20.06 | 20.06 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.87 | 0.83 | 0.74 | 0.61 | 0.46 | 0.32 | 0.21 | 0.24 | 0.42 | 0.67 | 0.82 | 0.89 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

# SAP WorkSheet: New dwelling design stage

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.12 | 18.5 | 19.05 | 19.59 | 19.9 | 20.04 | 20.07 | 20.06 | 19.98 | 19.55 | 18.77 | 18.05 | (90) |

fLA = Living area ÷ (4) = 0.48 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.79 | 19.13 | 19.6 | 20.07 | 20.35 | 20.48 | 20.51 | 20.5 | 20.42 | 20.03 | 19.35 | 18.73 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.79 | 19.13 | 19.6 | 20.07 | 20.35 | 20.48 | 20.51 | 20.5 | 20.42 | 20.03 | 19.35 | 18.73 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.85 | 0.81 | 0.73 | 0.61 | 0.47 | 0.34 | 0.24 | 0.27 | 0.44 | 0.67 | 0.81 | 0.87 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 459.71 | 498.74 | 518.73 | 495.79 | 416.42 | 293.61 | 199.11 | 207.61 | 306.47 | 397.23 | 427.44 | 443.82 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 772.56 | 756.46 | 694.86 | 585.52 | 452.05 | 303.31 | 201.71 | 211.31 | 327.84 | 493.15 | 643.7 | 766.94 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 232.76 | 173.19 | 131.04 | 64.61 | 26.51 | 0 | 0 | 0 | 0 | 71.37 | 155.7 | 240.4 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1095.57 (98)

Space heating requirement in kWh/m²/year 21.42 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | |
|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1095.57 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1150.34 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1833.05 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1924.7 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 30.75 | (313) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 99.2 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 99.2 | (331) |
| Energy for lighting (calculated in Appendix L) | | 236.47 | (332) |

## 10b. Fuel costs – Community heating scheme

| | Fuel kWh/year | Fuel Price (Table 12) | | Fuel Cost £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 4.24 | x 0.01 = | 48.77 | (340a) |
| Water heating from CHP | (310a) x | 4.24 | x 0.01 = | 81.61 | (342a) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 13.08 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 31.19 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 294.66 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.29 | (357) |
| **SAP rating (section12)** | | 82.04 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP)<br>Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 742.13 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 15.96 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 758.09 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 758.09 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 51.49 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 122.73 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 932.31 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 18.23 | (384) |

# SAP WorkSheet: New dwelling design stage

**EI rating (section 14)** 87.01 (385)

## 13b. Primary Energy – Community heating scheme

| | | Energy kWh/year | Primary factor | | P.Energy kWh/year | |
|---|---|---|---|---|---|---|
| Energy from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| Energy associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 1.22 | = | 4191.69 | (367) |
| Electrical energy for heat distribution | [(313) x | | | = | 94.4 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | = | 4286.09 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | 4286.09 | (373) |
| Energy associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | 4286.09 | (376) |
| Energy associated with space cooling | (315) x | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | 3.07 | = | 304.55 | (378) |
| Energy associated with electricity for lighting | (332))) x | | 3.07 | = | 725.96 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | 5316.6 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 D-1-01

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | Yes |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | South |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 102.37 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 6 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 243.02 | **(P1)** |
| **Transmission heat loss coefficient:** | 42.6 | |
| **Summer heat loss coefficient:** | 285.67 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Front) | 0 | 1 |
| East (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Front) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Front) | 0.9 x | 7.63 | 117.51 | 0.56 | 0.7 | 0.76 | 241.12 | |
| East (Rear) | 0.9 x | 8.4 | 117.51 | 0.56 | 0.7 | 0.76 | 265.45 | |
| | | | | | | **Total** | 506.56 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 367 | 354.24 | 360.53 | |
| Total summer gains | 904.73 | 860.8 | 806.19 | **(P5)** |
| Summer gain/loss ratio | 3.17 | 3.01 | 2.82 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.28 | 1.28 | 1.28 | |
| Threshold temperature | 20.45 | 22.2 | 21.91 | **(P7)** |
| **Likelihood of high internal temperature** | **Not significant** | **Medium** | **Slight** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:35:25*

## Project Information:

**Assessed By:** ()

**Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE**

Total Floor Area: 50.27m²

**Site Reference :** Bertram Street

**Plot Reference:** 06-18-69419 D-1-02

**Address :** D-1-02, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c) | | |
| Fuel factor: 1.00 (mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 18.15 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 17.91 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 39.9 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 39.6 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (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: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

DRAFT

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South | 16.03m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# Predicted Energy Assessment

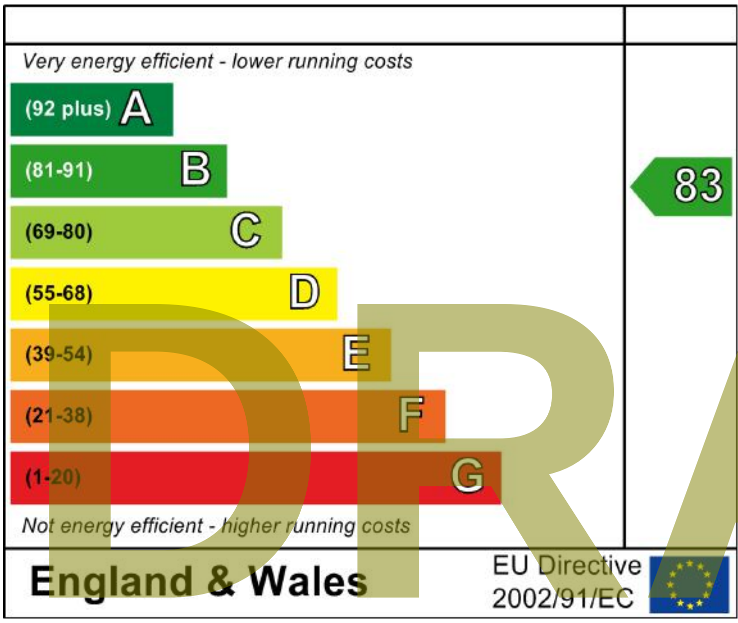
D-1-02
Bertram Street
London

Dwelling type: Mid floor Flat
Date of assessment: 24 January 2019
Produced by: Stroma Certification
Total floor area: 50.27 m²

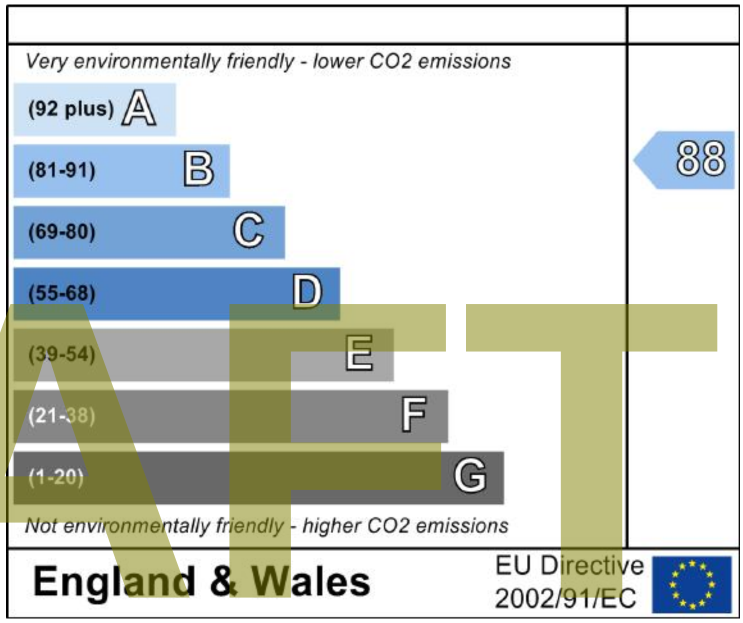
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating






The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-1-02

| | |
|---|---|
| Address: | D-1-02, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 24 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 98.25 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 50.27 m² | 2.4 m |
| Living area: | 22.61 m² (fraction 0.45) | |
| Front of dwelling faces: | North | |



## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 16.03 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | Stair Wall | North | 0 | 0 |
| Side | | External Wall | South | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 53.18 | 16.03 | 37.15 | 0.18 | 0 | False | 14 |
| Stair Wall | 15.06 | 2.1 | 12.96 | 0.18 | 0.9 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 67.2 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 5.7 | | | | | | 20 |
| Party Ceiling | 50.27 | | | | | | 30 |
| Party Floor | 50.27 | | | | | | 40 |

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1181

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |

# SAP Input

| | | | | |
|---|---|---|---|---|
| [Approved] | 18.6 | 0.05 | E4 | Jamb |
| [Approved] | 55.98 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 5.67 | 0.32 | E20 | Exposed floor (normal) |
| | 2.35 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 2.35 | 0.16 | P7 | Exposed floor (normal) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 3 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 1, efficiency 89.5<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

**User Details:**

| | | | |
|---|---|---|---|
| **Assessor Name:** | | **Stroma Number:** | |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

**Property Address: 06-18-69419 D-1-02**

**Address :** D-1-02, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 50.27 | (1a) x | 2.4 | (2a) = | 120.65 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 50.27 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 120.65 | (5) |

## 2. Ventilation rate:

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

| | | | Air changes per hour | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 3 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.78 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.12 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.15 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.12 | 0.12 | 0.13 | 0.14 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows | | | 16.03 | x1/[1/( 1.4 )+ 0.04] | | = | 21.25 | | | (27) |
| Walls Type1 | 53.18 | 16.03 | 37.15 | x | 0.18 | = | 6.69 | 14 | 520.1 | (29) |
| Walls Type2 | 15.06 | 2.1 | 12.96 | x | 0.15 | = | 2.01 | 14 | 181.44 | (29) |
| Total area of elements, m² | | | 68.24 | | | | | | | (31) |
| Party wall | | | 5.7 | x | 0 | = | 0 | 20 | 114 | (32) |
| Party floor | | | 50.27 | | | | | 40 | 2010.8 | (32a) |
| Party ceiling | | | 50.27 | | | | | 30 | 1508.1 | (32b) |
| Internal wall ** | | | 67.2 | | | | | 9 | 604.8 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.89 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 4939.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 98.25 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 8.06 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 40.95 (37)

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 9.9 | 9.79 | 9.67 | 9.09 | 8.98 | 8.4 | 8.4 | 8.28 | 8.63 | 8.98 | 9.21 | 9.44 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 50.85 | 50.73 | 50.62 | 50.04 | 49.92 | 49.34 | 49.34 | 49.23 | 49.58 | 49.92 | 50.15 | 50.39 |

Average = Sum(39)$_{1…12}$ /12= 50.01 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.01 | 1.01 | 1.01 | 1 | 0.99 | 0.98 | 0.98 | 0.98 | 0.99 | 0.99 | 1 | 1 | | |
| | | | | | | | | | | Average = Sum(40)$_{1...12}$ /12= | | | 0.99 | (40) |

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.53 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)* | | | | | | | | | | | | | | |
| (44)m= | 81.98 | 79 | 76.02 | 73.04 | 70.06 | 67.08 | 67.08 | 70.06 | 73.04 | 76.02 | 79 | 81.98 | | |
| | | | | | | | | | | Total = Sum(44)$_{1...12}$ = | | | 894.34 | (44) |
| *Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)* | | | | | | | | | | | | | | |
| (45)m= | 121.58 | 106.33 | 109.72 | 95.66 | 91.79 | 79.21 | 73.4 | 84.22 | 85.23 | 99.33 | 108.42 | 117.74 | | |
| | | | | | | | | | | Total = Sum(45)$_{1...12}$ = | | | 1172.63 | (45) |
| *If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)* | | | | | | | | | | | | | | |
| (46)m= | 18.24 | 15.95 | 16.46 | 14.35 | 13.77 | 11.88 | 11.01 | 12.63 | 12.78 | 14.9 | 16.26 | 17.66 | | (46) |



Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 176.85 | 156.26 | 165 | 149.15 | 147.07 | 132.7 | 128.67 | 139.5 | 138.72 | 154.6 | 161.92 | 173.02 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 176.85 | 156.26 | 165 | 149.15 | 147.07 | 132.7 | 128.67 | 139.5 | 138.72 | 154.6 | 161.92 | 173.02 | |

Output from water heater (annual)$_{1...12}$ 1823.47 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.65 | 75.3 | 80.7 | 74.6 | 74.74 | 69.13 | 68.63 | 72.23 | 71.13 | 77.25 | 78.85 | 83.37 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 32.97 | 29.28 | 23.82 | 18.03 | 13.48 | 11.38 | 12.29 | 15.98 | 21.45 | 27.24 | 31.79 | 33.89 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 220.8 | 223.09 | 217.32 | 205.02 | 189.51 | 174.93 | 165.18 | 162.89 | 168.67 | 180.96 | 196.47 | 211.06 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 113.77 | 112.05 | 108.47 | 103.61 | 100.46 | 96.02 | 92.24 | 97.08 | 98.8 | 103.83 | 109.51 | 112.06 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 448.39 | 445.27 | 430.45 | 407.52 | 384.29 | 363.17 | 350.56 | 356.8 | 369.76 | 392.87 | 418.62 | 437.85 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South | 0.9x | 0.77 | x | 16.03 | x | 46.75 | x | 0.56 | x | 0.7 | = | 202.86 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 76.57 | x | 0.56 | x | 0.7 | = | 332.24 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 97.53 | x | 0.56 | x | 0.7 | = | 423.21 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 110.23 | x | 0.56 | x | 0.7 | = | 478.32 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 114.87 | x | 0.56 | x | 0.7 | = | 498.44 | (78) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South | 0.9x | 0.77 | x | 16.03 | x | 110.55 | x | 0.56 | x | 0.7 | = | 479.68 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 108.01 | x | 0.56 | x | 0.7 | = | 468.67 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 104.89 | x | 0.56 | x | 0.7 | = | 455.15 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 101.89 | x | 0.56 | x | 0.7 | = | 442.09 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 82.59 | x | 0.56 | x | 0.7 | = | 358.35 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 55.42 | x | 0.56 | x | 0.7 | = | 240.46 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 40.4 | x | 0.56 | x | 0.7 | = | 175.29 | (78) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 202.86 | 332.24 | 423.21 | 478.32 | 498.44 | 479.68 | 468.67 | 455.15 | 442.09 | 358.35 | 240.46 | 175.29 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 651.25 | 777.51 | 853.66 | 885.83 | 882.73 | 842.84 | 819.24 | 811.95 | 811.85 | 751.22 | 659.08 | 613.14 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.83 | 0.75 | 0.68 | 0.59 | 0.48 | 0.36 | 0.26 | 0.27 | 0.4 | 0.59 | 0.76 | 0.84 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.82 | 20.13 | 20.42 | 20.68 | 20.85 | 20.95 | 20.99 | 20.98 | 20.93 | 20.72 | 20.25 | 19.75 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.07 | 20.08 | 20.08 | 20.09 | 20.09 | 20.1 | 20.1 | 20.1 | 20.09 | 20.09 | 20.09 | 20.08 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.81 | 0.73 | 0.65 | 0.56 | 0.44 | 0.31 | 0.21 | 0.22 | 0.35 | 0.55 | 0.73 | 0.83 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.55 | 18.97 | 19.36 | 19.71 | 19.93 | 20.06 | 20.09 | 20.09 | 20.03 | 19.77 | 19.15 | 18.45 | (90) |

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.12 | 19.49 | 19.84 | 20.14 | 20.35 | 20.46 | 20.49 | 20.49 | 20.44 | 20.2 | 19.65 | 19.04 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.12 | 19.49 | 19.84 | 20.14 | 20.35 | 20.46 | 20.49 | 20.49 | 20.44 | 20.2 | 19.65 | 19.04 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.79 | 0.72 | 0.65 | 0.56 | 0.45 | 0.33 | 0.23 | 0.24 | 0.37 | 0.56 | 0.72 | 0.81 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 513.16 | 558.82 | 551.34 | 493.62 | 400.53 | 280.06 | 189.74 | 198.59 | 300.93 | 420 | 475.33 | 494.23 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 753.68 | 740.33 | 674.99 | 562.64 | 431.61 | 289.18 | 192.09 | 201.43 | 314.21 | 479.08 | 629.35 | 747.61 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 178.94 | 121.98 | 92 | 49.69 | 23.12 | 0 | 0 | 0 | 0 | 43.96 | 110.9 | 188.51 | (98) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = Sum(98)1...5,9...12 = | 809.09 | (98) |
| Space heating requirement in kWh/m²/year | | 16.09 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 809.09 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 849.54 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1823.47 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1914.64 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 27.64 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 97.51 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 97.51 | (331) |
| Energy for lighting (calculated in Appendix L) | | 232.91 | (332) |



## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 4.24 | x 0.01 = | 36.02 | (340a) |
| Water heating from CHP | (310a) | x | 4.24 | x 0.01 = | 81.18 | (342a) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 12.86 | (349) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Energy for lighting | (332) | 13.19 | x 0.01 = | 30.72 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 280.78 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.24 | (357) |
| **SAP rating (section12)** | | 82.73 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 667.11 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 14.35 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 681.46 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 681.46 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 50.61 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 120.88 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 852.95 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 16.97 | (384) |
| **EI rating (section 14)** | | | | | 88 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | Energy kWh/year | Primary factor | | P.Energy kWh/year | |
|---|---|---|---|---|---|---|
| Energy from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| Energy associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 1.22 | = | 3767.94 | (367) |
| Electrical energy for heat distribution | [(313) x | | | = | 84.86 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | = | 3852.8 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | 3852.8 | (373) |
| Energy associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | 3852.8 | (376) |
| Energy associated with space cooling | (315) x | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | 3.07 | = | 299.37 | (378) |

| | | | | | |
|---|---|---|---|---|---|
| Energy associated with electricity for lighting | (332))) x | 3.07 | = | 715.04 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | 4867.21 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 D-1-02

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | North |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 98.25 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 159.26 | **(P1)** |
| **Transmission heat loss coefficient:** | 40.9 | |
| **Summer heat loss coefficient:** | 200.2 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| South (Side) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| South (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| South (Side) | 0.9 x | 16.03 | 112.21 | 0.56 | 0.7 | 0.76 | 483.71 | |
| | | | | | | **Total** | 483.71 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 363.17 | 350.56 | 356.8 | |
| Total summer gains | 864.57 | 834.28 | 834.05 | **(P5)** |
| Summer gain/loss ratio | 4.32 | 4.17 | 4.17 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.31 | 1.31 | 1.31 | |
| Threshold temperature | 21.63 | 23.38 | 23.28 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:35:22*

## Project Information:

**Assessed By:** ()

**Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE**

Total Floor Area: 51.14m²

**Site Reference :** Bertram Street

**Plot Reference:** 06-18-69419 D-2-01

**Address :** D-2-01, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 19.4 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 18.89 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 47.8 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 45.0 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| 7 Low energy lights | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: West | 7.63m² | |
| Windows facing: East | 8.4m² | |
| Ventilation rate: | 6.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party Walls U-value | 0 W/m²K | |
| Community heating, heat from boilers – mains gas | | |

# Predicted Energy Assessment

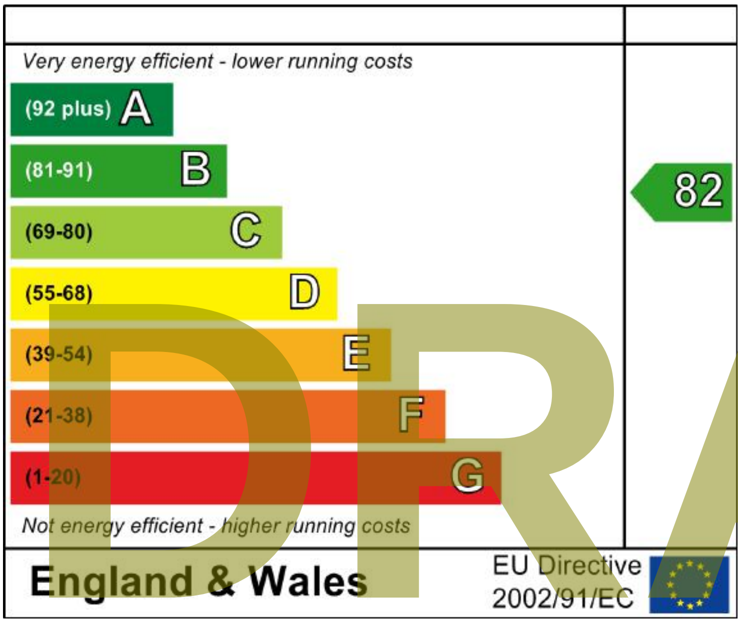
D-2-01
Bertram Street
London

Dwelling type: Mid floor Flat
Date of assessment: 24 January 2019
Produced by: Stroma Certification
Total floor area: 51.14 m²

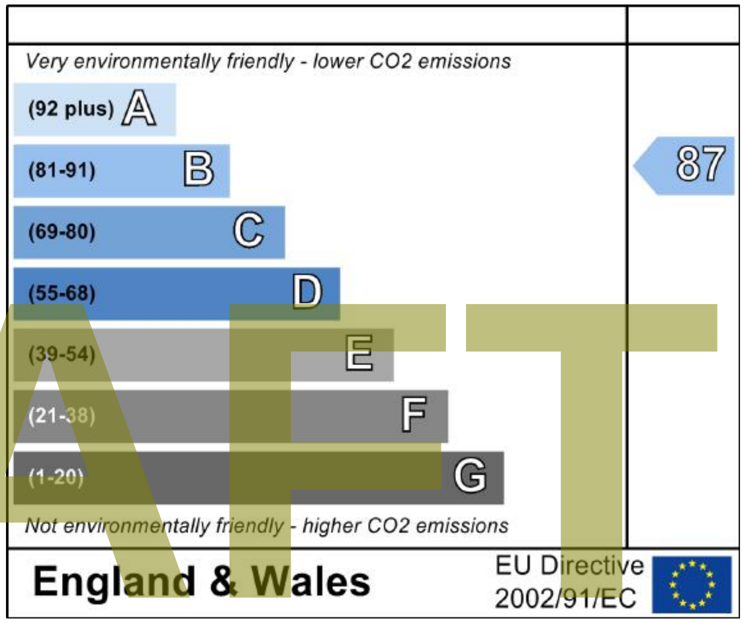
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating






The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-2-01

| | |
|---|---|
| Address: | D-2-01, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 24 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 98.05 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 51.14 m² | 2.4 m |
| Living area: | 24.52 m² (fraction 0.479) | |
| Front of dwelling faces: | South | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Front | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Front | 16mm or more | 0.7 | 0.558 | 1.4 | 7.63 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 8.4 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | Stair Wall | South | 0 | 0 |
| Front | | External Wall | West | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 53.01 | 16.03 | 36.98 | 0.18 | 0 | False | 14 |
| Stair Wall | 20.97 | 2.1 | 18.87 | 0.18 | 0.9 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 60 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 5.64 | | | | | | 20 |
| Party Ceiling | 51.14 | | | | | | 30 |
| Party Floor | 51.14 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0847

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 18.6 | 0.05 | E4 | Jamb |
| [Approved] | 61.65 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 4.7 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, Rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 3

## Main heating system:

Main heating system: Community heating schemes
Heat source: Community boilers
heat from boilers – mains gas, heat fraction 1, efficiency 89.5
Piping>=1991, pre-insulated, low temp, variable flow

## Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and TRVs
Control code: 2306

## Secondary heating system:

Secondary heating system: None

## Water heating:

Water heating: From main heating system
Water code: 901
Fuel :heat from CHP
No hot water cylinder
Solar panel: False

## Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Dense urban
EPC language: English
Wind turbine: No
Photovoltaics: None
Assess Zero Carbon Home: No

# SAP WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | | **Stroma Number:** | |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 D-2-01

**Address :** D-2-01, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 51.14 | (1a) x | 2.4 | (2a) = | 122.74 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 51.14 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 122.74 | (5) |

## 2. Ventilation rate:

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

DRAFT

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 7.63 | x1/[1/( 1.4 )+ 0.04] | | = | 10.12 | | | (27) |
| Windows Type 2 | | | 8.4 | x1/[1/( 1.4 )+ 0.04] | | = | 11.14 | | | (27) |
| Walls Type1 | 53.01 | 16.03 | 36.98 | x | 0.18 | = | 6.66 | 14 | 517.72 | (29) |
| Walls Type2 | 20.97 | 2.1 | 18.87 | x | 0.15 | = | 2.92 | 14 | 264.18 | (29) |
| Total area of elements, m² | | | 73.98 | | | | | | | (31) |
| Party wall | | | 5.64 | x | 0 | = | 0 | 20 | 112.8 | (32) |
| Party floor | | | 51.14 | | | | | 40 | 2045.6 | (32a) |
| Party ceiling | | | 51.14 | | | | | 30 | 1534.2 | (32b) |
| Internal wall ** | | | 60 | | | | | 9 | 540 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.77 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 5014.5 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 98.05 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 6.27 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 40.04 (37)

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

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.65 | 10.53 | 10.4 | 9.75 | 9.62 | 8.98 | 8.98 | 8.85 | 9.23 | 9.62 | 9.88 | 10.14 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 50.69 | 50.56 | 50.43 | 49.79 | 49.66 | 49.01 | 49.01 | 48.88 | 49.27 | 49.66 | 49.92 | 50.18 | |

Average = Sum(39)1...12 /12= 49.76 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.99 | 0.99 | 0.99 | 0.97 | 0.97 | 0.96 | 0.96 | 0.96 | 0.96 | 0.97 | 0.98 | 0.98 | |

Average = Sum(40)1...12 /12= 0.97 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.72 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.14 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 82.65 | 79.65 | 76.64 | 73.64 | 70.63 | 67.62 | 67.62 | 70.63 | 73.64 | 76.64 | 79.65 | 82.65 | |

Total = Sum(44)1...12 = 901.65 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 122.57 | 107.2 | 110.62 | 96.44 | 92.54 | 79.85 | 74 | 84.91 | 85.93 | 100.14 | 109.31 | 118.7 | |

Total = Sum(45)1...12 = 1182.21 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.39 | 16.08 | 16.59 | 14.47 | 13.88 | 11.98 | 11.1 | 12.74 | 12.89 | 15.02 | 16.4 | 17.81 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 177.85 | 157.13 | 165.9 | 149.94 | 147.82 | 133.35 | 129.27 | 140.19 | 139.42 | 155.42 | 162.8 | 173.98 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 177.85 | 157.13 | 165.9 | 149.94 | 147.82 | 133.35 | 129.27 | 140.19 | 139.42 | 155.42 | 162.8 | 173.98 |

Output from water heater (annual)$_{1...12}$ | 1833.05 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.98 | 75.59 | 81 | 74.86 | 74.99 | 69.35 | 68.83 | 72.45 | 71.37 | 77.52 | 79.14 | 83.69 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 33.47 | 29.73 | 24.18 | 18.31 | 13.68 | 11.55 | 12.48 | 16.23 | 21.78 | 27.65 | 32.27 | 34.41 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 224.17 | 226.5 | 220.63 | 208.16 | 192.4 | 177.6 | 167.71 | 165.38 | 171.24 | 183.72 | 199.47 | 214.28 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 114.22 | 112.48 | 108.88 | 103.98 | 100.79 | 96.31 | 92.51 | 97.39 | 99.12 | 104.19 | 109.92 | 112.49 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 453.4 | 450.25 | 435.23 | 411.98 | 388.42 | 367 | 354.24 | 360.53 | 373.68 | 397.1 | 423.2 | 442.71 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 8.4 | x | 19.64 | x | 0.56 | x | 0.7 | = | 44.66 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 38.42 | x | 0.56 | x | 0.7 | = | 87.36 | (76) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 8.4 | x | 63.27 | x | 0.56 | x | 0.7 | = | 143.87 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 92.28 | x | 0.56 | x | 0.7 | = | 209.82 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 113.09 | x | 0.56 | x | 0.7 | = | 257.15 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 115.77 | x | 0.56 | x | 0.7 | = | 263.23 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 110.22 | x | 0.56 | x | 0.7 | = | 250.61 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 94.68 | x | 0.56 | x | 0.7 | = | 215.27 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 73.59 | x | 0.56 | x | 0.7 | = | 167.32 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 45.59 | x | 0.56 | x | 0.7 | = | 103.66 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 24.49 | x | 0.56 | x | 0.7 | = | 55.68 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 16.15 | x | 0.56 | x | 0.7 | = | 36.72 | (76) |
| West | 0.9x | 0.77 | x | 7.63 | x | 19.64 | x | 0.56 | x | 0.7 | = | 40.56 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 38.42 | x | 0.56 | x | 0.7 | = | 79.35 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 63.27 | x | 0.56 | x | 0.7 | = | 130.68 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 92.28 | x | 0.56 | x | 0.7 | = | 190.59 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 113.09 | x | 0.56 | x | 0.7 | = | 233.57 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 115.77 | x | 0.56 | x | 0.7 | = | 239.1 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 110.22 | x | 0.56 | x | 0.7 | = | 227.64 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 94.68 | x | 0.56 | x | 0.7 | = | 195.54 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 73.59 | x | 0.56 | x | 0.7 | = | 151.99 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 45.59 | x | 0.56 | x | 0.7 | = | 94.16 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 24.49 | x | 0.56 | x | 0.7 | = | 50.58 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 16.15 | x | 0.56 | x | 0.7 | = | 33.36 | (80) |



Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 85.22 | 166.71 | 274.55 | 400.41 | 490.72 | 502.34 | 478.25 | 410.81 | 319.31 | 197.82 | 106.26 | 70.08 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 538.62 | 616.96 | 709.78 | 812.39 | 879.14 | 869.34 | 832.48 | 771.34 | 692.99 | 594.92 | 529.47 | 512.79 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.88 | 0.83 | 0.75 | 0.62 | 0.48 | 0.35 | 0.26 | 0.29 | 0.46 | 0.69 | 0.83 | 0.89 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.6 | 19.87 | 20.26 | 20.64 | 20.86 | 20.96 | 20.99 | 20.98 | 20.91 | 20.59 | 20.04 | 19.54 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.09 | 20.09 | 20.09 | 20.11 | 20.11 | 20.12 | 20.12 | 20.12 | 20.11 | 20.11 | 20.1 | 20.1 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.86 | 0.81 | 0.73 | 0.59 | 0.44 | 0.3 | 0.21 | 0.23 | 0.41 | 0.65 | 0.81 | 0.88 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.25 | 18.63 | 19.16 | 19.68 | 19.96 | 20.08 | 20.11 | 20.11 | 20.03 | 19.64 | 18.89 | 18.18 | (90) |

fLA = Living area ÷ (4) = | 0.48 | (91)

# SAP WorkSheet: New dwelling design stage

|  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2 | | | | | | | | | | | | | |
| (92)m= | 18.9 | 19.23 | 19.69 | 20.14 | 20.39 | 20.5 | 20.53 | 20.53 | 20.45 | 20.1 | 19.44 | 18.84 | (92) |
| Apply adjustment to the mean internal temperature from Table 4e, where appropriate | | | | | | | | | | | | | |
| (93)m= | 18.9 | 19.23 | 19.69 | 20.14 | 20.39 | 20.5 | 20.53 | 20.53 | 20.45 | 20.1 | 19.44 | 18.84 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

|  | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |  |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.84 | 0.8 | 0.72 | 0.59 | 0.46 | 0.32 | 0.23 | 0.26 | 0.43 | 0.65 | 0.79 | 0.86 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 453.92 | 490.77 | 507.58 | 481.1 | 401.04 | 281.22 | 190.52 | 198.71 | 294.82 | 386.96 | 420.52 | 438.59 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 740.02 | 724.43 | 665.03 | 559.45 | 431.46 | 289.33 | 192.67 | 201.78 | 312.97 | 471.59 | 616.21 | 734.32 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 212.85 | 157.02 | 117.14 | 56.41 | 22.64 | 0 | 0 | 0 | 0 | 62.96 | 140.9 | 220.02 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 989.95 (98)

Space heating requirement in kWh/m²/year 19.36 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 989.95 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1039.45 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1833.05 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1924.7 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 29.64 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |

# SAP WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):

| | | | |
|---|---|---|---|
| mechanical ventilation - balanced, extract or positive input from outside | | 99.2 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 99.2 | (331) |
| Energy for lighting (calculated in Appendix L) | | 236.47 | (332) |

## 10b. Fuel costs – Community heating scheme

| | Fuel kWh/year | Fuel Price (Table 12) | | Fuel Cost £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 4.24 | x 0.01 = | 44.07 | (340a) |
| Water heating from CHP | (310a) x | 4.24 | x 0.01 = | 81.61 | (342a) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 13.08 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 31.19 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 289.96 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.27 | (357) |
| **SAP rating (section12)** | | 82.33 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 715.37 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 15.38 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 730.75 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 730.75 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 51.49 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 122.73 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 904.97 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 17.7 | (384) |
| **EI rating (section 14)** | | | | | 87.39 | (385) |

## 13b. Primary Energy – Community heating scheme

| Energy kWh/year | Primary factor | P.Energy kWh/year |
|---|---|---|

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Energy from other sources of space and water heating (not CHP) | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 89.5 | (367a) |
| Energy associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | 1.22 | = | 4040.52 | (367) |
| Electrical energy for heat distribution | [(313) x | | = | 91 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | = | 4131.52 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | 4131.52 | (373) |
| Energy associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | 4131.52 | (376) |
| Energy associated with space cooling | (315) x | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | 3.07 | = | 304.55 | (378) |
| Energy associated with electricity for lighting | (332))) x | 3.07 | = | 725.96 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | 5162.03 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 D-2-01

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | Yes |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | South |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 98.05 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 6 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 243.02 | **(P1)** |
| **Transmission heat loss coefficient:** | 40 | |
| **Summer heat loss coefficient:** | 283.05 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Front) | 0 | 1 |
| East (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Front) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Front) | 0.9 x | 7.63 | 117.51 | 0.56 | 0.7 | 0.76 | 241.12 | |
| East (Rear) | 0.9 x | 8.4 | 117.51 | 0.56 | 0.7 | 0.76 | 265.45 | |
| | | | | | | **Total** | 506.56 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 367 | 354.24 | 360.53 | |
| Total summer gains | 904.73 | 860.8 | 806.19 | **(P5)** |
| Summer gain/loss ratio | 3.2 | 3.04 | 2.85 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.31 | 1.31 | 1.31 | |
| Threshold temperature | 20.51 | 22.25 | 21.96 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Slight** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:35:18*

## Project Information:

**Assessed By:** ()    **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE**    Total Floor Area: 50.27m²

**Site Reference :** Bertram Street    **Plot Reference:** 06-18-69419 D-2-02

**Address :** D-2-02, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 18.03 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 17.70 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 39.5 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 38.6 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (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: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| 7 Low energy lights | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

| 8 Mechanical ventilation | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

| 9 Summertime temperature | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South | 12.22m² | |
| Windows facing: East | 2.38m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

| 10 Key features | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# Predicted Energy Assessment

D-2-02
Bertram Street
London

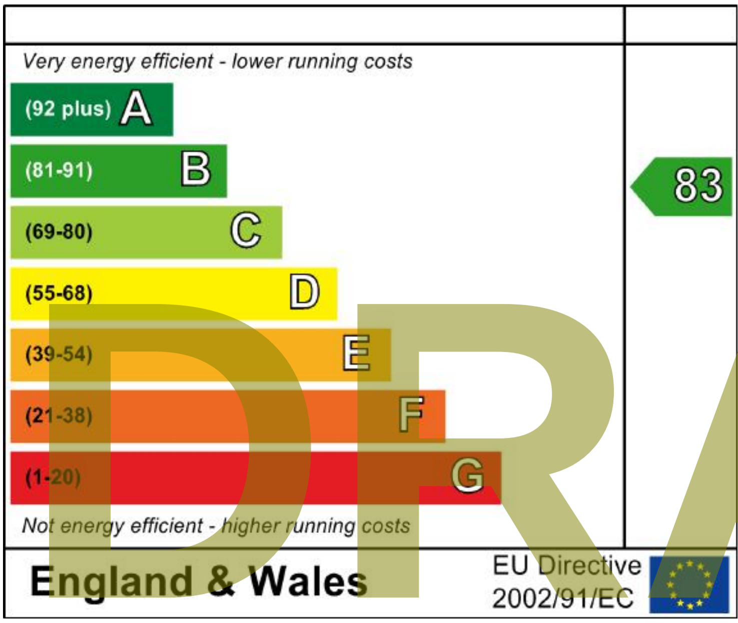
| | |
|---|---|
| Dwelling type: | Mid floor Flat |
| Date of assessment: | 24 January 2019 |
| Produced by: | Stroma Certification |
| Total floor area: | 50.27 m² |

This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

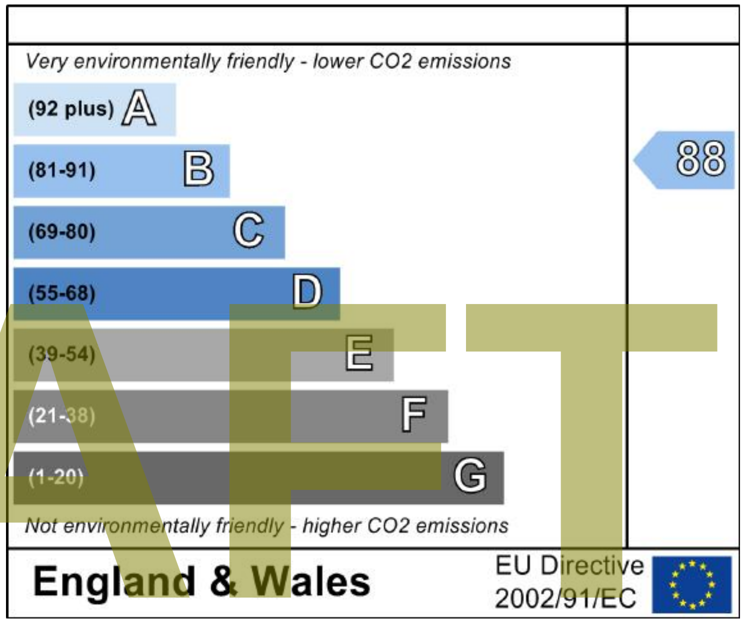
Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.



## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-2-02

| | |
|---|---|
| Address: | D-2-02, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 24 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 98.65 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | |
|---|---|
| Dwelling type: | Flat |
| Detachment: | |
| Year Completed: | 2018 |

| Floor Location: | Floor area: | Storey height: |
|---|---|---|
| Floor 0 | 50.27 m² | 2.4 m |

| | |
|---|---|
| Living area: | 22.61 m² (fraction 0.45) |
| Front of dwelling faces: | North |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 12.22 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 2.38 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | Stair Wall | North | 0 | 0 |
| Side | | External Wall | South | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 53.18 | 14.6 | 38.58 | 0.18 | 0 | False | 14 |
| Stair Wall | 15.06 | 2.1 | 12.96 | 0.18 | 0.9 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 67.2 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 5.7 | | | | | | 20 |
| Party Ceiling | 50.27 | | | | | | 30 |
| Party Floor | 50.27 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0946

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 2.59 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 16.8 | 0.05 | E4 | Jamb |
| [Approved] | 56.87 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 2.4 | 0.06 | E18 | Party wall between dwellings |
| [Approved] | 1.59 | 0.04 | E3 | Sill |
| | 4.75 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 1, efficiency 89.5<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

**User Details:**

| | | | |
|---|---|---|---|
| **Assessor Name:** | | **Stroma Number:** | |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

**Property Address: 06-18-69419 D-2-02**

**Address :** D-2-02, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 50.27 | (1a) x | 2.4 | (2a) = | 120.65 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 50.27 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 120.65 | (5) |

## 2. Ventilation rate:

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

| | | | Air changes per hour | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |
| *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | | |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

| | | |
|---|---|---|
| If mechanical ventilation: | 0.5 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0.5 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 79.9 | (23c) |

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 12.22 | x1/[1/( 1.4 )+ 0.04] | | = | 16.2 | | | (27) |
| Windows Type 2 | | | 2.38 | x1/[1/( 1.4 )+ 0.04] | | = | 3.16 | | | (27) |
| Walls Type1 | 53.18 | 14.6 | 38.58 | x | 0.18 | = | 6.94 | 14 | 540.12 | (29) |
| Walls Type2 | 15.06 | 2.1 | 12.96 | x | 0.15 | = | 2.01 | 14 | 181.44 | (29) |
| Total area of elements, m² | | | 68.24 | | | | | | | (31) |
| Party wall | | | 5.7 | x | 0 | = | 0 | 20 | 114 | (32) |
| Party floor | | | 50.27 | | | | | 40 | 2010.8 | (32a) |
| Party ceiling | | | 50.27 | | | | | 30 | 1508.1 | (32b) |
| Internal wall ** | | | 67.2 | | | | | 9 | 604.8 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

| | | | |
|---|---|---|---|
| Fabric heat loss, W/K = S (A x U) | (26)…(30) + (32) = | 31.25 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 4959.26 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 98.65 | (35) |

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

| | | | |
|---|---|---|---|
| Thermal bridges : S (L x Y) calculated using Appendix K | | 6.45 | (36) |

*if details of thermal bridging are not known (36) = 0.15 x (31)*

| | | | |
|---|---|---|---|
| Total fabric heat loss | (33) + (36) = | 37.7 | (37) |

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.47 | 10.35 | 10.22 | 9.59 | 9.46 | 8.82 | 8.82 | 8.7 | 9.08 | 9.46 | 9.71 | 9.97 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 48.18 | 48.05 | 47.92 | 47.29 | 47.16 | 46.53 | 46.53 | 46.4 | 46.78 | 47.16 | 47.41 | 47.67 | |

Average = Sum(39)$_{1...12}$ /12= 47.25 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.96 | 0.96 | 0.95 | 0.94 | 0.94 | 0.93 | 0.93 | 0.92 | 0.93 | 0.94 | 0.94 | 0.95 | |

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.53 (43)
*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*



| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)* | | | | | | | | | | | | | |
| (44)m= | 81.98 | 79 | 76.02 | 73.04 | 70.06 | 67.08 | 67.08 | 70.06 | 73.04 | 76.02 | 79 | 81.98 | |

Total = Sum(44)$_{1...12}$ = 894.34 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 121.58 | 106.33 | 109.72 | 95.66 | 91.79 | 79.21 | 73.4 | 84.22 | 85.23 | 99.33 | 108.42 | 117.74 | |

Total = Sum(45)$_{1...12}$ = 1172.63 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.24 | 15.95 | 16.46 | 14.35 | 13.77 | 11.88 | 11.01 | 12.63 | 12.78 | 14.9 | 16.26 | 17.66 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 176.85 | 156.26 | 165 | 149.15 | 147.07 | 132.7 | 128.67 | 139.5 | 138.72 | 154.6 | 161.92 | 173.02 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 176.85 | 156.26 | 165 | 149.15 | 147.07 | 132.7 | 128.67 | 139.5 | 138.72 | 154.6 | 161.92 | 173.02 |

Output from water heater (annual)1…12 | 1823.47 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.65 | 75.3 | 80.7 | 74.6 | 74.74 | 69.13 | 68.63 | 72.23 | 71.13 | 77.25 | 78.85 | 83.37 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | | | | | | | | | | | | | |
| (67)m= | 32.97 | 29.28 | 23.82 | 18.03 | 13.48 | 11.38 | 12.29 | 15.98 | 21.45 | 27.24 | 31.79 | 33.89 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | | | | | | | | | | | | | |
| (68)m= | 220.8 | 223.09 | 217.32 | 205.02 | 189.51 | 174.93 | 165.18 | 162.89 | 168.67 | 180.96 | 196.47 | 211.06 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | | | | | | | | | | | | | |
| (69)m= | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | (69) |
| Pumps and fans gains (Table 5a) | | | | | | | | | | | | | |
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |
| Losses e.g. evaporation (negative values) (Table 5) | | | | | | | | | | | | | |
| (71)m= | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | (71) |
| Water heating gains (Table 5) | | | | | | | | | | | | | |
| (72)m= | 113.77 | 112.05 | 108.47 | 103.61 | 100.46 | 96.02 | 92.24 | 97.08 | 98.8 | 103.83 | 109.51 | 112.06 | (72) |
| **Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m | | | | | | | | | | | | | |
| (73)m= | 448.39 | 445.27 | 430.45 | 407.52 | 384.29 | 363.17 | 350.56 | 356.8 | 369.76 | 392.87 | 418.62 | 437.85 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 2.38 | x | 19.64 | x | 0.56 | x | 0.7 | = | 12.65 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 38.42 | x | 0.56 | x | 0.7 | = | 24.75 | (76) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 2.38 | x | 63.27 | x | 0.56 | x | 0.7 | = | 40.76 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 92.28 | x | 0.56 | x | 0.7 | = | 59.45 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 113.09 | x | 0.56 | x | 0.7 | = | 72.86 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 115.77 | x | 0.56 | x | 0.7 | = | 74.58 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 110.22 | x | 0.56 | x | 0.7 | = | 71.01 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 94.68 | x | 0.56 | x | 0.7 | = | 60.99 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 73.59 | x | 0.56 | x | 0.7 | = | 47.41 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 45.59 | x | 0.56 | x | 0.7 | = | 29.37 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 24.49 | x | 0.56 | x | 0.7 | = | 15.78 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 16.15 | x | 0.56 | x | 0.7 | = | 10.41 | (76) |
| South | 0.9x | 0.77 | x | 12.22 | x | 46.75 | x | 0.56 | x | 0.7 | = | 154.65 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 76.57 | x | 0.56 | x | 0.7 | = | 253.27 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 97.53 | x | 0.56 | x | 0.7 | = | 322.62 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 110.23 | x | 0.56 | x | 0.7 | = | 364.63 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 114.87 | x | 0.56 | x | 0.7 | = | 379.97 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 110.55 | x | 0.56 | x | 0.7 | = | 365.67 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 108.01 | x | 0.56 | x | 0.7 | = | 357.28 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 104.89 | x | 0.56 | x | 0.7 | = | 346.97 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 101.89 | x | 0.56 | x | 0.7 | = | 337.02 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 82.59 | x | 0.56 | x | 0.7 | = | 273.18 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 55.42 | x | 0.56 | x | 0.7 | = | 183.31 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 40.4 | x | 0.56 | x | 0.7 | = | 133.63 | (78) |



Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 167.3 | 278.02 | 363.38 | 424.08 | 452.83 | 440.25 | 428.29 | 407.96 | 384.42 | 302.55 | 199.08 | 144.03 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 615.69 | 723.29 | 793.84 | 831.6 | 837.12 | 803.42 | 778.85 | 764.76 | 754.18 | 695.41 | 617.7 | 581.88 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.83 | 0.77 | 0.69 | 0.6 | 0.48 | 0.36 | 0.26 | 0.27 | 0.41 | 0.61 | 0.77 | 0.85 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.88 | 20.16 | 20.44 | 20.7 | 20.87 | 20.96 | 20.99 | 20.99 | 20.94 | 20.73 | 20.29 | 19.82 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.12 | 20.12 | 20.12 | 20.13 | 20.14 | 20.15 | 20.15 | 20.15 | 20.14 | 20.14 | 20.13 | 20.13 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.82 | 0.75 | 0.67 | 0.56 | 0.45 | 0.31 | 0.21 | 0.23 | 0.36 | 0.57 | 0.75 | 0.83 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.66 | 19.05 | 19.43 | 19.78 | 20 | 20.11 | 20.14 | 20.14 | 20.09 | 19.83 | 19.24 | 18.58 | (90) |

fLA = Living area ÷ (4) = | 0.45 | (91)

# SAP WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.21 | 19.55 | 19.89 | 20.2 | 20.39 | 20.49 | 20.52 | 20.52 | 20.47 | 20.24 | 19.71 | 19.14 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.21 | 19.55 | 19.89 | 20.2 | 20.39 | 20.49 | 20.52 | 20.52 | 20.47 | 20.24 | 19.71 | 19.14 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.8 | 0.73 | 0.66 | 0.57 | 0.46 | 0.33 | 0.23 | 0.25 | 0.38 | 0.57 | 0.73 | 0.82 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 491.47 | 531.02 | 524.66 | 471.22 | 382.67 | 266.71 | 180.56 | 188.85 | 286.18 | 399.23 | 453.29 | 474.26 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 718.31 | 703.97 | 641.53 | 534.16 | 409.76 | 274.2 | 182.43 | 191.16 | 297.98 | 454.48 | 598.09 | 712.08 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 168.77 | 116.22 | 86.95 | 45.31 | 20.15 | 0 | 0 | 0 | 0 | 41.11 | 104.25 | 176.94 | |

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 759.72 | (98) |
| Space heating requirement in kWh/m²/year | | 15.11 | (99) |



## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 759.72 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 797.71 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1823.47 | |
| If DHW from community scheme:<br>Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1914.64 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 27.12 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 97.51 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 97.51 | (331) |
| Energy for lighting (calculated in Appendix L) | | 232.91 | (332) |

## 10b. Fuel costs – Community heating scheme

| | Fuel kWh/year | Fuel Price (Table 12) | | Fuel Cost £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 4.24 | x 0.01 = | 33.82 | (340a) |
| Water heating from CHP | (310a) x | 4.24 | x 0.01 = | 81.18 | (342a) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 12.86 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 30.72 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 278.59 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.23 | (357) |
| **SAP rating (section12)** | | 82.87 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 654.6 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 14.08 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 668.68 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 668.68 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 50.61 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 120.88 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 840.17 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 16.71 | (384) |
| **EI rating (section 14)** | | | | | 88.18 | (385) |

## 13b. Primary Energy – Community heating scheme

| Energy kWh/year | Primary factor | P.Energy kWh/year |
|---|---|---|

# SAP WorkSheet: New dwelling design stage

| | | | | | | |
|---|---|---|---|---|---|---|
| Energy from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| Energy associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 1.22 | = | 3697.28 | (367) |
| Electrical energy for heat distribution | [(313) x | | | = | 83.27 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | = | 3780.55 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | 3780.55 | (373) |
| Energy associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | | (312) x | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | 3780.55 | (376) |
| Energy associated with space cooling | (315) x | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | | (331)) x | 3.07 | = | 299.37 | (378) |
| Energy associated with electricity for lighting | (332))) x | | 3.07 | = | 715.04 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | 4794.96 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 D-2-02

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | North |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 98.65 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 159.26 | **(P1)** |
| **Transmission heat loss coefficient:** | 37.7 | |
| **Summer heat loss coefficient:** | 196.96 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| South (Side) | 0 | 1 |
| East (Rear) | 0 | 1 |



## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| South (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| South (Side) | 0.9 x | 12.22 | 112.21 | 0.56 | 0.7 | 0.76 | 368.74 | |
| East (Rear) | 0.9 x | 2.38 | 117.51 | 0.56 | 0.7 | 0.76 | 75.21 | |
| | | | | | | **Total** | 443.95 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 363.17 | 350.56 | 356.8 | |
| Total summer gains | 825.24 | 794.52 | 786.78 | **(P5)** |
| Summer gain/loss ratio | 4.19 | 4.03 | 3.99 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.31 | 1.31 | 1.31 | |
| Threshold temperature | 21.5 | 23.24 | 23.1 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:35:15*

## Project Information:

**Assessed By:** ()

**Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE**

Total Floor Area: 51.14m²

**Site Reference :** Bertram Street

**Plot Reference:** 06-18-69419 D-3-01

**Address :** D-3-01, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 23.76 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 21.49 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 70.3 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 54.8 kWh/m² | |
| | | OK |

DRAFT

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | OK |
| Openings | 1.40 (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: Community heating schemes - mains gas

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: West | 7.63m² | |
| Windows facing: East | 8.4m² | |
| Ventilation rate: | 6.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# Predicted Energy Assessment

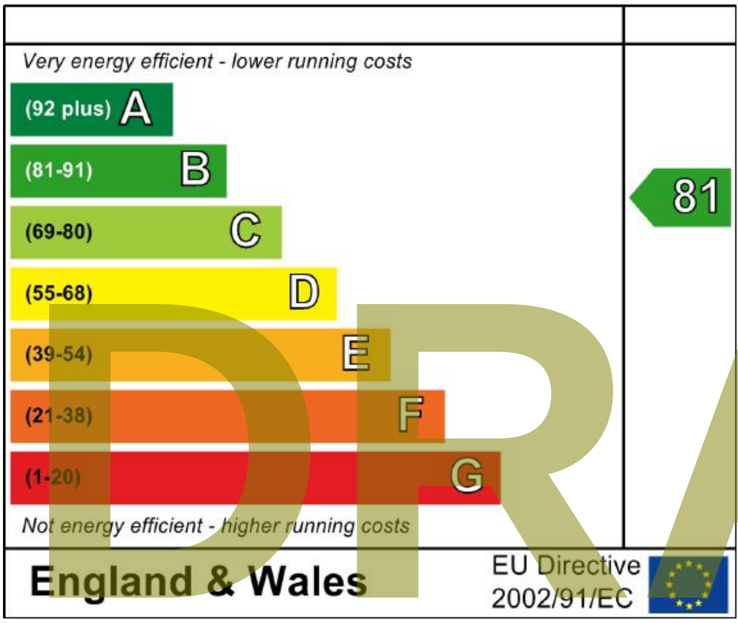


| | | | |
|---|---|---|---|
| D-3-01 | | Dwelling type: | Top floor Flat |
| Bertram Street | | Date of assessment: | 24 January 2019 |
| London | | Produced by: | Stroma Certification |
| | | Total floor area: | 51.14 m² |

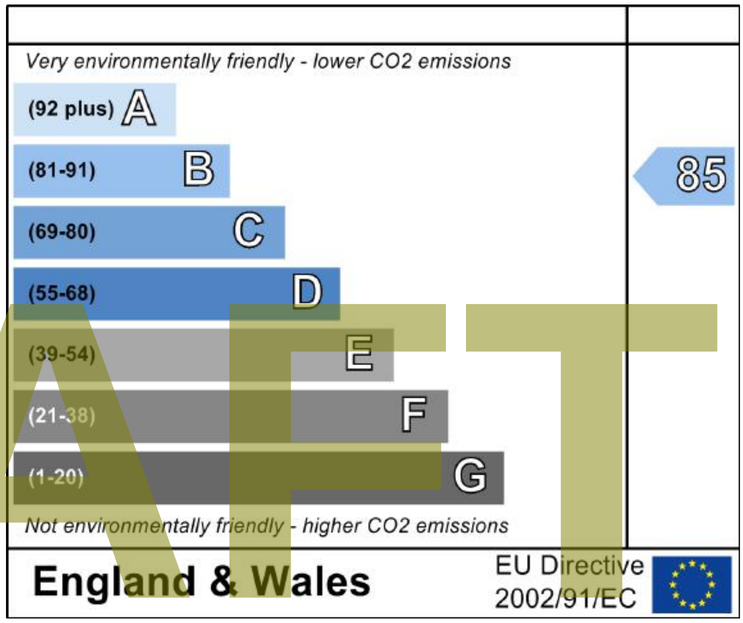
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating






The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-3-01

| | |
|---|---|
| Address: | D-3-01, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 24 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 77.05 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 51.14 m² | 2.4 m |
| Living area: | 24.52 m² (fraction 0.479) | |
| Front of dwelling faces: | South | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Front | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Front | 16mm or more | 0.7 | 0.558 | 1.4 | 7.63 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 8.4 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | Stair Wall | South | 0 | 0 |
| Front | | External Wall | West | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 53.01 | 16.03 | 36.98 | 0.18 | 0 | False | 14 |
| Stair Wall | 20.97 | 2.1 | 18.87 | 0.18 | 0.9 | False | 14 |
| Flat Roof | 51.14 | 0 | 51.14 | 0.13 | 0 | | 9 |
| Internal Elements | | | | | | | |
| Stud Walls | 60 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 5.64 | | | | | | 20 |
| Party Floor | 51.14 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0873

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 18.6 | 0.05 | E4 | Jamb |
| [Approved] | 30.83 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 8.74 | 0.04 | E14 | Flat roof |
| | 22.09 | 0.28 | E15 | Flat roof with parapet |
| | 2.35 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 2.35 | 0.12 | P4 | Roof (insulation at ceiling level) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 1, efficiency 89.5<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | | **Stroma Number:** | |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 D-3-01

**Address :** D-3-01, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 51.14 | (1a) x | 2.4 | (2a) = | 122.74 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 51.14 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 122.74 | (5) |

## 2. Ventilation rate:

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

DRAFT

| | | | Air changes per hour | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | 0 | (11) |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 7.63 | x1/[1/( 1.4 )+ 0.04] | | = | 10.12 | | | (27) |
| Windows Type 2 | | | 8.4 | x1/[1/( 1.4 )+ 0.04] | | = | 11.14 | | | (27) |
| Walls Type1 | 53.01 | 16.03 | 36.98 | x | 0.18 | = | 6.66 | 14 | 517.72 | (29) |
| Walls Type2 | 20.97 | 2.1 | 18.87 | x | 0.15 | = | 2.92 | 14 | 264.18 | (29) |
| Roof | 51.14 | 0 | 51.14 | x | 0.13 | = | 6.65 | 9 | 460.26 | (30) |
| Total area of elements, m² | | | 125.12 | | | | | | | (31) |
| Party wall | | | 5.64 | x | 0 | = | 0 | 20 | 112.8 | (32) |
| Party floor | | | 51.14 | | | | | 40 | 2045.6 | (32a) |
| Internal wall ** | | | 60 | | | | | 9 | 540 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.42 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 3940.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 77.05 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 10.92 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 51.34 (37)

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.65 | 10.53 | 10.4 | 9.75 | 9.62 | 8.98 | 8.98 | 8.85 | 9.23 | 9.62 | 9.88 | 10.14 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 62 | 61.87 | 61.74 | 61.1 | 60.97 | 60.32 | 60.32 | 60.19 | 60.58 | 60.97 | 61.22 | 61.48 | |

Average = Sum(39)$_{1…12}$ /12= 61.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.21 | 1.21 | 1.21 | 1.19 | 1.19 | 1.18 | 1.18 | 1.18 | 1.18 | 1.19 | 1.2 | 1.2 | |

Average = Sum(40)$_{1…12}$ /12= 1.19 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.72 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.14 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 82.65 | 79.65 | 76.64 | 73.64 | 70.63 | 67.62 | 67.62 | 70.63 | 73.64 | 76.64 | 79.65 | 82.65 | |

Total = Sum(44)$_{1…12}$ = 901.65 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 122.57 | 107.2 | 110.62 | 96.44 | 92.54 | 79.85 | 74 | 84.91 | 85.93 | 100.14 | 109.31 | 118.7 | |

Total = Sum(45)$_{1…12}$ = 1182.21 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.39 | 16.08 | 16.59 | 14.47 | 13.88 | 11.98 | 11.1 | 12.74 | 12.89 | 15.02 | 16.4 | 17.81 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# SAP WorkSheet: New dwelling design stage

| | | |
|---|---|---|
| Primary circuit loss (annual) from Table 3 | 0 | (58) |

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 177.85 | 157.13 | 165.9 | 149.94 | 147.82 | 133.35 | 129.27 | 140.19 | 139.42 | 155.42 | 162.8 | 173.98 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 177.85 | 157.13 | 165.9 | 149.94 | 147.82 | 133.35 | 129.27 | 140.19 | 139.42 | 155.42 | 162.8 | 173.98 | |

| | | |
|---|---|---|
| Output from water heater (annual)$_{1...12}$ | 1833.05 | (64) |

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.98 | 75.59 | 81 | 74.86 | 74.99 | 69.35 | 68.83 | 72.45 | 71.37 | 77.52 | 79.14 | 83.69 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating



## 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= | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 33.47 | 29.73 | 24.18 | 18.31 | 13.68 | 11.55 | 12.48 | 16.23 | 21.78 | 27.65 | 32.27 | 34.41 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 224.17 | 226.5 | 220.63 | 208.16 | 192.4 | 177.6 | 167.71 | 165.38 | 171.24 | 183.72 | 199.47 | 214.28 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 114.22 | 112.48 | 108.88 | 103.98 | 100.79 | 96.31 | 92.51 | 97.39 | 99.12 | 104.19 | 109.92 | 112.49 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 453.4 | 450.25 | 435.23 | 411.98 | 388.42 | 367 | 354.24 | 360.53 | 373.68 | 397.1 | 423.2 | 442.71 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 8.4 | x | 19.64 | x | 0.56 | x | 0.7 | = | 44.66 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 38.42 | x | 0.56 | x | 0.7 | = | 87.36 | (76) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 8.4 | x | 63.27 | x | 0.56 | x | 0.7 | = | 143.87 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 92.28 | x | 0.56 | x | 0.7 | = | 209.82 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 113.09 | x | 0.56 | x | 0.7 | = | 257.15 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 115.77 | x | 0.56 | x | 0.7 | = | 263.23 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 110.22 | x | 0.56 | x | 0.7 | = | 250.61 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 94.68 | x | 0.56 | x | 0.7 | = | 215.27 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 73.59 | x | 0.56 | x | 0.7 | = | 167.32 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 45.59 | x | 0.56 | x | 0.7 | = | 103.66 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 24.49 | x | 0.56 | x | 0.7 | = | 55.68 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 16.15 | x | 0.56 | x | 0.7 | = | 36.72 | (76) |
| West | 0.9x | 0.77 | x | 7.63 | x | 19.64 | x | 0.56 | x | 0.7 | = | 40.56 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 38.42 | x | 0.56 | x | 0.7 | = | 79.35 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 63.27 | x | 0.56 | x | 0.7 | = | 130.68 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 92.28 | x | 0.56 | x | 0.7 | = | 190.59 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 113.09 | x | 0.56 | x | 0.7 | = | 233.57 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 115.77 | x | 0.56 | x | 0.7 | = | 239.1 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 110.22 | x | 0.56 | x | 0.7 | = | 227.64 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 94.68 | x | 0.56 | x | 0.7 | = | 195.54 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 73.59 | x | 0.56 | x | 0.7 | = | 151.99 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 45.59 | x | 0.56 | x | 0.7 | = | 94.16 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 24.49 | x | 0.56 | x | 0.7 | = | 50.58 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 16.15 | x | 0.56 | x | 0.7 | = | 33.36 | (80) |



Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 85.22 | 166.71 | 274.55 | 400.41 | 490.72 | 502.34 | 478.25 | 410.81 | 319.31 | 197.82 | 106.26 | 70.08 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 538.62 | 616.96 | 709.78 | 812.39 | 879.14 | 869.34 | 832.48 | 771.34 | 692.99 | 594.92 | 529.47 | 512.79 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.87 | 0.83 | 0.76 | 0.65 | 0.53 | 0.4 | 0.3 | 0.33 | 0.51 | 0.71 | 0.83 | 0.88 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 18.75 | 19.08 | 19.59 | 20.17 | 20.59 | 20.85 | 20.94 | 20.92 | 20.73 | 20.15 | 19.36 | 18.69 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 19.91 | 19.91 | 19.91 | 19.92 | 19.93 | 19.94 | 19.94 | 19.94 | 19.93 | 19.93 | 19.92 | 19.92 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.85 | 0.81 | 0.74 | 0.62 | 0.48 | 0.34 | 0.23 | 0.26 | 0.45 | 0.67 | 0.81 | 0.86 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 16.97 | 17.43 | 18.15 | 18.94 | 19.49 | 19.8 | 19.9 | 19.89 | 19.67 | 18.94 | 17.85 | 16.88 | (90) |

fLA = Living area ÷ (4) = | 0.48 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 17.83 | 18.22 | 18.84 | 19.53 | 20.02 | 20.3 | 20.4 | 20.38 | 20.18 | 19.52 | 18.57 | 17.75 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 17.83 | 18.22 | 18.84 | 19.53 | 20.02 | 20.3 | 20.4 | 20.38 | 20.18 | 19.52 | 18.57 | 17.75 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.82 | 0.78 | 0.71 | 0.61 | 0.49 | 0.36 | 0.26 | 0.29 | 0.46 | 0.66 | 0.78 | 0.83 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 441.3 | 479.86 | 503.7 | 493.43 | 429.72 | 315.66 | 219.32 | 226.99 | 318.95 | 390.23 | 411.4 | 426.09 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 838.71 | 824.33 | 761.91 | 649.44 | 507.12 | 343.86 | 229.07 | 239.74 | 368.28 | 543.97 | 702.37 | 832.99 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 295.68 | 231.48 | 192.1 | 112.33 | 57.59 | 0 | 0 | 0 | 0 | 114.38 | 209.49 | 302.73 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1515.79 (98)

Space heating requirement in kWh/m²/year 29.64 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1515.79 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1591.58 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1833.05 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1924.7 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 35.16 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |

| | | | |
|---|---|---|---|
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 99.2 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 99.2 | (331) |
| Energy for lighting (calculated in Appendix L) | | 236.47 | (332) |

## 10b. Fuel costs – Community heating scheme

| | Fuel kWh/year | Fuel Price (Table 12) | | Fuel Cost £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 4.24 | x 0.01 = | 67.48 | (340a) |
| Water heating from CHP | (310a) x | 4.24 | x 0.01 = | 81.61 | (342a) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 13.08 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 31.19 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 313.37 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.37 | (357) |
| **SAP rating (section12)** | | 80.9 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 848.62 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 18.25 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 866.87 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 866.87 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 51.49 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 122.73 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 1041.09 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 20.36 | (384) |
| **EI rating (section 14)** | | | | | 85.49 | (385) |

## 13b. Primary Energy – Community heating scheme

| Energy kWh/year | Primary factor | P.Energy kWh/year |
|---|---|---|

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Energy from other sources of space and water heating (not CHP) | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 89.5 | (367a) |
| Energy associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | 1.22 | = | 4793.14 | (367) |
| Electrical energy for heat distribution | [(313) x | | = | 107.95 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | = | 4901.09 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | 4901.09 | (373) |
| Energy associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | 4901.09 | (376) |
| Energy associated with space cooling | (315) x | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | 3.07 | = | 304.55 | (378) |
| Energy associated with electricity for lighting | (332))) x | 3.07 | = | 725.96 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | 5931.6 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 D-3-01

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | Yes |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | South |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 77.05 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 6 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 243.02 | **(P1)** |
| **Transmission heat loss coefficient:** | 51.3 | |
| **Summer heat loss coefficient:** | 294.36 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Front) | 0 | 1 |
| East (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Front) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Front) | 0.9 x | 7.63 | 117.51 | 0.56 | 0.7 | 0.76 | 241.12 | |
| East (Rear) | 0.9 x | 8.4 | 117.51 | 0.56 | 0.7 | 0.76 | 265.45 | |
| | | | | | | **Total** | 506.56 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 367 | 354.24 | 360.53 | |
| Total summer gains | 904.73 | 860.8 | 806.19 | **(P5)** |
| Summer gain/loss ratio | 3.07 | 2.92 | 2.74 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.46 | 1.46 | 1.46 | |
| Threshold temperature | 20.53 | 22.28 | 22 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Slight** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:35:11*



## Project Information:

**Assessed By:** ()

**Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE**

Total Floor Area: 50.27m²

**Site Reference :** Bertram Street

**Plot Reference:** 06-18-69419 D-3-02

**Address :** D-3-02, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c)
Fuel factor: 1.00 (mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 22.41 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 20.52 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 62.4 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 49.8 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | OK |
| Openings | 1.40 (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: | Community heating schemes - mains gas |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South | 12.22m² | |
| Windows facing: East | 3.82m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from boilers – mains gas | |

# Predicted Energy Assessment

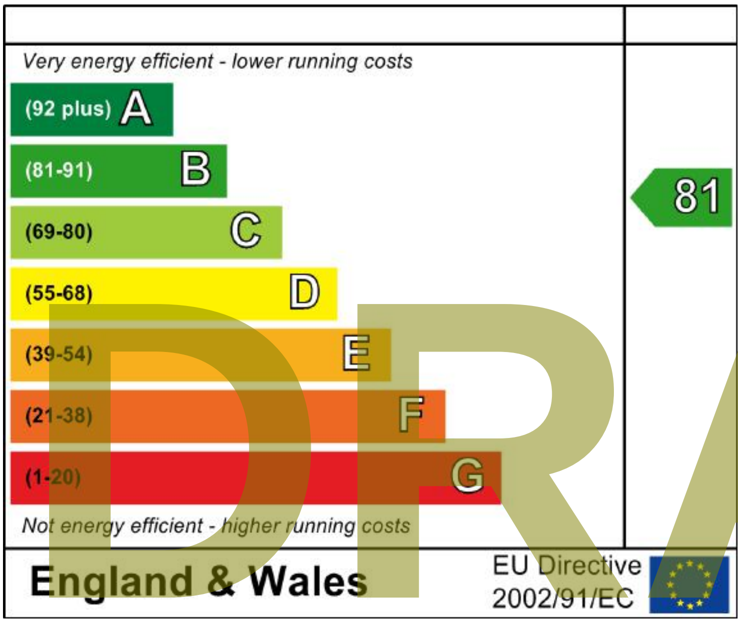
D-3-02
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Top floor Flat |
| Date of assessment: | 24 January 2019 |
| Produced by: | Stroma Certification |
| Total floor area: | 50.27 m² |

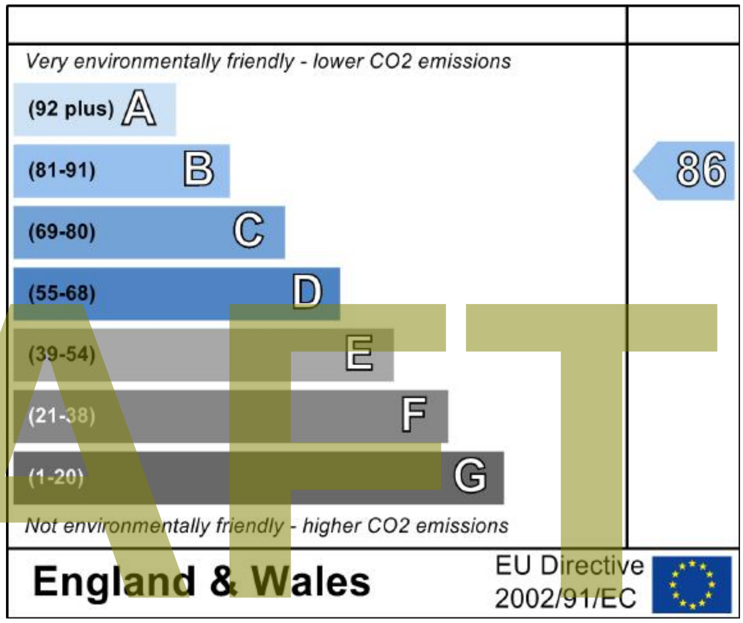
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating






The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-3-02

| | |
|---|---|
| Address: | D-3-02, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 24 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 77.25 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 50.27 m² | 2.4 m |
| Living area: | 22.61 m² (fraction 0.45) | |
| Front of dwelling faces: | North | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 12.22 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 3.82 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | Stair Wall | North | 0 | 0 |
| Side | | External Wall | South | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 53.18 | 16.04 | 37.14 | 0.18 | 0 | False | 14 |
| Stair Wall | 15.06 | 2.1 | 12.96 | 0.18 | 0.9 | False | 14 |
| Flat Roof | 50.27 | 0 | 50.27 | 0.13 | 0 | | 9 |
| Internal Elements | | | | | | | |
| Stud Walls | 67.2 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 5.7 | | | | | | 20 |
| Party Floor | 50.27 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0907

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 18.6 | 0.05 | E4 | Jamb |
| [Approved] | 28.43 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 2.4 | 0.06 | E18 | Party wall between dwellings |
| | 6.27 | 0.04 | E14 | Flat roof |
| | 22.16 | 0.28 | E15 | Flat roof with parapet |
| | 2.35 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 2.35 | 0.12 | P4 | Roof (insulation at ceiling level) |

## Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, Rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 3

## Main heating system:

Main heating system: Community heating schemes
Heat source: Community boilers
heat from boilers – mains gas, heat fraction 1, efficiency 89.5
Piping>=1991, pre-insulated, low temp, variable flow

## Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and TRVs
Control code: 2306

## Secondary heating system:

Secondary heating system: None

## Water heating:

Water heating: From main heating system
Water code: 901
Fuel :heat from CHP
No hot water cylinder
Solar panel: False

## Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Dense urban
EPC language: English
Wind turbine: No
Photovoltaics: None
Assess Zero Carbon Home: No

# SAP WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | | **Stroma Number:** | |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 D-3-02

**Address :** D-3-02, Bertram Street, London

1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 50.27 | (1a) | x | 2.4 | (2a) | = | 120.65 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 50.27 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 120.65 | (5) |

2. Ventilation rate:

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



| | | | Air changes per hour | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | 0 | (11) |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Monthly average wind speed from Table 7** | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| **Wind Factor (22a)m = (22)m ÷ 4** | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

| | | |
|---|---|---|
| If mechanical ventilation: | 0.5 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0.5 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 79.9 | (23c) |

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 12.22 | x1/[1/( 1.4 )+ 0.04] | | = | 16.2 | | | (27) |
| Windows Type 2 | | | 3.82 | x1/[1/( 1.4 )+ 0.04] | | = | 5.06 | | | (27) |
| Walls Type1 | 53.18 | 16.04 | 37.14 | x | 0.18 | = | 6.69 | 14 | 519.96 | (29) |
| Walls Type2 | 15.06 | 2.1 | 12.96 | x | 0.15 | = | 2.01 | 14 | 181.44 | (29) |
| Roof | 50.27 | 0 | 50.27 | x | 0.13 | = | 6.54 | 9 | 452.43 | (30) |
| Total area of elements, m² | | | 118.51 | | | | | | | (31) |
| Party wall | | | 5.7 | x | 0 | = | 0 | 20 | 114 | (32) |
| Party floor | | | 50.27 | | | | | 40 | 2010.8 | (32a) |
| Internal wall ** | | | 67.2 | | | | | 9 | 604.8 | (32c) |

* *for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

** *include the areas on both sides of internal walls and partitions*

| | | | |
|---|---|---|---|
| Fabric heat loss, W/K = S (A x U) | (26)…(30) + (32) = | 39.43 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 3883.43 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 77.25 | (35) |

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

| | | | |
|---|---|---|---|
| Thermal bridges : S (L x Y) calculated using Appendix K | | 10.75 | (36) |

*if details of thermal bridging are not known (36) = 0.15 x (31)*

| | | | |
|---|---|---|---|
| Total fabric heat loss | (33) + (36) = | 50.18 | (37) |

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.47 | 10.35 | 10.22 | 9.59 | 9.46 | 8.82 | 8.82 | 8.7 | 9.08 | 9.46 | 9.71 | 9.97 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 60.66 | 60.53 | 60.4 | 59.77 | 59.64 | 59.01 | 59.01 | 58.88 | 59.26 | 59.64 | 59.89 | 60.15 | |

Average = Sum(39)$_{1...12}$ /12= 59.74 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.21 | 1.2 | 1.2 | 1.19 | 1.19 | 1.17 | 1.17 | 1.17 | 1.18 | 1.19 | 1.19 | 1.2 | |

Average = Sum(40)$_{1...12}$ /12= 1.19 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.53 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*



*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 81.98 | 79 | 76.02 | 73.04 | 70.06 | 67.08 | 67.08 | 70.06 | 73.04 | 76.02 | 79 | 81.98 | |

Total = Sum(44)$_{1...12}$ = 894.34 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 121.58 | 106.33 | 109.72 | 95.66 | 91.79 | 79.21 | 73.4 | 84.22 | 85.23 | 99.33 | 108.42 | 117.74 | |

Total = Sum(45)$_{1...12}$ = 1172.63 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.24 | 15.95 | 16.46 | 14.35 | 13.77 | 11.88 | 11.01 | 12.63 | 12.78 | 14.9 | 16.26 | 17.66 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 176.85 | 156.26 | 165 | 149.15 | 147.07 | 132.7 | 128.67 | 139.5 | 138.72 | 154.6 | 161.92 | 173.02 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 176.85 | 156.26 | 165 | 149.15 | 147.07 | 132.7 | 128.67 | 139.5 | 138.72 | 154.6 | 161.92 | 173.02 |

Output from water heater (annual)$_{1...12}$ | 1823.47 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.65 | 75.3 | 80.7 | 74.6 | 74.74 | 69.13 | 68.63 | 72.23 | 71.13 | 77.25 | 78.85 | 83.37 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 32.97 | 29.28 | 23.82 | 18.03 | 13.48 | 11.38 | 12.29 | 15.98 | 21.45 | 27.24 | 31.79 | 33.89 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 220.8 | 223.09 | 217.32 | 205.02 | 189.51 | 174.93 | 165.18 | 162.89 | 168.67 | 180.96 | 196.47 | 211.06 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 113.77 | 112.05 | 108.47 | 103.61 | 100.46 | 96.02 | 92.24 | 97.08 | 98.8 | 103.83 | 109.51 | 112.06 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 448.39 | 445.27 | 430.45 | 407.52 | 384.29 | 363.17 | 350.56 | 356.8 | 369.76 | 392.87 | 418.62 | 437.85 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 3.82 | x | 19.64 | x | 0.56 | x | 0.7 | = | 20.31 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 38.42 | x | 0.56 | x | 0.7 | = | 39.73 | (76) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 3.82 | x | 63.27 | x | 0.56 | x | 0.7 | = | 65.43 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 92.28 | x | 0.56 | x | 0.7 | = | 95.42 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 113.09 | x | 0.56 | x | 0.7 | = | 116.94 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 115.77 | x | 0.56 | x | 0.7 | = | 119.71 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 110.22 | x | 0.56 | x | 0.7 | = | 113.97 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 94.68 | x | 0.56 | x | 0.7 | = | 97.9 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 73.59 | x | 0.56 | x | 0.7 | = | 76.09 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 45.59 | x | 0.56 | x | 0.7 | = | 47.14 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 24.49 | x | 0.56 | x | 0.7 | = | 25.32 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 16.15 | x | 0.56 | x | 0.7 | = | 16.7 | (76) |
| South | 0.9x | 0.77 | x | 12.22 | x | 46.75 | x | 0.56 | x | 0.7 | = | 154.65 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 76.57 | x | 0.56 | x | 0.7 | = | 253.27 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 97.53 | x | 0.56 | x | 0.7 | = | 322.62 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 110.23 | x | 0.56 | x | 0.7 | = | 364.63 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 114.87 | x | 0.56 | x | 0.7 | = | 379.97 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 110.55 | x | 0.56 | x | 0.7 | = | 365.67 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 108.01 | x | 0.56 | x | 0.7 | = | 357.28 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 104.89 | x | 0.56 | x | 0.7 | = | 346.97 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 101.89 | x | 0.56 | x | 0.7 | = | 337.02 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 82.59 | x | 0.56 | x | 0.7 | = | 273.18 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 55.42 | x | 0.56 | x | 0.7 | = | 183.31 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 40.4 | x | 0.56 | x | 0.7 | = | 133.63 | (78) |



Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 174.95 | 293 | 388.05 | 460.05 | 496.91 | 485.38 | 471.25 | 444.86 | 413.11 | 320.32 | 208.63 | 150.33 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 623.34 | 738.27 | 818.5 | 867.57 | 881.2 | 848.54 | 821.81 | 801.66 | 782.87 | 713.18 | 627.25 | 588.18 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.83 | 0.78 | 0.71 | 0.62 | 0.52 | 0.4 | 0.3 | 0.32 | 0.45 | 0.64 | 0.78 | 0.85 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.01 | 19.38 | 19.81 | 20.26 | 20.61 | 20.85 | 20.94 | 20.93 | 20.78 | 20.33 | 19.6 | 18.92 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 19.91 | 19.92 | 19.92 | 19.93 | 19.93 | 19.94 | 19.94 | 19.94 | 19.94 | 19.93 | 19.93 | 19.92 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.81 | 0.75 | 0.68 | 0.59 | 0.48 | 0.34 | 0.23 | 0.25 | 0.4 | 0.6 | 0.75 | 0.83 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 17.33 | 17.84 | 18.44 | 19.05 | 19.51 | 19.8 | 19.9 | 19.9 | 19.73 | 19.17 | 18.18 | 17.22 | (90) |

fLA = Living area ÷ (4) = | 0.45 | (91)

# SAP WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.08 | 18.53 | 19.05 | 19.6 | 20.01 | 20.27 | 20.37 | 20.36 | 20.21 | 19.69 | 18.82 | 17.99 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.08 | 18.53 | 19.05 | 19.6 | 20.01 | 20.27 | 20.37 | 20.36 | 20.21 | 19.69 | 18.82 | 17.99 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.78 | 0.72 | 0.66 | 0.58 | 0.48 | 0.36 | 0.26 | 0.28 | 0.41 | 0.59 | 0.73 | 0.79 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 485.92 | 534.23 | 540.2 | 501.72 | 423.1 | 307.66 | 213.41 | 222.43 | 323.38 | 420.72 | 454.94 | 467.45 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 836 | 825.24 | 758.31 | 639.29 | 495.4 | 334.75 | 222.48 | 233.29 | 361.86 | 542.15 | 701.95 | 829.16 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 260.46 | 195.56 | 162.27 | 99.05 | 53.79 | 0 | 0 | 0 | 0 | 90.34 | 177.85 | 269.11 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1308.43 (98)

Space heating requirement in kWh/m²/year 26.03 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none 0 (301)

Fraction of space heat from community system 1 – (301) = 1 (302)

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community boilers | | 1 | (303a) |
| Fraction of total space heat from Community boilers | (302) x (303a) = | 1 | (304a) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1308.43 | |
| Space heat from Community boilers | (98) x (304a) x (305) x (306) = | 1373.85 | (307a) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1823.47 | |
| If DHW from community scheme: Water heat from Community boilers | (64) x (303a) x (305) x (306) = | 1914.64 | (310a) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 32.88 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |

# SAP WorkSheet: New dwelling design stage

Electricity for pumps and fans within dwelling (Table 4f):

| | | | |
|---|---|---|---|
| mechanical ventilation - balanced, extract or positive input from outside | | 97.51 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 97.51 | (331) |
| Energy for lighting (calculated in Appendix L) | | 232.91 | (332) |

## 10b. Fuel costs – Community heating scheme

| | Fuel kWh/year | Fuel Price (Table 12) | | Fuel Cost £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 4.24 | x 0.01 = | 58.25 | (340a) |
| Water heating from CHP | (310a) x | 4.24 | x 0.01 = | 81.18 | (342a) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 12.86 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 30.72 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 303.02 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.34 | (357) |
| **SAP rating (section12)** | | 81.36 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | Energy kWh/year | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| CO2 from other sources of space and water heating (not CHP) | | | | | | |
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 89.5 | (367a) |
| CO2 associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 793.65 | (367) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 17.07 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 810.72 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 810.72 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 50.61 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 120.88 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 982.21 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 19.54 | (384) |
| **EI rating (section 14)** | | | | | 86.18 | (385) |

## 13b. Primary Energy – Community heating scheme

| Energy kWh/year | Primary factor | P.Energy kWh/year |
|---|---|---|

# SAP WorkSheet: New dwelling design stage

Energy from other sources of space and water heating (not CHP)

| | | | | | |
|---|---|---|---|---|---|
| Efficiency of heat source 1 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 89.5 | (367a) |
| Energy associated with heat source 1 | [(307b)+(310b)] x 100 ÷ (367b) x | 1.22 | = | 4482.64 | (367) |
| Electrical energy for heat distribution | [(313) x | | = | 100.96 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | = | 4583.6 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | 4583.6 | (373) |
| Energy associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | 4583.6 | (376) |
| Energy associated with space cooling | (315) x | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | 3.07 | = | 299.37 | (378) |
| Energy associated with electricity for lighting | (332))) x | 3.07 | = | 715.04 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | 5598.01 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 D-3-02

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | North |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 77.25 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 159.26 | **(P1)** |
| **Transmission heat loss coefficient:** | 50.2 | |
| **Summer heat loss coefficient:** | 209.44 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| South (Side) | 0 | 1 |
| East (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| South (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| South (Side) | 0.9 x | 12.22 | 112.21 | 0.56 | 0.7 | 0.76 | 368.74 | |
| East (Rear) | 0.9 x | 3.82 | 117.51 | 0.56 | 0.7 | 0.76 | 120.72 | |
| | | | | | | **Total** | 489.46 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 363.17 | 350.56 | 356.8 | |
| Total summer gains | 873.54 | 840.02 | 826.81 | **(P5)** |
| Summer gain/loss ratio | 4.17 | 4.01 | 3.95 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.46 | 1.46 | 1.46 | |
| Threshold temperature | 21.63 | 23.37 | 23.21 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# APPENDIX B2 – SAP OUTPUTS FOR SAMPLE UNITS “CLEAN”

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:27:37*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 100.24m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 A-0-06

**Address :** A-0-06, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 15.23 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 10.42 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 43.7 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 39.2 kWh/m² | |
| | | **OK** |

## 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 | 0.11 (max. 0.25) | 0.11 (max. 0.70) | **OK** |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | **OK** |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South | 12.15m² | |
| Windows facing: South East | 7.63m² | |
| Ventilation rate: | 2.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Floors U-value | 0.11 W/m²K |
| Community heating, heat from CHP | |

# Predicted Energy Assessment

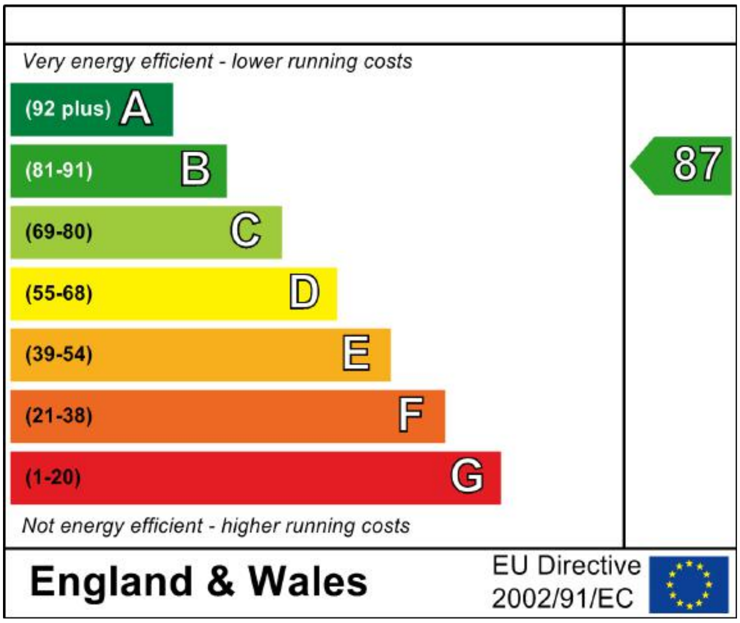
A-0-06
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Ground floor Flat |
| Date of assessment: | 22 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 100.24 m² |

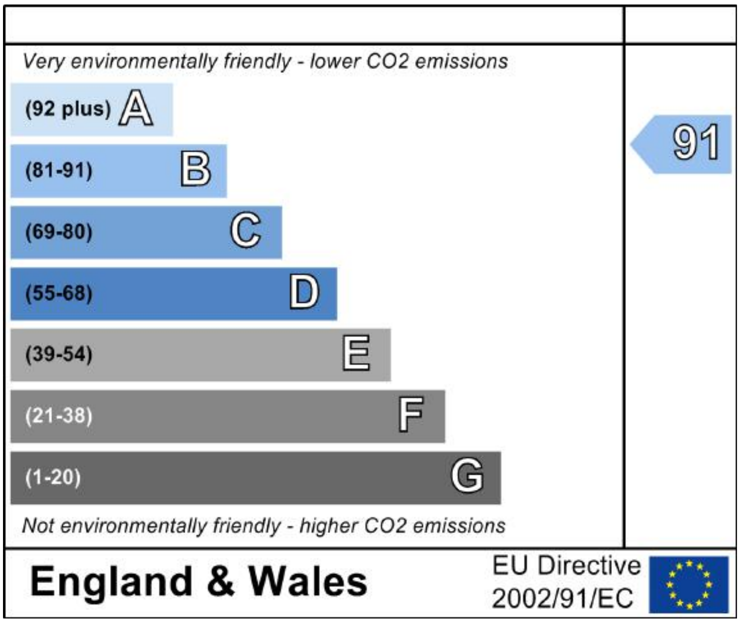
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-0-06

| | |
|---|---|
| Address: | A-0-06, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 166.49 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | |
|---|---|
| Dwelling type: | Flat |
| Detachment: | |
| Year Completed: | 2018 |

| Floor Location: | Floor area: | Storey height: |
|---|---|---|
| Floor 0 | 100.24 m² | 2.4 m |

| | |
|---|---|
| Living area: | 37.51 m² (fraction 0.374) |
| Front of dwelling faces: | North |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.44 | 1.4 | 12.15 | 1 |
| Side | 16mm or more | 0.7 | 0.44 | 1.4 | 7.63 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | North | 0 | 0 |
| Rear | | External Wall | South | 0 | 0 |
| Side | | External Wall | South East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 77.99 | 21.88 | 56.11 | 0.15 | 0 | False | 14 |
| Corridor Wall | 3.6 | 0 | 3.6 | 0.15 | 0.43 | False | 14 |
| Riser Wall | 4.8 | 0 | 4.8 | 0.15 | 0 | False | 14 |
| Ground Floor | 100.24 | | | 0.11 | | | 110 |
| Internal Elements | | | | | | | |
| Stud Walls | 144 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 22.8 | | | | | | 20 |
| Party Ceiling | 100.24 | | | | | | 30 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0654

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 23.4 | 0.05 | E4 | Jamb |
| [Approved] | 35.99 | 0.16 | E5 | Ground floor (normal) |
| [Approved] | 35.99 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 9.5 | 0.16 | P1 | Ground floor |
| | 9.5 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from boilers – mains gas<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 A-0-06

**Address :** A-0-06, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 100.24 | (1a) | x | 2.4 | (2a) | = | 240.58 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 100.24 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 240.58 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

Wind Factor (22a)m = (22)m ÷ 4

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 12.15 | x1/[1/( 1.4 )+ 0.04] | | = | 16.11 | | | (27) |
| Windows Type 2 | | | 7.63 | x1/[1/( 1.4 )+ 0.04] | | = | 10.12 | | | (27) |
| Floor | | | 100.24 | x | 0.11 | = | 11.0264 | 110 | 11026.4 | (28) |
| Walls Type1 | 77.99 | 21.88 | 56.11 | x | 0.15 | = | 8.42 | 14 | 785.54 | (29) |
| Walls Type2 | 3.6 | 0 | 3.6 | x | 0.14 | = | 0.51 | 14 | 50.4 | (29) |
| Walls Type3 | 4.8 | 0 | 4.8 | x | 0.15 | = | 0.72 | 14 | 67.2 | (29) |
| Total area of elements, m² | | | 186.63 | | | | | | | (31) |
| Party wall | | | 22.8 | x | 0 | = | 0 | 20 | 456 | (32) |
| Party ceiling | | | 100.24 | | | | | 30 | 3007.2 | (32b) |
| Internal wall ** | | | 144 | | | | | 9 | 1296 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 49.83 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 16688.74 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 166.49 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 12.2 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 62.04 (37)

# SAP WorkSheet: New dwelling design stage

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 20.88 | 20.63 | 20.38 | 19.11 | 18.86 | 17.59 | 17.59 | 17.34 | 18.1 | 18.86 | 19.37 | 19.87 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 82.92 | 82.67 | 82.42 | 81.15 | 80.9 | 79.63 | 79.63 | 79.38 | 80.14 | 80.9 | 81.4 | 81.91 | |

Average = Sum(39)$_{1…12}$ /12= 81.09 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.83 | 0.82 | 0.82 | 0.81 | 0.81 | 0.79 | 0.79 | 0.79 | 0.8 | 0.81 | 0.81 | 0.82 | |

Average = Sum(40)$_{1…12}$ /12= 0.81 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.74 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.32 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 109.25 | 105.28 | 101.3 | 97.33 | 93.36 | 89.38 | 89.38 | 93.36 | 97.33 | 101.3 | 105.28 | 109.25 | |

Total = Sum(44)$_{1…12}$ = 1191.79 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 162.01 | 141.7 | 146.22 | 127.48 | 122.32 | 105.55 | 97.81 | 112.24 | 113.58 | 132.36 | 144.48 | 156.9 | |

Total = Sum(45)$_{1…12}$ = 1562.63 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 24.3 | 21.25 | 21.93 | 19.12 | 18.35 | 15.83 | 14.67 | 16.84 | 17.04 | 19.85 | 21.67 | 23.53 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 217.29 | 191.62 | 201.49 | 180.97 | 177.59 | 159.04 | 153.08 | 167.51 | 167.07 | 187.64 | 197.98 | 212.18 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 217.29 | 191.62 | 201.49 | 180.97 | 177.59 | 159.04 | 153.08 | 167.51 | 167.07 | 187.64 | 197.98 | 212.18 |

Output from water heater (annual)$_{1...12}$ | 2213.47 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 98.09 | 87.06 | 92.84 | 85.18 | 84.89 | 77.89 | 76.74 | 81.54 | 80.56 | 88.23 | 90.84 | 96.39 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 57.7 | 51.25 | 41.68 | 31.55 | 23.59 | 19.91 | 21.52 | 27.97 | 37.54 | 47.67 | 55.63 | 59.31 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 383.16 | 387.13 | 377.11 | 355.78 | 328.86 | 303.55 | 286.65 | 282.67 | 292.69 | 314.02 | 340.95 | 366.25 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 131.84 | 129.55 | 124.78 | 118.31 | 114.1 | 108.18 | 103.15 | 109.6 | 111.89 | 118.59 | 126.16 | 129.56 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 681.73 | 676.96 | 652.6 | 614.67 | 575.57 | 540.67 | 520.34 | 529.26 | 551.14 | 589.3 | 631.77 | 664.14 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | Access Factor Table 6d | Area m² | Flux Table 6a | g_ Table 6b | FF Table 6c | Gains (W) |
|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 36.79 | x | 0.44 | x | 0.7 | = | 59.92 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 62.67 | x | 0.44 | x | 0.7 | = | 102.07 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 85.75 | x | 0.44 | x | 0.7 | = | 139.65 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 106.25 | x | 0.44 | x | 0.7 | = | 173.04 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 119.01 | x | 0.44 | x | 0.7 | = | 193.82 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 118.15 | x | 0.44 | x | 0.7 | = | 192.42 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 113.91 | x | 0.44 | x | 0.7 | = | 185.51 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 104.39 | x | 0.44 | x | 0.7 | = | 170.01 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 92.85 | x | 0.44 | x | 0.7 | = | 151.22 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 69.27 | x | 0.44 | x | 0.7 | = | 112.81 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 44.07 | x | 0.44 | x | 0.7 | = | 71.77 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 31.49 | x | 0.44 | x | 0.7 | = | 51.28 | (77) |
| South | 0.9x | 0.77 | x | 12.15 | x | 46.75 | x | 0.44 | x | 0.7 | = | 121.24 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 76.57 | x | 0.44 | x | 0.7 | = | 198.57 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 97.53 | x | 0.44 | x | 0.7 | = | 252.94 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 110.23 | x | 0.44 | x | 0.7 | = | 285.88 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 114.87 | x | 0.44 | x | 0.7 | = | 297.9 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 110.55 | x | 0.44 | x | 0.7 | = | 286.69 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 108.01 | x | 0.44 | x | 0.7 | = | 280.11 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 104.89 | x | 0.44 | x | 0.7 | = | 272.03 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 101.89 | x | 0.44 | x | 0.7 | = | 264.22 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 82.59 | x | 0.44 | x | 0.7 | = | 214.17 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 55.42 | x | 0.44 | x | 0.7 | = | 143.72 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 40.4 | x | 0.44 | x | 0.7 | = | 104.77 | (78) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 181.17 | 300.64 | 392.59 | 458.91 | 491.72 | 479.11 | 465.62 | 442.04 | 415.44 | 326.98 | 215.49 | 156.05 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 862.89 | 977.59 | 1045.2 | 1073.59 | 1067.29 | 1019.78 | 985.96 | 971.3 | 966.59 | 916.28 | 847.25 | 820.19 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.96 | 0.93 | 0.88 | 0.79 | 0.66 | 0.49 | 0.35 | 0.37 | 0.56 | 0.79 | 0.92 | 0.96 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.23 | 20.41 | 20.61 | 20.81 | 20.93 | 20.99 | 21 | 21 | 20.98 | 20.84 | 20.51 | 20.19 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.23 | 20.23 | 20.23 | 20.25 | 20.25 | 20.26 | 20.26 | 20.26 | 20.25 | 20.25 | 20.24 | 20.24 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.95 | 0.91 | 0.86 | 0.76 | 0.62 | 0.44 | 0.29 | 0.31 | 0.5 | 0.76 | 0.91 | 0.96 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.21 | 19.47 | 19.76 | 20.03 | 20.18 | 20.25 | 20.26 | 20.26 | 20.23 | 20.07 | 19.63 | 19.16 | (90) |

fLA = Living area ÷ (4) = 0.37 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.59 | 19.82 | 20.08 | 20.32 | 20.46 | 20.53 | 20.53 | 20.54 | 20.51 | 20.36 | 19.96 | 19.55 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.59 | 19.82 | 20.08 | 20.32 | 20.46 | 20.53 | 20.53 | 20.54 | 20.51 | 20.36 | 19.96 | 19.55 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.94 | 0.91 | 0.85 | 0.76 | 0.63 | 0.46 | 0.32 | 0.34 | 0.52 | 0.76 | 0.9 | 0.95 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 812.67 | 886.16 | 891.54 | 818.05 | 672.39 | 465.88 | 312.5 | 327.17 | 502.41 | 697.44 | 764.41 | 779.61 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 1268.05 | 1233.74 | 1118.92 | 926.91 | 708.88 | 471.83 | 313.3 | 328.25 | 513.89 | 789.25 | 1047.02 | 1257.12 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 338.8 | 233.57 | 169.17 | 78.39 | 27.15 | 0 | 0 | 0 | 0 | 68.31 | 203.47 | 355.27 | |

Total per year (kWh/year) = Sum(98)1...5,9...12 = 1474.12 (98)

Space heating requirement in kWh/m²/year 14.71 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1474.12 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 928.7 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 619.13 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2213.47 | |

If DHW from community scheme:

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1394.49 | (310a) |
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 929.66 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 38.72 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 194.45 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 194.45 | (331) |
| Energy for lighting (calculated in Appendix L) | | 407.62 | (332) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 2.97 | x 0.01 = | 27.58 | (340a) |
| Space heating from heat source 2 | (307b) | x | 4.24 | x 0.01 = | 26.25 | (340b) |
| Water heating from CHP | (310a) | x | 2.97 | x 0.01 = | 41.42 | (342a) |
| Water heating from heat source 2 | (310b) | x | 4.24 | x 0.01 = | 39.42 | (342b) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 25.65 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 53.77 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 334.08 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 0.97 | (357) |
| **SAP rating (section12)** | | 86.52 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| Electrical efficiency of CHP unit | | | | | 29.8 | (361) |
| Heat efficiency of CHP unit | | | | | 57.6 | (362) |
| | | **Energy** kWh/year | | **Emission factor** kg CO2/kWh | **Emissions** kg CO2/year | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1612.32 | x | 0.22 | 348.26 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 480.47 | x | 0.52 | -249.37 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2420.98 | x | 0.22 | 522.93 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 721.45 | x | 0.52 | -374.43 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | 0.22 | = | 367.62 | (368) |
| Electrical energy for heat distribution | [(313) x | 0.52 | = | 20.1 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 635.12 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 635.12 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 100.92 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 211.56 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 947.59 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 9.45 | (384) |
| **EI rating (section 14)** | | | | 91.26 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1612.32 | x | 1.22 | 1967.03 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 480.47 | x | 3.07 | -1475.05 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2420.98 | x | 1.22 | 2953.6 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 721.45 | x | 3.07 | -2214.86 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |

| | | | | | |
|---|---|---|---|---|---|
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | 1.22 | = | 2076.4 | (368) |
| Electrical energy for heat distribution | [(313) x | | = | 118.87 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | = | 3425.99 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | 3425.99 | (373) |
| Energy associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | 3425.99 | (376) |
| Energy associated with space cooling | (315) x | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | 3.07 | = | 596.95 | (378) |
| Energy associated with electricity for lighting | (332))) x | 3.07 | = | 1251.4 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | 5274.34 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 A-0-06

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | North |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 166.49 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 2 ( Windows open half the time) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 158.78 | **(P1)** |
| **Transmission heat loss coefficient:** | 62 | |
| **Summer heat loss coefficient:** | 220.82 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| South (Rear) | 0 | 1 |
| South East (Side) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| South (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| South East (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| South (Rear) | 0.9 x | 12.15 | 112.21 | 0.44 | 0.7 | 0.76 | 289.1 | |
| South East (Side) | 0.9 x | 7.63 | 119.92 | 0.44 | 0.7 | 0.76 | 194.03 | |
| | | | | | | **Total** | 483.13 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 540.67 | 520.34 | 529.26 | |
| Total summer gains | 1044.04 | 1003.47 | 995.51 | **(P5)** |
| Summer gain/loss ratio | 4.73 | 4.54 | 4.51 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 0.83 | 0.83 | 0.83 | |
| Threshold temperature | 21.56 | 23.28 | 23.14 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:27:27*

## Project Information:

| | | | |
|---|---|---|---|
| **Assessed By:** | Matthew Stainrod (STRO023501) | **Building Type:** | Flat |

## Dwelling Details:

| | | | |
|---|---|---|---|
| **NEW DWELLING DESIGN STAGE** | | Total Floor Area: 70.75m² | |
| **Site Reference :** | Bertram Street | **Plot Reference:** | 06-18-69419 A-1-01 |
| **Address :** | A-1-01, Bertram Street, London | | |

## Client Details:

| | |
|---|---|
| **Name:** | McBains |
| **Address :** | 26 Finsbury Square, London, EC2A 1DS |

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 15.86 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 10.83 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 38.8 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 34.4 kWh/m² | |
| | | **OK** |

## 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 | 1.40 (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: | Community heating schemes - CommCHP |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | **OK** |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North | 1.92m² | |
| Windows facing: West | 15.96m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from CHP | |

# Predicted Energy Assessment

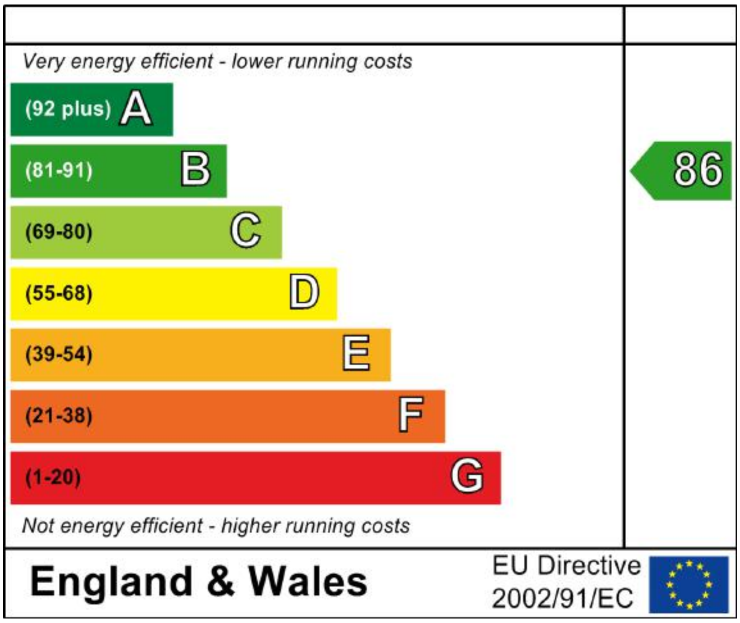
A-1-01
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Mid floor Flat |
| Date of assessment: | 22 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 70.75 m² |

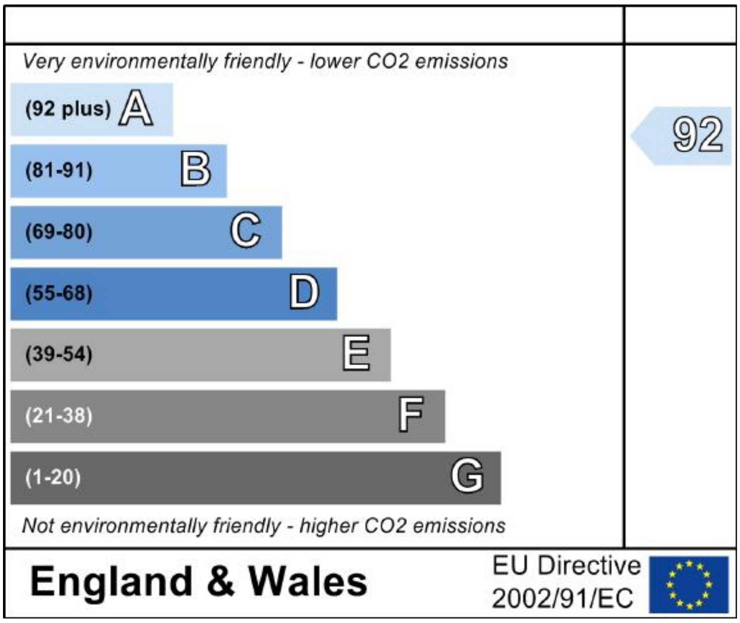
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-1-01

| | |
|---|---|
| Address: | A-1-01, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 99.4 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 70.75 m² | 2.4 m |
| Living area: | 25.03 m² (fraction 0.354) | |
| Front of dwelling faces: | South | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 1.92 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 15.96 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | South | 0 | 0 |
| Rear | | External Wall | North | 0 | 0 |
| Side | | External Wall | West | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| <u>External Elements</u> | | | | | | | |
| External Wall | 47.64 | 19.98 | 27.66 | 0.15 | 0 | False | 14 |
| Corridor Wall | 8.02 | 0 | 8.02 | 0.15 | 0.43 | False | 14 |
| <u>Internal Elements</u> | | | | | | | |
| Stud Walls | 105.6 | | | | | | 9 |
| <u>Party Elements</u> | | | | | | | |
| Party Wall | 31.51 | | | | | | 20 |
| Party Ceiling | 70.75 | | | | | | 30 |
| Party Floor | 70.75 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0964

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 23.4 | 0.05 | E4 | Jamb |
| [Approved] | 46.38 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 4.8 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 7.2 | 0.06 | E18 | Party wall between dwellings |
| | 26.26 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 2<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 A-1-01

**Address :** A-1-01, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 70.75 | (1a) x | 2.4 | (2a) = | 169.8 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 70.75 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 169.8 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 1.92 | x1/[1/( 1.4 )+ 0.04] | | = | 2.55 | | | (27) |
| Windows Type 2 | | | 15.96 | x1/[1/( 1.4 )+ 0.04] | | = | 21.16 | | | (27) |
| Walls Type1 | 47.64 | 19.98 | 27.66 | x | 0.15 | = | 4.15 | 14 | 387.24 | (29) |
| Walls Type2 | 8.02 | 0 | 8.02 | x | 0.14 | = | 1.13 | 14 | 112.28 | (29) |
| Total area of elements, m² | | | 55.66 | | | | | | | (31) |
| Party wall | | | 31.51 | x | 0 | = | 0 | 20 | 630.2 | (32) |
| Party floor | | | 70.75 | | | | | 40 | 2830 | (32a) |
| Party ceiling | | | 70.75 | | | | | 30 | 2122.5 | (32b) |
| Internal wall ** | | | 105.6 | | | | | 9 | 950.4 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.92 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 7032.62 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 99.4 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 5.36 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 37.29 (37)

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 14.74 | 14.56 | 14.38 | 13.49 | 13.31 | 12.42 | 12.42 | 12.24 | 12.78 | 13.31 | 13.67 | 14.03 | (38) |

Heat transfer coefficient, W/K — (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 52.03 | 51.85 | 51.67 | 50.78 | 50.6 | 49.71 | 49.71 | 49.53 | 50.06 | 50.6 | 50.96 | 51.31 | |

Average = $Sum(39)_{1...12}$ /12= 50.73 (39)

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.74 | 0.73 | 0.73 | 0.72 | 0.72 | 0.7 | 0.7 | 0.7 | 0.71 | 0.72 | 0.72 | 0.73 | |

Average = $Sum(40)_{1...12}$ /12= 0.72 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 2.26 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 87.97 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)* | | | | | | | | | | | | | |
| (44)m= | 96.77 | 93.25 | 89.73 | 86.22 | 82.7 | 79.18 | 79.18 | 82.7 | 86.22 | 89.73 | 93.25 | 96.77 | |

Total = $Sum(44)_{1...12}$ = 1055.7 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 143.51 | 125.51 | 129.52 | 112.92 | 108.35 | 93.5 | 86.64 | 99.42 | 100.61 | 117.25 | 127.98 | 138.98 | |

Total = $Sum(45)_{1...12}$ = 1384.18 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 21.53 | 18.83 | 19.43 | 16.94 | 16.25 | 14.02 | 13 | 14.91 | 15.09 | 17.59 | 19.2 | 20.85 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = — 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 198.79 | 175.44 | 184.8 | 166.41 | 163.63 | 146.99 | 141.91 | 154.7 | 154.1 | 172.52 | 181.48 | 194.26 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 198.79 | 175.44 | 184.8 | 166.41 | 163.63 | 146.99 | 141.91 | 154.7 | 154.1 | 172.52 | 181.48 | 194.26 |

Output from water heater (annual)$_{1...12}$ | 2035.02 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 91.94 | 81.68 | 87.29 | 80.34 | 80.25 | 73.88 | 73.03 | 77.28 | 76.25 | 83.21 | 85.35 | 90.43 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | | | | | | | | | | | | | |
| (67)m= | 44.36 | 39.4 | 32.04 | 24.26 | 18.13 | 15.31 | 16.54 | 21.5 | 28.86 | 36.64 | 42.77 | 45.59 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | | | | | | | | | | | | | |
| (68)m= | 297.08 | 300.16 | 292.39 | 275.85 | 254.98 | 235.36 | 222.25 | 219.17 | 226.93 | 243.47 | 264.35 | 283.97 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | | | | | | | | | | | | | |
| (69)m= | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | (69) |
| Pumps and fans gains (Table 5a) | | | | | | | | | | | | | |
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |
| Losses e.g. evaporation (negative values) (Table 5) | | | | | | | | | | | | | |
| (71)m= | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | (71) |
| Water heating gains (Table 5) | | | | | | | | | | | | | |
| (72)m= | 123.57 | 121.54 | 117.32 | 111.58 | 107.86 | 102.61 | 98.16 | 103.87 | 105.9 | 111.84 | 118.54 | 121.55 | (72) |
| **Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m | | | | | | | | | | | | | |
| (73)m= | 561.14 | 557.24 | 537.89 | 507.83 | 477.1 | 449.41 | 433.08 | 440.67 | 457.83 | 488.09 | 521.79 | 547.25 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 1.92 | x | 10.63 | x | 0.558 | x | 0.7 | = | 5.53 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 20.32 | x | 0.558 | x | 0.7 | = | 10.56 | (74) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 1.92 | x | 34.53 | x | 0.558 | x | 0.7 | = | 17.95 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 55.46 | x | 0.558 | x | 0.7 | = | 28.83 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 74.72 | x | 0.558 | x | 0.7 | = | 38.83 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 79.99 | x | 0.558 | x | 0.7 | = | 41.57 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 74.68 | x | 0.558 | x | 0.7 | = | 38.81 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 59.25 | x | 0.558 | x | 0.7 | = | 30.79 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 41.52 | x | 0.558 | x | 0.7 | = | 21.58 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 24.19 | x | 0.558 | x | 0.7 | = | 12.57 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 13.12 | x | 0.558 | x | 0.7 | = | 6.82 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 8.86 | x | 0.558 | x | 0.7 | = | 4.61 | (74) |
| West | 0.9x | 0.77 | x | 15.96 | x | 19.64 | x | 0.56 | x | 0.7 | = | 84.85 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 38.42 | x | 0.56 | x | 0.7 | = | 165.98 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 63.27 | x | 0.56 | x | 0.7 | = | 273.35 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 92.28 | x | 0.56 | x | 0.7 | = | 398.66 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 113.09 | x | 0.56 | x | 0.7 | = | 488.58 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 115.77 | x | 0.56 | x | 0.7 | = | 500.15 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 110.22 | x | 0.56 | x | 0.7 | = | 476.16 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 94.68 | x | 0.56 | x | 0.7 | = | 409.01 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 73.59 | x | 0.56 | x | 0.7 | = | 317.92 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 45.59 | x | 0.56 | x | 0.7 | = | 196.95 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 24.49 | x | 0.56 | x | 0.7 | = | 105.8 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 16.15 | x | 0.56 | x | 0.7 | = | 69.78 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 90.38 | 176.54 | 291.3 | 427.49 | 527.41 | 541.72 | 514.97 | 439.8 | 339.49 | 209.52 | 112.61 | 74.38 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 651.52 | 733.78 | 829.18 | 935.32 | 1004.51 | 991.13 | 948.05 | 880.47 | 797.32 | 697.61 | 634.41 | 621.63 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.87 | 0.83 | 0.74 | 0.6 | 0.45 | 0.32 | 0.23 | 0.26 | 0.42 | 0.66 | 0.82 | 0.89 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.11 | 20.32 | 20.59 | 20.84 | 20.95 | 20.99 | 21 | 21 | 20.97 | 20.81 | 20.44 | 20.08 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.31 | 20.31 | 20.31 | 20.33 | 20.33 | 20.34 | 20.34 | 20.34 | 20.33 | 20.33 | 20.32 | 20.32 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.86 | 0.81 | 0.72 | 0.57 | 0.42 | 0.29 | 0.2 | 0.22 | 0.38 | 0.63 | 0.8 | 0.88 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.13 | 19.42 | 19.8 | 20.13 | 20.27 | 20.33 | 20.34 | 20.34 | 20.31 | 20.1 | 19.61 | 19.09 | (90) |

fLA = Living area ÷ (4) = | 0.35 | (91)

# SAP WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.48 | 19.74 | 20.08 | 20.38 | 20.51 | 20.56 | 20.57 | 20.57 | 20.54 | 20.35 | 19.9 | 19.44 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.48 | 19.74 | 20.08 | 20.38 | 20.51 | 20.56 | 20.57 | 20.57 | 20.54 | 20.35 | 19.9 | 19.44 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.85 | 0.8 | 0.71 | 0.57 | 0.43 | 0.3 | 0.21 | 0.23 | 0.4 | 0.63 | 0.79 | 0.86 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 551.26 | 584.45 | 588.51 | 536.83 | 431.89 | 293.74 | 196.83 | 205.75 | 314.96 | 440.63 | 501.98 | 534.12 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 789.82 | 769.53 | 701.59 | 582.83 | 445.83 | 296.37 | 197.36 | 206.57 | 322.44 | 493.29 | 652.36 | 781.84 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 177.49 | 124.37 | 84.13 | 33.12 | 10.37 | 0 | 0 | 0 | 0 | 39.18 | 108.28 | 184.3 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 761.25 (98)

Space heating requirement in kWh/m²/year 10.76 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 761.25 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 479.59 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 319.73 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2035.02 | |
| If DHW from community scheme: Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1282.06 | (310a) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 854.71 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 29.36 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 137.24 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 137.24 | (331) |
| Energy for lighting (calculated in Appendix L) | | 313.38 | (332) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 2.97 | x 0.01 = | 14.24 | (340a) |
| Space heating from heat source 2 | (307b) | x | 4.24 | x 0.01 = | 13.56 | (340b) |
| Water heating from CHP | (310a) | x | 2.97 | x 0.01 = | 38.08 | (342a) |
| Water heating from heat source 2 | (310b) | x | 4.24 | x 0.01 = | 36.24 | (342b) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 18.1 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 41.33 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 281.55 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.02 | (357) |
| **SAP rating (section12)** | | 85.75 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| Electrical efficiency of CHP unit | | | | | 29.8 | (361) |
| Heat efficiency of CHP unit | | | | | 57.6 | (362) |
| | | **Energy** kWh/year | | **Emission factor** kg CO2/kWh | **Emissions** kg CO2/year | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 832.62 | x | 0.22 | 179.85 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 248.12 | x | 0.52 | -128.77 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2225.81 | x | 0.22 | 480.77 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 663.29 | x | 0.52 | -344.25 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |

| | | | | | |
|---|---|---|---|---|---|
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | 0.22 | = | 278.77 | (368) |
| Electrical energy for heat distribution | [(313) x | 0.52 | = | 15.24 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 481.6 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 481.6 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 71.23 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 162.64 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 715.47 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 10.11 | (384) |
| **EI rating (section 14)** | | | | 91.72 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 832.62 | x | 1.22 | | 1015.8 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 248.12 | x | 3.07 | | -761.73 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2225.81 | x | 1.22 | | 2715.48 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 663.29 | x | 3.07 | | -2036.3 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1574.52 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 90.14 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 2597.9 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 2597.9 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 2597.9 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 421.33 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 962.07 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | | 3981.3 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 A-1-01

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | South |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 99.4 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 224.14 | **(P1)** |
| **Transmission heat loss coefficient:** | 37.3 | |
| **Summer heat loss coefficient:** | 261.42 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| North (Rear) | 0 | 1 |
| West (Side) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| North (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| West (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| North (Rear) | 0.9 x | 1.92 | 81.19 | 0.56 | 0.7 | 0.76 | 41.92 | |
| West (Side) | 0.9 x | 15.96 | 117.51 | 0.56 | 0.7 | 0.76 | 504.35 | |
| | | | | | | **Total** | 546.27 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 449.41 | 433.08 | 440.67 | |
| Total summer gains | 1030.15 | 979.35 | 918.46 | **(P5)** |
| Summer gain/loss ratio | 3.94 | 3.75 | 3.51 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.3 | 1.3 | 1.3 | |
| Threshold temperature | 21.24 | 22.95 | 22.62 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:27:17*

## Project Information:

| | | | |
|---|---|---|---|
| **Assessed By:** | Matthew Stainrod (STRO023501) | **Building Type:** | Flat |

## Dwelling Details:

| | | | |
|---|---|---|---|
| **NEW DWELLING DESIGN STAGE** | | Total Floor Area: 53.39m² | |
| **Site Reference :** | Bertram Street | **Plot Reference:** | 06-18-69419 A-1-07 |
| **Address :** | A-1-07, Bertram Street, London | | |

## Client Details:

| | |
|---|---|
| **Name:** | McBains |
| **Address :** | 26 Finsbury Square, London, EC2A 1DS |

**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 system: Mains gas (c), Mains gas (c) | | |
| Fuel factor: 1.00 (mains gas (c), mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 21.9 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.81 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 62.0 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 59.4 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.14 (max. 0.30) | 0.15 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | 0.20 (max. 0.25) | 0.20 (max. 0.70) | **OK** |
| Roof | (no roof) | | |
| Openings | 1.40 (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: | Community heating schemes - CommCHP |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | **OK** |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: East | 15.96m² | |
| Windows facing: North | 2.4m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| External Walls U-value | 0.13 W/m²K |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from CHP | |

# Predicted Energy Assessment

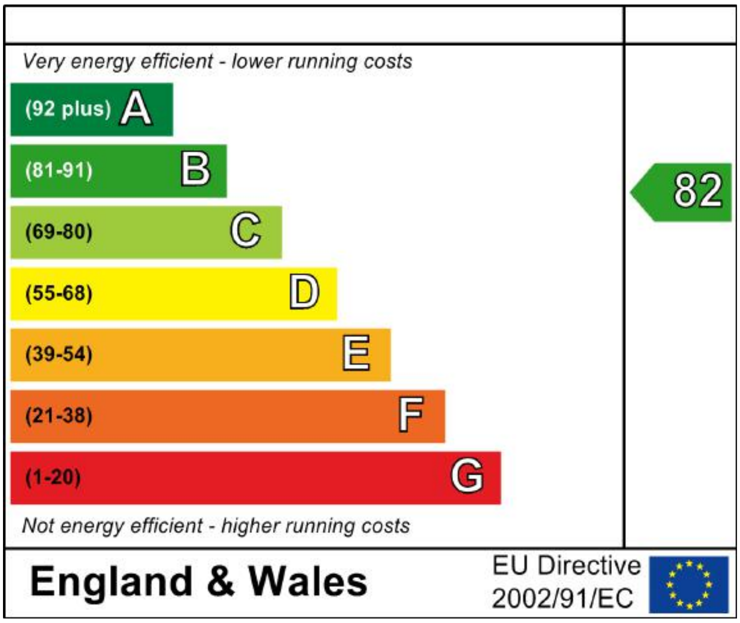
A-1-07
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Mid floor Flat |
| Date of assessment: | 22 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 53.39 m² |

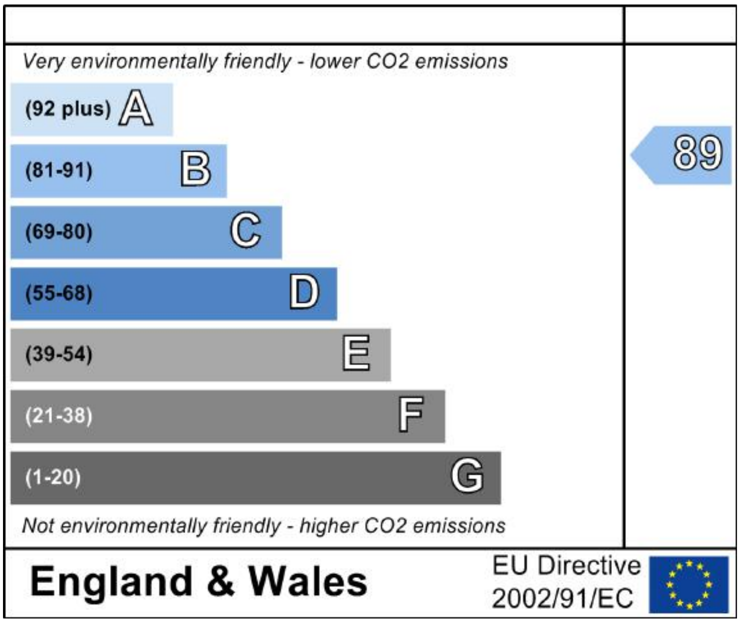
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-1-07

| | |
|---|---|
| Address: | A-1-07, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 136.43 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 53.39 m² | 2.4 m |
| Living area: | 24.42 m² (fraction 0.457) | |
| Front of dwelling faces: | West | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 15.96 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 2.4 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | West | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |
| Side | | External Wall | North | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 27.89 | 20.46 | 7.43 | 0.15 | 0 | False | 14 |
| Corridor Wall | 15.07 | 0 | 15.07 | 0.15 | 0.43 | False | 14 |
| Lift Wall | 14.57 | 0 | 14.57 | 0.15 | 0 | False | 14 |
| Stair Wall | 7.03 | 0 | 7.03 | 0.15 | 0.9 | False | 14 |
| Exposed Floor | 53.39 | | | 0.2 | | | 75 |
| Internal Elements | | | | | | | |
| Stud Walls | 81.6 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 16.32 | | | | | | 20 |
| Party Ceiling | 53.39 | | | | | | 30 |

# SAP Input

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1167

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 23.4 | 0.05 | E4 | Jamb |
| [Approved] | 26.9 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 4.8 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 26.9 | 0.32 | E20 | Exposed floor (normal) |
| | 6.8 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 6.8 | 0.16 | P7 | Exposed floor (normal) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 3 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP Input

# SAP WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 A-1-07

**Address :** A-1-07, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 53.39 | (1a) x | 2.4 | (2a) = | 128.14 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 53.39 | (4) | | | | |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | 128.14 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | |
|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 ÷ (5) = | 0 | (8) |
| *If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)* | | | |
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |
| *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | | |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 3 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.78 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.12 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.15 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.12 | 0.12 | 0.13 | 0.14 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 15.96 | x1/[1/( 1.4 )+ 0.04] | | = | 21.16 | | | (27) |
| Windows Type 2 | | | 2.4 | x1/[1/( 1.4 )+ 0.04] | | = | 3.18 | | | (27) |
| Floor | | | 53.39 | x | 0.2 | = | 10.678 | 75 | 4004.25 | (28) |
| Walls Type1 | 27.89 | 20.46 | 7.43 | x | 0.15 | = | 1.11 | 14 | 104.02 | (29) |
| Walls Type2 | 15.07 | 0 | 15.07 | x | 0.14 | = | 2.12 | 14 | 210.98 | (29) |
| Walls Type3 | 14.57 | 0 | 14.57 | x | 0.15 | = | 2.19 | 14 | 203.98 | (29) |
| Walls Type4 | 7.03 | 0 | 7.03 | x | 0.13 | = | 0.93 | 14 | 98.42 | (29) |
| Total area of elements, m² | | | 117.95 | | | | | | | (31) |
| Party wall | | | 16.32 | x | 0 | = | 0 | 20 | 326.4 | (32) |
| Party ceiling | | | 53.39 | | | | | 30 | 1601.7 | (32b) |
| Internal wall ** | | | 81.6 | | | | | 9 | 734.4 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 44.31 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 7284.15 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 136.43 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 13.77 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = **58.08** (37)

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.52 | 10.39 | 10.27 | 9.66 | 9.53 | 8.92 | 8.92 | 8.8 | 9.17 | 9.53 | 9.78 | 10.03 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 68.6 | 68.47 | 68.35 | 67.74 | 67.61 | 67 | 67 | 66.88 | 67.25 | 67.61 | 67.86 | 68.11 | |

Average = Sum(39)$_{1…12}$ /12= **67.71** (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.28 | 1.28 | 1.28 | 1.27 | 1.27 | 1.25 | 1.25 | 1.25 | 1.26 | 1.27 | 1.27 | 1.28 | |

Average = Sum(40)$_{1…12}$ /12= **1.27** (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N **1.79** (42)
  if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
  if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 **76.71** (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)* | | | | | | | | | | | | | |
| (44)m= | 84.39 | 81.32 | 78.25 | 75.18 | 72.11 | 69.04 | 69.04 | 72.11 | 75.18 | 78.25 | 81.32 | 84.39 | |

Total = Sum(44)$_{1…12}$ = **920.56** (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 125.14 | 109.45 | 112.94 | 98.47 | 94.48 | 81.53 | 75.55 | 86.69 | 87.73 | 102.24 | 111.6 | 121.19 | |

Total = Sum(45)$_{1…12}$ = **1207.01** (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.77 | 16.42 | 16.94 | 14.77 | 14.17 | 12.23 | 11.33 | 13 | 13.16 | 15.34 | 16.74 | 18.18 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel **0** (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): **0** (48)

Temperature factor from Table 2b **0** (49)

Energy lost from water storage, kWh/year (48) x (49) = **110** (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) **0.02** (51)

If community heating see section 4.3

Volume factor from Table 2a **1.03** (52)

Temperature factor from Table 2b **0.6** (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = **1.03** (54)

Enter (50) or (54) in (55) **1.03** (55)

# SAP WorkSheet: New dwelling design stage

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 180.42 | 159.38 | 168.22 | 151.96 | 149.76 | 135.02 | 130.83 | 141.97 | 141.22 | 157.52 | 165.1 | 176.47 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 180.42 | 159.38 | 168.22 | 151.96 | 149.76 | 135.02 | 130.83 | 141.97 | 141.22 | 157.52 | 165.1 | 176.47 |

Output from water heater (annual)$_{1…12}$ 1857.85 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 85.83 | 76.33 | 81.77 | 75.53 | 75.64 | 69.9 | 69.34 | 73.05 | 71.96 | 78.22 | 79.9 | 84.52 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 34.77 | 30.89 | 25.12 | 19.02 | 14.22 | 12 | 12.97 | 16.86 | 22.62 | 28.73 | 33.53 | 35.74 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 232.88 | 235.29 | 229.2 | 216.24 | 199.87 | 184.49 | 174.22 | 171.8 | 177.89 | 190.86 | 207.22 | 222.6 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 115.36 | 113.59 | 109.91 | 104.91 | 101.66 | 97.09 | 93.2 | 98.18 | 99.95 | 105.13 | 110.98 | 113.6 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 466.35 | 463.1 | 447.57 | 423.5 | 399.08 | 376.91 | 363.72 | 370.17 | 383.8 | 408.04 | 435.06 | 455.27 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 2.4 | x | 10.63 | x | 0.558 | x | 0.7 | = | 6.91 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 20.32 | x | 0.558 | x | 0.7 | = | 13.2 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 34.53 | x | 0.558 | x | 0.7 | = | 22.43 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 55.46 | x | 0.558 | x | 0.7 | = | 36.03 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 74.72 | x | 0.558 | x | 0.7 | = | 48.54 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 79.99 | x | 0.558 | x | 0.7 | = | 51.96 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 74.68 | x | 0.558 | x | 0.7 | = | 48.51 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 59.25 | x | 0.558 | x | 0.7 | = | 38.49 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 41.52 | x | 0.558 | x | 0.7 | = | 26.97 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 24.19 | x | 0.558 | x | 0.7 | = | 15.71 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 13.12 | x | 0.558 | x | 0.7 | = | 8.52 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 8.86 | x | 0.558 | x | 0.7 | = | 5.76 | (74) |
| East | 0.9x | 1 | x | 15.96 | x | 19.64 | x | 0.56 | x | 0.7 | = | 84.85 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 38.42 | x | 0.56 | x | 0.7 | = | 165.98 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 63.27 | x | 0.56 | x | 0.7 | = | 273.35 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 92.28 | x | 0.56 | x | 0.7 | = | 398.66 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 113.09 | x | 0.56 | x | 0.7 | = | 488.58 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 115.77 | x | 0.56 | x | 0.7 | = | 500.15 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 110.22 | x | 0.56 | x | 0.7 | = | 476.16 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 94.68 | x | 0.56 | x | 0.7 | = | 409.01 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 73.59 | x | 0.56 | x | 0.7 | = | 317.92 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 45.59 | x | 0.56 | x | 0.7 | = | 196.95 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 24.49 | x | 0.56 | x | 0.7 | = | 105.8 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 16.15 | x | 0.56 | x | 0.7 | = | 69.78 | (76) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 91.76 | 179.18 | 295.78 | 434.7 | 537.12 | 552.11 | 524.67 | 447.5 | 344.89 | 212.67 | 114.32 | 75.53 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 558.1 | 642.29 | 743.35 | 858.19 | 936.2 | 929.02 | 888.39 | 817.67 | 728.69 | 620.71 | 549.37 | 530.81 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.94 | 0.9 | 0.84 | 0.73 | 0.59 | 0.44 | 0.32 | 0.36 | 0.57 | 0.79 | 0.91 | 0.94 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.35 | 19.62 | 20.04 | 20.49 | 20.79 | 20.94 | 20.98 | 20.97 | 20.86 | 20.44 | 19.82 | 19.29 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 19.85 | 19.85 | 19.86 | 19.87 | 19.87 | 19.88 | 19.88 | 19.88 | 19.87 | 19.87 | 19.86 | 19.86 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.92 | 0.89 | 0.82 | 0.69 | 0.53 | 0.37 | 0.24 | 0.28 | 0.49 | 0.75 | 0.89 | 0.93 | (89) |

# SAP WorkSheet: New dwelling design stage

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 17.72 | 18.1 | 18.68 | 19.29 | 19.66 | 19.83 | 19.87 | 19.86 | 19.76 | 19.25 | 18.39 | 17.64 | (90) |

fLA = Living area ÷ (4) = 0.46 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.47 | 18.8 | 19.3 | 19.84 | 20.18 | 20.34 | 20.38 | 20.37 | 20.26 | 19.79 | 19.04 | 18.4 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.47 | 18.8 | 19.3 | 19.84 | 20.18 | 20.34 | 20.38 | 20.37 | 20.26 | 19.79 | 19.04 | 18.4 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.91 | 0.87 | 0.81 | 0.69 | 0.55 | 0.4 | 0.28 | 0.32 | 0.52 | 0.75 | 0.87 | 0.92 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 506.54 | 560.05 | 598.89 | 593.94 | 513.69 | 368.07 | 248.88 | 259.46 | 377.81 | 465.69 | 479.1 | 486.69 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 971.77 | 951.53 | 874.89 | 741.02 | 573.21 | 384.3 | 253.01 | 265.55 | 414.39 | 621.66 | 810.58 | 966.98 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 346.13 | 263.07 | 205.35 | 105.89 | 44.29 | 0 | 0 | 0 | 0 | 116.04 | 238.67 | 357.33 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1676.77 (98)

Space heating requirement in kWh/m²/year 31.41 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1676.77 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 1056.36 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 704.24 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |

**Water heating**

| | | | |
|---|---|---|---|
| Annual water heating requirement | | 1857.85 | |
| If DHW from community scheme: | | | |
| Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1170.44 | (310a) |
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 780.3 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 37.11 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): | | | |
| mechanical ventilation - balanced, extract or positive input from outside | | 103.57 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 103.57 | (331) |
| Energy for lighting (calculated in Appendix L) | | 245.65 | (332) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 2.97 | x 0.01 = | 31.37 | (340a) |
| Space heating from heat source 2 | (307b) x | 4.24 | x 0.01 = | 29.86 | (340b) |
| Water heating from CHP | (310a) x | 2.97 | x 0.01 = | 34.76 | (342a) |
| Water heating from heat source 2 | (310b) x | 4.24 | x 0.01 = | 33.08 | (342b) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 13.66 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 32.4 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 295.14 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.26 | (357) |
| **SAP rating (section12)** | | 82.42 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | |
|---|---|---|---|
| Electrical efficiency of CHP unit | | 29.8 | (361) |
| Heat efficiency of CHP unit | | 57.6 | (362) |

| | | **Energy** kWh/year | | **Emission factor** kg CO2/kWh | **Emissions** kg CO2/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1833.97 | x | 0.22 | 396.14 | (363) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 546.52 | x | 0.52 | | -283.64 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2032.02 | x | 0.22 | | 438.92 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 605.54 | x | 0.52 | | -314.28 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 0.22 | = | 352.37 | (368) |
| Electrical energy for heat distribution | [(313) x | | | 0.52 | = | 19.26 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | | = | 608.77 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | | 608.77 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | | 0.52 | = | 53.75 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | | 0.52 | = | 127.49 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | | 790.01 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | | 14.8 | (384) |
| **EI rating (section 14)** | | | | | | 89.24 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1833.97 | x | 1.22 | | 2237.44 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 546.52 | x | 3.07 | | -1677.82 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2032.02 | x | 1.22 | | 2479.06 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 605.54 | x | 3.07 | | -1859.01 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1990.26 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 113.94 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 3283.87 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 3283.87 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 3283.87 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 317.95 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 754.16 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | | 4355.97 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 A-1-07

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | West |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 136.43 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 169.14 | **(P1)** |
| **Transmission heat loss coefficient:** | 58.1 | |
| **Summer heat loss coefficient:** | 227.22 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| East (Rear) | 0 | 1 |
| North (Side) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| North (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| East (Rear) | 0.9 x | 15.96 | 117.51 | 0.56 | 0.7 | 0.76 | 504.35 | |
| North (Side) | 0.9 x | 2.4 | 81.19 | 0.56 | 0.7 | 0.76 | 52.4 | |
| | | | | | | **Total** | 556.75 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 376.91 | 363.72 | 370.17 | |
| Total summer gains | 968.99 | 920.47 | 856.49 | **(P5)** |
| Summer gain/loss ratio | 4.26 | 4.05 | 3.77 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.04 | 1.04 | 1.04 | |
| Threshold temperature | 21.31 | 23 | 22.61 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:27:06*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 50.87m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 A-2-04

**Address :** A-2-04, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 18.94 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 12.95 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 45.1 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 40.2 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.14 (max. 0.30) | 0.15 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: East | 12.17m² | |
| Windows facing: North | 1.68m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| External Walls U-value | 0.13 W/m²K | |
| Party Walls U-value | 0 W/m²K | |
| Community heating, heat from CHP | | |

# Predicted Energy Assessment

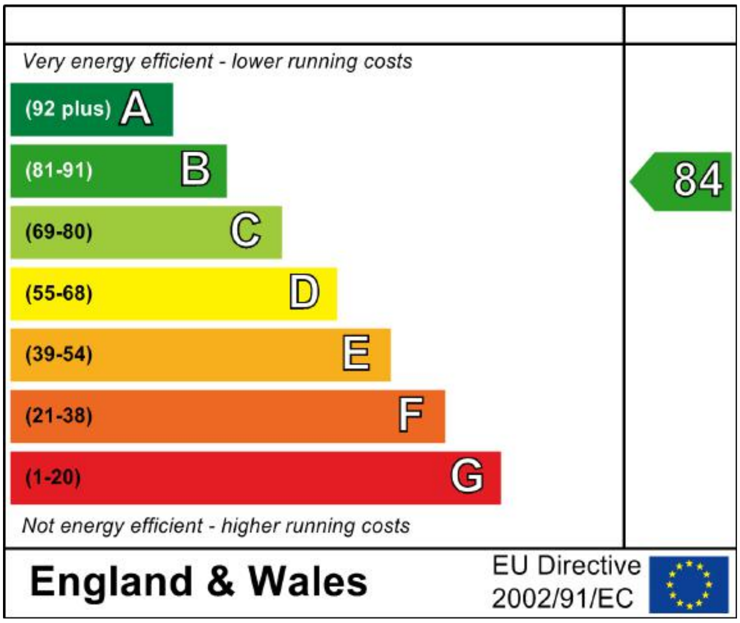
A-2-04
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Mid floor Flat |
| Date of assessment: | 22 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 50.87 m² |

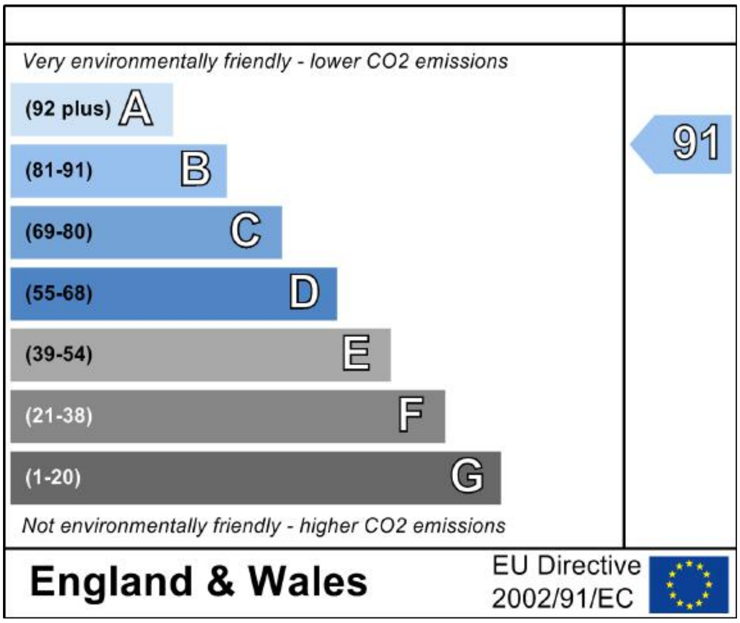
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-2-04

| | |
|---|---|
| Address: | A-2-04, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 98.75 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 50.87 m² | 2.4 m |
| Living area: | 26.6 m² (fraction 0.523) | |
| Front of dwelling faces: | West | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 12.17 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 1.68 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | West | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |
| Side | | External Wall | North | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 27.03 | 15.95 | 11.08 | 0.15 | 0 | False | 14 |
| Corridor Wall | 24.7 | 0 | 24.7 | 0.15 | 0.43 | False | 14 |
| Stair Wall | 12.64 | 0 | 12.64 | 0.15 | 0.9 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 62.4 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 11.16 | | | | | | 20 |
| Party Ceiling | 50.87 | | | | | | 30 |
| Party Floor | 50.87 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0897

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 18.6 | 0.05 | E4 | Jamb |
| [Approved] | 53.64 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 2.4 | 0.06 | E18 | Party wall between dwellings |
| | 9.3 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, Rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 3
Pressure test: 3

## Main heating system:

Main heating system: Community heating schemes
Heat source: Community CHP
heat from CHP, heat fraction 0.6, efficiency 57.6
Heat source: Community boilers
heat from boilers – mains gas, heat fraction 0.4, efficiency 91
Piping>=1991, pre-insulated, low temp, variable flow

## Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and TRVs
Control code: 2306

## Secondary heating system:

Secondary heating system: None

## Water heating:

Water heating: From main heating system
Water code: 901
Fuel :heat from CHP
No hot water cylinder
Solar panel: False

## Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Dense urban
EPC language: English
Wind turbine: No
Photovoltaics: None
Assess Zero Carbon Home: No

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 A-2-04

**Address :** A-2-04, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 50.87 | (1a) x | 2.4 | (2a) = | 122.09 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 50.87 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 122.09 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | | |
|---|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = | (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 3 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.78 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.12 | (21) |

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.15 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.12 | 0.12 | 0.13 | 0.14 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 12.17 | x1/[1/( 1.4 )+ 0.04] | | = | 16.13 | | | (27) |
| Windows Type 2 | | | 1.68 | x1/[1/( 1.4 )+ 0.04] | | = | 2.23 | | | (27) |
| Walls Type1 | 27.03 | 15.95 | 11.08 | x | 0.15 | = | 1.66 | 14 | 155.12 | (29) |
| Walls Type2 | 24.7 | 0 | 24.7 | x | 0.14 | = | 3.48 | 14 | 345.8 | (29) |
| Walls Type3 | 12.64 | 0 | 12.64 | x | 0.13 | = | 1.67 | 14 | 176.96 | (29) |
| Total area of elements, m² | | | 64.37 | | | | | | | (31) |
| Party wall | | | 11.16 | x | 0 | = | 0 | 20 | 223.2 | (32) |
| Party floor | | | 50.87 | | | | | 40 | 2034.8 | (32a) |
| Party ceiling | | | 50.87 | | | | | 30 | 1526.1 | (32b) |
| Internal wall ** | | | 62.4 | | | | | 9 | 561.6 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.11 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 5023.58 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 98.75 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 5.78 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 33.89 (37)

# SAP WorkSheet: New dwelling design stage

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.02 | 9.9 | 9.79 | 9.2 | 9.08 | 8.5 | 8.5 | 8.38 | 8.73 | 9.08 | 9.32 | 9.55 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 43.91 | 43.8 | 43.68 | 43.09 | 42.98 | 42.39 | 42.39 | 42.27 | 42.62 | 42.98 | 43.21 | 43.44 | |

Average = Sum(39)$_{1...12}$ /12= 43.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.86 | 0.86 | 0.86 | 0.85 | 0.84 | 0.83 | 0.83 | 0.83 | 0.84 | 0.85 | 0.85 | 0.85 | |

Average = Sum(40)$_{1...12}$ /12= 0.85 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.72 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.95 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)* | | | | | | | | | | | | | |
| (44)m= | 82.44 | 79.45 | 76.45 | 73.45 | 70.45 | 67.45 | 67.45 | 70.45 | 73.45 | 76.45 | 79.45 | 82.44 | |

Total = Sum(44)$_{1...12}$ = 899.39 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 122.26 | 106.93 | 110.34 | 96.2 | 92.31 | 79.65 | 73.81 | 84.7 | 85.71 | 99.89 | 109.03 | 118.4 | |

Total = Sum(45)$_{1...12}$ = 1179.24 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.34 | 16.04 | 16.55 | 14.43 | 13.85 | 11.95 | 11.07 | 12.7 | 12.86 | 14.98 | 16.36 | 17.76 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 177.54 | 156.86 | 165.62 | 149.69 | 147.58 | 133.15 | 129.09 | 139.98 | 139.2 | 155.16 | 162.53 | 173.68 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 177.54 | 156.86 | 165.62 | 149.69 | 147.58 | 133.15 | 129.09 | 139.98 | 139.2 | 155.16 | 162.53 | 173.68 |

Output from water heater (annual)$_{1...12}$ | 1830.08 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.87 | 75.5 | 80.91 | 74.78 | 74.91 | 69.28 | 68.76 | 72.38 | 71.29 | 77.43 | 79.05 | 83.59 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 33.32 | 29.59 | 24.07 | 18.22 | 13.62 | 11.5 | 12.42 | 16.15 | 21.68 | 27.52 | 32.12 | 34.24 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 223.12 | 225.44 | 219.61 | 207.18 | 191.5 | 176.77 | 166.92 | 164.61 | 170.44 | 182.86 | 198.54 | 213.28 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 114.08 | 112.35 | 108.75 | 103.86 | 100.69 | 96.22 | 92.42 | 97.29 | 99.02 | 104.08 | 109.79 | 112.35 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 451.84 | 448.7 | 433.75 | 410.59 | 387.14 | 365.81 | 353.1 | 359.37 | 372.46 | 395.79 | 421.78 | 441.2 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | Access Factor Table 6d | Area m² | Flux Table 6a | g_ Table 6b | FF Table 6c | Gains (W) |
|---|---|---|---|---|---|---|

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 1.68 | x | 10.63 | x | 0.558 | x | 0.7 | = | 4.84 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 20.32 | x | 0.558 | x | 0.7 | = | 9.24 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 34.53 | x | 0.558 | x | 0.7 | = | 15.7 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 55.46 | x | 0.558 | x | 0.7 | = | 25.22 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 74.72 | x | 0.558 | x | 0.7 | = | 33.98 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 79.99 | x | 0.558 | x | 0.7 | = | 36.37 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 74.68 | x | 0.558 | x | 0.7 | = | 33.96 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 59.25 | x | 0.558 | x | 0.7 | = | 26.94 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 41.52 | x | 0.558 | x | 0.7 | = | 18.88 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 24.19 | x | 0.558 | x | 0.7 | = | 11 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 13.12 | x | 0.558 | x | 0.7 | = | 5.97 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 8.86 | x | 0.558 | x | 0.7 | = | 4.03 | (74) |
| East | 0.9x | 1 | x | 12.17 | x | 19.64 | x | 0.56 | x | 0.7 | = | 64.7 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 38.42 | x | 0.56 | x | 0.7 | = | 126.57 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 63.27 | x | 0.56 | x | 0.7 | = | 208.44 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 92.28 | x | 0.56 | x | 0.7 | = | 303.99 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 113.09 | x | 0.56 | x | 0.7 | = | 372.56 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 115.77 | x | 0.56 | x | 0.7 | = | 381.38 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 110.22 | x | 0.56 | x | 0.7 | = | 363.09 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 94.68 | x | 0.56 | x | 0.7 | = | 311.89 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 73.59 | x | 0.56 | x | 0.7 | = | 242.42 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 45.59 | x | 0.56 | x | 0.7 | = | 150.18 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 24.49 | x | 0.56 | x | 0.7 | = | 80.67 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 16.15 | x | 0.56 | x | 0.7 | = | 53.21 | (76) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 69.54 | 135.81 | 224.14 | 329.22 | 406.53 | 417.75 | 397.05 | 338.83 | 261.3 | 161.18 | 86.64 | 57.24 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 521.38 | 584.51 | 657.89 | 739.81 | 793.67 | 783.56 | 750.14 | 698.2 | 633.76 | 556.97 | 508.42 | 498.44 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.87 | 0.82 | 0.74 | 0.61 | 0.47 | 0.34 | 0.25 | 0.28 | 0.44 | 0.67 | 0.82 | 0.88 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.9 | 20.12 | 20.43 | 20.74 | 20.9 | 20.98 | 20.99 | 20.99 | 20.94 | 20.71 | 20.27 | 19.85 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.2 | 20.2 | 20.2 | 20.21 | 20.21 | 20.22 | 20.22 | 20.23 | 20.22 | 20.21 | 20.21 | 20.21 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.85 | 0.81 | 0.72 | 0.59 | 0.44 | 0.3 | 0.2 | 0.23 | 0.4 | 0.64 | 0.8 | 0.87 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.74 | 19.06 | 19.49 | 19.9 | 20.11 | 20.2 | 20.22 | 20.22 | 20.17 | 19.88 | 19.28 | 18.69 | (90) |

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.35 | 19.61 | 19.98 | 20.34 | 20.53 | 20.61 | 20.62 | 20.62 | 20.57 | 20.31 | 19.8 | 19.29 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.35 | 19.61 | 19.98 | 20.34 | 20.53 | 20.61 | 20.62 | 20.62 | 20.57 | 20.31 | 19.8 | 19.29 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.84 | 0.79 | 0.71 | 0.59 | 0.45 | 0.32 | 0.23 | 0.25 | 0.42 | 0.64 | 0.79 | 0.85 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 437.05 | 463.55 | 469.93 | 436.93 | 359.25 | 249.86 | 169.43 | 176.82 | 264.5 | 357.36 | 400.29 | 424.03 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 660.7 | 644.3 | 588.79 | 492.86 | 379.33 | 254.64 | 170.6 | 178.51 | 275.89 | 417.39 | 548.69 | 655.75 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 166.39 | 121.46 | 88.43 | 40.27 | 14.93 | 0 | 0 | 0 | 0 | 44.66 | 106.85 | 172.4 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 755.41 (98)

Space heating requirement in kWh/m²/year 14.85 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 755.41 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 475.91 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 317.27 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |

**Water heating**

Annual water heating requirement 1830.08

If DHW from community scheme:

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1152.95 | (310a) |
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 768.63 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 27.15 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 98.68 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 98.68 | (331) |
| Energy for lighting (calculated in Appendix L) | | 235.37 | (332) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 2.97 | x 0.01 = | 14.13 | (340a) |
| Space heating from heat source 2 | (307b) | x | 4.24 | x 0.01 = | 13.45 | (340b) |
| Water heating from CHP | (310a) | x | 2.97 | x 0.01 = | 34.24 | (342a) |
| Water heating from heat source 2 | (310b) | x | 4.24 | x 0.01 = | 32.59 | (342b) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 13.02 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 31.04 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 258.48 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.13 | (357) |
| **SAP rating (section12)** | | 84.2 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| Electrical efficiency of CHP unit | | | | | 29.8 | (361) |
| Heat efficiency of CHP unit | | | | | 57.6 | (362) |
| | | **Energy** kWh/year | | **Emission factor** kg CO2/kWh | **Emissions** kg CO2/year | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 826.23 | x | 0.22 | 178.47 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 246.22 | x | 0.52 | -127.79 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2001.65 | x | 0.22 | 432.36 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 596.49 | x | 0.52 | -309.58 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | 0.22 | = | 257.75 | (368) |
| Electrical energy for heat distribution | [(313) x | 0.52 | = | 14.09 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 445.3 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 445.3 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 51.21 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 122.16 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 618.67 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 12.16 | (384) |
| **EI rating (section 14)** | | | | 91.35 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 826.23 | x | 1.22 | | 1008 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 246.22 | x | 3.07 | | -755.88 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2001.65 | x | 1.22 | | 2442.01 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 596.49 | x | 3.07 | | -1831.23 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1455.83 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 83.34 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 2402.07 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 2402.07 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 2402.07 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 302.94 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 722.58 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | | 3427.58 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 A-2-04

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | West |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 98.75 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 161.16 | **(P1)** |
| **Transmission heat loss coefficient:** | 33.9 | |
| **Summer heat loss coefficient:** | 195.05 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| East (Rear) | 0 | 1 |
| North (Side) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| North (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| East (Rear) | 0.9 x | 12.17 | 117.51 | 0.56 | 0.7 | 0.76 | 384.58 | |
| North (Side) | 0.9 x | 1.68 | 81.19 | 0.56 | 0.7 | 0.76 | 36.68 | |
| | | | | | | **Total** | 421.26 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 365.81 | 353.1 | 359.37 | |
| Total summer gains | 813.74 | 774.36 | 727.54 | **(P5)** |
| Summer gain/loss ratio | 4.17 | 3.97 | 3.73 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.31 | 1.31 | 1.31 | |
| Threshold temperature | 21.48 | 23.18 | 22.84 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:26:56*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 81.07m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 A-2-05

**Address :** A-2-05, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 15.58 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 10.60 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 40.9 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 35.9 kWh/m² | |
| | | **OK** |

## 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 | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | **OK** |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: West | 20.76m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from CHP | |

# Predicted Energy Assessment

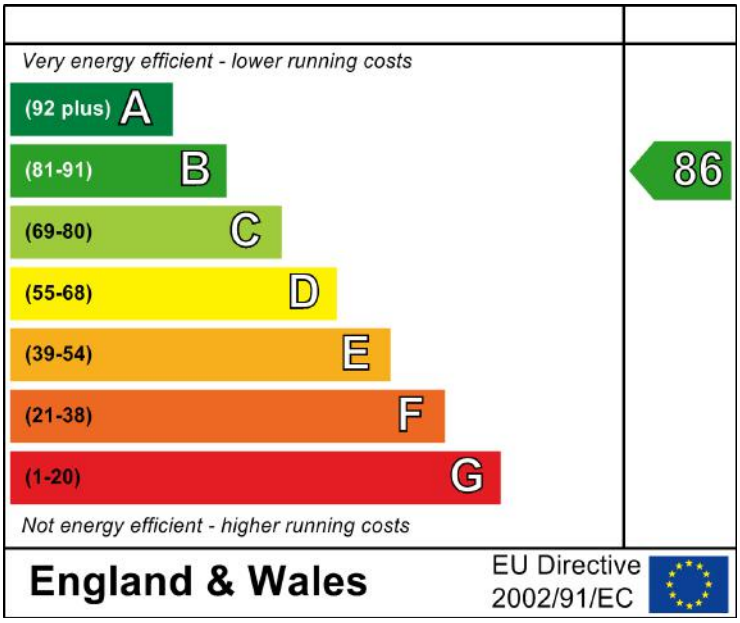
A-2-05
Bertram Street
London

Dwelling type: Mid floor Flat
Date of assessment: 22 January 2019
Produced by: Matthew Stainrod
Total floor area: 81.07 m²

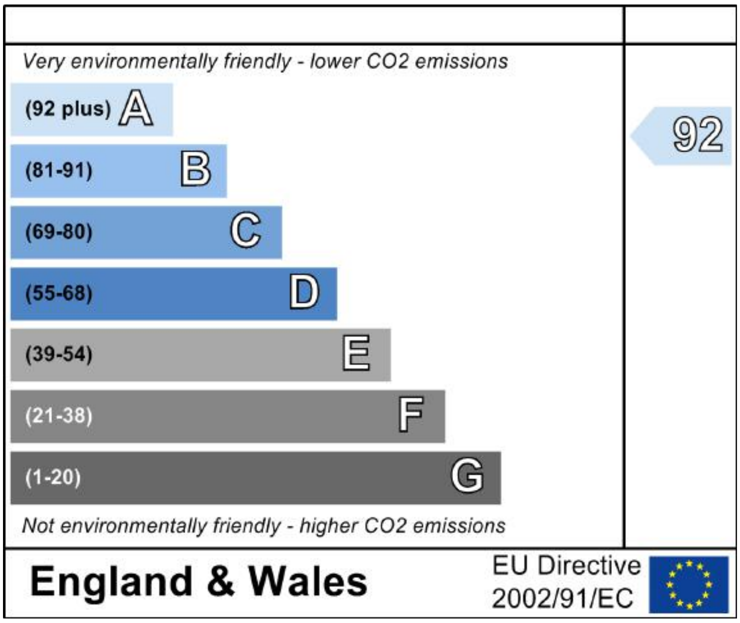
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-2-05

| | |
|---|---|
| Address: | A-2-05, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 100.03 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 81.07 m² | 2.4 m |
| Living area: | 34.57 m² (fraction 0.426) | |
| Front of dwelling faces: | East | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 20.76 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | East | 0 | 0 |
| Rear | | External Wall | West | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 45.29 | 22.86 | 22.43 | 0.15 | 0 | False | 14 |
| Corridor Wall | 10.7 | 0 | 10.7 | 0.15 | 0.43 | False | 14 |
| Riser Wall | 24.31 | 0 | 24.31 | 0.15 | 0 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 120 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 27.5 | | | | | | 20 |
| Party Ceiling | 81.07 | | | | | | 30 |
| Party Floor | 81.07 | | | | | | 40 |

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.082

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |

# SAP Input

| | | | | |
|---|---|---|---|---|
| [Approved] | 23.4 | 0.05 | E4 | Jamb |
| [Approved] | 66.92 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 9.6 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 7.2 | 0.06 | E18 | Party wall between dwellings |
| | 22.92 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 2<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 3 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 A-2-05

**Address :** A-2-05, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 81.07 | (1a) x | 2.4 | (2a) = | 194.57 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 81.07 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 194.57 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 3 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.78 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.12 | (21) |

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.15 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.12 | 0.12 | 0.13 | 0.14 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows | | | 20.76 | x1/[1/( 1.4 )+ 0.04] | | = | 27.52 | | | (27) |
| Walls Type1 | 45.29 | 22.86 | 22.43 | x | 0.15 | = | 3.36 | 14 | 314.02 | (29) |
| Walls Type2 | 10.7 | 0 | 10.7 | x | 0.14 | = | 1.51 | 14 | 149.8 | (29) |
| Walls Type3 | 24.31 | 0 | 24.31 | x | 0.15 | = | 3.65 | 14 | 340.34 | (29) |
| Total area of elements, m² | | | 80.3 | | | | | | | (31) |
| Party wall | | | 27.5 | x | 0 | = | 0 | 20 | 550 | (32) |
| Party floor | | | 81.07 | | | | | 40 | 3242.8 | (32a) |
| Party ceiling | | | 81.07 | | | | | 30 | 2432.1 | (32b) |
| Internal wall ** | | | 120 | | | | | 9 | 1080 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 38.98 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 8109.06 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 100.03 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 6.59 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 45.57 (37)

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

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 15.97 | 15.78 | 15.6 | 14.66 | 14.48 | 13.54 | 13.54 | 13.36 | 13.92 | 14.48 | 14.85 | 15.22 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 61.54 | 61.35 | 61.16 | 60.23 | 60.04 | 59.11 | 59.11 | 58.93 | 59.48 | 60.04 | 60.42 | 60.79 | |

Average = $Sum(39)_{1...12}$ /12= 60.18 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.76 | 0.76 | 0.75 | 0.74 | 0.74 | 0.73 | 0.73 | 0.73 | 0.73 | 0.74 | 0.75 | 0.75 | |

Average = $Sum(40)_{1...12}$ /12= 0.74 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.17 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)* | | | | | | | | | | | | | |
| (44)m= | 102.48 | 98.76 | 95.03 | 91.3 | 87.58 | 83.85 | 83.85 | 87.58 | 91.3 | 95.03 | 98.76 | 102.48 | |

Total = $Sum(44)_{1...12}$ = 1118.01 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 151.98 | 132.92 | 137.17 | 119.58 | 114.74 | 99.02 | 91.75 | 105.29 | 106.54 | 124.17 | 135.54 | 147.19 | |

Total = $Sum(45)_{1...12}$ = 1465.89 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 22.8 | 19.94 | 20.57 | 17.94 | 17.21 | 14.85 | 13.76 | 15.79 | 15.98 | 18.63 | 20.33 | 22.08 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 207.26 | 182.85 | 192.44 | 173.08 | 170.02 | 152.51 | 147.03 | 160.56 | 160.04 | 179.44 | 189.03 | 202.46 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 207.26 | 182.85 | 192.44 | 173.08 | 170.02 | 152.51 | 147.03 | 160.56 | 160.04 | 179.44 | 189.03 | 202.46 |

Output from water heater (annual)$_{1...12}$ | 2116.73 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 94.76 | 84.14 | 89.83 | 82.56 | 82.37 | 75.72 | 74.73 | 79.23 | 78.22 | 85.51 | 87.86 | 93.16 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 49.4 | 43.88 | 35.69 | 27.02 | 20.19 | 17.05 | 18.42 | 23.95 | 32.14 | 40.81 | 47.63 | 50.78 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 330.84 | 334.27 | 325.62 | 307.2 | 283.95 | 262.1 | 247.51 | 244.07 | 252.72 | 271.14 | 294.39 | 316.24 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 127.36 | 125.21 | 120.74 | 114.66 | 110.72 | 105.16 | 100.44 | 106.49 | 108.64 | 114.93 | 122.03 | 125.22 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 609.64 | 605.4 | 584.08 | 550.92 | 516.9 | 486.35 | 468.41 | 476.55 | 495.54 | 528.92 | 566.09 | 594.27 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 0.9x | 0.77 | x | 20.76 | x | 19.64 | x | 0.56 | x | 0.7 | = | 110.37 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 38.42 | x | 0.56 | x | 0.7 | = | 215.9 | (80) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 0.9x | 0.77 | x | 20.76 | x | 63.27 | x | 0.56 | x | 0.7 | = | 355.56 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 92.28 | x | 0.56 | x | 0.7 | = | 518.56 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 113.09 | x | 0.56 | x | 0.7 | = | 635.52 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 115.77 | x | 0.56 | x | 0.7 | = | 650.57 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 110.22 | x | 0.56 | x | 0.7 | = | 619.36 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 94.68 | x | 0.56 | x | 0.7 | = | 532.03 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 73.59 | x | 0.56 | x | 0.7 | = | 413.53 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 45.59 | x | 0.56 | x | 0.7 | = | 256.19 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 24.49 | x | 0.56 | x | 0.7 | = | 137.61 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 16.15 | x | 0.56 | x | 0.7 | = | 90.76 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 110.37 | 215.9 | 355.56 | 518.56 | 635.52 | 650.57 | 619.36 | 532.03 | 413.53 | 256.19 | 137.61 | 90.76 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 720.01 | 821.3 | 939.64 | 1069.48 | 1152.42 | 1136.92 | 1087.77 | 1008.57 | 909.07 | 785.1 | 703.7 | 685.03 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.89 | 0.84 | 0.75 | 0.61 | 0.46 | 0.33 | 0.24 | 0.27 | 0.44 | 0.68 | 0.84 | 0.9 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.01 | 20.24 | 20.54 | 20.81 | 20.94 | 20.99 | 21 | 21 | 20.96 | 20.77 | 20.36 | 19.97 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.29 | 20.29 | 20.29 | 20.3 | 20.31 | 20.32 | 20.32 | 20.32 | 20.31 | 20.31 | 20.3 | 20.3 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.88 | 0.83 | 0.73 | 0.59 | 0.43 | 0.29 | 0.2 | 0.23 | 0.4 | 0.65 | 0.82 | 0.89 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.98 | 19.3 | 19.71 | 20.08 | 20.24 | 20.3 | 20.31 | 20.31 | 20.28 | 20.04 | 19.48 | 18.92 | (90) |

fLA = Living area ÷ (4) = 0.43 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.42 | 19.7 | 20.06 | 20.39 | 20.54 | 20.59 | 20.6 | 20.6 | 20.57 | 20.35 | 19.86 | 19.36 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.42 | 19.7 | 20.06 | 20.39 | 20.54 | 20.59 | 20.6 | 20.6 | 20.57 | 20.35 | 19.86 | 19.36 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.86 | 0.81 | 0.73 | 0.59 | 0.44 | 0.31 | 0.22 | 0.24 | 0.41 | 0.65 | 0.81 | 0.88 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 620.81 | 667.19 | 681.29 | 629.81 | 511.09 | 350.39 | 235.87 | 246.45 | 373.87 | 512.71 | 570.71 | 599.57 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |

# SAP WorkSheet: New dwelling design stage

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (97)m= | 930.31 | 907.99 | 829.68 | 691.98 | 530.64 | 354.34 | 236.71 | 247.73 | 384.82 | 585.39 | 770.76 | 921.87 | (97) |

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (98)m= | 230.27 | 161.82 | 110.4 | 44.76 | 14.54 | 0 | 0 | 0 | 0 | 54.07 | 144.04 | 239.79 |

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 999.69 (98)

Space heating requirement in kWh/m²/year 12.33 (99)

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme.<br>Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 999.69 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 629.81 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 419.87 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2116.73 | |
| If DHW from community scheme:<br>Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1333.54 | (310a) |
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 889.03 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 32.72 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 157.26 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 157.26 | (331) |
| Energy for lighting (calculated in Appendix L) | | 348.99 | (332) |

# SAP WorkSheet: New dwelling design stage

## 10b. Fuel costs – Community heating scheme

| | | Fuel kWh/year | | Fuel Price (Table 12) | | Fuel Cost £/year | |
|---|---|---|---|---|---|---|---|
| Space heating from CHP | | (307a) | x | 2.97 | x 0.01 = | 18.71 | (340a) |
| Space heating from heat source 2 | | (307b) | x | 4.24 | x 0.01 = | 17.8 | (340b) |
| Water heating from CHP | | (310a) | x | 2.97 | x 0.01 = | 39.61 | (342a) |
| Water heating from heat source 2 | | (310b) | x | 4.24 | x 0.01 = | 37.69 | (342b) |
| | | | | **Fuel Price** | | | |
| Pumps and fans | | (331) | | 13.19 | x 0.01 = | 20.74 | (349) |
| Energy for lighting | | (332) | | 13.19 | x 0.01 = | 46.03 | (350) |
| Additional standing charges (Table 12) | | | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | | 300.58 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1 | (357) |
| **SAP rating (section12)** | | 86.03 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Electrical efficiency of CHP unit | | | | | | 29.8 | (361) |
| Heat efficiency of CHP unit | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Emission factor kg CO2/kWh** | | **Emissions kg CO2/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1093.41 | x | 0.22 | | 236.18 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 325.84 | x | 0.52 | | -169.11 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2315.17 | x | 0.22 | | 500.08 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 689.92 | x | 0.52 | | -358.07 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 0.22 | = | 310.68 | (368) |
| Electrical energy for heat distribution | [(313) x | | | 0.52 | = | 16.98 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | | = | 536.74 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | | 536.74 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | | 0.52 | = | 81.62 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | | 0.52 | = | 181.13 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | | 799.49 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | | 9.86 | (384) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | |
|---|---|---|---|---|---|---|
| **EI rating (section 14)** | | | | | 91.5 | (385) |
| **13b. Primary Energy – Community heating scheme** | | | | | | |
| **Electrical efficiency of CHP unit** | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1093.41 | x | 1.22 | 1333.96 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 325.84 | x | 3.07 | -1000.32 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2315.17 | x | 1.22 | 2824.51 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 689.92 | x | 3.07 | -2118.06 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 = | 1754.79 | (368) |
| Electrical energy for heat distribution | [(313) x | | | = | 100.46 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | = | 2895.34 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | 2895.34 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | 2895.34 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 = | 482.79 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 = | 1071.4 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | 4449.53 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 A-2-05

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | East |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 100.03 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 256.83 | **(P1)** |
| **Transmission heat loss coefficient:** | 45.6 | |
| **Summer heat loss coefficient:** | 302.4 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Rear) | 0.9 x | 20.76 | 117.51 | 0.56 | 0.7 | 0.76 | 656.04 | |
| | | | | | | **Total** | 656.04 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 486.35 | 468.41 | 476.55 | |
| Total summer gains | 1182.75 | 1124.44 | 1053.7 | **(P5)** |
| Summer gain/loss ratio | 3.91 | 3.72 | 3.48 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.3 | 1.3 | 1.3 | |
| Threshold temperature | 21.21 | 22.92 | 22.58 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:26:46*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 57.93m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 A-3-03

**Address :** A-3-03, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 17.4 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 11.69 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 41.2 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 35.0 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.14 (max. 0.30) | 0.15 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: West | 12.15m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party  Walls U-value | 0 W/m²K | |
| Community heating, heat from CHP | | |

## Predicted Energy Assessment

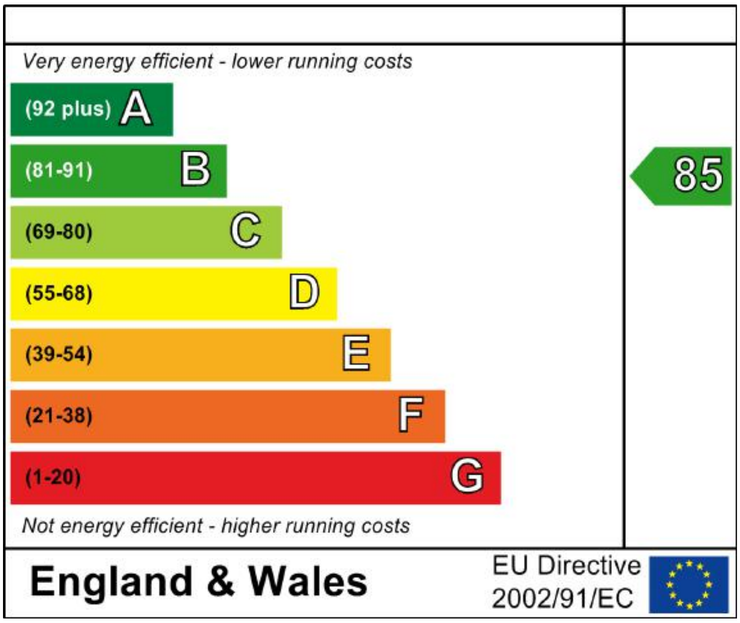
A-3-03
Bertram Street
London

Dwelling type: Mid floor Flat
Date of assessment: 22 January 2019
Produced by: Matthew Stainrod
Total floor area: 57.93 m²

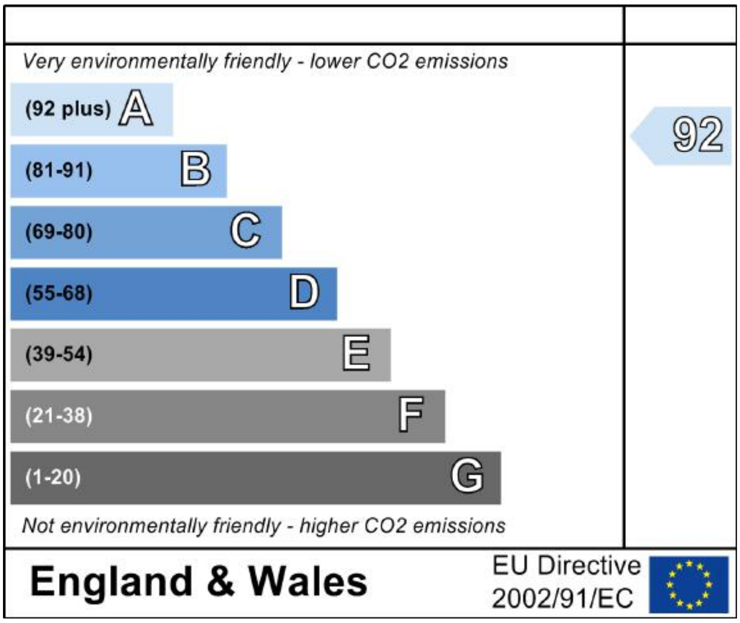
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

### Energy Efficiency Rating




### Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-3-03

| | |
|---|---|
| Address: | A-3-03, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 98.76 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 57.93 m² | 2.4 m |
| Living area: | 27.94 m² (fraction 0.482) | |
| Front of dwelling faces: | East | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 12.15 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | East | 0 | 0 |
| Rear | | External Wall | West | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| <u>External Elements</u> | | | | | | | |
| External Wall | 35.93 | 14.25 | 21.68 | 0.15 | 0 | False | 14 |
| Corridor Wall | 24.82 | 0 | 24.82 | 0.15 | 0.43 | False | 14 |
| Riser Wall | 2.23 | 0 | 2.23 | 0.15 | 0 | False | 14 |
| <u>Internal Elements</u> | | | | | | | |
| Stud Walls | 72 | | | | | | 9 |
| <u>Party Elements</u> | | | | | | | |
| Party Wall | 16.8 | | | | | | 20 |
| Party Ceiling | 57.93 | | | | | | 30 |
| Party Floor | 57.93 | | | | | | 40 |

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0866

| | **Length** | **Psi-value** | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |

# SAP Input

| | | | | |
|---|---|---|---|---|
| [Approved] | 13.8 | 0.05 | E4 | Jamb |
| [Approved] | 52.48 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 2.4 | 0.06 | E18 | Party wall between dwellings |
| | 14 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 3 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 A-3-03

| | |
|---|---|
| **Address :** | A-3-03, Bertram Street, London |

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 57.93 | (1a) | x | 2.4 | (2a) | = | 139.03 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 57.93 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) | | = | 139.03 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 3 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.78 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.12 | (21) |

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.15 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.12 | 0.12 | 0.13 | 0.14 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows | | | 12.15 | x1/[1/( 1.4 )+ 0.04] | | = | 16.11 | | | (27) |
| Walls Type1 | 35.93 | 14.25 | 21.68 | x | 0.15 | = | 3.25 | 14 | 303.52 | (29) |
| Walls Type2 | 24.82 | 0 | 24.82 | x | 0.14 | = | 3.5 | 14 | 347.48 | (29) |
| Walls Type3 | 2.23 | 0 | 2.23 | x | 0.15 | = | 0.33 | 14 | 31.22 | (29) |
| Total area of elements, m² | | | 62.98 | | | | | | | (31) |
| Party wall | | | 16.8 | x | 0 | = | 0 | 20 | 336 | (32) |
| Party floor | | | 57.93 | | | | | 40 | 2317.2 | (32a) |
| Party ceiling | | | 57.93 | | | | | 30 | 1737.9 | (32b) |
| Internal wall ** | | | 72 | | | | | 9 | 648 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.13 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 5721.32 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 98.76 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 5.46 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 31.59 (37)

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

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 11.41 | 11.28 | 11.14 | 10.48 | 10.34 | 9.68 | 9.68 | 9.54 | 9.94 | 10.34 | 10.61 | 10.88 | | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 43 | 42.87 | 42.73 | 42.07 | 41.93 | 41.27 | 41.27 | 41.13 | 41.53 | 41.93 | 42.2 | 42.47 | | |

Average = Sum(39)1…12 /12= 42.03 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.74 | 0.74 | 0.74 | 0.73 | 0.72 | 0.71 | 0.71 | 0.71 | 0.72 | 0.72 | 0.73 | 0.73 |

Average = Sum(40)1…12 /12= 0.73 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.92 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 79.86 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

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

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 87.85 | 84.65 | 81.46 | 78.26 | 75.07 | 71.87 | 71.87 | 75.07 | 78.26 | 81.46 | 84.65 | 87.85 |

Total = Sum(44)1…12 = 958.32 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 130.27 | 113.94 | 117.57 | 102.5 | 98.35 | 84.87 | 78.65 | 90.25 | 91.33 | 106.43 | 116.18 | 126.16 |

Total = Sum(45)1…12 = 1256.52 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 19.54 | 17.09 | 17.64 | 15.38 | 14.75 | 12.73 | 11.8 | 13.54 | 13.7 | 15.96 | 17.43 | 18.92 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# SAP WorkSheet: New dwelling design stage

| | | |
|---|---|---|
| Primary circuit loss (annual) from Table 3 | 0 | (58) |

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 185.55 | 163.87 | 172.85 | 156 | 153.63 | 138.37 | 133.92 | 145.53 | 144.82 | 161.71 | 169.67 | 181.44 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 185.55 | 163.87 | 172.85 | 156 | 153.63 | 138.37 | 133.92 | 145.53 | 144.82 | 161.71 | 169.67 | 181.44 | |

| | | |
|---|---|---|
| Output from water heater (annual)$_{1\ldots12}$ | 1907.35 | (64) |

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 87.54 | 77.83 | 83.31 | 76.88 | 76.92 | 71.02 | 70.37 | 74.23 | 73.16 | 79.61 | 81.42 | 86.17 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | | | | | | | | | | | | | |
| (67)m= | 37.48 | 33.29 | 27.07 | 20.5 | 15.32 | 12.94 | 13.98 | 18.17 | 24.38 | 30.96 | 36.14 | 38.52 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | | | | | | | | | | | | | |
| (68)m= | 250.3 | 252.89 | 246.35 | 232.41 | 214.83 | 198.29 | 187.25 | 184.65 | 191.2 | 205.13 | 222.72 | 239.25 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | | | | | | | | | | | | | |
| (69)m= | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | (69) |
| Pumps and fans gains (Table 5a) | | | | | | | | | | | | | |
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |
| Losses e.g. evaporation (negative values) (Table 5) | | | | | | | | | | | | | |
| (71)m= | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | (71) |
| Water heating gains (Table 5) | | | | | | | | | | | | | |
| (72)m= | 117.66 | 115.81 | 111.98 | 106.77 | 103.39 | 98.63 | 94.59 | 99.77 | 101.61 | 107 | 113.09 | 115.82 | (72) |
| **Total internal gains =** | | | | | | (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m | | | | | | | |
| (73)m= | 492.34 | 488.91 | 472.31 | 446.59 | 420.45 | 396.77 | 382.72 | 389.5 | 404.1 | 430.01 | 458.86 | 480.5 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 0.9x | 0.77 | x | 12.15 | x | 19.64 | x | 0.56 | x | 0.7 | = | 64.59 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 38.42 | x | 0.56 | x | 0.7 | = | 126.36 | (80) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 0.9x | 0.77 | x | 12.15 | x | 63.27 | x | 0.56 | x | 0.7 | = | 208.09 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 92.28 | x | 0.56 | x | 0.7 | = | 303.49 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 113.09 | x | 0.56 | x | 0.7 | = | 371.94 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 115.77 | x | 0.56 | x | 0.7 | = | 380.75 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 110.22 | x | 0.56 | x | 0.7 | = | 362.49 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 94.68 | x | 0.56 | x | 0.7 | = | 311.37 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 73.59 | x | 0.56 | x | 0.7 | = | 242.02 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 45.59 | x | 0.56 | x | 0.7 | = | 149.94 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 24.49 | x | 0.56 | x | 0.7 | = | 80.54 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 16.15 | x | 0.56 | x | 0.7 | = | 53.12 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 64.59 | 126.36 | 208.09 | 303.49 | 371.94 | 380.75 | 362.49 | 311.37 | 242.02 | 149.94 | 80.54 | 53.12 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 556.94 | 615.26 | 680.41 | 750.09 | 792.39 | 777.52 | 745.21 | 700.87 | 646.13 | 579.94 | 539.4 | 533.62 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.86 | 0.82 | 0.74 | 0.61 | 0.47 | 0.33 | 0.24 | 0.27 | 0.43 | 0.66 | 0.81 | 0.87 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.14 | 20.32 | 20.58 | 20.82 | 20.94 | 20.99 | 21 | 21 | 20.97 | 20.8 | 20.45 | 20.1 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.3 | 20.31 | 20.31 | 20.32 | 20.32 | 20.33 | 20.33 | 20.33 | 20.33 | 20.32 | 20.32 | 20.31 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.85 | 0.8 | 0.72 | 0.58 | 0.44 | 0.3 | 0.21 | 0.23 | 0.39 | 0.63 | 0.79 | 0.86 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.16 | 19.42 | 19.77 | 20.1 | 20.25 | 20.32 | 20.33 | 20.33 | 20.29 | 20.09 | 19.62 | 19.12 | (90) |

fLA = Living area ÷ (4) = 0.48 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.63 | 19.86 | 20.16 | 20.44 | 20.58 | 20.64 | 20.65 | 20.65 | 20.62 | 20.43 | 20.02 | 19.59 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.63 | 19.86 | 20.16 | 20.44 | 20.58 | 20.64 | 20.65 | 20.65 | 20.62 | 20.43 | 20.02 | 19.59 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.84 | 0.79 | 0.71 | 0.59 | 0.45 | 0.32 | 0.22 | 0.25 | 0.41 | 0.63 | 0.78 | 0.85 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 465.87 | 487.34 | 485.72 | 442.45 | 358.24 | 246.3 | 166.51 | 173.9 | 263.41 | 366.76 | 422.07 | 453.04 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (97)m= | 659.37 | 641.15 | 583.67 | 485.56 | 372.48 | 249.24 | 167.14 | 174.81 | 270.71 | 412.22 | 545.24 | 653.71 | (97) |

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (98)m= | 143.97 | 103.36 | 72.87 | 31.04 | 10.6 | 0 | 0 | 0 | 0 | 33.82 | 88.68 | 149.3 |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 633.64 | (98) |
| Space heating requirement in kWh/m²/year | 10.94 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 633.64 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 399.2 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 266.13 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1907.35 | |
| If DHW from community scheme: Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1201.63 | (310a) |
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 801.09 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 26.68 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 112.37 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 112.37 | (331) |
| Energy for lighting (calculated in Appendix L) | | 264.78 | (332) |

## 10b. Fuel costs – Community heating scheme

| | | Fuel kWh/year | Fuel Price (Table 12) | | Fuel Cost £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | | (307a) x | 2.97 | x 0.01 = | 11.86 | (340a) |
| Space heating from heat source 2 | | (307b) x | 4.24 | x 0.01 = | 11.28 | (340b) |
| Water heating from CHP | | (310a) x | 2.97 | x 0.01 = | 35.69 | (342a) |
| Water heating from heat source 2 | | (310b) x | 4.24 | x 0.01 = | 33.97 | (342b) |
| | | | **Fuel Price** | | | |
| Pumps and fans | | (331) | 13.19 | x 0.01 = | 14.82 | (349) |
| Energy for lighting | | (332) | 13.19 | x 0.01 = | 34.92 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 262.54 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.07 | (357) |
| **SAP rating (section12)** | | 85.06 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| Electrical efficiency of CHP unit | | | | | 29.8 | (361) |
| Heat efficiency of CHP unit | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Emission factor kg CO2/kWh** | **Emissions kg CO2/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 693.05 | x | 0.22 | 149.7 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 206.53 | x | 0.52 | -107.19 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2086.17 | x | 0.22 | 450.61 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 621.68 | x | 0.52 | -322.65 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 0.22 = | 253.32 | (368) |
| Electrical energy for heat distribution | [(313) x | | | 0.52 = | 13.85 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 437.64 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | | 0 = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | | 0.22 = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 437.64 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | | 0.52 = | 58.32 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | | 0.52 = | 137.42 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 633.38 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 10.93 | (384) |

## EI rating (section 14)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **EI rating (section 14)** | | | | | | 91.75 | (385) |

### 13b. Primary Energy – Community heating scheme

| | | Energy kWh/year | | Primary factor | | P.Energy kWh/year | |
|---|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 693.05 | x | 1.22 | | 845.52 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 206.53 | x | 3.07 | | -634.04 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2086.17 | x | 1.22 | | 2545.13 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 621.68 | x | 3.07 | | -1908.55 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1430.78 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 81.91 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 2360.74 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 2360.74 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 2360.74 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 344.98 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 812.86 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | | 3518.58 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 A-3-03

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | East |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 98.76 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 183.52 | **(P1)** |
| **Transmission heat loss coefficient:** | 31.6 | |
| **Summer heat loss coefficient:** | 215.11 | **(P2)** |

## Overhangs:

| Orientation: | Ratio: | Z_overhangs: |
|---|---|---|
| West (Rear) | 0 | 1 |

## Solar shading:

| Orientation: | Z blinds: | Solar access: | Overhangs: | Z summer: | |
|---|---|---|---|---|---|
| West (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| Orientation | | Area | Flux | g_ | FF | Shading | Gains | |
|---|---|---|---|---|---|---|---|---|
| West (Rear) | 0.9 x | 12.15 | 117.51 | 0.56 | 0.7 | 0.76 | 383.95 | |
| | | | | | | **Total** | 383.95 | **(P3/P4)** |

## Internal gains:

| | June | July | August | |
|---|---|---|---|---|
| Internal gains | 396.77 | 382.72 | 389.5 | |
| Total summer gains | 804.34 | 766.67 | 727.29 | **(P5)** |
| Summer gain/loss ratio | 3.74 | 3.56 | 3.38 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.31 | 1.31 | 1.31 | |
| Threshold temperature | 21.05 | 22.77 | 22.49 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:26:36*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 66.7m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 A-3-06

**Address :** A-3-06, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 15.45 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 11.05 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 34.8 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 33.8 kWh/m² | |
| | | OK |

## 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 | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South | 3.82m² | |
| Windows facing: West | 8.35m² | |
| Windows facing: South East | 7.63m² | |
| Ventilation rate: | 6.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party Walls U-value | 0 W/m²K | |
| Community heating, heat from CHP | | |

# Predicted Energy Assessment

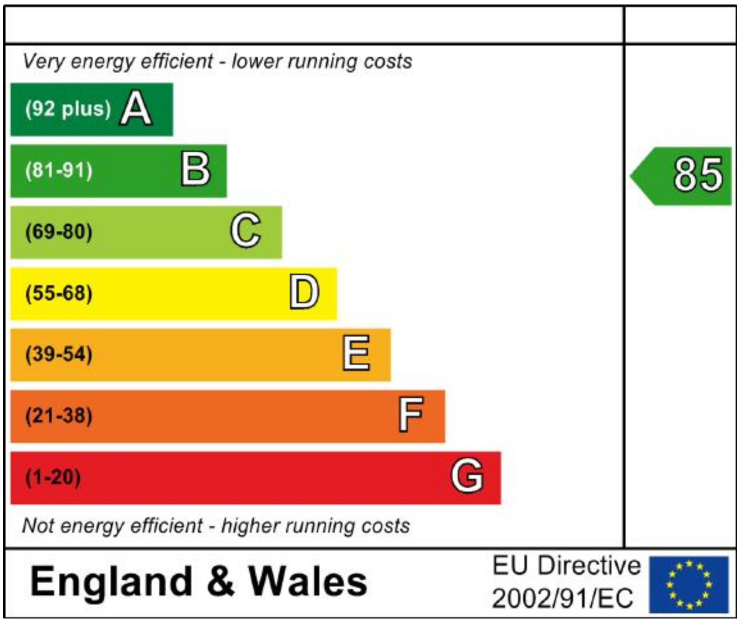
A-3-06
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Mid floor Flat |
| Date of assessment: | 22 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 66.7 m² |

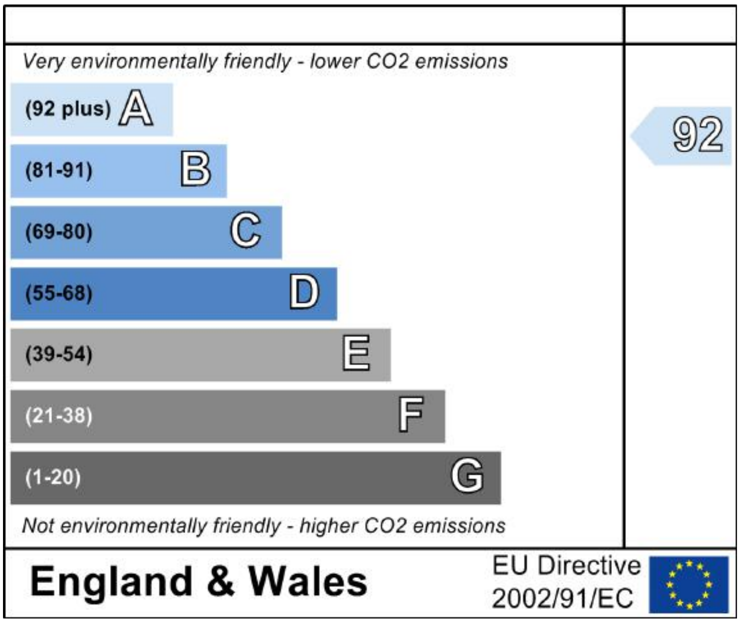
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-3-06

| | |
|---|---|
| Address: | A-3-06, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 98.32 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 66.7 m² | 2.4 m |
| Living area: | 30.23 m² (fraction 0.453) | |
| Front of dwelling faces: | North | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 3.82 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 8.35 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 7.63 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | North | 0 | 0 |
| Rear | | External Wall | South | 0 | 0 |
| Side | | External Wall | West | 0 | 0 |
| Side | | External Wall | South East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 52.8 | 21.9 | 30.9 | 0.15 | 0 | False | 14 |
| Corridor Wall | 4.32 | 0 | 4.32 | 0.15 | 0.43 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 96 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 26.6 | | | | | | 20 |
| Party Ceiling | 66.7 | | | | | | 30 |

# SAP Input

| | | |
|---|---|---|
| Party Floor | 66.7 | 40 |

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0948

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 23.4 | 0.05 | E4 | Jamb |
| [Approved] | 44 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 4.8 | 0.09 | E16 | Corner (normal) |
| [Approved] | 7.2 | 0.06 | E18 | Party wall between dwellings |
| | 25.76 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, Rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 3

## Main heating system:

Main heating system: Community heating schemes
Heat source: Community CHP
heat from CHP, heat fraction 0.6, efficiency 57.6
Heat source: Community boilers
heat from boilers – mains gas, heat fraction 0.4, efficiency 91
Piping>=1991, pre-insulated, low temp, variable flow

## Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and TRVs
Control code: 2306

## Secondary heating system:

Secondary heating system: None

## Water heating:

Water heating: From main heating system
Water code: 901
Fuel :heat from CHP
No hot water cylinder
Solar panel: False

## Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Dense urban
EPC language: English
Wind turbine: No
Photovoltaics: None
Assess Zero Carbon Home: No

# SAP WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 A-3-06

**Address :** A-3-06, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 66.7 | (1a) | x | 2.4 | (2a) | = | 160.08 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 66.7 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) | | = | 160.08 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | | |
|---|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = | (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 3.82 | x1/[1/( 1.4 )+ 0.04] | | = | 5.06 | | | (27) |
| Windows Type 2 | | | 8.35 | x1/[1/( 1.4 )+ 0.04] | | = | 11.07 | | | (27) |
| Windows Type 3 | | | 7.63 | x1/[1/( 1.4 )+ 0.04] | | = | 10.12 | | | (27) |
| Walls Type1 | 52.8 | 21.9 | 30.9 | x | 0.15 | = | 4.64 | 14 | 432.6 | (29) |
| Walls Type2 | 4.32 | 0 | 4.32 | x | 0.14 | = | 0.61 | 14 | 60.48 | (29) |
| Total area of elements, m² | | | 57.12 | | | | | | | (31) |
| Party wall | | | 26.6 | x | 0 | = | 0 | 20 | 532 | (32) |
| Party floor | | | 66.7 | | | | | 40 | 2668 | (32a) |
| Party ceiling | | | 66.7 | | | | | 30 | 2001 | (32b) |
| Internal wall ** | | | 96 | | | | | 9 | 864 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.43 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 6558.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 98.32 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 5.41 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 39.85 (37)

# SAP WorkSheet: New dwelling design stage

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 13.9 | 13.73 | 13.56 | 12.72 | 12.55 | 11.71 | 11.71 | 11.54 | 12.04 | 12.55 | 12.89 | 13.22 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 53.74 | 53.58 | 53.41 | 52.57 | 52.4 | 51.56 | 51.56 | 51.39 | 51.89 | 52.4 | 52.73 | 53.07 | |

Average = Sum(39)$_{1\ldots12}$ /12= 52.52 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.81 | 0.8 | 0.8 | 0.79 | 0.79 | 0.77 | 0.77 | 0.77 | 0.78 | 0.79 | 0.79 | 0.8 |

Average = Sum(40)$_{1\ldots12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.16 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 85.58 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 94.14 | 90.72 | 87.29 | 83.87 | 80.45 | 77.02 | 77.02 | 80.45 | 83.87 | 87.29 | 90.72 | 94.14 |

Total = Sum(44)$_{1\ldots12}$ = 1026.98 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 139.61 | 122.1 | 126 | 109.85 | 105.4 | 90.95 | 84.28 | 96.71 | 97.87 | 114.06 | 124.5 | 135.2 |

Total = Sum(45)$_{1\ldots12}$ = 1346.53 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 20.94 | 18.32 | 18.9 | 16.48 | 15.81 | 13.64 | 12.64 | 14.51 | 14.68 | 17.11 | 18.68 | 20.28 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 194.88 | 172.03 | 181.27 | 163.34 | 160.68 | 144.45 | 139.56 | 151.99 | 151.36 | 169.33 | 178 | 190.48 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 194.88 | 172.03 | 181.27 | 163.34 | 160.68 | 144.45 | 139.56 | 151.99 | 151.36 | 169.33 | 178 | 190.48 |

Output from water heater (annual)$_{1...12}$ | 1997.37 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 90.64 | 80.54 | 86.12 | 79.32 | 79.27 | 73.04 | 72.24 | 76.38 | 75.34 | 82.15 | 84.19 | 89.18 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 42.23 | 37.51 | 30.5 | 23.09 | 17.26 | 14.57 | 15.75 | 20.47 | 27.47 | 34.88 | 40.71 | 43.4 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 282.8 | 285.73 | 278.34 | 262.6 | 242.72 | 224.05 | 211.57 | 208.63 | 216.03 | 231.77 | 251.64 | 270.32 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 121.83 | 119.85 | 115.75 | 110.17 | 106.54 | 101.44 | 97.1 | 102.66 | 104.63 | 110.41 | 116.93 | 119.86 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 540.27 | 536.51 | 518 | 489.27 | 459.94 | 433.47 | 417.83 | 425.17 | 441.55 | 470.48 | 502.7 | 527 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | Access Factor Table 6d | Area m² | Flux Table 6a | g_ Table 6b | FF Table 6c | Gains (W) |
|---|---|---|---|---|---|---|

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 36.79 | x | 0.56 | x | 0.7 | = | 75.99 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 62.67 | x | 0.56 | x | 0.7 | = | 129.44 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 85.75 | x | 0.56 | x | 0.7 | = | 177.11 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 106.25 | x | 0.56 | x | 0.7 | = | 219.44 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 119.01 | x | 0.56 | x | 0.7 | = | 245.8 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 118.15 | x | 0.56 | x | 0.7 | = | 244.02 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 113.91 | x | 0.56 | x | 0.7 | = | 235.26 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 104.39 | x | 0.56 | x | 0.7 | = | 215.6 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 92.85 | x | 0.56 | x | 0.7 | = | 191.77 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 69.27 | x | 0.56 | x | 0.7 | = | 143.06 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 44.07 | x | 0.56 | x | 0.7 | = | 91.02 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 31.49 | x | 0.56 | x | 0.7 | = | 65.03 | (77) |
| South | 0.9x | 0.77 | x | 3.82 | x | 46.75 | x | 0.56 | x | 0.7 | = | 48.34 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 76.57 | x | 0.56 | x | 0.7 | = | 79.17 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 97.53 | x | 0.56 | x | 0.7 | = | 100.85 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 110.23 | x | 0.56 | x | 0.7 | = | 113.98 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 114.87 | x | 0.56 | x | 0.7 | = | 118.78 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 110.55 | x | 0.56 | x | 0.7 | = | 114.31 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 108.01 | x | 0.56 | x | 0.7 | = | 111.69 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 104.89 | x | 0.56 | x | 0.7 | = | 108.46 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 101.89 | x | 0.56 | x | 0.7 | = | 105.35 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 82.59 | x | 0.56 | x | 0.7 | = | 85.4 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 55.42 | x | 0.56 | x | 0.7 | = | 57.3 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 40.4 | x | 0.56 | x | 0.7 | = | 41.77 | (78) |
| West | 0.9x | 0.77 | x | 8.35 | x | 19.64 | x | 0.56 | x | 0.7 | = | 44.39 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 38.42 | x | 0.56 | x | 0.7 | = | 86.84 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 63.27 | x | 0.56 | x | 0.7 | = | 143.01 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 92.28 | x | 0.56 | x | 0.7 | = | 208.57 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 113.09 | x | 0.56 | x | 0.7 | = | 255.62 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 115.77 | x | 0.56 | x | 0.7 | = | 261.67 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 110.22 | x | 0.56 | x | 0.7 | = | 249.12 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 94.68 | x | 0.56 | x | 0.7 | = | 213.99 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 73.59 | x | 0.56 | x | 0.7 | = | 166.33 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 45.59 | x | 0.56 | x | 0.7 | = | 103.04 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 24.49 | x | 0.56 | x | 0.7 | = | 55.35 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 16.15 | x | 0.56 | x | 0.7 | = | 36.51 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 168.73 | 295.45 | 420.97 | 542 | 620.19 | 620 | 596.07 | 538.05 | 463.45 | 331.5 | 203.67 | 143.31 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 709 | 831.96 | 938.97 | 1031.27 | 1080.13 | 1053.47 | 1013.9 | 963.23 | 905 | 801.98 | 706.38 | 670.31 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.85 | 0.78 | 0.69 | 0.56 | 0.43 | 0.31 | 0.22 | 0.24 | 0.38 | 0.61 | 0.78 | 0.86 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.08 | 20.34 | 20.6 | 20.83 | 20.94 | 20.99 | 21 | 21 | 20.97 | 20.81 | 20.44 | 20.03 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.25 | 20.25 | 20.25 | 20.26 | 20.27 | 20.28 | 20.28 | 20.28 | 20.27 | 20.27 | 20.26 | 20.26 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.83 | 0.76 | 0.66 | 0.54 | 0.4 | 0.28 | 0.19 | 0.21 | 0.35 | 0.57 | 0.76 | 0.85 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.04 | 19.4 | 19.76 | 20.06 | 20.2 | 20.26 | 20.27 | 20.28 | 20.24 | 20.05 | 19.55 | 18.98 | (90) |

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.52 | 19.82 | 20.14 | 20.41 | 20.53 | 20.59 | 20.6 | 20.6 | 20.57 | 20.4 | 19.95 | 19.45 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.52 | 19.82 | 20.14 | 20.41 | 20.53 | 20.59 | 20.6 | 20.6 | 20.57 | 20.4 | 19.95 | 19.45 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.82 | 0.75 | 0.66 | 0.54 | 0.41 | 0.29 | 0.2 | 0.22 | 0.36 | 0.58 | 0.75 | 0.83 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 579 | 624.16 | 621.02 | 557.28 | 446.59 | 305.29 | 205.52 | 214.81 | 328.03 | 464.14 | 530.87 | 558.62 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 817.77 | 799.61 | 728.46 | 604.79 | 462.92 | 308.86 | 206.3 | 215.91 | 335.84 | 513.37 | 677.85 | 809.59 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 177.64 | 117.9 | 79.94 | 34.21 | 12.15 | 0 | 0 | 0 | 0 | 36.63 | 105.83 | 186.73 | |

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 751.01 (98)

Space heating requirement in kWh/m²/year 11.26 (99)

## 9b. Energy requirements – Community heating scheme

| | | |
|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 751.01 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 473.14 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 315.43 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1997.37 | |
| If DHW from community scheme:<br>Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1258.34 | (310a) |
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 838.89 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 28.86 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 129.38 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 129.38 | (331) |
| Energy for lighting (calculated in Appendix L) | | 298.32 | (332) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 2.97 | x 0.01 = | 14.05 | (340a) |
| Space heating from heat source 2 | (307b) x | 4.24 | x 0.01 = | 13.37 | (340b) |
| Water heating from CHP | (310a) x | 2.97 | x 0.01 = | 37.37 | (342a) |
| Water heating from heat source 2 | (310b) x | 4.24 | x 0.01 = | 35.57 | (342b) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 17.07 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 39.35 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 276.78 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.04 | (357) |
| **SAP rating (section12)** | | 85.48 | (358) |

# SAP WorkSheet: New dwelling design stage

## 12b. CO2 Emissions – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Electrical efficiency of CHP unit | | | | | | 29.8 | (361) |
| Heat efficiency of CHP unit | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Emission factor kg CO2/kWh** | | **Emissions kg CO2/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 821.42 | x | 0.22 | | 177.43 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 244.78 | x | 0.52 | | -127.04 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2184.62 | x | 0.22 | | 471.88 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 651.02 | x | 0.52 | | -337.88 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 0.22 | = | 273.99 | (368) |
| Electrical energy for heat distribution | [(313) x | | | 0.52 | = | 14.98 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | | = | 473.35 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | | 473.35 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | | 0.52 | = | 67.15 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | | 0.52 | = | 154.83 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | | 695.33 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | | 10.42 | (384) |
| **EI rating (section 14)** | | | | | | 91.66 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 821.42 | x | 1.22 | | 1002.14 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 244.78 | x | 3.07 | | -751.49 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2184.62 | x | 1.22 | | 2665.24 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 651.02 | x | 3.07 | | -1998.62 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1547.55 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 88.59 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 2553.41 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 2553.41 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |

| | | | | | |
|---|---|---|---|---|---|
| Energy associated with water from immersion heater or instantaneous heater | (312) x | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | 2553.41 | (376) |
| Energy associated with space cooling | (315) x | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | 3.07 | = | 397.21 | (378) |
| Energy associated with electricity for lighting | (332))) x | 3.07 | = | 915.83 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | 3866.45 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 A-3-06

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | Yes |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | North |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 98.32 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 6 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 316.96 | **(P1)** |
| **Transmission heat loss coefficient:** | 39.8 | |
| **Summer heat loss coefficient:** | 356.81 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| South (Rear) | 0 | 1 |
| West (Side) | 0 | 1 |
| South East (Side) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| South (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| West (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| South East (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| South (Rear) | 0.9 x | 3.82 | 112.21 | 0.56 | 0.7 | 0.76 | 115.27 | |
| West (Side) | 0.9 x | 8.35 | 117.51 | 0.56 | 0.7 | 0.76 | 263.87 | |
| South East (Side) | 0.9 x | 7.63 | 119.92 | 0.56 | 0.7 | 0.76 | 246.07 | |
| | | | | | | **Total** | 625.21 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 433.47 | 417.83 | 425.17 | |
| Total summer gains | 1091.38 | 1043.04 | 1000.6 | **(P5)** |
| Summer gain/loss ratio | 3.06 | 2.92 | 2.8 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.31 | 1.31 | 1.31 | |
| Threshold temperature | 20.37 | 22.14 | 21.92 | **(P7)** |
| **Likelihood of high internal temperature** | **Not significant** | **Medium** | **Slight** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:26:27*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 86.19m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 A-4-01

**Address :** A-4-01, Bertram Street, London

## Client Details:

**Name:** McBains
**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 18.24 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 11.70 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 56.1 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 43.1 kWh/m² | |
| | | **OK** |

## 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 | 0.11 (max. 0.20) | 0.11 (max. 0.35) | **OK** |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | **OK** |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| 7 Low energy lights | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

| 8 Mechanical ventilation | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

| 9 Summertime temperature | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: West | 17.05m² | |
| Windows facing: North | 6m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

| 10 Key features | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Roofs U-value | 0.11 W/m²K |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from CHP | |

# Predicted Energy Assessment

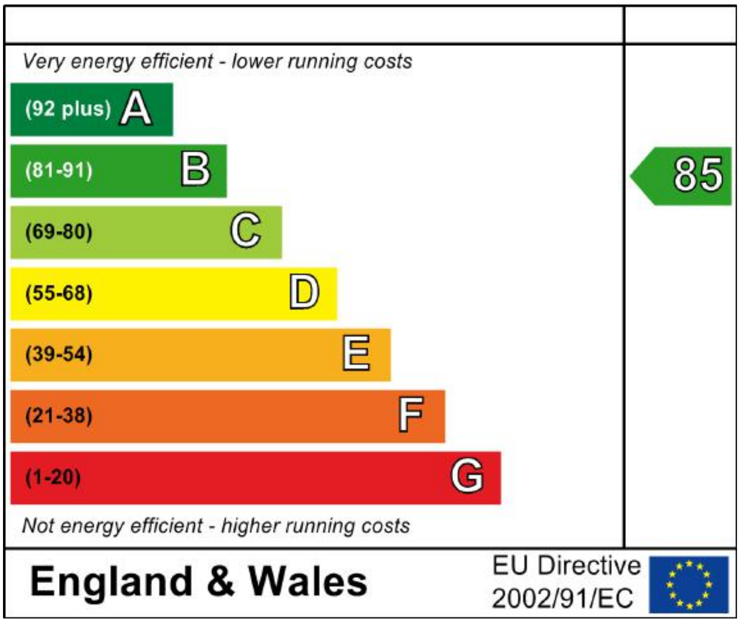
A-4-01
Bertram Street
London

Dwelling type: Top floor Flat
Date of assessment: 22 January 2019
Produced by: Matthew Stainrod
Total floor area: 86.19 m²

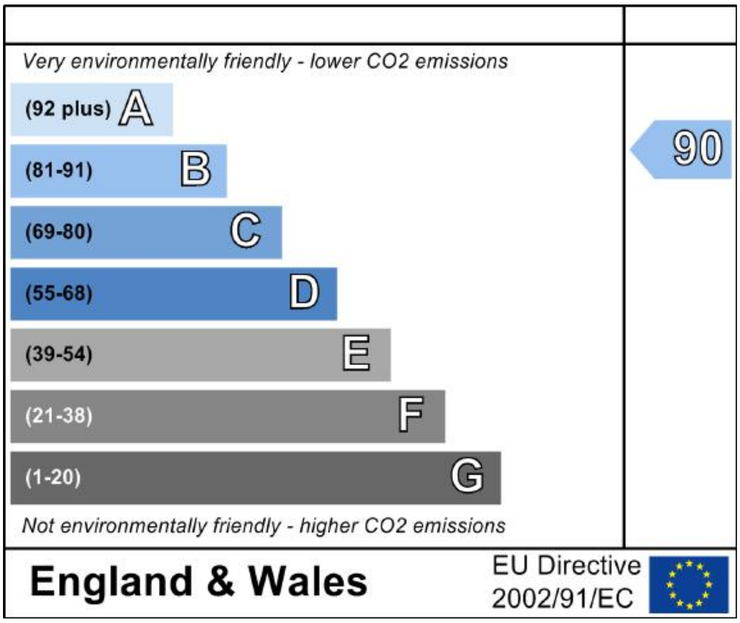
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-4-01

| | |
|---|---|
| Address: | A-4-01, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 81.19 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 86.19 m² | 2.4 m |
| Living area: | 24.1 m² (fraction 0.278) | |
| Front of dwelling faces: | South | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 17.05 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 6 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | South | 0 | 0 |
| Side | | External Wall | West | 0 | 0 |
| Rear | | External Wall | North | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 55.68 | 25.15 | 30.53 | 0.15 | 0 | False | 14 |
| Corridor Wall | 8.9 | 0 | 8.9 | 0.15 | 0.43 | False | 14 |
| Roof | 86.19 | 0 | 86.19 | 0.11 | 0 | | 9 |
| Internal Elements | | | | | | | |
| Stud Walls | 163.2 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 37.7 | | | | | | 20 |
| Party Floor | 86.19 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 28.2 | 0.05 | E4 | Jamb |
| [Approved] | 26.91 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 4.8 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 7.2 | 0.06 | E18 | Party wall between dwellings |
| | 5.6 | 0.04 | E14 | Flat roof |
| | 21.31 | 0.28 | E15 | Flat roof with parapet |
| | 15.71 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 15.71 | 0.12 | P4 | Roof (insulation at ceiling level) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 2<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

## Property Address: 06-18-69419 A-4-01

**Address :** A-4-01, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 86.19 | (1a) | x | 2.4 | (2a) | = | 206.86 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 86.19 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 206.86 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | |
|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = 0 | ÷ (5) = | 0 | (8) |
| *If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)* | | | |
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |
| *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | | |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 17.05 | x1/[1/( 1.4 )+ 0.04] | | = | 22.6 | | | (27) |
| Windows Type 2 | | | 6 | x1/[1/( 1.4 )+ 0.04] | | = | 7.95 | | | (27) |
| Walls Type1 | 55.68 | 25.15 | 30.53 | x | 0.15 | = | 4.58 | 14 | 427.42 | (29) |
| Walls Type2 | 8.9 | 0 | 8.9 | x | 0.14 | = | 1.25 | 14 | 124.6 | (29) |
| Roof | 86.19 | 0 | 86.19 | x | 0.11 | = | 9.48 | 9 | 775.71 | (30) |
| Total area of elements, m² | | | 150.77 | | | | | | | (31) |
| Party wall | | | 37.7 | x | 0 | = | 0 | 20 | 754 | (32) |
| Party floor | | | 86.19 | | | | | 40 | 3447.6 | (32a) |
| Internal wall ** | | | 163.2 | | | | | 9 | 1468.8 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 48.81 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 6998.13 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 81.19 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 12.32 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 61.13 (37)

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 17.96 | 17.74 | 17.52 | 16.43 | 16.22 | 15.13 | 15.13 | 14.91 | 15.56 | 16.22 | 16.65 | 17.09 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 79.09 | 78.87 | 78.65 | 77.57 | 77.35 | 76.26 | 76.26 | 76.04 | 76.69 | 77.35 | 77.78 | 78.22 | |

Average = Sum(39)$_{1...12}$ /12= 77.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.92 | 0.92 | 0.91 | 0.9 | 0.9 | 0.88 | 0.88 | 0.88 | 0.89 | 0.9 | 0.9 | 0.91 | |

Average = Sum(40)$_{1...12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.24 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)* | | | | | | | | | | | | | |
| (44)m= | 104.76 | 100.95 | 97.14 | 93.33 | 89.52 | 85.71 | 85.71 | 89.52 | 93.33 | 97.14 | 100.95 | 104.76 | |

Total = Sum(44)$_{1...12}$ = 1142.82 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 155.35 | 135.87 | 140.21 | 122.24 | 117.29 | 101.21 | 93.79 | 107.62 | 108.91 | 126.92 | 138.55 | 150.45 | |

Total = Sum(45)$_{1...12}$ = 1498.42 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 23.3 | 20.38 | 21.03 | 18.34 | 17.59 | 15.18 | 14.07 | 16.14 | 16.34 | 19.04 | 20.78 | 22.57 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 210.63 | 185.8 | 195.49 | 175.73 | 172.57 | 154.71 | 149.07 | 162.9 | 162.4 | 182.2 | 192.04 | 205.73 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 210.63 | 185.8 | 195.49 | 175.73 | 172.57 | 154.71 | 149.07 | 162.9 | 162.4 | 182.2 | 192.04 | 205.73 | |

Output from water heater (annual)1…12 | 2149.26 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 95.88 | 85.12 | 90.84 | 83.44 | 83.22 | 76.45 | 75.41 | 80.01 | 79.01 | 86.42 | 88.86 | 94.25 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | | | | | | | | | | | | | |
| (67)m= | 51.68 | 45.9 | 37.33 | 28.26 | 21.13 | 17.84 | 19.27 | 25.05 | 33.62 | 42.69 | 49.83 | 53.12 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | | | | | | | | | | | | | |
| (68)m= | 346.11 | 349.7 | 340.65 | 321.38 | 297.06 | 274.2 | 258.93 | 255.34 | 264.39 | 283.65 | 307.98 | 330.84 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | | | | | | | | | | | | | |
| (69)m= | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | (69) |
| Pumps and fans gains (Table 5a) | | | | | | | | | | | | | |
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |
| Losses e.g. evaporation (negative values) (Table 5) | | | | | | | | | | | | | |
| (71)m= | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | (71) |
| Water heating gains (Table 5) | | | | | | | | | | | | | |
| (72)m= | 128.87 | 126.67 | 122.1 | 115.89 | 111.86 | 106.18 | 101.35 | 107.54 | 109.73 | 116.16 | 123.42 | 126.68 | (72) |
| **Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m | | | | | | | | | | | | | |
| (73)m= | 631.04 | 626.66 | 604.46 | 569.92 | 534.43 | 502.6 | 483.94 | 492.31 | 512.13 | 546.9 | 585.61 | 615.02 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 6 | x | 10.63 | x | 0.558 | x | 0.7 | = | 17.27 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 20.32 | x | 0.558 | x | 0.7 | = | 33 | (74) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 6 | x | 34.53 | x | 0.558 | x | 0.7 | = | 56.08 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 55.46 | x | 0.558 | x | 0.7 | = | 90.08 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 74.72 | x | 0.558 | x | 0.7 | = | 121.35 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 79.99 | x | 0.558 | x | 0.7 | = | 129.91 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 74.68 | x | 0.558 | x | 0.7 | = | 121.28 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 59.25 | x | 0.558 | x | 0.7 | = | 96.22 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 41.52 | x | 0.558 | x | 0.7 | = | 67.43 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 24.19 | x | 0.558 | x | 0.7 | = | 39.29 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 13.12 | x | 0.558 | x | 0.7 | = | 21.3 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 8.86 | x | 0.558 | x | 0.7 | = | 14.4 | (74) |
| West | 0.9x | 0.77 | x | 17.05 | x | 19.64 | x | 0.56 | x | 0.7 | = | 90.64 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 38.42 | x | 0.56 | x | 0.7 | = | 177.32 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 63.27 | x | 0.56 | x | 0.7 | = | 292.02 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 92.28 | x | 0.56 | x | 0.7 | = | 425.89 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 113.09 | x | 0.56 | x | 0.7 | = | 521.94 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 115.77 | x | 0.56 | x | 0.7 | = | 534.3 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 110.22 | x | 0.56 | x | 0.7 | = | 508.68 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 94.68 | x | 0.56 | x | 0.7 | = | 436.95 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 73.59 | x | 0.56 | x | 0.7 | = | 339.63 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 45.59 | x | 0.56 | x | 0.7 | = | 210.4 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 24.49 | x | 0.56 | x | 0.7 | = | 113.02 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 16.15 | x | 0.56 | x | 0.7 | = | 74.54 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 107.91 | 210.32 | 348.1 | 515.97 | 643.29 | 664.21 | 629.96 | 533.17 | 407.06 | 249.69 | 134.33 | 88.94 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 738.96 | 836.98 | 952.56 | 1085.89 | 1177.72 | 1166.81 | 1113.9 | 1025.48 | 919.19 | 796.58 | 719.94 | 703.96 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.89 | 0.85 | 0.79 | 0.67 | 0.53 | 0.39 | 0.29 | 0.33 | 0.51 | 0.73 | 0.85 | 0.9 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.3 | 19.57 | 19.99 | 20.46 | 20.77 | 20.93 | 20.98 | 20.97 | 20.85 | 20.43 | 19.79 | 19.25 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.15 | 20.15 | 20.16 | 20.17 | 20.17 | 20.18 | 20.18 | 20.18 | 20.18 | 20.17 | 20.17 | 20.16 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.88 | 0.84 | 0.77 | 0.64 | 0.5 | 0.35 | 0.24 | 0.27 | 0.46 | 0.7 | 0.84 | 0.89 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 17.88 | 18.27 | 18.86 | 19.51 | 19.91 | 20.11 | 20.16 | 20.16 | 20.02 | 19.48 | 18.6 | 17.81 | (90) |

fLA = Living area ÷ (4) = | 0.28 | (91)

# SAP WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.28 | 18.64 | 19.18 | 19.77 | 20.15 | 20.34 | 20.39 | 20.38 | 20.25 | 19.74 | 18.93 | 18.21 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.28 | 18.64 | 19.18 | 19.77 | 20.15 | 20.34 | 20.39 | 20.38 | 20.25 | 19.74 | 18.93 | 18.21 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.85 | 0.81 | 0.74 | 0.63 | 0.5 | 0.36 | 0.25 | 0.29 | 0.47 | 0.68 | 0.81 | 0.86 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 628.91 | 679.06 | 707.09 | 684.8 | 585.58 | 417.75 | 283.38 | 294.92 | 430.15 | 544.31 | 582.74 | 607.12 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 1105.55 | 1083.42 | 997.32 | 843.47 | 653.56 | 437.66 | 289.02 | 302.9 | 471.94 | 707.19 | 920.47 | 1096.13 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 354.62 | 271.73 | 215.93 | 114.24 | 50.58 | 0 | 0 | 0 | 0 | 121.18 | 243.16 | 363.83 | |

Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = 1735.28 (98)

Space heating requirement in kWh/m²/year 20.13 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1735.28 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 1093.22 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 728.82 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2149.26 | |
| If DHW from community scheme:<br>Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1354.03 | (310a) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 902.69 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 40.79 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 167.19 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 167.19 | (331) |
| Energy for lighting (calculated in Appendix L) | | 365.1 | (332) |

## 10b. Fuel costs – Community heating scheme

| | Fuel kWh/year | | Fuel Price (Table 12) | | Fuel Cost £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 2.97 | x 0.01 = | 32.47 | (340a) |
| Space heating from heat source 2 | (307b) | x | 4.24 | x 0.01 = | 30.9 | (340b) |
| Water heating from CHP | (310a) | x | 2.97 | x 0.01 = | 40.21 | (342a) |
| Water heating from heat source 2 | (310b) | x | 4.24 | x 0.01 = | 38.27 | (342b) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 22.05 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 48.16 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 332.07 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.06 | (357) |
| **SAP rating (section12)** | | 85.17 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| Electrical efficiency of CHP unit | | | | | 29.8 | (361) |
| Heat efficiency of CHP unit | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Emission factor kg CO2/kWh** | **Emissions kg CO2/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1897.96 | x | 0.22 | 409.96 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 565.59 | x | 0.52 | -293.54 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2350.75 | x | 0.22 | 507.76 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 700.52 | x | 0.52 | -363.57 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | 0.22 | = | 387.26 | (368) |
| Electrical energy for heat distribution | [(313) x | 0.52 | = | 21.17 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 669.03 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 669.03 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 86.77 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 189.49 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 945.29 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 10.97 | (384) |
| **EI rating (section 14)** | | | | 90.34 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1897.96 | x | 1.22 | | 2315.51 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 565.59 | x | 3.07 | | -1736.37 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2350.75 | x | 1.22 | | 2867.92 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 700.52 | x | 3.07 | | -2150.61 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 2187.29 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 125.22 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 3608.96 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 3608.96 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 3608.96 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 513.28 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 1120.85 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | | 5243.08 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 A-4-01

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | South |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 81.19 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 273.05 | **(P1)** |
| **Transmission heat loss coefficient:** | 61.1 | |
| **Summer heat loss coefficient:** | 334.18 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Side) | 0 | 1 |
| North (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| North (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Side) | 0.9 x | 17.05 | 117.51 | 0.56 | 0.7 | 0.76 | 538.8 | |
| North (Rear) | 0.9 x | 6 | 81.19 | 0.56 | 0.7 | 0.76 | 131 | |
| | | | | | | **Total** | 669.79 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 502.6 | 483.94 | 492.31 | |
| Total summer gains | 1216.27 | 1153.73 | 1072.84 | **(P5)** |
| Summer gain/loss ratio | 3.64 | 3.45 | 3.21 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.43 | 1.43 | 1.43 | |
| Threshold temperature | 21.07 | 22.78 | 22.44 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:26:17*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 88.69m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 A-4-02

**Address :** A-4-02, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 17.96 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 11.49 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 55.4 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 42.3 kWh/m² | |
| | | **OK** |

## 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 | 0.11 (max. 0.20) | 0.11 (max. 0.35) | **OK** |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | **OK** |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: East | 17.05m² | |
| Windows facing: North | 6m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Roofs U-value | 0.11 W/m²K |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from CHP | |

# Predicted Energy Assessment

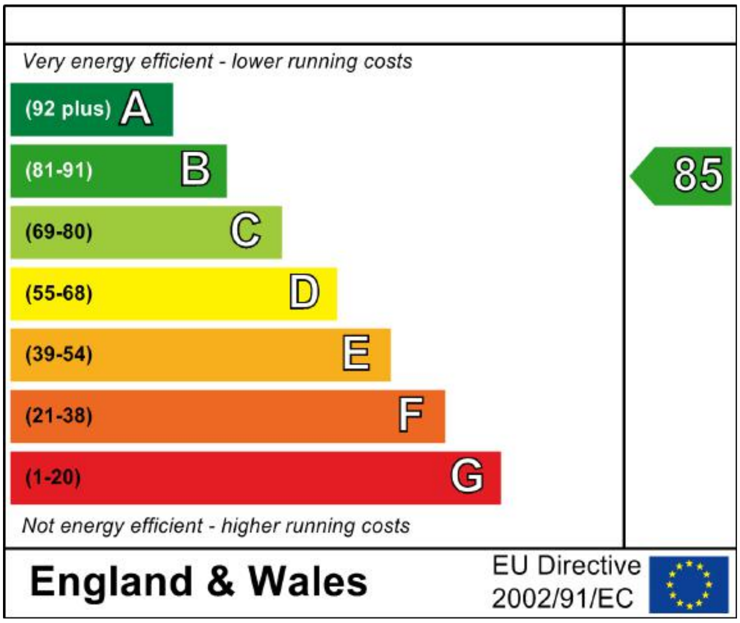
A-4-02
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Top floor Flat |
| Date of assessment: | 22 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 88.69 m² |

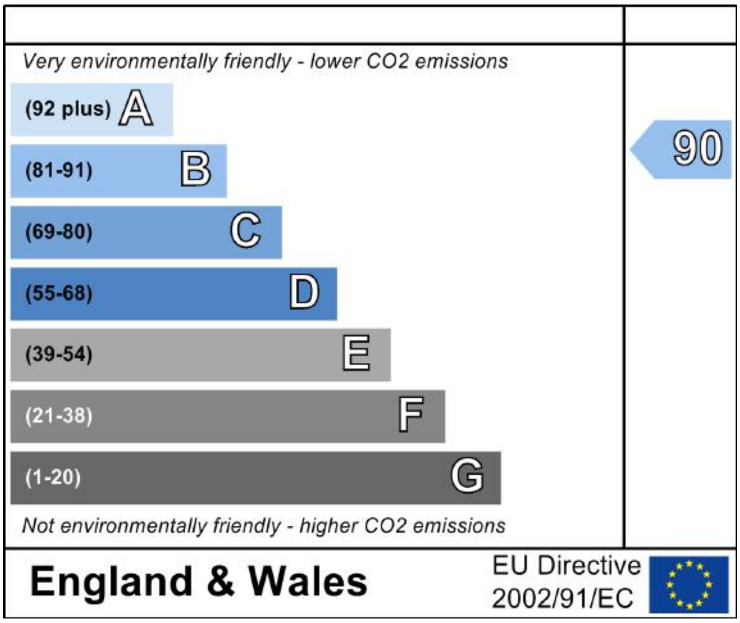
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-4-02

| | |
|---|---|
| Address: | A-4-02, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 78.39 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 88.69 m² | 2.4 m |
| Living area: | 25.61 m² (fraction 0.289) | |
| Front of dwelling faces: | South | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 17.05 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 6 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | South | 0 | 0 |
| Side | | External Wall | East | 0 | 0 |
| Rear | | External Wall | North | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| <u>External Elements</u> | | | | | | | |
| External Wall | 51.58 | 25.15 | 26.43 | 0.15 | 0 | False | 14 |
| Corridor Wall | 9.22 | 0 | 9.22 | 0.15 | 0.43 | False | 14 |
| Roof | 88.69 | 0 | 88.69 | 0.11 | 0 | | 9 |
| <u>Internal Elements</u> | | | | | | | |
| Stud Walls | 163.2 | | | | | | 9 |
| <u>Party Elements</u> | | | | | | | |
| Party Wall | 31.94 | | | | | | 20 |
| Party Floor | 88.69 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0833

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 28.2 | 0.05 | E4 | Jamb |
| [Approved] | 29.67 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 8.18 | 0.04 | E14 | Flat roof |
| | 21.49 | 0.28 | E15 | Flat roof with parapet |
| | 13.31 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 13.31 | 0.12 | P4 | Roof (insulation at ceiling level) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 2<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 A-4-02

**Address :** A-4-02, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 88.69 | (1a) x | 2.4 | (2a) = | 212.86 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 88.69 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 212.86 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 17.05 | x1/[1/( 1.4 )+ 0.04] | | = | 22.6 | | | (27) |
| Windows Type 2 | | | 6 | x1/[1/( 1.4 )+ 0.04] | | = | 7.95 | | | (27) |
| Walls Type1 | 51.58 | 25.15 | 26.43 | x | 0.15 | = | 3.96 | 14 | 370.02 | (29) |
| Walls Type2 | 9.22 | 0 | 9.22 | x | 0.14 | = | 1.3 | 14 | 129.08 | (29) |
| Roof | 88.69 | 0 | 88.69 | x | 0.11 | = | 9.76 | 9 | 798.21 | (30) |
| Total area of elements, m² | | | 149.49 | | | | | | | (31) |
| Party wall | | | 31.94 | x | 0 | = | 0 | 20 | 638.8 | (32) |
| Party floor | | | 88.69 | | | | | 40 | 3547.6 | (32a) |
| Internal wall ** | | | 163.2 | | | | | 9 | 1468.8 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 48.52 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 6952.51 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 78.39 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 12.45 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 60.97 (37)

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

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 18.48 | 18.25 | 18.03 | 16.91 | 16.69 | 15.57 | 15.57 | 15.34 | 16.02 | 16.69 | 17.13 | 17.58 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 79.44 | 79.22 | 79 | 77.88 | 77.65 | 76.53 | 76.53 | 76.31 | 76.98 | 77.65 | 78.1 | 78.55 | |

Average = $Sum(39)_{1...12}$ /12= 77.82 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.9 | 0.89 | 0.89 | 0.88 | 0.88 | 0.86 | 0.86 | 0.86 | 0.87 | 0.88 | 0.88 | 0.89 | |

Average = $Sum(40)_{1...12}$ /12= 0.88 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.61 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.12 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 105.74 | 101.89 | 98.05 | 94.2 | 90.36 | 86.51 | 86.51 | 90.36 | 94.2 | 98.05 | 101.89 | 105.74 | |

Total = $Sum(44)_{1...12}$ = 1153.5 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 156.81 | 137.14 | 141.52 | 123.38 | 118.39 | 102.16 | 94.66 | 108.63 | 109.93 | 128.11 | 139.84 | 151.86 | |

Total = $Sum(45)_{1...12}$ = 1512.42 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 23.52 | 20.57 | 21.23 | 18.51 | 17.76 | 15.32 | 14.2 | 16.29 | 16.49 | 19.22 | 20.98 | 22.78 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 212.08 | 187.07 | 196.8 | 176.87 | 173.66 | 155.65 | 149.94 | 163.91 | 163.42 | 183.39 | 193.33 | 207.13 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 212.08 | 187.07 | 196.8 | 176.87 | 173.66 | 155.65 | 149.94 | 163.91 | 163.42 | 183.39 | 193.33 | 207.13 |

Output from water heater (annual)$_{1...12}$ | 2163.26 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 96.36 | 85.54 | 91.28 | 83.82 | 83.58 | 76.76 | 75.7 | 80.34 | 79.35 | 86.82 | 89.29 | 94.71 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 52.74 | 46.85 | 38.1 | 28.84 | 21.56 | 18.2 | 19.67 | 25.56 | 34.31 | 43.57 | 50.85 | 54.21 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 353.2 | 356.87 | 347.63 | 327.97 | 303.15 | 279.82 | 264.24 | 260.57 | 269.81 | 289.47 | 314.29 | 337.62 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 129.52 | 127.29 | 122.68 | 116.41 | 112.35 | 106.61 | 101.74 | 107.98 | 110.2 | 116.69 | 124.02 | 127.3 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 640.86 | 636.41 | 613.81 | 578.63 | 542.45 | 510.04 | 491.05 | 499.52 | 519.72 | 555.13 | 594.56 | 624.53 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 6 | x | 10.63 | x | 0.558 | x | 0.7 | = | 17.27 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 20.32 | x | 0.558 | x | 0.7 | = | 33 | (74) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 6 | x | 34.53 | x | 0.558 | x | 0.7 | = | 56.08 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 55.46 | x | 0.558 | x | 0.7 | = | 90.08 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 74.72 | x | 0.558 | x | 0.7 | = | 121.35 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 79.99 | x | 0.558 | x | 0.7 | = | 129.91 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 74.68 | x | 0.558 | x | 0.7 | = | 121.28 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 59.25 | x | 0.558 | x | 0.7 | = | 96.22 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 41.52 | x | 0.558 | x | 0.7 | = | 67.43 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 24.19 | x | 0.558 | x | 0.7 | = | 39.29 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 13.12 | x | 0.558 | x | 0.7 | = | 21.3 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 8.86 | x | 0.558 | x | 0.7 | = | 14.4 | (74) |
| East | 0.9x | 1 | x | 17.05 | x | 19.64 | x | 0.56 | x | 0.7 | = | 90.64 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 38.42 | x | 0.56 | x | 0.7 | = | 177.32 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 63.27 | x | 0.56 | x | 0.7 | = | 292.02 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 92.28 | x | 0.56 | x | 0.7 | = | 425.89 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 113.09 | x | 0.56 | x | 0.7 | = | 521.94 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 115.77 | x | 0.56 | x | 0.7 | = | 534.3 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 110.22 | x | 0.56 | x | 0.7 | = | 508.68 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 94.68 | x | 0.56 | x | 0.7 | = | 436.95 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 73.59 | x | 0.56 | x | 0.7 | = | 339.63 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 45.59 | x | 0.56 | x | 0.7 | = | 210.4 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 24.49 | x | 0.56 | x | 0.7 | = | 113.02 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 16.15 | x | 0.56 | x | 0.7 | = | 74.54 | (76) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 107.91 | 210.32 | 348.1 | 515.97 | 643.29 | 664.21 | 629.96 | 533.17 | 407.06 | 249.69 | 134.33 | 88.94 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 748.77 | 846.73 | 961.91 | 1094.6 | 1185.75 | 1174.25 | 1121.01 | 1032.69 | 926.78 | 804.82 | 728.89 | 713.47 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.89 | 0.85 | 0.78 | 0.67 | 0.53 | 0.39 | 0.29 | 0.33 | 0.51 | 0.73 | 0.85 | 0.9 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.3 | 19.57 | 19.99 | 20.46 | 20.77 | 20.93 | 20.98 | 20.97 | 20.85 | 20.42 | 19.79 | 19.24 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.17 | 20.17 | 20.18 | 20.19 | 20.19 | 20.2 | 20.2 | 20.2 | 20.19 | 20.19 | 20.18 | 20.18 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.88 | 0.84 | 0.77 | 0.64 | 0.5 | 0.35 | 0.24 | 0.27 | 0.46 | 0.7 | 0.83 | 0.89 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 17.89 | 18.28 | 18.87 | 19.52 | 19.92 | 20.13 | 20.18 | 20.17 | 20.04 | 19.49 | 18.61 | 17.83 | (90) |

fLA = Living area ÷ (4) = 0.29 (91)

# SAP WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.3 | 18.65 | 19.2 | 19.79 | 20.17 | 20.36 | 20.41 | 20.4 | 20.27 | 19.76 | 18.95 | 18.23 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.3 | 18.65 | 19.2 | 19.79 | 20.17 | 20.36 | 20.41 | 20.4 | 20.27 | 19.76 | 18.95 | 18.23 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.85 | 0.81 | 0.74 | 0.63 | 0.5 | 0.36 | 0.25 | 0.29 | 0.47 | 0.68 | 0.81 | 0.86 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 634.81 | 684.27 | 711.29 | 688.01 | 588.38 | 420.26 | 285.73 | 297.24 | 432.64 | 547.61 | 587.51 | 613.01 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 1112.12 | 1089.66 | 1002.94 | 848.08 | 657.45 | 440.68 | 291.6 | 305.48 | 475.12 | 711.37 | 925.79 | 1102.43 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 355.12 | 272.42 | 216.98 | 115.25 | 51.39 | 0 | 0 | 0 | 0 | 121.84 | 243.56 | 364.12 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1740.69 | (98) |
| Space heating requirement in kWh/m²/year | 19.63 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1740.69 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 1096.64 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 731.09 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2163.26 | |
| If DHW from community scheme: Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1362.85 | (310a) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 908.57 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 40.99 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 172.04 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 172.04 | (331) |
| Energy for lighting (calculated in Appendix L) | | 372.58 | (332) |

## 10b. Fuel costs – Community heating scheme

| | Fuel kWh/year | Fuel Price (Table 12) | | Fuel Cost £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 2.97 | x 0.01 = | 32.57 | (340a) |
| Space heating from heat source 2 | (307b) x | 4.24 | x 0.01 = | 31 | (340b) |
| Water heating from CHP | (310a) x | 2.97 | x 0.01 = | 40.48 | (342a) |
| Water heating from heat source 2 | (310b) x | 4.24 | x 0.01 = | 38.52 | (342b) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 22.69 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 49.14 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 334.4 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.05 | (357) |
| **SAP rating (section12)** | | 85.34 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | |
|---|---|---|---|
| Electrical efficiency of CHP unit | | 29.8 | (361) |
| Heat efficiency of CHP unit | | 57.6 | (362) |

| | | Energy kWh/year | | Emission factor kg CO2/kWh | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1903.88 | x | 0.22 | 411.24 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 567.36 | x | 0.52 | -294.46 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2366.06 | x | 0.22 | 511.07 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 705.09 | x | 0.52 | -365.94 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | |
|---|---|---|---|---|---|---|
| $CO_2$ associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 389.19 | (368) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 21.27 | (372) |
| Total $CO_2$ associated with community systems | (363)…(366) + (368)...(372) | | | = | 672.38 | (373) |
| $CO_2$ associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| $CO_2$ associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total $CO_2$ associated with space and water heating | (373) + (374) + (375) = | | | | 672.38 | (376) |
| $CO_2$ associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 89.29 | (378) |
| $CO_2$ associated with electricity for lighting | (332))) x | | 0.52 | = | 193.37 | (379) |
| **Total $CO_2$, kg/year** | sum of (376)…(382) = | | | | 955.04 | (383) |
| **Dwelling $CO_2$ Emission Rate** | (383) ÷ (4) = | | | | 10.77 | (384) |
| **EI rating (section 14)** | | | | | 90.43 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1903.88 | x | 1.22 | | 2322.74 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 567.36 | x | 3.07 | | -1741.79 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2366.06 | x | 1.22 | | 2886.6 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 705.09 | x | 3.07 | | -2164.62 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 2198.22 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 125.84 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 3627 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 3627 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 3627 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 528.17 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 1143.83 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | | 5299 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 A-4-02

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | South |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 78.39 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 280.97 | **(P1)** |
| **Transmission heat loss coefficient:** | 61 | |
| **Summer heat loss coefficient:** | 341.94 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| East (Side) | 0 | 1 |
| North (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| East (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| North (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| East (Side) | 0.9 x | 17.05 | 117.51 | 0.56 | 0.7 | 0.76 | 538.8 | |
| North (Rear) | 0.9 x | 6 | 81.19 | 0.56 | 0.7 | 0.76 | 131 | |
| | | | | | | **Total** | 669.79 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 510.04 | 491.05 | 499.52 | |
| Total summer gains | 1223.71 | 1160.84 | 1080.05 | **(P5)** |
| Summer gain/loss ratio | 3.58 | 3.39 | 3.16 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.45 | 1.45 | 1.45 | |
| Threshold temperature | 21.03 | 22.75 | 22.41 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:25:49*

## Project Information:

| | | | |
|---|---|---|---|
| **Assessed By:** | Matthew Stainrod (STRO023501) | **Building Type:** | Flat |

## Dwelling Details:

| | | | |
|---|---|---|---|
| **NEW DWELLING DESIGN STAGE** | | Total Floor Area: 44.29m² | |
| **Site Reference :** | Bertram Street | **Plot Reference:** | 06-18-69419 D-0-01 |
| **Address :** | D-0-01, Bertram Street, London | | |

## Client Details:

| | |
|---|---|
| **Name:** | McBains |
| **Address :** | 26 Finsbury Square, London, EC2A 1DS |

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 24.05 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 16.20 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 64.4 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 56.9 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.18 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | OK |
| Roof | (no roof) | | |
| Openings | 1.40 (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: | Community heating schemes - CommCHP |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: West | $7.63m^2$ | |
| Ventilation rate: | 2.00 | |
| Blinds/curtains: | Light-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

## 10 Key features

| | |
|---|---|
| Air permeablility | $3.0 m^3/m^2h$ |
| Community heating, heat from CHP | |

# Predicted Energy Assessment



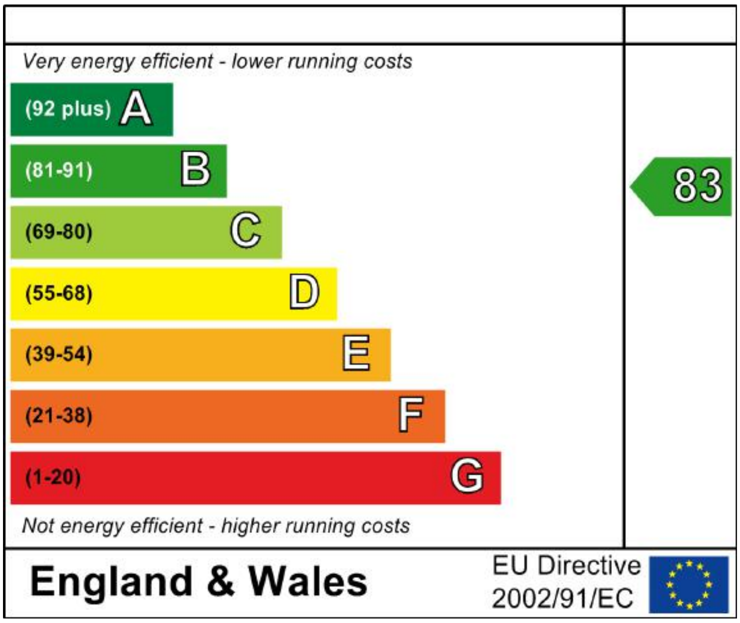
D-0-01
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Ground floor Flat |
| Date of assessment: | 24 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 44.29 m² |

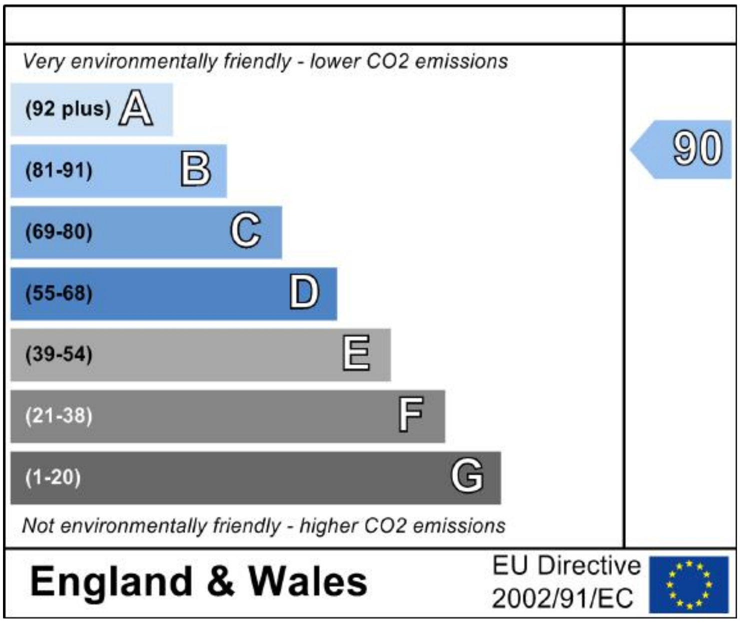
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-0-01

| | |
|---|---|
| Address: | D-0-01, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 24 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 163.84 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 44.29 m² | 2.4 m |
| Living area: | 37.16 m² (fraction 0.839) | |
| Front of dwelling faces: | West | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Front | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Front | 16mm or more | 0.7 | 0.558 | 1.4 | 7.63 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | West | 0 | 0 |
| Front | | External Wall | West | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 65.09 | 9.73 | 55.36 | 0.18 | 0 | False | 14 |
| Ground Floor | 44.29 | | | 0.13 | | | 110 |
| Internal Elements | | | | | | | |
| Stud Walls | 31.2 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Ceiling | 44.29 | | | | | | 30 |

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0966

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 13.8 | 0.05 | E4 | Jamb |
| [Approved] | 27.12 | 0.16 | E5 | Ground floor (normal) |

# SAP Input

| | | | | |
|---|---|---|---|---|
| [Approved] | 27.12 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| | 15.47 | 0.16 | P1 | Ground floor |
| | 15.47 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from boilers – mains gas<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

**User Details:**

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

**Property Address: 06-18-69419 D-0-01**

**Address :** D-0-01, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 44.29 | (1a) x | 2.4 | (2a) = | 106.3 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 44.29 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 106.3 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows | | | 7.63 | x1/[1/( 1.4 )+ 0.04] | | = | 10.12 | | | (27) |
| Floor | | | 44.29 | x | 0.13 | = | 5.7577 | 110 | 4871.9 | (28) |
| Walls | 65.09 | 9.73 | 55.36 | x | 0.18 | = | 9.96 | 14 | 775.04 | (29) |
| Total area of elements, m² | | | 109.38 | | | | | | | (31) |
| Party ceiling | | | 44.29 | | | | | 30 | 1328.7 | (32b) |
| Internal wall ** | | | 31.2 | | | | | 9 | 280.8 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 28.78 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 7256.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 163.84 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 10.57 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 39.34 (37)

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 9.23 | 9.12 | 9 | 8.44 | 8.33 | 7.77 | 7.77 | 7.66 | 8 | 8.33 | 8.56 | 8.78 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 48.57 | 48.46 | 48.35 | 47.79 | 47.68 | 47.12 | 47.12 | 47.01 | 47.34 | 47.68 | 47.9 | 48.13 | |

Average = Sum(39)$_{1…12}$ /12= 47.76 (39)

# SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.1 | 1.09 | 1.09 | 1.08 | 1.08 | 1.06 | 1.06 | 1.06 | 1.07 | 1.08 | 1.08 | 1.09 |

Average = $Sum(40)_{1...12}$ /12= 1.08 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.52 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 70.41 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

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

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 77.45 | 74.63 | 71.81 | 69 | 66.18 | 63.37 | 63.37 | 66.18 | 69 | 71.81 | 74.63 | 77.45 |

Total = $Sum(44)_{1...12}$ = 844.87 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 114.85 | 100.45 | 103.65 | 90.37 | 86.71 | 74.82 | 69.34 | 79.56 | 80.51 | 93.83 | 102.42 | 111.23 |

Total = $Sum(45)_{1...12}$ = 1107.75 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 17.23 | 15.07 | 15.55 | 13.56 | 13.01 | 11.22 | 10.4 | 11.93 | 12.08 | 14.07 | 15.36 | 16.68 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# SAP WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 170.13 | 150.38 | 158.93 | 143.86 | 141.99 | 128.32 | 124.61 | 134.84 | 134.01 | 149.11 | 155.92 | 166.5 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 170.13 | 150.38 | 158.93 | 143.86 | 141.99 | 128.32 | 124.61 | 134.84 | 134.01 | 149.11 | 155.92 | 166.5 | |

Output from water heater (annual)$_{1...12}$ 1758.59 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 82.41 | 73.34 | 78.69 | 72.84 | 73.05 | 67.67 | 67.28 | 70.68 | 69.57 | 75.42 | 76.85 | 81.2 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 30.37 | 26.98 | 21.94 | 16.61 | 12.42 | 10.48 | 11.33 | 14.72 | 19.76 | 25.09 | 29.28 | 31.22 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 197.69 | 199.74 | 194.57 | 183.57 | 169.68 | 156.62 | 147.9 | 145.85 | 151.01 | 162.02 | 175.91 | 188.97 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 110.77 | 109.14 | 105.76 | 101.17 | 98.19 | 93.99 | 90.42 | 95 | 96.62 | 101.37 | 106.74 | 109.15 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 414.99 | 412.02 | 398.44 | 377.51 | 356.44 | 337.25 | 325.81 | 331.72 | 343.56 | 364.64 | 388.09 | 405.49 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 0.9x | 0.77 | x | 7.63 | x | 19.64 | x | 0.56 | x | 0.7 | = | 40.56 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 38.42 | x | 0.56 | x | 0.7 | = | 79.35 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 63.27 | x | 0.56 | x | 0.7 | = | 130.68 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 92.28 | x | 0.56 | x | 0.7 | = | 190.59 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 113.09 | x | 0.56 | x | 0.7 | = | 233.57 | (80) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 0.9x | 0.77 | x | 7.63 | x | 115.77 | x | 0.56 | x | 0.7 | = | 239.1 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 110.22 | x | 0.56 | x | 0.7 | = | 227.64 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 94.68 | x | 0.56 | x | 0.7 | = | 195.54 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 73.59 | x | 0.56 | x | 0.7 | = | 151.99 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 45.59 | x | 0.56 | x | 0.7 | = | 94.16 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 24.49 | x | 0.56 | x | 0.7 | = | 50.58 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 16.15 | x | 0.56 | x | 0.7 | = | 33.36 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 40.56 | 79.35 | 130.68 | 190.59 | 233.57 | 239.1 | 227.64 | 195.54 | 151.99 | 94.16 | 50.58 | 33.36 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 455.55 | 491.37 | 529.12 | 568.1 | 590.02 | 576.36 | 553.44 | 527.26 | 495.54 | 458.8 | 438.67 | 438.85 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.95 | 0.93 | 0.89 | 0.8 | 0.67 | 0.5 | 0.37 | 0.4 | 0.61 | 0.82 | 0.92 | 0.95 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.88 | 20.04 | 20.31 | 20.63 | 20.85 | 20.96 | 20.99 | 20.99 | 20.92 | 20.65 | 20.22 | 19.84 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20 | 20.01 | 20.01 | 20.02 | 20.02 | 20.03 | 20.03 | 20.03 | 20.03 | 20.02 | 20.02 | 20.01 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.94 | 0.91 | 0.86 | 0.76 | 0.62 | 0.43 | 0.29 | 0.32 | 0.54 | 0.78 | 0.9 | 0.94 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.55 | 18.78 | 19.16 | 19.6 | 19.87 | 20 | 20.03 | 20.03 | 19.96 | 19.63 | 19.05 | 18.51 | (90) |

fLA = Living area ÷ (4) = 0.84 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.66 | 19.84 | 20.13 | 20.46 | 20.7 | 20.81 | 20.84 | 20.83 | 20.77 | 20.48 | 20.03 | 19.63 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.66 | 19.84 | 20.13 | 20.46 | 20.7 | 20.81 | 20.84 | 20.83 | 20.77 | 20.48 | 20.03 | 19.63 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.93 | 0.91 | 0.87 | 0.78 | 0.65 | 0.49 | 0.36 | 0.39 | 0.59 | 0.8 | 0.9 | 0.94 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 425 | 447.95 | 459.07 | 443.77 | 384.74 | 281.56 | 197.06 | 204.83 | 292.81 | 368.39 | 396.14 | 412.28 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 746.27 | 723.9 | 658.84 | 552.68 | 428.88 | 292.54 | 199.58 | 208.37 | 315.69 | 471.25 | 619.5 | 742.49 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 239.03 | 185.44 | 148.63 | 78.42 | 32.84 | 0 | 0 | 0 | 0 | 76.53 | 160.82 | 245.67 | |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1167.37 | (98) |
| Space heating requirement in kWh/m²/year | | 26.36 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1167.37 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 735.45 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 490.3 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1758.59 | |
| If DHW from community scheme: Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1107.91 | (310a) |
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 738.61 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 30.72 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 85.91 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 85.91 | (331) |
| Energy for lighting (calculated in Appendix L) | | 214.57 | (332) |

## 10b. Fuel costs – Community heating scheme

| | Fuel kWh/year | Fuel Price (Table 12) | Fuel Cost £/year |
|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 2.97 | x 0.01 = | 21.84 | (340a) |
| Space heating from heat source 2 | (307b) x | 4.24 | x 0.01 = | 20.79 | (340b) |
| Water heating from CHP | (310a) x | 2.97 | x 0.01 = | 32.91 | (342a) |
| Water heating from heat source 2 | (310b) x | 4.24 | x 0.01 = | 31.32 | (342b) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 11.33 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 28.3 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 266.49 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.25 | (357) |
| **SAP rating (section12)** | | 82.51 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| Electrical efficiency of CHP unit | | | | | 29.8 | (361) |
| Heat efficiency of CHP unit | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Emission factor kg CO2/kWh** | **Emissions kg CO2/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1276.82 | x | 0.22 | 275.79 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 380.49 | x | 0.52 | -197.47 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 1923.46 | x | 0.22 | 415.47 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 573.19 | x | 0.52 | -297.49 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 0.22 = | 291.7 | (368) |
| Electrical energy for heat distribution | [(313) x | | | 0.52 = | 15.95 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 503.94 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | | 0 = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | | 0.22 = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 503.94 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | | 0.52 = | 44.59 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | | 0.52 = | 111.36 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 659.89 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 14.9 | (384) |
| **EI rating (section 14)** | | | | | 90.1 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | |
|---|---|---|
| **Electrical efficiency of CHP unit** | 29.8 | (361) |

# SAP WorkSheet: New dwelling design stage

| | | Energy kWh/year | | Primary factor | | P.Energy kWh/year | |
|---|---|---|---|---|---|---|---|
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1276.82 | x | 1.22 | | 1557.72 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 380.49 | x | 3.07 | | -1168.11 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 1923.46 | x | 1.22 | | 2346.62 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 573.19 | x | 3.07 | | -1759.7 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1647.55 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 94.32 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 2718.4 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 2718.4 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 2718.4 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 263.76 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 658.73 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | | 3640.88 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 D-0-01

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | West |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 163.84 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Light-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 2 ( Windows open half the time) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 70.16 | **(P1)** |
| **Transmission heat loss coefficient:** | 39.3 | |
| **Summer heat loss coefficient:** | 109.5 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Front) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Front) | 0.6 | 0.9 | 1 | 0.54 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Front) | 0.9 x | 7.63 | 117.51 | 0.56 | 0.7 | 0.54 | 170.2 | |
| | | | | | | **Total** | 170.2 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 337.25 | 325.81 | 331.72 | |
| Total summer gains | 517.92 | 496.01 | 481.46 | **(P5)** |
| Summer gain/loss ratio | 4.73 | 4.53 | 4.4 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 0.85 | 0.85 | 0.85 | |
| Threshold temperature | 21.58 | 23.28 | 23.05 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:25:40*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 51.14m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 D-1-01

**Address :** D-1-01, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 20.04 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 14.10 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 51.1 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 47.4 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.13 (max. 0.25) | 0.13 (max. 0.70) | OK |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: West | 7.63m² | |
| Windows facing: East | 8.4m² | |
| Ventilation rate: | 6.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from CHP | |

# Predicted Energy Assessment

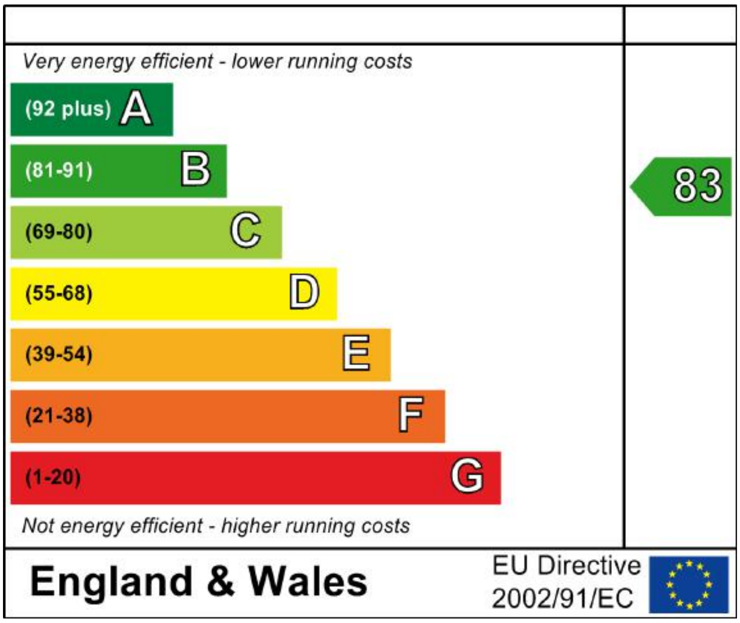
D-1-01
Bertram Street
London

Dwelling type: Mid floor Flat
Date of assessment: 24 January 2019
Produced by: Matthew Stainrod
Total floor area: 51.14 m²

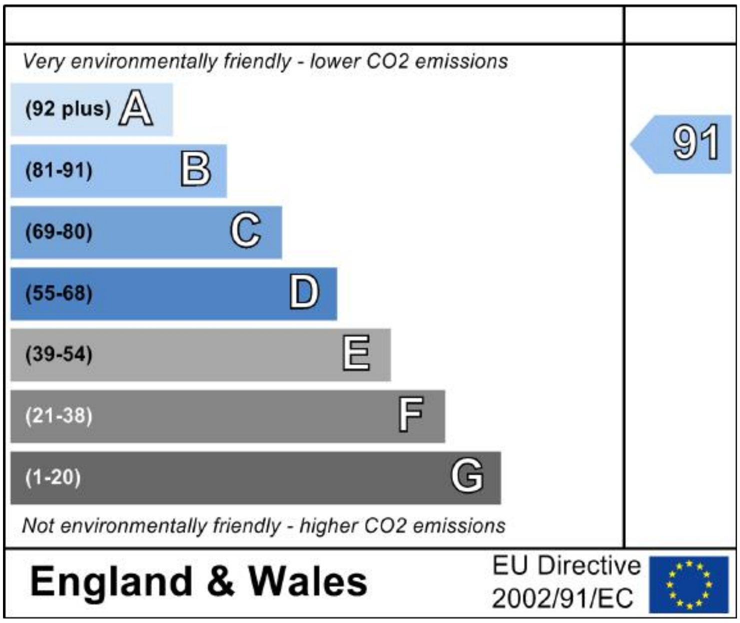
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-1-01

| | |
|---|---|
| Address: | D-1-01, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 24 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 102.37 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | |
|---|---|
| Dwelling type: | Flat |
| Detachment: | |
| Year Completed: | 2018 |

| Floor Location: | Floor area: | Storey height: |
|---|---|---|
| Floor 0 | 51.14 m² | 2.4 m |

| | |
|---|---|
| Living area: | 24.52 m² (fraction 0.479) |
| Front of dwelling faces: | South |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Front | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Front | 16mm or more | 0.7 | 0.558 | 1.4 | 7.63 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 8.4 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | Stair Wall | South | 0 | 0 |
| Front | | External Wall | West | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 53.01 | 16.03 | 36.98 | 0.18 | 0 | False | 14 |
| Stair Wall | 20.97 | 2.1 | 18.87 | 0.18 | 0.9 | False | 14 |
| Exposed Floor | 6.3 | | | 0.13 | | | 75 |
| Internal Elements | | | | | | | |
| Stud Walls | 60 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 5.64 | | | | | | 20 |
| Party Ceiling | 51.14 | | | | | | 30 |
| Party Floor | 44.84 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1004

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 18.6 | 0.05 | E4 | Jamb |
| [Approved] | 55.98 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 5.67 | 0.32 | E20 | Exposed floor (normal) |
| | 2.35 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 2.35 | 0.16 | P7 | Exposed floor (normal) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 D-1-01

**Address :** D-1-01, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 51.14 | (1a) x | 2.4 | (2a) = | 122.74 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 51.14 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 122.74 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

| | | |
|---|---|---|
| If mechanical ventilation: | 0.5 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0.5 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 79.9 | (23c) |

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 7.63 | x1/[1/( 1.4 )+ 0.04] | | = | 10.12 | | | (27) |
| Windows Type 2 | | | 8.4 | x1/[1/( 1.4 )+ 0.04] | | = | 11.14 | | | (27) |
| Floor | | | 6.3 | x | 0.13 | = | 0.819 | 75 | 472.5 | (28) |
| Walls Type1 | 53.01 | 16.03 | 36.98 | x | 0.18 | = | 6.66 | 14 | 517.72 | (29) |
| Walls Type2 | 20.97 | 2.1 | 18.87 | x | 0.15 | = | 2.92 | 14 | 264.18 | (29) |
| Total area of elements, m² | | | 80.28 | | | | | | | (31) |
| Party wall | | | 5.64 | x | 0 | = | 0 | 20 | 112.8 | (32) |
| Party floor | | | 44.84 | | | | | 40 | 1793.6 | (32a) |
| Party ceiling | | | 51.14 | | | | | 30 | 1534.2 | (32b) |
| Internal wall ** | | | 60 | | | | | 9 | 540 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

| | | | |
|---|---|---|---|
| Fabric heat loss, W/K = S (A x U) | (26)…(30) + (32) = | 34.59 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 5235 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 102.37 | (35) |

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

| | | | |
|---|---|---|---|
| Thermal bridges : S (L x Y) calculated using Appendix K | | 8.06 | (36) |

*if details of thermal bridging are not known (36) = 0.15 x (31)*

| | | | |
|---|---|---|---|
| Total fabric heat loss | (33) + (36) = | 42.65 | (37) |

# SAP WorkSheet: New dwelling design stage

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.65 | 10.53 | 10.4 | 9.75 | 9.62 | 8.98 | 8.98 | 8.85 | 9.23 | 9.62 | 9.88 | 10.14 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 53.3 | 53.18 | 53.05 | 52.4 | 52.27 | 51.63 | 51.63 | 51.5 | 51.88 | 52.27 | 52.53 | 52.79 | |

Average = Sum(39)1…12 /12= 52.37 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.04 | 1.04 | 1.04 | 1.02 | 1.02 | 1.01 | 1.01 | 1.01 | 1.01 | 1.02 | 1.03 | 1.03 | |

Average = Sum(40)1…12 /12= 1.02 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.72 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.14 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)* | | | | | | | | | | | | | |
| (44)m= | 82.65 | 79.65 | 76.64 | 73.64 | 70.63 | 67.62 | 67.62 | 70.63 | 73.64 | 76.64 | 79.65 | 82.65 | |

Total = Sum(44)1…12 = 901.65 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 122.57 | 107.2 | 110.62 | 96.44 | 92.54 | 79.85 | 74 | 84.91 | 85.93 | 100.14 | 109.31 | 118.7 | |

Total = Sum(45)1…12 = 1182.21 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.39 | 16.08 | 16.59 | 14.47 | 13.88 | 11.98 | 11.1 | 12.74 | 12.89 | 15.02 | 16.4 | 17.81 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 177.85 | 157.13 | 165.9 | 149.94 | 147.82 | 133.35 | 129.27 | 140.19 | 139.42 | 155.42 | 162.8 | 173.98 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 177.85 | 157.13 | 165.9 | 149.94 | 147.82 | 133.35 | 129.27 | 140.19 | 139.42 | 155.42 | 162.8 | 173.98 |

Output from water heater (annual)$_{1...12}$ — 1833.05 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.98 | 75.59 | 81 | 74.86 | 74.99 | 69.35 | 68.83 | 72.45 | 71.37 | 77.52 | 79.14 | 83.69 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 33.47 | 29.73 | 24.18 | 18.31 | 13.68 | 11.55 | 12.48 | 16.23 | 21.78 | 27.65 | 32.27 | 34.41 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 224.17 | 226.5 | 220.63 | 208.16 | 192.4 | 177.6 | 167.71 | 165.38 | 171.24 | 183.72 | 199.47 | 214.28 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 114.22 | 112.48 | 108.88 | 103.98 | 100.79 | 96.31 | 92.51 | 97.39 | 99.12 | 104.19 | 109.92 | 112.49 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 453.4 | 450.25 | 435.23 | 411.98 | 388.42 | 367 | 354.24 | 360.53 | 373.68 | 397.1 | 423.2 | 442.71 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | Access Factor Table 6d | Area m² | Flux Table 6a | g_ Table 6b | FF Table 6c | Gains (W) |
|---|---|---|---|---|---|---|

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 8.4 | x | 19.64 | x | 0.56 | x | 0.7 | = | 44.66 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 38.42 | x | 0.56 | x | 0.7 | = | 87.36 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 63.27 | x | 0.56 | x | 0.7 | = | 143.87 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 92.28 | x | 0.56 | x | 0.7 | = | 209.82 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 113.09 | x | 0.56 | x | 0.7 | = | 257.15 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 115.77 | x | 0.56 | x | 0.7 | = | 263.23 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 110.22 | x | 0.56 | x | 0.7 | = | 250.61 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 94.68 | x | 0.56 | x | 0.7 | = | 215.27 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 73.59 | x | 0.56 | x | 0.7 | = | 167.32 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 45.59 | x | 0.56 | x | 0.7 | = | 103.66 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 24.49 | x | 0.56 | x | 0.7 | = | 55.68 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 16.15 | x | 0.56 | x | 0.7 | = | 36.72 | (76) |
| West | 0.9x | 0.77 | x | 7.63 | x | 19.64 | x | 0.56 | x | 0.7 | = | 40.56 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 38.42 | x | 0.56 | x | 0.7 | = | 79.35 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 63.27 | x | 0.56 | x | 0.7 | = | 130.68 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 92.28 | x | 0.56 | x | 0.7 | = | 190.59 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 113.09 | x | 0.56 | x | 0.7 | = | 233.57 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 115.77 | x | 0.56 | x | 0.7 | = | 239.1 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 110.22 | x | 0.56 | x | 0.7 | = | 227.64 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 94.68 | x | 0.56 | x | 0.7 | = | 195.54 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 73.59 | x | 0.56 | x | 0.7 | = | 151.99 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 45.59 | x | 0.56 | x | 0.7 | = | 94.16 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 24.49 | x | 0.56 | x | 0.7 | = | 50.58 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 16.15 | x | 0.56 | x | 0.7 | = | 33.36 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 85.22 | 166.71 | 274.55 | 400.41 | 490.72 | 502.34 | 478.25 | 410.81 | 319.31 | 197.82 | 106.26 | 70.08 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 538.62 | 616.96 | 709.78 | 812.39 | 879.14 | 869.34 | 832.48 | 771.34 | 692.99 | 594.92 | 529.47 | 512.79 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.89 | 0.84 | 0.77 | 0.64 | 0.5 | 0.37 | 0.27 | 0.3 | 0.48 | 0.71 | 0.84 | 0.9 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.53 | 19.8 | 20.2 | 20.6 | 20.84 | 20.95 | 20.99 | 20.98 | 20.9 | 20.56 | 19.98 | 19.47 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.05 | 20.05 | 20.05 | 20.06 | 20.06 | 20.08 | 20.08 | 20.08 | 20.07 | 20.06 | 20.06 | 20.06 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.87 | 0.83 | 0.74 | 0.61 | 0.46 | 0.32 | 0.21 | 0.24 | 0.42 | 0.67 | 0.82 | 0.89 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.12 | 18.5 | 19.05 | 19.59 | 19.9 | 20.04 | 20.07 | 20.06 | 19.98 | 19.55 | 18.77 | 18.05 | (90) |

fLA = Living area ÷ (4) = 0.48 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.79 | 19.13 | 19.6 | 20.07 | 20.35 | 20.48 | 20.51 | 20.5 | 20.42 | 20.03 | 19.35 | 18.73 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.79 | 19.13 | 19.6 | 20.07 | 20.35 | 20.48 | 20.51 | 20.5 | 20.42 | 20.03 | 19.35 | 18.73 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.85 | 0.81 | 0.73 | 0.61 | 0.47 | 0.34 | 0.24 | 0.27 | 0.44 | 0.67 | 0.81 | 0.87 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 459.71 | 498.74 | 518.73 | 495.79 | 416.42 | 293.61 | 199.11 | 207.61 | 306.47 | 397.23 | 427.44 | 443.82 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 772.56 | 756.46 | 694.86 | 585.52 | 452.05 | 303.31 | 201.71 | 211.31 | 327.84 | 493.15 | 643.7 | 766.94 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 232.76 | 173.19 | 131.04 | 64.61 | 26.51 | 0 | 0 | 0 | 0 | 71.37 | 155.7 | 240.4 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1095.57 (98)

Space heating requirement in kWh/m²/year 21.42 (99)

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1095.57 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 690.21 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 460.14 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1833.05 | |
| If DHW from community scheme: | | | |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1154.82 | (310a) |
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 769.88 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 30.75 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 99.2 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 99.2 | (331) |
| Energy for lighting (calculated in Appendix L) | | 236.47 | (332) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 2.97 | x 0.01 = | 20.5 | (340a) |
| Space heating from heat source 2 | (307b) | x | 4.24 | x 0.01 = | 19.51 | (340b) |
| Water heating from CHP | (310a) | x | 2.97 | x 0.01 = | 34.3 | (342a) |
| Water heating from heat source 2 | (310b) | x | 4.24 | x 0.01 = | 32.64 | (342b) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 13.08 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 31.19 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 271.23 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.18 | (357) |
| **SAP rating (section12)** | | 83.47 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| Electrical efficiency of CHP unit | | | | | 29.8 | (361) |
| Heat efficiency of CHP unit | | | | | 57.6 | (362) |
| | | **Energy** kWh/year | | **Emission factor** kg CO2/kWh | **Emissions** kg CO2/year | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1198.28 | x | 0.22 | 258.83 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 357.09 | x | 0.52 | -185.33 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2004.9 | x | 0.22 | 433.06 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 597.46 | x | 0.52 | -310.08 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | 0.22 | = | 291.96 | (368) |
| Electrical energy for heat distribution | [(313) x | 0.52 | = | 15.96 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 504.4 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 504.4 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 51.49 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 122.73 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 678.61 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 13.27 | (384) |
| **EI rating (section 14)** | | | | 90.54 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1198.28 | x | 1.22 | 1461.9 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 357.09 | x | 3.07 | -1096.25 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2004.9 | x | 1.22 | 2445.98 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 597.46 | x | 3.07 | -1834.2 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 = | 1649.04 | (368) |
| Electrical energy for heat distribution | [(313) x | | | = | 94.4 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | = | 2720.86 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | 2720.86 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | 2720.86 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 = | 304.55 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 = | 725.96 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | 3751.37 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 D-1-01

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | Yes |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | South |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 102.37 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 6 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 243.02 | **(P1)** |
| **Transmission heat loss coefficient:** | 42.6 | |
| **Summer heat loss coefficient:** | 285.67 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Front) | 0 | 1 |
| East (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Front) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Front) | 0.9 x | 7.63 | 117.51 | 0.56 | 0.7 | 0.76 | 241.12 | |
| East (Rear) | 0.9 x | 8.4 | 117.51 | 0.56 | 0.7 | 0.76 | 265.45 | |
| | | | | | | **Total** | 506.56 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 367 | 354.24 | 360.53 | |
| Total summer gains | 904.73 | 860.8 | 806.19 | **(P5)** |
| Summer gain/loss ratio | 3.17 | 3.01 | 2.82 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.28 | 1.28 | 1.28 | |
| Threshold temperature | 20.45 | 22.2 | 21.91 | **(P7)** |
| **Likelihood of high internal temperature** | **Not significant** | **Medium** | **Slight** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:25:30*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 50.27m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 D-1-02

**Address :** D-1-02, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 18.15 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 13.06 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 39.9 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 39.6 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |

Based on:

| | |
|---|---|
| Overshading: | Average or unknown |
| Windows facing: South | 16.03m² |
| Ventilation rate: | 4.00 |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from CHP | |

# Predicted Energy Assessment

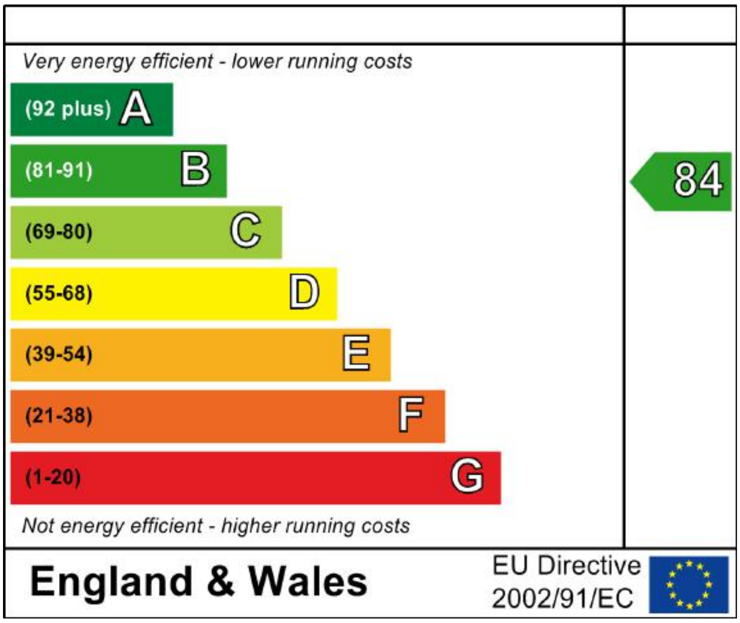
D-1-02
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Mid floor Flat |
| Date of assessment: | 24 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 50.27 m² |

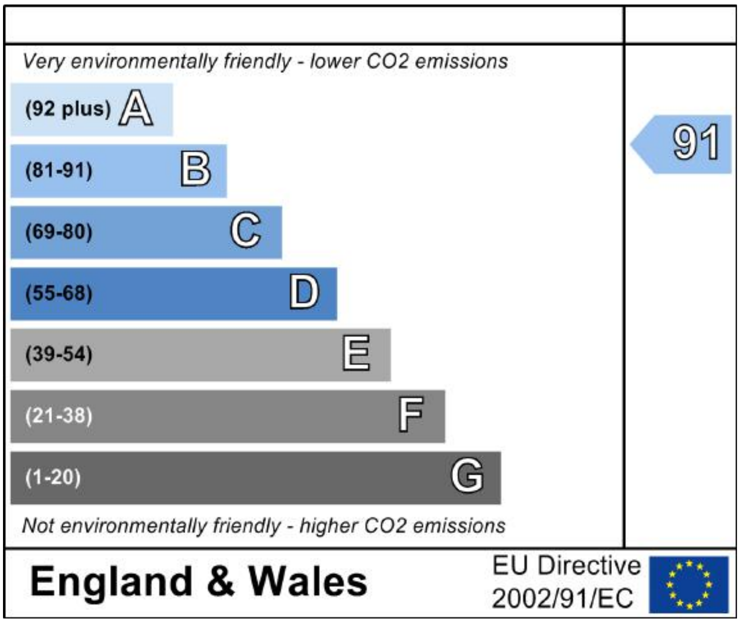
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide ($CO_2$) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide ($CO_2$) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-1-02

| | |
|---|---|
| Address: | D-1-02, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 24 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 98.25 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 50.27 m² | 2.4 m |
| Living area: | 22.61 m² (fraction 0.45) | |
| Front of dwelling faces: | North | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 16.03 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | Stair Wall | North | 0 | 0 |
| Side | | External Wall | South | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| <u>External Elements</u> | | | | | | | |
| External Wall | 53.18 | 16.03 | 37.15 | 0.18 | 0 | False | 14 |
| Stair Wall | 15.06 | 2.1 | 12.96 | 0.18 | 0.9 | False | 14 |
| <u>Internal Elements</u> | | | | | | | |
| Stud Walls | 67.2 | | | | | | 9 |
| <u>Party Elements</u> | | | | | | | |
| Party Wall | 5.7 | | | | | | 20 |
| Party Ceiling | 50.27 | | | | | | 30 |
| Party Floor | 50.27 | | | | | | 40 |

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1181

| | **Length** | **Psi-value** | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |

# SAP Input

| | | | | |
|---|---|---|---|---|
| [Approved] | 18.6 | 0.05 | E4 | Jamb |
| [Approved] | 55.98 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 5.67 | 0.32 | E20 | Exposed floor (normal) |
| | 2.35 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 2.35 | 0.16 | P7 | Exposed floor (normal) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 3 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

## Property Address: 06-18-69419 D-1-02

**Address :** D-1-02, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 50.27 | (1a) x | 2.4 | (2a) = | 120.65 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 50.27 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 120.65 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = | (6a)+(6b)+(7a)+(7b)+(7c) = 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 3 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.78 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.12 | (21) |

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.15 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.12 | 0.12 | 0.13 | 0.14 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows | | | 16.03 | x1/[1/( 1.4 )+ 0.04] | | = | 21.25 | | | (27) |
| Walls Type1 | 53.18 | 16.03 | 37.15 | x | 0.18 | = | 6.69 | 14 | 520.1 | (29) |
| Walls Type2 | 15.06 | 2.1 | 12.96 | x | 0.15 | = | 2.01 | 14 | 181.44 | (29) |
| Total area of elements, m² | | | 68.24 | | | | | | | (31) |
| Party wall | | | 5.7 | x | 0 | = | 0 | 20 | 114 | (32) |
| Party floor | | | 50.27 | | | | | 40 | 2010.8 | (32a) |
| Party ceiling | | | 50.27 | | | | | 30 | 1508.1 | (32b) |
| Internal wall ** | | | 67.2 | | | | | 9 | 604.8 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.89 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 4939.24 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 98.25 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 8.06 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 40.95 (37)

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 9.9 | 9.79 | 9.67 | 9.09 | 8.98 | 8.4 | 8.4 | 8.28 | 8.63 | 8.98 | 9.21 | 9.44 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 50.85 | 50.73 | 50.62 | 50.04 | 49.92 | 49.34 | 49.34 | 49.23 | 49.58 | 49.92 | 50.15 | 50.39 | |

Average = Sum(39)$_{1…12}$ /12= 50.01 (39)

# SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.01 | 1.01 | 1.01 | 1 | 0.99 | 0.98 | 0.98 | 0.98 | 0.99 | 0.99 | 1 | 1 |

Average = Sum(40)$_{1…12}$ /12= 0.99 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 74.53 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)* | | | | | | | | | | | | | |
| (44)m= | 81.98 | 79 | 76.02 | 73.04 | 70.06 | 67.08 | 67.08 | 70.06 | 73.04 | 76.02 | 79 | 81.98 | |
| | | | | | | | | | | Total = Sum(44)$_{1…12}$ = | | 894.34 | (44) |
| *Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)* | | | | | | | | | | | | | |
| (45)m= | 121.58 | 106.33 | 109.72 | 95.66 | 91.79 | 79.21 | 73.4 | 84.22 | 85.23 | 99.33 | 108.42 | 117.74 | |
| | | | | | | | | | | Total = Sum(45)$_{1…12}$ = | | 1172.63 | (45) |
| *If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)* | | | | | | | | | | | | | |
| (46)m= | 18.24 | 15.95 | 16.46 | 14.35 | 13.77 | 11.88 | 11.01 | 12.63 | 12.78 | 14.9 | 16.26 | 17.66 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = — 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |
| If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H | | | | | | | | | | | | | |
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 176.85 | 156.26 | 165 | 149.15 | 147.07 | 132.7 | 128.67 | 139.5 | 138.72 | 154.6 | 161.92 | 173.02 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 176.85 | 156.26 | 165 | 149.15 | 147.07 | 132.7 | 128.67 | 139.5 | 138.72 | 154.6 | 161.92 | 173.02 | |

Output from water heater (annual)$_{1...12}$ 1823.47 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.65 | 75.3 | 80.7 | 74.6 | 74.74 | 69.13 | 68.63 | 72.23 | 71.13 | 77.25 | 78.85 | 83.37 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 32.97 | 29.28 | 23.82 | 18.03 | 13.48 | 11.38 | 12.29 | 15.98 | 21.45 | 27.24 | 31.79 | 33.89 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 220.8 | 223.09 | 217.32 | 205.02 | 189.51 | 174.93 | 165.18 | 162.89 | 168.67 | 180.96 | 196.47 | 211.06 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 113.77 | 112.05 | 108.47 | 103.61 | 100.46 | 96.02 | 92.24 | 97.08 | 98.8 | 103.83 | 109.51 | 112.06 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 448.39 | 445.27 | 430.45 | 407.52 | 384.29 | 363.17 | 350.56 | 356.8 | 369.76 | 392.87 | 418.62 | 437.85 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South | 0.9x | 0.77 | x | 16.03 | x | 46.75 | x | 0.56 | x | 0.7 | = | 202.86 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 76.57 | x | 0.56 | x | 0.7 | = | 332.24 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 97.53 | x | 0.56 | x | 0.7 | = | 423.21 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 110.23 | x | 0.56 | x | 0.7 | = | 478.32 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 114.87 | x | 0.56 | x | 0.7 | = | 498.44 | (78) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South | 0.9x | 0.77 | x | 16.03 | x | 110.55 | x | 0.56 | x | 0.7 | = | 479.68 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 108.01 | x | 0.56 | x | 0.7 | = | 468.67 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 104.89 | x | 0.56 | x | 0.7 | = | 455.15 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 101.89 | x | 0.56 | x | 0.7 | = | 442.09 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 82.59 | x | 0.56 | x | 0.7 | = | 358.35 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 55.42 | x | 0.56 | x | 0.7 | = | 240.46 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 40.4 | x | 0.56 | x | 0.7 | = | 175.29 | (78) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 202.86 | 332.24 | 423.21 | 478.32 | 498.44 | 479.68 | 468.67 | 455.15 | 442.09 | 358.35 | 240.46 | 175.29 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 651.25 | 777.51 | 853.66 | 885.83 | 882.73 | 842.84 | 819.24 | 811.95 | 811.85 | 751.22 | 659.08 | 613.14 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.83 | 0.75 | 0.68 | 0.59 | 0.48 | 0.36 | 0.26 | 0.27 | 0.4 | 0.59 | 0.76 | 0.84 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.82 | 20.13 | 20.42 | 20.68 | 20.85 | 20.95 | 20.99 | 20.98 | 20.93 | 20.72 | 20.25 | 19.75 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.07 | 20.08 | 20.08 | 20.09 | 20.09 | 20.1 | 20.1 | 20.1 | 20.09 | 20.09 | 20.09 | 20.08 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.81 | 0.73 | 0.65 | 0.56 | 0.44 | 0.31 | 0.21 | 0.22 | 0.35 | 0.55 | 0.73 | 0.83 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.55 | 18.97 | 19.36 | 19.71 | 19.93 | 20.06 | 20.09 | 20.09 | 20.03 | 19.77 | 19.15 | 18.45 | (90) |

fLA = Living area ÷ (4) = | 0.45 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.12 | 19.49 | 19.84 | 20.14 | 20.35 | 20.46 | 20.49 | 20.49 | 20.44 | 20.2 | 19.65 | 19.04 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.12 | 19.49 | 19.84 | 20.14 | 20.35 | 20.46 | 20.49 | 20.49 | 20.44 | 20.2 | 19.65 | 19.04 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.79 | 0.72 | 0.65 | 0.56 | 0.45 | 0.33 | 0.23 | 0.24 | 0.37 | 0.56 | 0.72 | 0.81 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 513.16 | 558.82 | 551.34 | 493.62 | 400.53 | 280.06 | 189.74 | 198.59 | 300.93 | 420 | 475.33 | 494.23 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 753.68 | 740.33 | 674.99 | 562.64 | 431.61 | 289.18 | 192.09 | 201.43 | 314.21 | 479.08 | 629.35 | 747.61 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 178.94 | 121.98 | 92 | 49.69 | 23.12 | 0 | 0 | 0 | 0 | 43.96 | 110.9 | 188.51 | (98) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = | 809.09 | (98) |
| Space heating requirement in kWh/m²/year | | 16.09 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 809.09 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 509.73 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 339.82 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1823.47 | |
| If DHW from community scheme: Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1148.78 | (310a) |
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 765.86 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 27.64 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 97.51 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 97.51 | (331) |
| Energy for lighting (calculated in Appendix L) | | 232.91 | (332) |

## 10b. Fuel costs – Community heating scheme

| | Fuel kWh/year | Fuel Price (Table 12) | Fuel Cost £/year |
|---|---|---|---|

# SAP WorkSheet: New dwelling design stage

| | | | | | | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 2.97 | x 0.01 = | 15.14 | (340a) |
| Space heating from heat source 2 | (307b) | x | 4.24 | x 0.01 = | 14.41 | (340b) |
| Water heating from CHP | (310a) | x | 2.97 | x 0.01 = | 34.12 | (342a) |
| Water heating from heat source 2 | (310b) | x | 4.24 | x 0.01 = | 32.47 | (342b) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 12.86 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 30.72 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 259.72 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.14 | (357) |
| **SAP rating (section12)** | | 84.03 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Electrical efficiency of CHP unit | | | | | | 29.8 | (361) |
| Heat efficiency of CHP unit | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Emission factor kg CO2/kWh** | | **Emissions kg CO2/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 884.94 | x | 0.22 | | 191.15 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 263.71 | x | 0.52 | | -136.87 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 1994.42 | x | 0.22 | | 430.79 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 594.34 | x | 0.52 | | -308.46 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 0.22 | = | 262.45 | (368) |
| Electrical energy for heat distribution | [(313) x | | | 0.52 | = | 14.35 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | | = | 453.41 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | | 453.41 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | | 0.52 | = | 50.61 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | | 0.52 | = | 120.88 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | | 624.9 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | | 12.43 | (384) |
| **EI rating (section 14)** | | | | | | 91.21 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | |
|---|---|---|
| **Electrical efficiency of CHP unit** | 29.8 | (361) |

# SAP WorkSheet: New dwelling design stage

| | | Energy kWh/year | | Primary factor | | P.Energy kWh/year | |
|---|---|---|---|---|---|---|---|
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 884.94 | x | 1.22 | | 1079.63 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 263.71 | x | 3.07 | | -809.6 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 1994.42 | x | 1.22 | | 2433.19 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 594.34 | x | 3.07 | | -1824.61 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1482.33 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 84.86 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 2445.8 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 2445.8 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 2445.8 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 299.37 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 715.04 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | | 3460.21 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 D-1-02

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | North |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 98.25 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 159.26 | **(P1)** |
| **Transmission heat loss coefficient:** | 40.9 | |
| **Summer heat loss coefficient:** | 200.2 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| South (Side) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| South (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| South (Side) | 0.9 x | 16.03 | 112.21 | 0.56 | 0.7 | 0.76 | 483.71 | |
| | | | | | | **Total** | 483.71 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 363.17 | 350.56 | 356.8 | |
| Total summer gains | 864.57 | 834.28 | 834.05 | **(P5)** |
| Summer gain/loss ratio | 4.32 | 4.17 | 4.17 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.31 | 1.31 | 1.31 | |
| Threshold temperature | 21.63 | 23.38 | 23.28 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:25:21*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 51.14m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 D-2-01

**Address :** D-2-01, Bertram Street, London

## Client Details:

**Name:** McBains
**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 19.4 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 13.71 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 47.8 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 45.0 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | **OK** |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |

Based on:

| | |
|---|---|
| Overshading: | Average or unknown |
| Windows facing: West | 7.63m² |
| Windows facing: East | 8.4m² |
| Ventilation rate: | 6.00 |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from CHP | |

# Predicted Energy Assessment

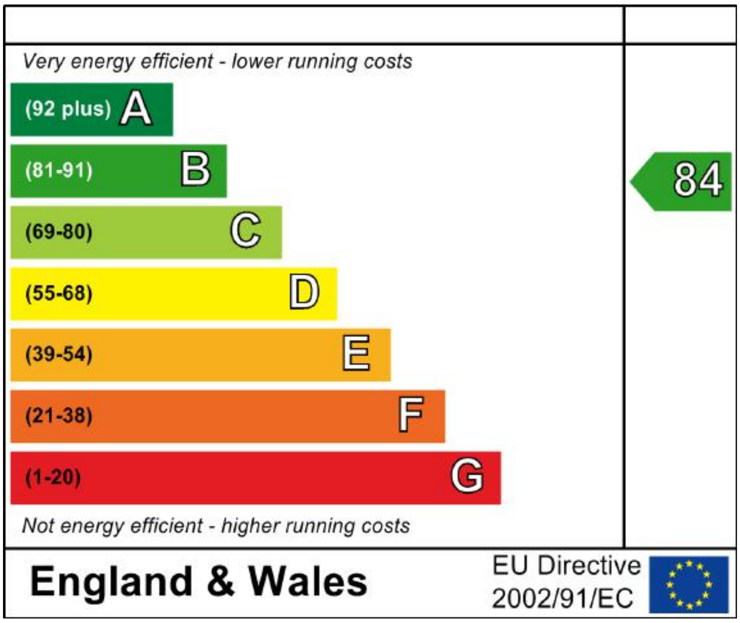
D-2-01
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Mid floor Flat |
| Date of assessment: | 24 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 51.14 m² |

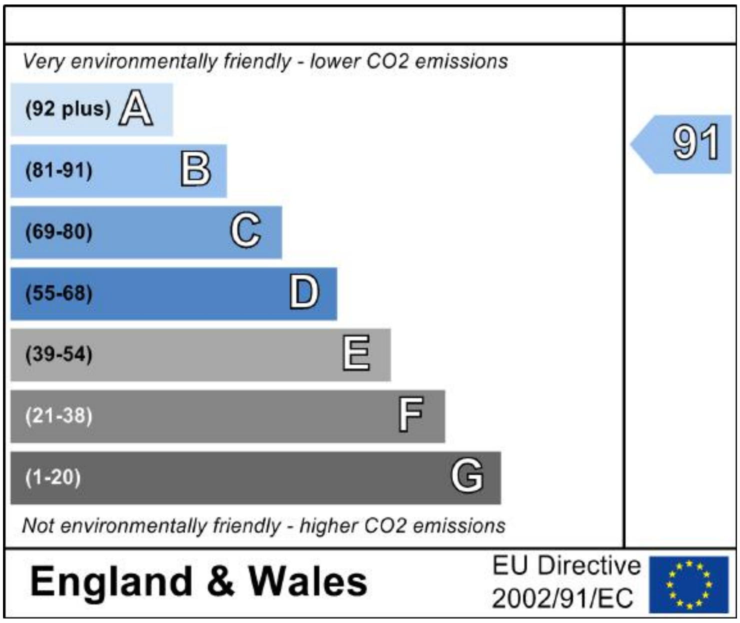
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-2-01

| | |
|---|---|
| Address: | D-2-01, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 24 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 98.05 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 51.14 m² | 2.4 m |
| Living area: | 24.52 m² (fraction 0.479) | |
| Front of dwelling faces: | South | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Front | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Front | 16mm or more | 0.7 | 0.558 | 1.4 | 7.63 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 8.4 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | Stair Wall | South | 0 | 0 |
| Front | | External Wall | West | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 53.01 | 16.03 | 36.98 | 0.18 | 0 | False | 14 |
| Stair Wall | 20.97 | 2.1 | 18.87 | 0.18 | 0.9 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 60 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 5.64 | | | | | | 20 |
| Party Ceiling | 51.14 | | | | | | 30 |
| Party Floor | 51.14 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0847

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 18.6 | 0.05 | E4 | Jamb |
| [Approved] | 61.65 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 4.7 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, Rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 3

## Main heating system:

Main heating system: Community heating schemes
Heat source: Community CHP
heat from CHP, heat fraction 0.6, efficiency 57.6
Heat source: Community boilers
heat from boilers – mains gas, heat fraction 0.4, efficiency 91
Piping>=1991, pre-insulated, low temp, variable flow

## Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and TRVs
Control code: 2306

## Secondary heating system:

Secondary heating system: None

## Water heating:

Water heating: From main heating system
Water code: 901
Fuel :heat from CHP
No hot water cylinder
Solar panel: False

## Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Dense urban
EPC language: English
Wind turbine: No
Photovoltaics: None
Assess Zero Carbon Home: No

# SAP WorkSheet: New dwelling design stage

**User Details:**

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

**Property Address: 06-18-69419 D-2-01**

**Address :** D-2-01, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 51.14 | (1a) x | 2.4 | (2a) = | 122.74 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 51.14 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 122.74 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 7.63 | x1/[1/( 1.4 )+ 0.04] | | = | 10.12 | | | (27) |
| Windows Type 2 | | | 8.4 | x1/[1/( 1.4 )+ 0.04] | | = | 11.14 | | | (27) |
| Walls Type1 | 53.01 | 16.03 | 36.98 | x | 0.18 | = | 6.66 | 14 | 517.72 | (29) |
| Walls Type2 | 20.97 | 2.1 | 18.87 | x | 0.15 | = | 2.92 | 14 | 264.18 | (29) |
| Total area of elements, m² | | | 73.98 | | | | | | | (31) |
| Party wall | | | 5.64 | x | 0 | = | 0 | 20 | 112.8 | (32) |
| Party floor | | | 51.14 | | | | | 40 | 2045.6 | (32a) |
| Party ceiling | | | 51.14 | | | | | 30 | 1534.2 | (32b) |
| Internal wall ** | | | 60 | | | | | 9 | 540 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 33.77 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 5014.5 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 98.05 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 6.27 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 40.04 (37)

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.65 | 10.53 | 10.4 | 9.75 | 9.62 | 8.98 | 8.98 | 8.85 | 9.23 | 9.62 | 9.88 | 10.14 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 50.69 | 50.56 | 50.43 | 49.79 | 49.66 | 49.01 | 49.01 | 48.88 | 49.27 | 49.66 | 49.92 | 50.18 | |

Average = $Sum(39)_{1...12}$ /12= 49.76 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.99 | 0.99 | 0.99 | 0.97 | 0.97 | 0.96 | 0.96 | 0.96 | 0.96 | 0.97 | 0.98 | 0.98 |

Average = $Sum(40)_{1...12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.72 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.14 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

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

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 82.65 | 79.65 | 76.64 | 73.64 | 70.63 | 67.62 | 67.62 | 70.63 | 73.64 | 76.64 | 79.65 | 82.65 |

Total = $Sum(44)_{1...12}$ = 901.65 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 122.57 | 107.2 | 110.62 | 96.44 | 92.54 | 79.85 | 74 | 84.91 | 85.93 | 100.14 | 109.31 | 118.7 |

Total = $Sum(45)_{1...12}$ = 1182.21 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.39 | 16.08 | 16.59 | 14.47 | 13.88 | 11.98 | 11.1 | 12.74 | 12.89 | 15.02 | 16.4 | 17.81 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 177.85 | 157.13 | 165.9 | 149.94 | 147.82 | 133.35 | 129.27 | 140.19 | 139.42 | 155.42 | 162.8 | 173.98 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 177.85 | 157.13 | 165.9 | 149.94 | 147.82 | 133.35 | 129.27 | 140.19 | 139.42 | 155.42 | 162.8 | 173.98 |

Output from water heater (annual)$_{1...12}$ | 1833.05 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.98 | 75.59 | 81 | 74.86 | 74.99 | 69.35 | 68.83 | 72.45 | 71.37 | 77.52 | 79.14 | 83.69 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 33.47 | 29.73 | 24.18 | 18.31 | 13.68 | 11.55 | 12.48 | 16.23 | 21.78 | 27.65 | 32.27 | 34.41 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 224.17 | 226.5 | 220.63 | 208.16 | 192.4 | 177.6 | 167.71 | 165.38 | 171.24 | 183.72 | 199.47 | 214.28 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 114.22 | 112.48 | 108.88 | 103.98 | 100.79 | 96.31 | 92.51 | 97.39 | 99.12 | 104.19 | 109.92 | 112.49 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 453.4 | 450.25 | 435.23 | 411.98 | 388.42 | 367 | 354.24 | 360.53 | 373.68 | 397.1 | 423.2 | 442.71 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 8.4 | x | 19.64 | x | 0.56 | x | 0.7 | = | 44.66 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 38.42 | x | 0.56 | x | 0.7 | = | 87.36 | (76) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 8.4 | x | 63.27 | x | 0.56 | x | 0.7 | = | 143.87 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 92.28 | x | 0.56 | x | 0.7 | = | 209.82 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 113.09 | x | 0.56 | x | 0.7 | = | 257.15 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 115.77 | x | 0.56 | x | 0.7 | = | 263.23 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 110.22 | x | 0.56 | x | 0.7 | = | 250.61 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 94.68 | x | 0.56 | x | 0.7 | = | 215.27 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 73.59 | x | 0.56 | x | 0.7 | = | 167.32 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 45.59 | x | 0.56 | x | 0.7 | = | 103.66 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 24.49 | x | 0.56 | x | 0.7 | = | 55.68 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 16.15 | x | 0.56 | x | 0.7 | = | 36.72 | (76) |
| West | 0.9x | 0.77 | x | 7.63 | x | 19.64 | x | 0.56 | x | 0.7 | = | 40.56 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 38.42 | x | 0.56 | x | 0.7 | = | 79.35 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 63.27 | x | 0.56 | x | 0.7 | = | 130.68 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 92.28 | x | 0.56 | x | 0.7 | = | 190.59 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 113.09 | x | 0.56 | x | 0.7 | = | 233.57 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 115.77 | x | 0.56 | x | 0.7 | = | 239.1 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 110.22 | x | 0.56 | x | 0.7 | = | 227.64 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 94.68 | x | 0.56 | x | 0.7 | = | 195.54 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 73.59 | x | 0.56 | x | 0.7 | = | 151.99 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 45.59 | x | 0.56 | x | 0.7 | = | 94.16 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 24.49 | x | 0.56 | x | 0.7 | = | 50.58 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 16.15 | x | 0.56 | x | 0.7 | = | 33.36 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 85.22 | 166.71 | 274.55 | 400.41 | 490.72 | 502.34 | 478.25 | 410.81 | 319.31 | 197.82 | 106.26 | 70.08 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 538.62 | 616.96 | 709.78 | 812.39 | 879.14 | 869.34 | 832.48 | 771.34 | 692.99 | 594.92 | 529.47 | 512.79 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.88 | 0.83 | 0.75 | 0.62 | 0.48 | 0.35 | 0.26 | 0.29 | 0.46 | 0.69 | 0.83 | 0.89 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.6 | 19.87 | 20.26 | 20.64 | 20.86 | 20.96 | 20.99 | 20.98 | 20.91 | 20.59 | 20.04 | 19.54 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.09 | 20.09 | 20.09 | 20.11 | 20.11 | 20.12 | 20.12 | 20.12 | 20.11 | 20.11 | 20.1 | 20.1 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.86 | 0.81 | 0.73 | 0.59 | 0.44 | 0.3 | 0.21 | 0.23 | 0.41 | 0.65 | 0.81 | 0.88 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.25 | 18.63 | 19.16 | 19.68 | 19.96 | 20.08 | 20.11 | 20.11 | 20.03 | 19.64 | 18.89 | 18.18 | (90) |

fLA = Living area ÷ (4) = | 0.48 | (91)

# SAP WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.9 | 19.23 | 19.69 | 20.14 | 20.39 | 20.5 | 20.53 | 20.53 | 20.45 | 20.1 | 19.44 | 18.84 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.9 | 19.23 | 19.69 | 20.14 | 20.39 | 20.5 | 20.53 | 20.53 | 20.45 | 20.1 | 19.44 | 18.84 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.84 | 0.8 | 0.72 | 0.59 | 0.46 | 0.32 | 0.23 | 0.26 | 0.43 | 0.65 | 0.79 | 0.86 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 453.92 | 490.77 | 507.58 | 481.1 | 401.04 | 281.22 | 190.52 | 198.71 | 294.82 | 386.96 | 420.52 | 438.59 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 740.02 | 724.43 | 665.03 | 559.45 | 431.46 | 289.33 | 192.67 | 201.78 | 312.97 | 471.59 | 616.21 | 734.32 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 212.85 | 157.02 | 117.14 | 56.41 | 22.64 | 0 | 0 | 0 | 0 | 62.96 | 140.9 | 220.02 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 989.95 (98)

Space heating requirement in kWh/m²/year 19.36 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 989.95 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 623.67 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 415.78 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1833.05 | |
| If DHW from community scheme:<br>Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1154.82 | (310a) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 769.88 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 29.64 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 99.2 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 99.2 | (331) |
| Energy for lighting (calculated in Appendix L) | | 236.47 | (332) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 2.97 | x 0.01 = | 18.52 | (340a) |
| Space heating from heat source 2 | (307b) x | 4.24 | x 0.01 = | 17.63 | (340b) |
| Water heating from CHP | (310a) x | 2.97 | x 0.01 = | 34.3 | (342a) |
| Water heating from heat source 2 | (310b) x | 4.24 | x 0.01 = | 32.64 | (342b) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 13.08 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 31.19 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 267.37 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.17 | (357) |
| **SAP rating (section12)** | | 83.71 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | |
|---|---|---|---|
| Electrical efficiency of CHP unit | | 29.8 | (361) |
| Heat efficiency of CHP unit | | 57.6 | (362) |

| | | **Energy** kWh/year | | **Emission factor** kg CO2/kWh | **Emissions** kg CO2/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1082.76 | x | 0.22 | 233.88 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 322.66 | x | 0.52 | -167.46 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2004.9 | x | 0.22 | 433.06 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 597.46 | x | 0.52 | -310.08 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | |
|---|---|---|---|---|---|---|
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 281.43 | (368) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 15.38 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 486.21 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 486.21 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 51.49 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 122.73 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 660.42 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 12.91 | (384) |
| **EI rating (section 14)** | | | | | 90.8 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1082.76 | x 1.22 | | 1320.96 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 322.66 | x 3.07 | | -990.57 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2004.9 | x 1.22 | | 2445.98 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 597.46 | x 3.07 | | -1834.2 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | 1.22 | = | 1589.57 | (368) |
| Electrical energy for heat distribution | [(313) x | | | = | 91 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | = | 2622.73 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | 2622.73 | (373) |
| Energy associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | 2622.73 | (376) |
| Energy associated with space cooling | (315) x | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | 3.07 | = | 304.55 | (378) |
| Energy associated with electricity for lighting | (332))) x | | 3.07 | = | 725.96 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | 3653.25 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 D-2-01

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | Yes |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | South |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 98.05 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 6 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 243.02 | **(P1)** |
| **Transmission heat loss coefficient:** | 40 | |
| **Summer heat loss coefficient:** | 283.05 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Front) | 0 | 1 |
| East (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Front) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Front) | 0.9 x | 7.63 | 117.51 | 0.56 | 0.7 | 0.76 | 241.12 | |
| East (Rear) | 0.9 x | 8.4 | 117.51 | 0.56 | 0.7 | 0.76 | 265.45 | |
| | | | | | | **Total** | 506.56 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 367 | 354.24 | 360.53 | |
| Total summer gains | 904.73 | 860.8 | 806.19 | **(P5)** |
| Summer gain/loss ratio | 3.2 | 3.04 | 2.85 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.31 | 1.31 | 1.31 | |
| Threshold temperature | 20.51 | 22.25 | 21.96 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Slight** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:25:12*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 50.27m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 D-2-02

**Address :** D-2-02, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 18.03 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 12.92 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 39.5 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 38.6 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South | 12.22m² | |
| Windows facing: East | 2.38m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from CHP | |

# Predicted Energy Assessment

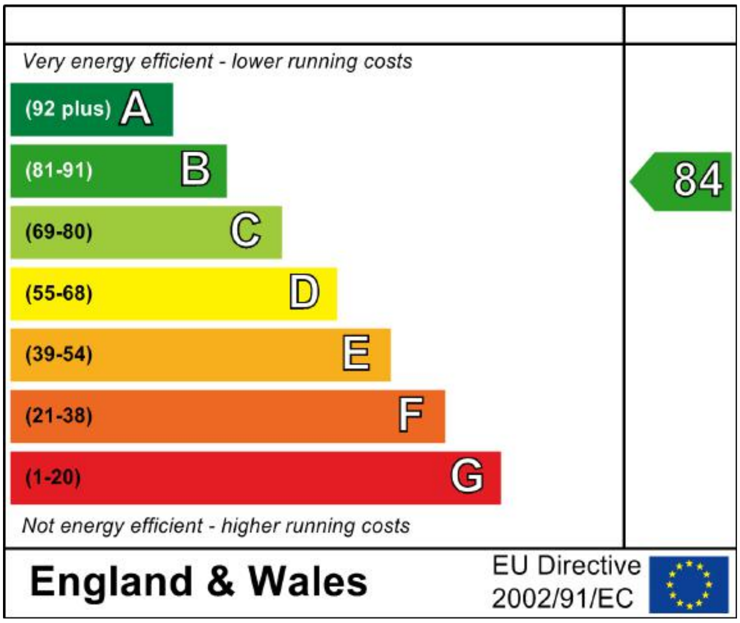
D-2-02
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Mid floor Flat |
| Date of assessment: | 24 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 50.27 m² |

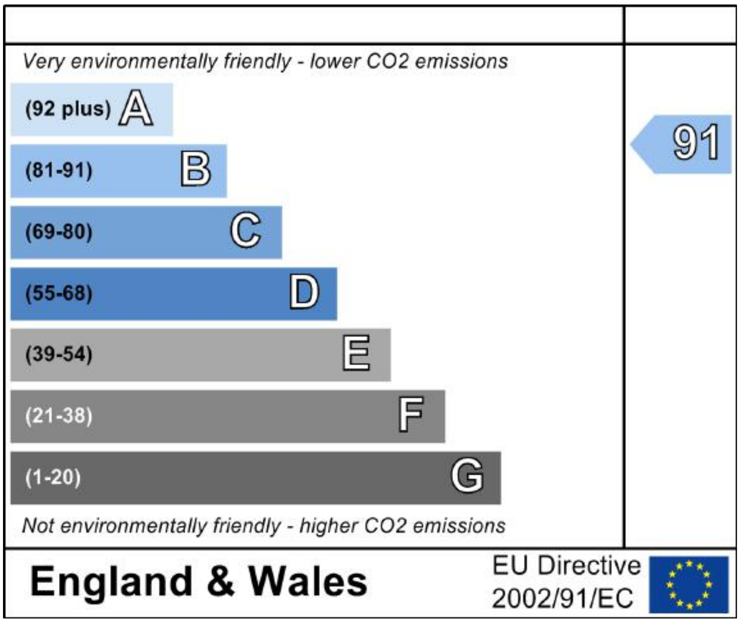
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-2-02

| | |
|---|---|
| Address: | D-2-02, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 24 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 98.65 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 50.27 m² | 2.4 m |
| Living area: | 22.61 m² (fraction 0.45) | |
| Front of dwelling faces: | North | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 12.22 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 2.38 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | Stair Wall | North | 0 | 0 |
| Side | | External Wall | South | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| <u>External Elements</u> | | | | | | | |
| External Wall | 53.18 | 14.6 | 38.58 | 0.18 | 0 | False | 14 |
| Stair Wall | 15.06 | 2.1 | 12.96 | 0.18 | 0.9 | False | 14 |
| <u>Internal Elements</u> | | | | | | | |
| Stud Walls | 67.2 | | | | | | 9 |
| <u>Party Elements</u> | | | | | | | |
| Party Wall | 5.7 | | | | | | 20 |
| Party Ceiling | 50.27 | | | | | | 30 |
| Party Floor | 50.27 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0946

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 2.59 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 16.8 | 0.05 | E4 | Jamb |
| [Approved] | 56.87 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 2.4 | 0.06 | E18 | Party wall between dwellings |
| [Approved] | 1.59 | 0.04 | E3 | Sill |
| | 4.75 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

## Property Address: 06-18-69419 D-2-02

**Address :** D-2-02, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 50.27 | (1a) | x | 2.4 | (2a) | = | 120.65 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 50.27 | (4) | | | | | | |
| Dwelling volume | | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | 120.65 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |
| *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | | |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 12.22 | x1/[1/( 1.4 )+ 0.04] | | = | 16.2 | | | (27) |
| Windows Type 2 | | | 2.38 | x1/[1/( 1.4 )+ 0.04] | | = | 3.16 | | | (27) |
| Walls Type1 | 53.18 | 14.6 | 38.58 | x | 0.18 | = | 6.94 | 14 | 540.12 | (29) |
| Walls Type2 | 15.06 | 2.1 | 12.96 | x | 0.15 | = | 2.01 | 14 | 181.44 | (29) |
| Total area of elements, m² | | | 68.24 | | | | | | | (31) |
| Party wall | | | 5.7 | x | 0 | = | 0 | 20 | 114 | (32) |
| Party floor | | | 50.27 | | | | | 40 | 2010.8 | (32a) |
| Party ceiling | | | 50.27 | | | | | 30 | 1508.1 | (32b) |
| Internal wall ** | | | 67.2 | | | | | 9 | 604.8 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.25 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 4959.26 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 98.65 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 6.45 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 37.7 (37)

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

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.47 | 10.35 | 10.22 | 9.59 | 9.46 | 8.82 | 8.82 | 8.7 | 9.08 | 9.46 | 9.71 | 9.97 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 48.18 | 48.05 | 47.92 | 47.29 | 47.16 | 46.53 | 46.53 | 46.4 | 46.78 | 47.16 | 47.41 | 47.67 | |

Average = Sum(39)$_{1...12}$ /12= 47.25 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.96 | 0.96 | 0.95 | 0.94 | 0.94 | 0.93 | 0.93 | 0.92 | 0.93 | 0.94 | 0.94 | 0.95 | |

Average = Sum(40)$_{1...12}$ /12= 0.94 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.53 (43)
*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)* | | | | | | | | | | | | | |
| (44)m= | 81.98 | 79 | 76.02 | 73.04 | 70.06 | 67.08 | 67.08 | 70.06 | 73.04 | 76.02 | 79 | 81.98 | |

Total = Sum(44)$_{1...12}$ = 894.34 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 121.58 | 106.33 | 109.72 | 95.66 | 91.79 | 79.21 | 73.4 | 84.22 | 85.23 | 99.33 | 108.42 | 117.74 | |

Total = Sum(45)$_{1...12}$ = 1172.63 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.24 | 15.95 | 16.46 | 14.35 | 13.77 | 11.88 | 11.01 | 12.63 | 12.78 | 14.9 | 16.26 | 17.66 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 176.85 | 156.26 | 165 | 149.15 | 147.07 | 132.7 | 128.67 | 139.5 | 138.72 | 154.6 | 161.92 | 173.02 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 176.85 | 156.26 | 165 | 149.15 | 147.07 | 132.7 | 128.67 | 139.5 | 138.72 | 154.6 | 161.92 | 173.02 |

Output from water heater (annual)$_{1...12}$ | 1823.47 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.65 | 75.3 | 80.7 | 74.6 | 74.74 | 69.13 | 68.63 | 72.23 | 71.13 | 77.25 | 78.85 | 83.37 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 32.97 | 29.28 | 23.82 | 18.03 | 13.48 | 11.38 | 12.29 | 15.98 | 21.45 | 27.24 | 31.79 | 33.89 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 220.8 | 223.09 | 217.32 | 205.02 | 189.51 | 174.93 | 165.18 | 162.89 | 168.67 | 180.96 | 196.47 | 211.06 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 113.77 | 112.05 | 108.47 | 103.61 | 100.46 | 96.02 | 92.24 | 97.08 | 98.8 | 103.83 | 109.51 | 112.06 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 448.39 | 445.27 | 430.45 | 407.52 | 384.29 | 363.17 | 350.56 | 356.8 | 369.76 | 392.87 | 418.62 | 437.85 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 2.38 | x | 19.64 | x | 0.56 | x | 0.7 | = | 12.65 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 38.42 | x | 0.56 | x | 0.7 | = | 24.75 | (76) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 2.38 | x | 63.27 | x | 0.56 | x | 0.7 | = | 40.76 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 92.28 | x | 0.56 | x | 0.7 | = | 59.45 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 113.09 | x | 0.56 | x | 0.7 | = | 72.86 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 115.77 | x | 0.56 | x | 0.7 | = | 74.58 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 110.22 | x | 0.56 | x | 0.7 | = | 71.01 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 94.68 | x | 0.56 | x | 0.7 | = | 60.99 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 73.59 | x | 0.56 | x | 0.7 | = | 47.41 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 45.59 | x | 0.56 | x | 0.7 | = | 29.37 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 24.49 | x | 0.56 | x | 0.7 | = | 15.78 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 16.15 | x | 0.56 | x | 0.7 | = | 10.41 | (76) |
| South | 0.9x | 0.77 | x | 12.22 | x | 46.75 | x | 0.56 | x | 0.7 | = | 154.65 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 76.57 | x | 0.56 | x | 0.7 | = | 253.27 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 97.53 | x | 0.56 | x | 0.7 | = | 322.62 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 110.23 | x | 0.56 | x | 0.7 | = | 364.63 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 114.87 | x | 0.56 | x | 0.7 | = | 379.97 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 110.55 | x | 0.56 | x | 0.7 | = | 365.67 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 108.01 | x | 0.56 | x | 0.7 | = | 357.28 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 104.89 | x | 0.56 | x | 0.7 | = | 346.97 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 101.89 | x | 0.56 | x | 0.7 | = | 337.02 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 82.59 | x | 0.56 | x | 0.7 | = | 273.18 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 55.42 | x | 0.56 | x | 0.7 | = | 183.31 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 40.4 | x | 0.56 | x | 0.7 | = | 133.63 | (78) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 167.3 | 278.02 | 363.38 | 424.08 | 452.83 | 440.25 | 428.29 | 407.96 | 384.42 | 302.55 | 199.08 | 144.03 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 615.69 | 723.29 | 793.84 | 831.6 | 837.12 | 803.42 | 778.85 | 764.76 | 754.18 | 695.41 | 617.7 | 581.88 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.83 | 0.77 | 0.69 | 0.6 | 0.48 | 0.36 | 0.26 | 0.27 | 0.41 | 0.61 | 0.77 | 0.85 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.88 | 20.16 | 20.44 | 20.7 | 20.87 | 20.96 | 20.99 | 20.99 | 20.94 | 20.73 | 20.29 | 19.82 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.12 | 20.12 | 20.12 | 20.13 | 20.14 | 20.15 | 20.15 | 20.15 | 20.14 | 20.14 | 20.13 | 20.13 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.82 | 0.75 | 0.67 | 0.56 | 0.45 | 0.31 | 0.21 | 0.23 | 0.36 | 0.57 | 0.75 | 0.83 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.66 | 19.05 | 19.43 | 19.78 | 20 | 20.11 | 20.14 | 20.14 | 20.09 | 19.83 | 19.24 | 18.58 | (90) |

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.21 | 19.55 | 19.89 | 20.2 | 20.39 | 20.49 | 20.52 | 20.52 | 20.47 | 20.24 | 19.71 | 19.14 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.21 | 19.55 | 19.89 | 20.2 | 20.39 | 20.49 | 20.52 | 20.52 | 20.47 | 20.24 | 19.71 | 19.14 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.8 | 0.73 | 0.66 | 0.57 | 0.46 | 0.33 | 0.23 | 0.25 | 0.38 | 0.57 | 0.73 | 0.82 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 491.47 | 531.02 | 524.66 | 471.22 | 382.67 | 266.71 | 180.56 | 188.85 | 286.18 | 399.23 | 453.29 | 474.26 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 718.31 | 703.97 | 641.53 | 534.16 | 409.76 | 274.2 | 182.43 | 191.16 | 297.98 | 454.48 | 598.09 | 712.08 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 168.77 | 116.22 | 86.95 | 45.31 | 20.15 | 0 | 0 | 0 | 0 | 41.11 | 104.25 | 176.94 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 759.72 (98)

Space heating requirement in kWh/m²/year 15.11 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 759.72 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 478.62 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 319.08 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1823.47 | |
| If DHW from community scheme: Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1148.78 | (310a) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 765.86 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 27.12 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 97.51 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 97.51 | (331) |
| Energy for lighting (calculated in Appendix L) | | 232.91 | (332) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 2.97 | x 0.01 = | 14.22 | (340a) |
| Space heating from heat source 2 | (307b) | x | 4.24 | x 0.01 = | 13.53 | (340b) |
| Water heating from CHP | (310a) | x | 2.97 | x 0.01 = | 34.12 | (342a) |
| Water heating from heat source 2 | (310b) | x | 4.24 | x 0.01 = | 32.47 | (342b) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 12.86 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 30.72 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 257.92 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.14 | (357) |
| **SAP rating (section12)** | | 84.14 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | |
|---|---|---|---|
| Electrical efficiency of CHP unit | | 29.8 | (361) |
| Heat efficiency of CHP unit | | 57.6 | (362) |

| | | **Energy** kWh/year | | **Emission factor** kg CO2/kWh | **Emissions** kg CO2/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 830.94 | x | 0.22 | 179.48 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 247.62 | x | 0.52 | -128.52 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 1994.42 | x | 0.22 | 430.79 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 594.34 | x | 0.52 | -308.46 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | |
|---|---|---|---|---|---|---|
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 257.52 | (368) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 14.08 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 444.9 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 444.9 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 50.61 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 120.88 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 616.39 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 12.26 | (384) |
| **EI rating (section 14)** | | | | | 91.33 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 830.94 | x | 1.22 | 1013.75 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 247.62 | x | 3.07 | -760.2 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 1994.42 | x | 1.22 | 2433.19 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 594.34 | x | 3.07 | -1824.61 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 = | 1454.53 | (368) |
| Electrical energy for heat distribution | [(313) x | | | = | 83.27 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | = | 2399.93 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | 2399.93 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | 2399.93 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 = | 299.37 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 = | 715.04 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | 3414.34 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 D-2-02

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | North |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 98.65 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 159.26 | **(P1)** |
| **Transmission heat loss coefficient:** | 37.7 | |
| **Summer heat loss coefficient:** | 196.96 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| South (Side) | 0 | 1 |
| East (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| South (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| South (Side) | 0.9 x | 12.22 | 112.21 | 0.56 | 0.7 | 0.76 | 368.74 | |
| East (Rear) | 0.9 x | 2.38 | 117.51 | 0.56 | 0.7 | 0.76 | 75.21 | |
| | | | | | | **Total** | 443.95 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 363.17 | 350.56 | 356.8 | |
| Total summer gains | 825.24 | 794.52 | 786.78 | **(P5)** |
| Summer gain/loss ratio | 4.19 | 4.03 | 3.99 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.31 | 1.31 | 1.31 | |
| Threshold temperature | 21.5 | 23.24 | 23.1 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:25:02*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 51.14m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 D-3-01

**Address :** D-3-01, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 23.76 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 15.44 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 70.3 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 54.8 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | OK |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| 7 Low energy lights | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

| 8 Mechanical ventilation | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

| 9 Summertime temperature | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: West | 7.63m² | |
| Windows facing: East | 8.4m² | |
| Ventilation rate: | 6.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

| 10 Key features | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from CHP | |

# Predicted Energy Assessment

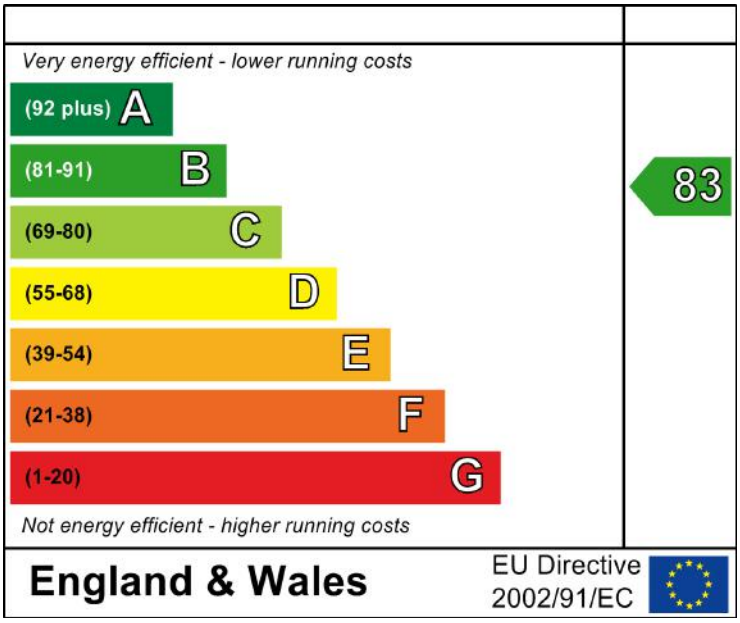
D-3-01
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Top floor Flat |
| Date of assessment: | 24 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 51.14 m² |

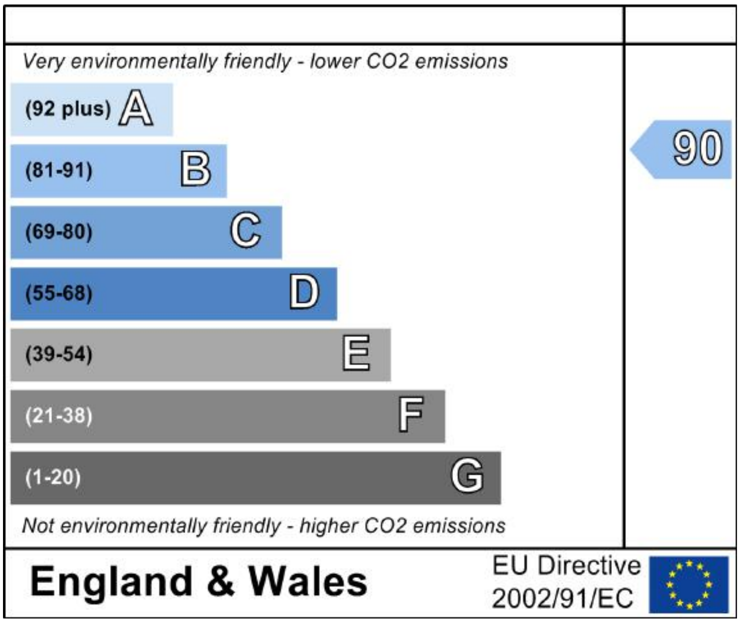
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-3-01

| | |
|---|---|
| Address: | D-3-01, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 24 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 77.05 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 51.14 m² | 2.4 m |
| Living area: | 24.52 m² (fraction 0.479) | |
| Front of dwelling faces: | South | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Front | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Front | 16mm or more | 0.7 | 0.558 | 1.4 | 7.63 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 8.4 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | Stair Wall | South | 0 | 0 |
| Front | | External Wall | West | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 53.01 | 16.03 | 36.98 | 0.18 | 0 | False | 14 |
| Stair Wall | 20.97 | 2.1 | 18.87 | 0.18 | 0.9 | False | 14 |
| Flat Roof | 51.14 | 0 | 51.14 | 0.13 | 0 | | 9 |
| Internal Elements | | | | | | | |
| Stud Walls | 60 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 5.64 | | | | | | 20 |
| Party Floor | 51.14 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0873

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 18.6 | 0.05 | E4 | Jamb |
| [Approved] | 30.83 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 8.74 | 0.04 | E14 | Flat roof |
| | 22.09 | 0.28 | E15 | Flat roof with parapet |
| | 2.35 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 2.35 | 0.12 | P4 | Roof (insulation at ceiling level) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 D-3-01

**Address :** D-3-01, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 51.14 | (1a) x | 2.4 | (2a) = | 122.74 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 51.14 | (4) | | | | |
| Dwelling volume | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | 122.74 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 7.63 | x1/[1/( 1.4 )+ 0.04] | | = | 10.12 | | | (27) |
| Windows Type 2 | | | 8.4 | x1/[1/( 1.4 )+ 0.04] | | = | 11.14 | | | (27) |
| Walls Type1 | 53.01 | 16.03 | 36.98 | x | 0.18 | = | 6.66 | 14 | 517.72 | (29) |
| Walls Type2 | 20.97 | 2.1 | 18.87 | x | 0.15 | = | 2.92 | 14 | 264.18 | (29) |
| Roof | 51.14 | 0 | 51.14 | x | 0.13 | = | 6.65 | 9 | 460.26 | (30) |
| Total area of elements, m² | | | 125.12 | | | | | | | (31) |
| Party wall | | | 5.64 | x | 0 | = | 0 | 20 | 112.8 | (32) |
| Party floor | | | 51.14 | | | | | 40 | 2045.6 | (32a) |
| Internal wall ** | | | 60 | | | | | 9 | 540 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 40.42 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 3940.56 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 77.05 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 10.92 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 51.34 (37)

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.65 | 10.53 | 10.4 | 9.75 | 9.62 | 8.98 | 8.98 | 8.85 | 9.23 | 9.62 | 9.88 | 10.14 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 62 | 61.87 | 61.74 | 61.1 | 60.97 | 60.32 | 60.32 | 60.19 | 60.58 | 60.97 | 61.22 | 61.48 | |

Average = Sum(39)$_{1…12}$ /12= 61.06 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.21 | 1.21 | 1.21 | 1.19 | 1.19 | 1.18 | 1.18 | 1.18 | 1.18 | 1.19 | 1.2 | 1.2 |

Average = Sum(40)$_{1…12}$ /12= 1.19 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.72 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.14 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

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

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 82.65 | 79.65 | 76.64 | 73.64 | 70.63 | 67.62 | 67.62 | 70.63 | 73.64 | 76.64 | 79.65 | 82.65 |

Total = Sum(44)$_{1…12}$ = 901.65 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 122.57 | 107.2 | 110.62 | 96.44 | 92.54 | 79.85 | 74 | 84.91 | 85.93 | 100.14 | 109.31 | 118.7 |

Total = Sum(45)$_{1…12}$ = 1182.21 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.39 | 16.08 | 16.59 | 14.47 | 13.88 | 11.98 | 11.1 | 12.74 | 12.89 | 15.02 | 16.4 | 17.81 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 177.85 | 157.13 | 165.9 | 149.94 | 147.82 | 133.35 | 129.27 | 140.19 | 139.42 | 155.42 | 162.8 | 173.98 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 177.85 | 157.13 | 165.9 | 149.94 | 147.82 | 133.35 | 129.27 | 140.19 | 139.42 | 155.42 | 162.8 | 173.98 |

Output from water heater (annual)$_{1...12}$ | 1833.05 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.98 | 75.59 | 81 | 74.86 | 74.99 | 69.35 | 68.83 | 72.45 | 71.37 | 77.52 | 79.14 | 83.69 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 33.47 | 29.73 | 24.18 | 18.31 | 13.68 | 11.55 | 12.48 | 16.23 | 21.78 | 27.65 | 32.27 | 34.41 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 224.17 | 226.5 | 220.63 | 208.16 | 192.4 | 177.6 | 167.71 | 165.38 | 171.24 | 183.72 | 199.47 | 214.28 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 114.22 | 112.48 | 108.88 | 103.98 | 100.79 | 96.31 | 92.51 | 97.39 | 99.12 | 104.19 | 109.92 | 112.49 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 453.4 | 450.25 | 435.23 | 411.98 | 388.42 | 367 | 354.24 | 360.53 | 373.68 | 397.1 | 423.2 | 442.71 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x 1 | x | 8.4 | x | 19.64 | x | 0.56 | x | 0.7 | = | 44.66 | (76) |
| East | 0.9x 1 | x | 8.4 | x | 38.42 | x | 0.56 | x | 0.7 | = | 87.36 | (76) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 8.4 | x | 63.27 | x | 0.56 | x | 0.7 | = | 143.87 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 92.28 | x | 0.56 | x | 0.7 | = | 209.82 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 113.09 | x | 0.56 | x | 0.7 | = | 257.15 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 115.77 | x | 0.56 | x | 0.7 | = | 263.23 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 110.22 | x | 0.56 | x | 0.7 | = | 250.61 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 94.68 | x | 0.56 | x | 0.7 | = | 215.27 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 73.59 | x | 0.56 | x | 0.7 | = | 167.32 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 45.59 | x | 0.56 | x | 0.7 | = | 103.66 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 24.49 | x | 0.56 | x | 0.7 | = | 55.68 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 16.15 | x | 0.56 | x | 0.7 | = | 36.72 | (76) |
| West | 0.9x | 0.77 | x | 7.63 | x | 19.64 | x | 0.56 | x | 0.7 | = | 40.56 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 38.42 | x | 0.56 | x | 0.7 | = | 79.35 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 63.27 | x | 0.56 | x | 0.7 | = | 130.68 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 92.28 | x | 0.56 | x | 0.7 | = | 190.59 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 113.09 | x | 0.56 | x | 0.7 | = | 233.57 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 115.77 | x | 0.56 | x | 0.7 | = | 239.1 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 110.22 | x | 0.56 | x | 0.7 | = | 227.64 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 94.68 | x | 0.56 | x | 0.7 | = | 195.54 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 73.59 | x | 0.56 | x | 0.7 | = | 151.99 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 45.59 | x | 0.56 | x | 0.7 | = | 94.16 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 24.49 | x | 0.56 | x | 0.7 | = | 50.58 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 16.15 | x | 0.56 | x | 0.7 | = | 33.36 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 85.22 | 166.71 | 274.55 | 400.41 | 490.72 | 502.34 | 478.25 | 410.81 | 319.31 | 197.82 | 106.26 | 70.08 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 538.62 | 616.96 | 709.78 | 812.39 | 879.14 | 869.34 | 832.48 | 771.34 | 692.99 | 594.92 | 529.47 | 512.79 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.87 | 0.83 | 0.76 | 0.65 | 0.53 | 0.4 | 0.3 | 0.33 | 0.51 | 0.71 | 0.83 | 0.88 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 18.75 | 19.08 | 19.59 | 20.17 | 20.59 | 20.85 | 20.94 | 20.92 | 20.73 | 20.15 | 19.36 | 18.69 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 19.91 | 19.91 | 19.91 | 19.92 | 19.93 | 19.94 | 19.94 | 19.94 | 19.93 | 19.93 | 19.92 | 19.92 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.85 | 0.81 | 0.74 | 0.62 | 0.48 | 0.34 | 0.23 | 0.26 | 0.45 | 0.67 | 0.81 | 0.86 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 16.97 | 17.43 | 18.15 | 18.94 | 19.49 | 19.8 | 19.9 | 19.89 | 19.67 | 18.94 | 17.85 | 16.88 | (90) |

fLA = Living area ÷ (4) = 0.48 (91)

# SAP WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 17.83 | 18.22 | 18.84 | 19.53 | 20.02 | 20.3 | 20.4 | 20.38 | 20.18 | 19.52 | 18.57 | 17.75 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 17.83 | 18.22 | 18.84 | 19.53 | 20.02 | 20.3 | 20.4 | 20.38 | 20.18 | 19.52 | 18.57 | 17.75 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.82 | 0.78 | 0.71 | 0.61 | 0.49 | 0.36 | 0.26 | 0.29 | 0.46 | 0.66 | 0.78 | 0.83 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 441.3 | 479.86 | 503.7 | 493.43 | 429.72 | 315.66 | 219.32 | 226.99 | 318.95 | 390.23 | 411.4 | 426.09 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 838.71 | 824.33 | 761.91 | 649.44 | 507.12 | 343.86 | 229.07 | 239.74 | 368.28 | 543.97 | 702.37 | 832.99 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 295.68 | 231.48 | 192.1 | 112.33 | 57.59 | 0 | 0 | 0 | 0 | 114.38 | 209.49 | 302.73 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1515.79 (98)

Space heating requirement in kWh/m²/year 29.64 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1515.79 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 954.95 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 636.63 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |

**Water heating**

| | | | |
|---|---|---|---|
| Annual water heating requirement | | 1833.05 | |
| If DHW from community scheme:<br>Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1154.82 | (310a) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 769.88 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 35.16 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 99.2 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 99.2 | (331) |
| Energy for lighting (calculated in Appendix L) | | 236.47 | (332) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 2.97 | x 0.01 = | 28.36 | (340a) |
| Space heating from heat source 2 | (307b) x | 4.24 | x 0.01 = | 26.99 | (340b) |
| Water heating from CHP | (310a) x | 2.97 | x 0.01 = | 34.3 | (342a) |
| Water heating from heat source 2 | (310b) x | 4.24 | x 0.01 = | 32.64 | (342b) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 13.08 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 31.19 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 286.57 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.25 | (357) |
| **SAP rating (section12)** | | 82.54 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | |
|---|---|---|---|
| Electrical efficiency of CHP unit | | 29.8 | (361) |
| Heat efficiency of CHP unit | | 57.6 | (362) |

| | | **Energy** kWh/year | | **Emission factor** kg CO2/kWh | **Emissions** kg CO2/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1657.89 | x | 0.22 | 358.1 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 494.05 | x | 0.52 | -256.41 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2004.9 | x | 0.22 | 433.06 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 597.46 | x | 0.52 | -310.08 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | 0.22 | = | 333.85 | (368) |
| Electrical energy for heat distribution | [(313) x | 0.52 | = | 18.25 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 576.77 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 576.77 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 51.49 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 122.73 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 750.99 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 14.68 | (384) |
| **EI rating (section 14)** | | | | 89.53 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1657.89 | x | 1.22 | | 2022.63 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 494.05 | x | 3.07 | | -1516.74 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2004.9 | x | 1.22 | | 2445.98 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 597.46 | x | 3.07 | | -1834.2 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1885.65 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 107.95 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 3111.27 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 3111.27 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 3111.27 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 304.55 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 725.96 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | | 4141.78 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 D-3-01

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | Yes |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | South |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 77.05 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 6 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 243.02 | **(P1)** |
| **Transmission heat loss coefficient:** | 51.3 | |
| **Summer heat loss coefficient:** | 294.36 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Front) | 0 | 1 |
| East (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Front) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Front) | 0.9 x | 7.63 | 117.51 | 0.56 | 0.7 | 0.76 | 241.12 | |
| East (Rear) | 0.9 x | 8.4 | 117.51 | 0.56 | 0.7 | 0.76 | 265.45 | |
| | | | | | | **Total** | 506.56 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 367 | 354.24 | 360.53 | |
| Total summer gains | 904.73 | 860.8 | 806.19 | **(P5)** |
| Summer gain/loss ratio | 3.07 | 2.92 | 2.74 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.46 | 1.46 | 1.46 | |
| Threshold temperature | 20.53 | 22.28 | 22 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Slight** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 25 January 2019 at 12:24:51*

## Project Information:

| | | | |
|---|---|---|---|
| **Assessed By:** | Matthew Stainrod (STRO023501) | **Building Type:** | Flat |

## Dwelling Details:

| | | | |
|---|---|---|---|
| **NEW DWELLING DESIGN STAGE** | | Total Floor Area: 50.27m² | |
| **Site Reference :** | Bertram Street | **Plot Reference:** | 06-18-69419 D-3-02 |
| **Address :** | D-3-02, Bertram Street, London | | |

## Client Details:

| | |
|---|---|
| **Name:** | McBains |
| **Address :** | 26 Finsbury Square, London, EC2A 1DS |

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 22.41 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 14.79 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 62.4 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 49.8 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | (no floor) | | |
| Roof | 0.13 (max. 0.20) | 0.13 (max. 0.35) | **OK** |
| Openings | 1.40 (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: | Community heating schemes - CommCHP |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | **OK** |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South | 12.22m² | |
| Windows facing: East | 3.82m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party  Walls U-value | 0 W/m²K | |
| Community heating, heat from CHP | | |

# Predicted Energy Assessment

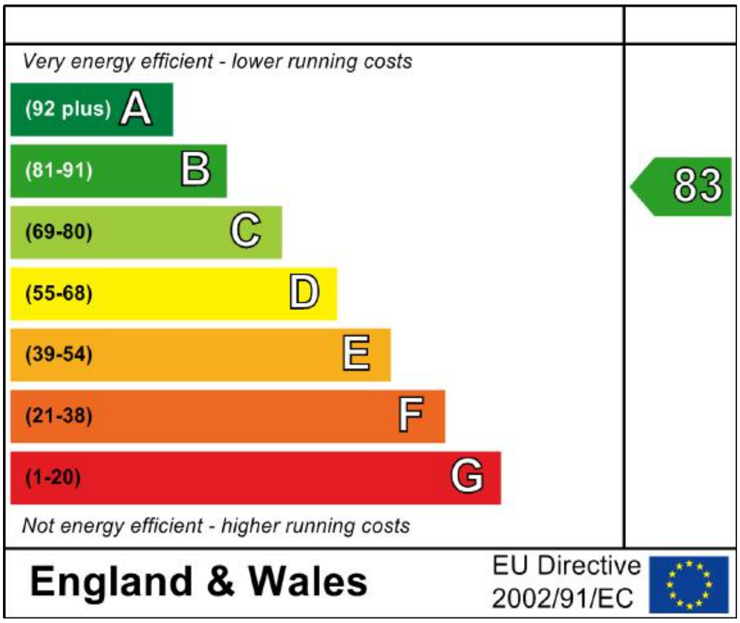
D-3-02
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Top floor Flat |
| Date of assessment: | 24 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 50.27 m² |

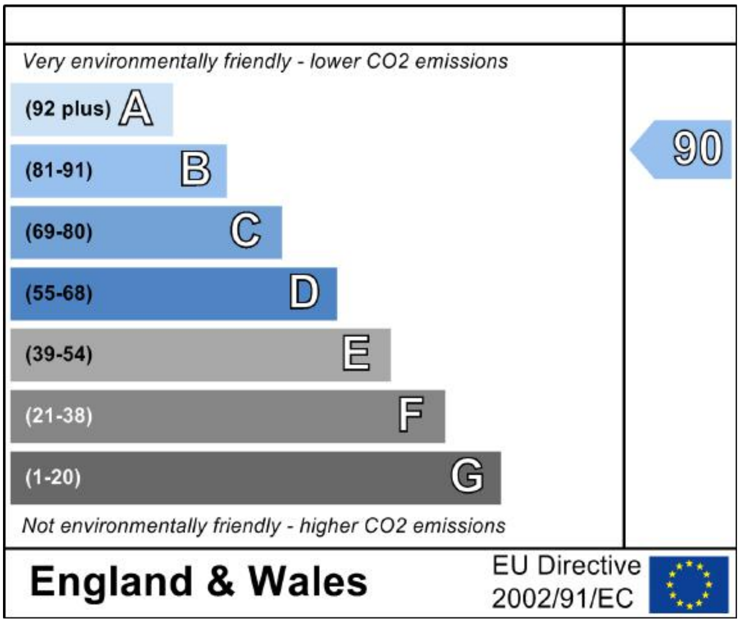
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-3-02

| | |
|---|---|
| Address: | D-3-02, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 24 January 2019 |
| Date of certificate: | 25 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 77.25 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 50.27 m² | 2.4 m |
| Living area: | 22.61 m² (fraction 0.45) | |
| Front of dwelling faces: | North | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 12.22 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 3.82 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | Stair Wall | North | 0 | 0 |
| Side | | External Wall | South | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| <u>External Elements</u> | | | | | | | |
| External Wall | 53.18 | 16.04 | 37.14 | 0.18 | 0 | False | 14 |
| Stair Wall | 15.06 | 2.1 | 12.96 | 0.18 | 0.9 | False | 14 |
| Flat Roof | 50.27 | 0 | 50.27 | 0.13 | 0 | | 9 |
| <u>Internal Elements</u> | | | | | | | |
| Stud Walls | 67.2 | | | | | | 9 |
| <u>Party Elements</u> | | | | | | | |
| Party Wall | 5.7 | | | | | | 20 |
| Party Floor | 50.27 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0907

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 18.6 | 0.05 | E4 | Jamb |
| [Approved] | 28.43 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 2.4 | 0.06 | E18 | Party wall between dwellings |
| | 6.27 | 0.04 | E14 | Flat roof |
| | 22.16 | 0.28 | E15 | Flat roof with parapet |
| | 2.35 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 2.35 | 0.12 | P4 | Roof (insulation at ceiling level) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | None |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

## Property Address: 06-18-69419 D-3-02

**Address :** D-3-02, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 50.27 | (1a) x | 2.4 | (2a) = | 120.65 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 50.27 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 120.65 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |
| *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | | |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 12.22 | x1/[1/( 1.4 )+ 0.04] | | = | 16.2 | | | (27) |
| Windows Type 2 | | | 3.82 | x1/[1/( 1.4 )+ 0.04] | | = | 5.06 | | | (27) |
| Walls Type1 | 53.18 | 16.04 | 37.14 | x | 0.18 | = | 6.69 | 14 | 519.96 | (29) |
| Walls Type2 | 15.06 | 2.1 | 12.96 | x | 0.15 | = | 2.01 | 14 | 181.44 | (29) |
| Roof | 50.27 | 0 | 50.27 | x | 0.13 | = | 6.54 | 9 | 452.43 | (30) |
| Total area of elements, m² | | | 118.51 | | | | | | | (31) |
| Party wall | | | 5.7 | x | 0 | = | 0 | 20 | 114 | (32) |
| Party floor | | | 50.27 | | | | | 40 | 2010.8 | (32a) |
| Internal wall ** | | | 67.2 | | | | | 9 | 604.8 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 39.43 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 3883.43 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 77.25 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 10.75 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 50.18 (37)

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.47 | 10.35 | 10.22 | 9.59 | 9.46 | 8.82 | 8.82 | 8.7 | 9.08 | 9.46 | 9.71 | 9.97 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 60.66 | 60.53 | 60.4 | 59.77 | 59.64 | 59.01 | 59.01 | 58.88 | 59.26 | 59.64 | 59.89 | 60.15 | |

Average = $Sum(39)_{1...12}$ /12= 59.74 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.21 | 1.2 | 1.2 | 1.19 | 1.19 | 1.17 | 1.17 | 1.17 | 1.18 | 1.19 | 1.19 | 1.2 |

Average = $Sum(40)_{1...12}$ /12= 1.19 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.53 (43)
*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)* | | | | | | | | | | | | |
| (44)m= | 81.98 | 79 | 76.02 | 73.04 | 70.06 | 67.08 | 67.08 | 70.06 | 73.04 | 76.02 | 79 | 81.98 |

Total = $Sum(44)_{1...12}$ = 894.34 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 121.58 | 106.33 | 109.72 | 95.66 | 91.79 | 79.21 | 73.4 | 84.22 | 85.23 | 99.33 | 108.42 | 117.74 |

Total = $Sum(45)_{1...12}$ = 1172.63 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.24 | 15.95 | 16.46 | 14.35 | 13.77 | 11.88 | 11.01 | 12.63 | 12.78 | 14.9 | 16.26 | 17.66 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# SAP WorkSheet: New dwelling design stage

| | | |
|---|---|---|
| Primary circuit loss (annual) from Table 3 | 0 | (58) |

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 176.85 | 156.26 | 165 | 149.15 | 147.07 | 132.7 | 128.67 | 139.5 | 138.72 | 154.6 | 161.92 | 173.02 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 176.85 | 156.26 | 165 | 149.15 | 147.07 | 132.7 | 128.67 | 139.5 | 138.72 | 154.6 | 161.92 | 173.02 |

| | | |
|---|---|---|
| Output from water heater (annual)1…12 | 1823.47 | (64) |

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.65 | 75.3 | 80.7 | 74.6 | 74.74 | 69.13 | 68.63 | 72.23 | 71.13 | 77.25 | 78.85 | 83.37 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | | | | | | | | | | | | | |
| (67)m= | 32.97 | 29.28 | 23.82 | 18.03 | 13.48 | 11.38 | 12.29 | 15.98 | 21.45 | 27.24 | 31.79 | 33.89 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | | | | | | | | | | | | | |
| (68)m= | 220.8 | 223.09 | 217.32 | 205.02 | 189.51 | 174.93 | 165.18 | 162.89 | 168.67 | 180.96 | 196.47 | 211.06 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | | | | | | | | | | | | | |
| (69)m= | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | (69) |
| Pumps and fans gains (Table 5a) | | | | | | | | | | | | | |
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |
| Losses e.g. evaporation (negative values) (Table 5) | | | | | | | | | | | | | |
| (71)m= | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | (71) |
| Water heating gains (Table 5) | | | | | | | | | | | | | |
| (72)m= | 113.77 | 112.05 | 108.47 | 103.61 | 100.46 | 96.02 | 92.24 | 97.08 | 98.8 | 103.83 | 109.51 | 112.06 | (72) |
| **Total internal gains =** | | | | | | (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m | | | | | | | |
| (73)m= | 448.39 | 445.27 | 430.45 | 407.52 | 384.29 | 363.17 | 350.56 | 356.8 | 369.76 | 392.87 | 418.62 | 437.85 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 3.82 | x | 19.64 | x | 0.56 | x | 0.7 | = | 20.31 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 38.42 | x | 0.56 | x | 0.7 | = | 39.73 | (76) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 3.82 | x | 63.27 | x | 0.56 | x | 0.7 | = | 65.43 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 92.28 | x | 0.56 | x | 0.7 | = | 95.42 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 113.09 | x | 0.56 | x | 0.7 | = | 116.94 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 115.77 | x | 0.56 | x | 0.7 | = | 119.71 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 110.22 | x | 0.56 | x | 0.7 | = | 113.97 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 94.68 | x | 0.56 | x | 0.7 | = | 97.9 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 73.59 | x | 0.56 | x | 0.7 | = | 76.09 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 45.59 | x | 0.56 | x | 0.7 | = | 47.14 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 24.49 | x | 0.56 | x | 0.7 | = | 25.32 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 16.15 | x | 0.56 | x | 0.7 | = | 16.7 | (76) |
| South | 0.9x | 0.77 | x | 12.22 | x | 46.75 | x | 0.56 | x | 0.7 | = | 154.65 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 76.57 | x | 0.56 | x | 0.7 | = | 253.27 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 97.53 | x | 0.56 | x | 0.7 | = | 322.62 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 110.23 | x | 0.56 | x | 0.7 | = | 364.63 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 114.87 | x | 0.56 | x | 0.7 | = | 379.97 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 110.55 | x | 0.56 | x | 0.7 | = | 365.67 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 108.01 | x | 0.56 | x | 0.7 | = | 357.28 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 104.89 | x | 0.56 | x | 0.7 | = | 346.97 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 101.89 | x | 0.56 | x | 0.7 | = | 337.02 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 82.59 | x | 0.56 | x | 0.7 | = | 273.18 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 55.42 | x | 0.56 | x | 0.7 | = | 183.31 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 40.4 | x | 0.56 | x | 0.7 | = | 133.63 | (78) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 174.95 | 293 | 388.05 | 460.05 | 496.91 | 485.38 | 471.25 | 444.86 | 413.11 | 320.32 | 208.63 | 150.33 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 623.34 | 738.27 | 818.5 | 867.57 | 881.2 | 848.54 | 821.81 | 801.66 | 782.87 | 713.18 | 627.25 | 588.18 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.83 | 0.78 | 0.71 | 0.62 | 0.52 | 0.4 | 0.3 | 0.32 | 0.45 | 0.64 | 0.78 | 0.85 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.01 | 19.38 | 19.81 | 20.26 | 20.61 | 20.85 | 20.94 | 20.93 | 20.78 | 20.33 | 19.6 | 18.92 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 19.91 | 19.92 | 19.92 | 19.93 | 19.93 | 19.94 | 19.94 | 19.94 | 19.94 | 19.93 | 19.93 | 19.92 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.81 | 0.75 | 0.68 | 0.59 | 0.48 | 0.34 | 0.23 | 0.25 | 0.4 | 0.6 | 0.75 | 0.83 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 17.33 | 17.84 | 18.44 | 19.05 | 19.51 | 19.8 | 19.9 | 19.9 | 19.73 | 19.17 | 18.18 | 17.22 | (90) |

fLA = Living area ÷ (4) = | 0.45 | (91)

# SAP WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.08 | 18.53 | 19.05 | 19.6 | 20.01 | 20.27 | 20.37 | 20.36 | 20.21 | 19.69 | 18.82 | 17.99 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.08 | 18.53 | 19.05 | 19.6 | 20.01 | 20.27 | 20.37 | 20.36 | 20.21 | 19.69 | 18.82 | 17.99 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.78 | 0.72 | 0.66 | 0.58 | 0.48 | 0.36 | 0.26 | 0.28 | 0.41 | 0.59 | 0.73 | 0.79 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 485.92 | 534.23 | 540.2 | 501.72 | 423.1 | 307.66 | 213.41 | 222.43 | 323.38 | 420.72 | 454.94 | 467.45 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 836 | 825.24 | 758.31 | 639.29 | 495.4 | 334.75 | 222.48 | 233.29 | 361.86 | 542.15 | 701.95 | 829.16 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 260.46 | 195.56 | 162.27 | 99.05 | 53.79 | 0 | 0 | 0 | 0 | 90.34 | 177.85 | 269.11 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1308.43 (98)

Space heating requirement in kWh/m²/year 26.03 (99)

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1308.43 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 824.31 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 549.54 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1823.47 | |
| If DHW from community scheme: Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1148.78 | (310a) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 765.86 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 32.88 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 97.51 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 97.51 | (331) |
| Energy for lighting (calculated in Appendix L) | | 232.91 | (332) |

## 10b. Fuel costs – Community heating scheme

| | Fuel kWh/year | | Fuel Price (Table 12) | | Fuel Cost £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 2.97 | x 0.01 = | 24.48 | (340a) |
| Space heating from heat source 2 | (307b) | x | 4.24 | x 0.01 = | 23.3 | (340b) |
| Water heating from CHP | (310a) | x | 2.97 | x 0.01 = | 34.12 | (342a) |
| Water heating from heat source 2 | (310b) | x | 4.24 | x 0.01 = | 32.47 | (342b) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 12.86 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 30.72 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 277.96 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.23 | (357) |
| **SAP rating (section12)** | | 82.91 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | |
|---|---|---|---|
| Electrical efficiency of CHP unit | | 29.8 | (361) |
| Heat efficiency of CHP unit | | 57.6 | (362) |

| | | Energy kWh/year | | Emission factor kg CO2/kWh | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1431.1 | x | 0.22 | 309.12 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 426.47 | x | 0.52 | -221.34 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 1994.42 | x | 0.22 | 430.79 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 594.34 | x | 0.52 | -308.46 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |

| | | | | | |
|---|---|---|---|---|---|
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | 0.22 | = | 312.23 | (368) |
| Electrical energy for heat distribution | [(313) x | 0.52 | = | 17.07 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 539.41 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 539.41 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 50.61 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 120.88 | (379) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 710.9 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 14.14 | (384) |
| **EI rating (section 14)** | | | | 90 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | |
|---|---|---|
| **Electrical efficiency of CHP unit** | 29.8 | (361) |
| **Heat efficiency of CHP unit** | 57.6 | (362) |

| | | **Energy kWh/year** | | **Primary factor** | | **P.Energy kWh/year** | |
|---|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1431.1 | x | 1.22 | | 1745.94 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 426.47 | x | 3.07 | | -1309.25 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 1994.42 | x | 1.22 | | 2433.19 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 594.34 | x | 3.07 | | -1824.61 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1763.5 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 100.96 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 2909.72 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 2909.72 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 2909.72 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 299.37 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 715.04 | (379) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | | 3924.13 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 25 January 2019

## Property Details: 06-18-69419 D-3-02

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | North |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 77.25 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 159.26 | **(P1)** |
| **Transmission heat loss coefficient:** | 50.2 | |
| **Summer heat loss coefficient:** | 209.44 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| South (Side) | 0 | 1 |
| East (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| South (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| South (Side) | 0.9 x | 12.22 | 112.21 | 0.56 | 0.7 | 0.76 | 368.74 | |
| East (Rear) | 0.9 x | 3.82 | 117.51 | 0.56 | 0.7 | 0.76 | 120.72 | |
| | | | | | | **Total** | 489.46 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 363.17 | 350.56 | 356.8 | |
| Total summer gains | 873.54 | 840.02 | 826.81 | **(P5)** |
| Summer gain/loss ratio | 4.17 | 4.01 | 3.95 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.46 | 1.46 | 1.46 | |
| Threshold temperature | 21.63 | 23.37 | 23.21 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# APPENDIX B3 – SAP OUTPUTS FOR SAMPLE UNITS “GREEN”

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 22 January 2019 at 11:30:26*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 73.52m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 A-0-02

**Address :** A-0-02, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 17.39 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 9.35 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 47.6 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 43.2 kWh/m² | |
| | | OK |

## 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 | 0.11 (max. 0.25) | 0.11 (max. 0.70) | OK |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: North | 3.8m² | |
| Windows facing: East | 15.96m² | |
| Ventilation rate: | 2.00 | |
| Blinds/curtains: | Light-coloured curtain or roller blind<br>Closed 100% of daylight hours | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party  Walls U-value | 0 W/m²K | |
| Floors U-value | 0.11 W/m²K | |
| Community heating, heat from CHP | | |
| Photovoltaic array | | |

# Predicted Energy Assessment

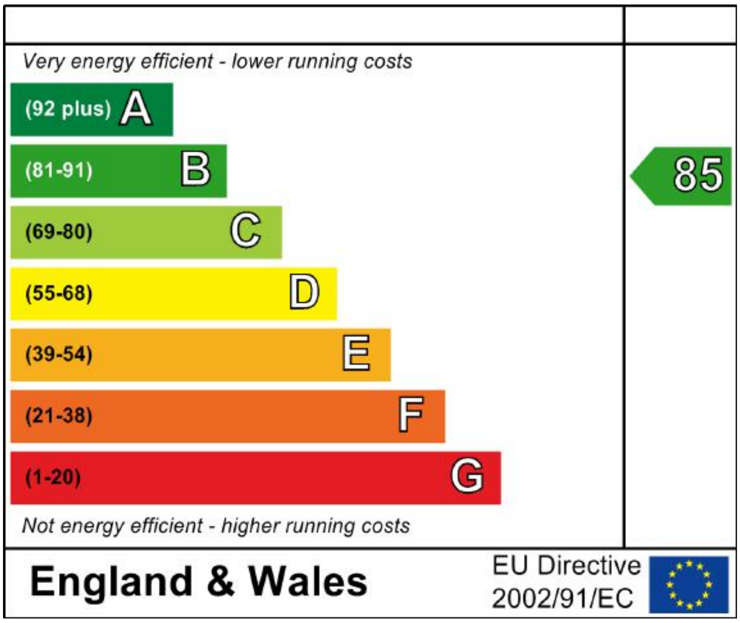
A-0-02
Bertram Street
London

Dwelling type: Ground floor Flat
Date of assessment: 22 January 2019
Produced by: Matthew Stainrod
Total floor area: 73.52 m²

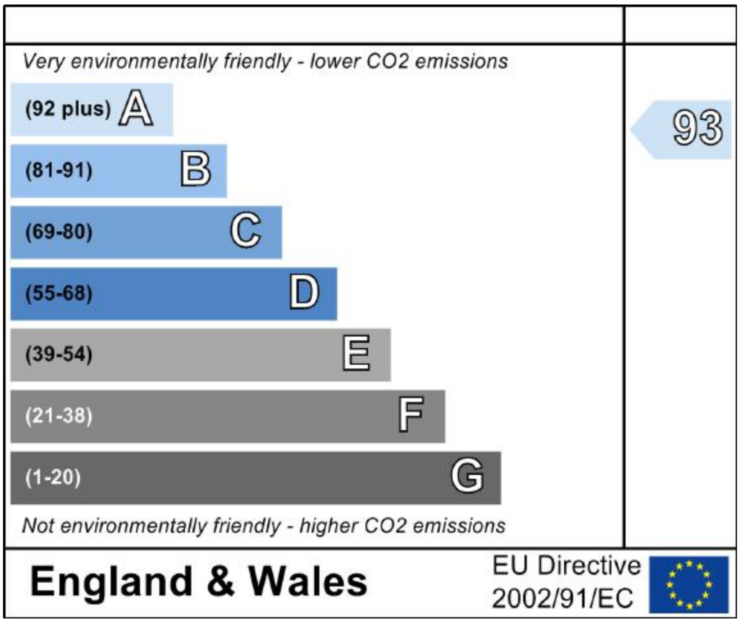
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-0-02

| | |
|---|---|
| Address: | A-0-02, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 22 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 169.63 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 73.52 m² | 2.4 m |
| Living area: | 25.1 m² (fraction 0.341) | |
| Front of dwelling faces: | North | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Front | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Front | 16mm or more | 0.7 | 0.48 | 1.4 | 3.8 | 1 |
| Side | 16mm or more | 0.7 | 0.48 | 1.4 | 15.96 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | North | 0 | 0 |
| Front | | External Wall | North | 0 | 0 |
| Side | | External Wall | East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 47.64 | 21.86 | 25.78 | 0.15 | 0 | False | 14 |
| Corridor Wall | 2.4 | 0 | 2.4 | 0.15 | 0.43 | False | 14 |
| Ground Floor | 73.52 | | | 0.11 | | | 110 |
| Internal Elements | | | | | | | |
| Stud Walls | 110.4 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 39.53 | | | | | | 20 |
| Party Ceiling | 73.52 | | | | | | 30 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.076

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 23.4 | 0.05 | E4 | Jamb |
| [Approved] | 19.85 | 0.16 | E5 | Ground floor (normal) |
| [Approved] | 19.85 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| | 16.47 | 0.16 | P1 | Ground floor |
| | 16.47 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 2<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 3 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from boilers – mains gas<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | <u>Photovoltaic 1</u><br>Installed Peak power: 0.492<br>Tilt of collector: Horizontal<br>Overshading: None or very little<br>Collector Orientation: South |

# SAP Input

Assess Zero Carbon Home: No

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

## Property Address: 06-18-69419 A-0-02

**Address :** A-0-02, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 73.52 | (1a) | x | 2.4 | (2a) | = | 176.45 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 73.52 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 176.45 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | |
|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 3 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.78 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.12 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Monthly average wind speed from Table 7** | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| **Wind Factor (22a)m = (22)m ÷ 4** | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.15 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.12 | 0.12 | 0.13 | 0.14 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 3.8 | x1/[1/( 1.4 )+ 0.04] | | = | 5.04 | | | (27) |
| Windows Type 2 | | | 15.96 | x1/[1/( 1.4 )+ 0.04] | | = | 21.16 | | | (27) |
| Floor | | | 73.52 | x | 0.11 | = | 8.087199 | 110 | 8087.2 | (28) |
| Walls Type1 | 47.64 | 21.86 | 25.78 | x | 0.15 | = | 3.87 | 14 | 360.92 | (29) |
| Walls Type2 | 2.4 | 0 | 2.4 | x | 0.14 | = | 0.34 | 14 | 33.6 | (29) |
| Total area of elements, m² | | | 123.56 | | | | | | | (31) |
| Party wall | | | 39.53 | x | 0 | = | 0 | 20 | 790.6 | (32) |
| Party ceiling | | | 73.52 | | | | | 30 | 2205.6 | (32b) |
| Internal wall ** | | | 110.4 | | | | | 9 | 993.6 | (32c) |

* *for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

** *include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 41.43 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 12471.52 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 169.63 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 9.39 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 50.82 (37)

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 14.48 | 14.31 | 14.14 | 13.3 | 13.13 | 12.28 | 12.28 | 12.11 | 12.62 | 13.13 | 13.47 | 13.81 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 65.3 | 65.13 | 64.96 | 64.12 | 63.95 | 63.1 | 63.1 | 62.93 | 63.44 | 63.95 | 64.29 | 64.63 | |

Average = Sum(39)$_{1\ldots12}$ /12= 64.08 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.89 | 0.89 | 0.88 | 0.87 | 0.87 | 0.86 | 0.86 | 0.86 | 0.86 | 0.87 | 0.87 | 0.88 | |

Average = Sum(40)$_{1\ldots12}$ /12= 0.87 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.33 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 89.5 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 98.45 | 94.87 | 91.29 | 87.71 | 84.13 | 80.55 | 80.55 | 84.13 | 87.71 | 91.29 | 94.87 | 98.45 | |

Total = Sum(44)$_{1\ldots12}$ = 1074.01 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 146 | 127.69 | 131.77 | 114.88 | 110.23 | 95.12 | 88.14 | 101.14 | 102.35 | 119.28 | 130.2 | 141.39 | |

Total = Sum(45)$_{1\ldots12}$ = 1408.2 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 21.9 | 19.15 | 19.77 | 17.23 | 16.53 | 14.27 | 13.22 | 15.17 | 15.35 | 17.89 | 19.53 | 21.21 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 201.28 | 177.62 | 187.04 | 168.37 | 165.5 | 148.61 | 143.42 | 156.42 | 155.85 | 174.56 | 183.7 | 196.67 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 201.28 | 177.62 | 187.04 | 168.37 | 165.5 | 148.61 | 143.42 | 156.42 | 155.85 | 174.56 | 183.7 | 196.67 |

Output from water heater (annual)$_{1...12}$ | 2059.04 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 92.77 | 82.4 | 88.03 | 80.99 | 80.87 | 74.42 | 73.53 | 77.85 | 76.83 | 83.88 | 86.09 | 91.23 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 139.71 | 139.71 | 139.71 | 139.71 | 139.71 | 139.71 | 139.71 | 139.71 | 139.71 | 139.71 | 139.71 | 139.71 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 45.77 | 40.65 | 33.06 | 25.03 | 18.71 | 15.8 | 17.07 | 22.19 | 29.78 | 37.81 | 44.13 | 47.04 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 306.52 | 309.7 | 301.69 | 284.62 | 263.08 | 242.84 | 229.31 | 226.13 | 234.15 | 251.21 | 272.75 | 293 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 51.3 | 51.3 | 51.3 | 51.3 | 51.3 | 51.3 | 51.3 | 51.3 | 51.3 | 51.3 | 51.3 | 51.3 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -93.14 | -93.14 | -93.14 | -93.14 | -93.14 | -93.14 | -93.14 | -93.14 | -93.14 | -93.14 | -93.14 | -93.14 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 124.69 | 122.62 | 118.33 | 112.49 | 108.7 | 103.36 | 98.83 | 104.64 | 106.7 | 112.74 | 119.57 | 122.63 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 574.85 | 570.84 | 550.94 | 520.01 | 488.36 | 459.87 | 443.08 | 450.83 | 468.5 | 499.64 | 534.32 | 560.54 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 3.8 | x | 10.63 | x | 0.48 | x | 0.7 | = | 9.41 | (74) |
| North | 0.9x | 0.77 | x | 3.8 | x | 20.32 | x | 0.48 | x | 0.7 | = | 17.98 | (74) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 3.8 | x | 34.53 | x | 0.48 | x | 0.7 | = | 30.55 | (74) |
| North | 0.9x | 0.77 | x | 3.8 | x | 55.46 | x | 0.48 | x | 0.7 | = | 49.08 | (74) |
| North | 0.9x | 0.77 | x | 3.8 | x | 74.72 | x | 0.48 | x | 0.7 | = | 66.11 | (74) |
| North | 0.9x | 0.77 | x | 3.8 | x | 79.99 | x | 0.48 | x | 0.7 | = | 70.77 | (74) |
| North | 0.9x | 0.77 | x | 3.8 | x | 74.68 | x | 0.48 | x | 0.7 | = | 66.08 | (74) |
| North | 0.9x | 0.77 | x | 3.8 | x | 59.25 | x | 0.48 | x | 0.7 | = | 52.42 | (74) |
| North | 0.9x | 0.77 | x | 3.8 | x | 41.52 | x | 0.48 | x | 0.7 | = | 36.73 | (74) |
| North | 0.9x | 0.77 | x | 3.8 | x | 24.19 | x | 0.48 | x | 0.7 | = | 21.4 | (74) |
| North | 0.9x | 0.77 | x | 3.8 | x | 13.12 | x | 0.48 | x | 0.7 | = | 11.61 | (74) |
| North | 0.9x | 0.77 | x | 3.8 | x | 8.86 | x | 0.48 | x | 0.7 | = | 7.84 | (74) |
| East | 0.9x | 1 | x | 15.96 | x | 19.64 | x | 0.48 | x | 0.7 | = | 72.99 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 38.42 | x | 0.48 | x | 0.7 | = | 142.78 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 63.27 | x | 0.48 | x | 0.7 | = | 235.14 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 92.28 | x | 0.48 | x | 0.7 | = | 342.94 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 113.09 | x | 0.48 | x | 0.7 | = | 420.28 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 115.77 | x | 0.48 | x | 0.7 | = | 430.23 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 110.22 | x | 0.48 | x | 0.7 | = | 409.6 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 94.68 | x | 0.48 | x | 0.7 | = | 351.84 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 73.59 | x | 0.48 | x | 0.7 | = | 273.48 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 45.59 | x | 0.48 | x | 0.7 | = | 169.42 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 24.49 | x | 0.48 | x | 0.7 | = | 91.01 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 16.15 | x | 0.48 | x | 0.7 | = | 60.02 | (76) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 82.4 | 160.76 | 265.69 | 392.01 | 486.39 | 501.01 | 475.67 | 404.26 | 310.21 | 190.82 | 102.61 | 67.87 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 657.24 | 731.6 | 816.64 | 912.02 | 974.75 | 960.87 | 918.75 | 855.09 | 778.71 | 690.46 | 636.93 | 628.4 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.96 | 0.93 | 0.87 | 0.75 | 0.58 | 0.42 | 0.3 | 0.34 | 0.54 | 0.81 | 0.93 | 0.96 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.16 | 20.33 | 20.58 | 20.83 | 20.95 | 20.99 | 21 | 21 | 20.97 | 20.8 | 20.45 | 20.12 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.18 | 20.18 | 20.18 | 20.19 | 20.19 | 20.2 | 20.2 | 20.21 | 20.2 | 20.19 | 20.19 | 20.19 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.95 | 0.92 | 0.85 | 0.72 | 0.54 | 0.37 | 0.25 | 0.28 | 0.49 | 0.77 | 0.91 | 0.96 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.07 | 19.32 | 19.67 | 20 | 20.15 | 20.2 | 20.2 | 20.2 | 20.18 | 19.97 | 19.49 | 19.03 | (90) |

fLA = Living area ÷ (4) = 0.34 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.44 | 19.66 | 19.98 | 20.28 | 20.42 | 20.47 | 20.47 | 20.47 | 20.45 | 20.26 | 19.82 | 19.4 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.44 | 19.66 | 19.98 | 20.28 | 20.42 | 20.47 | 20.47 | 20.47 | 20.45 | 20.26 | 19.82 | 19.4 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.94 | 0.91 | 0.85 | 0.72 | 0.55 | 0.38 | 0.27 | 0.3 | 0.51 | 0.77 | 0.91 | 0.95 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 618.68 | 666.86 | 691.96 | 656.54 | 538.8 | 367.64 | 244.1 | 255.8 | 393.5 | 533.75 | 577.52 | 596.4 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 988.8 | 961.47 | 875.58 | 729.88 | 557.82 | 370.33 | 244.47 | 256.45 | 402.86 | 617.46 | 817.58 | 982.25 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 275.37 | 197.97 | 136.61 | 52.81 | 14.15 | 0 | 0 | 0 | 0 | 62.28 | 172.85 | 287.08 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1199.12 | (98) |
| Space heating requirement in kWh/m²/year | 16.31 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1199.12 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 755.44 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 503.63 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2059.04 | |
| If DHW from community scheme:<br>Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1297.19 | (310a) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 864.8 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 34.21 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 142.61 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 142.61 | (331) |
| Energy for lighting (calculated in Appendix L) | | 323.34 | (332) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | -374.16 | (333) |
| Electricity generated by wind turbine (Appendix M) (negative quantity) | | 0 | (334) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 2.97 | x 0.01 = | 22.44 | (340a) |
| Space heating from heat source 2 | (307b) | x | 4.24 | x 0.01 = | 21.35 | (340b) |
| Water heating from CHP | (310a) | x | 2.97 | x 0.01 = | 38.53 | (342a) |
| Water heating from heat source 2 | (310b) | x | 4.24 | x 0.01 = | 36.67 | (342b) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 18.81 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 42.65 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| Energy saving/generation technologies | | | | | | |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 300.44 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.06 | (357) |
| **SAP rating (section12)** | | 85.15 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | |
|---|---|---|---|
| Electrical efficiency of CHP unit | | 29.8 | (361) |
| Heat efficiency of CHP unit | | 57.6 | (362) |

| | | **Energy** kWh/year | | **Emission factor** kg CO2/kWh | **Emissions** kg CO2/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1311.53 | x | 0.22 | 283.29 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 390.84 | x | 0.52 | -202.84 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2252.07 | x | 0.22 | 486.45 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 671.12 | x | 0.52 | -348.31 | (366) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | |
|---|---|---|---|---|---|---|
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 324.81 | (368) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 17.76 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 561.15 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 561.15 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 74.02 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 167.81 | (379) |
| Energy saving/generation technologies (333) to (334) as applicable<br>Item 1 | | | 0.52 | x 0.01 = | -194.19 | (380) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 608.79 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 8.28 | (384) |
| **EI rating (section 14)** | | | | | 93.12 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1311.53 | x | 1.22 | 1600.07 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 390.84 | x | 3.07 | -1199.87 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2252.07 | x | 1.22 | 2747.53 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 671.12 | x | 3.07 | -2060.33 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 = | 1834.59 | (368) |
| Electrical energy for heat distribution | [(313) x | | | = | 105.03 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | = | 3027.02 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | 3027.02 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | 3027.02 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 = | 437.83 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 = | 992.65 | (379) |
| Energy saving/generation technologies<br>Item 1 | | | | 3.07 x 0.01 = | -1148.68 | (380) |

| | | | |
|---|---|---|---|
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | 3308.82 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 22 January 2019

## Property Details: 06-18-69419 A-0-02

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | North |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 169.63 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Light-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 2 ( Windows open half the time) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 116.46 | **(P1)** |
| **Transmission heat loss coefficient:** | 50.8 | |
| **Summer heat loss coefficient:** | 167.28 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| North (Front) | 0 | 1 |
| East (Side) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| North (Front) | 0.6 | 0.9 | 1 | 0.54 | **(P8)** |
| East (Side) | 0.6 | 0.9 | 1 | 0.54 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| North (Front) | 0.9 x | 3.8 | 81.19 | 0.48 | 0.7 | 0.54 | 50.38 | |
| East (Side) | 0.9 x | 15.96 | 117.51 | 0.48 | 0.7 | 0.54 | 306.25 | |
| | | | | | | **Total** | 356.62 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 459.87 | 443.08 | 450.83 | |
| Total summer gains | 839.46 | 799.7 | 761.21 | **(P5)** |
| Summer gain/loss ratio | 5.02 | 4.78 | 4.55 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 0.81 | 0.81 | 0.81 | |
| Threshold temperature | 21.83 | 23.49 | 23.16 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 22 January 2019 at 11:30:17*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 100.24m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 A-0-06

**Address :** A-0-06, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 15.23 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 8.49 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 43.7 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 39.2 kWh/m² | |
| | | OK |

## 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 | 0.11 (max. 0.25) | 0.11 (max. 0.70) | OK |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |

Based on:

| | |
|---|---|
| Overshading: | Average or unknown |
| Windows facing: South | $12.15m^2$ |
| Windows facing: South East | $7.63m^2$ |
| Ventilation rate: | 2.00 |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours |

## 10 Key features

| | |
|---|---|
| Air permeablility | $3.0\ m^3/m^2h$ |
| Party  Walls U-value | $0\ W/m^2K$ |
| Floors U-value | $0.11\ W/m^2K$ |
| Community heating, heat from CHP | |
| Photovoltaic array | |

# Predicted Energy Assessment

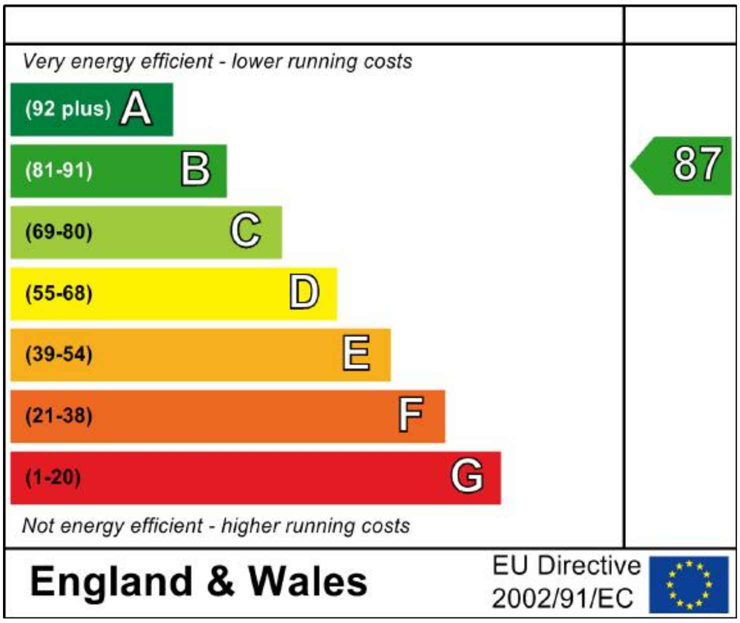
A-0-06
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Ground floor Flat |
| Date of assessment: | 22 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 100.24 m² |

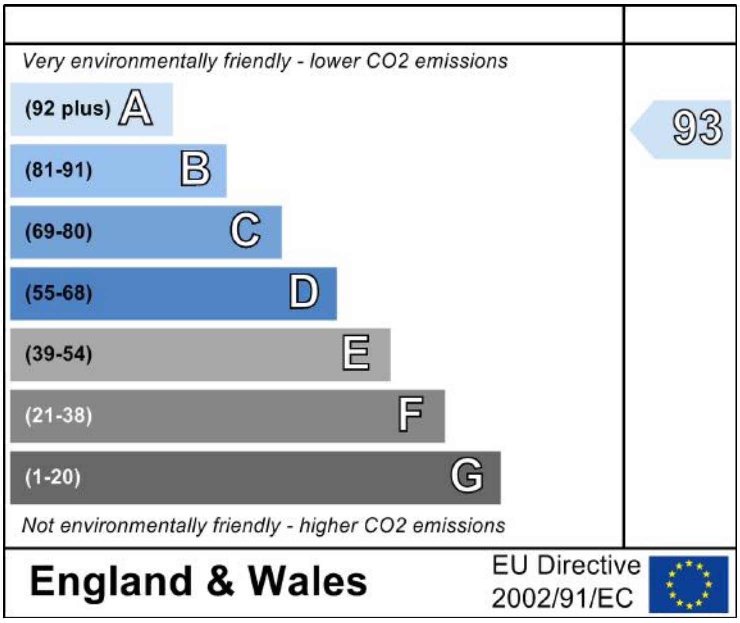
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-0-06

| | |
|---|---|
| Address: | A-0-06, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 22 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 166.49 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 100.24 m² | 2.4 m |
| Living area: | 37.51 m² (fraction 0.374) | |
| Front of dwelling faces: | North | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.44 | 1.4 | 12.15 | 1 |
| Side | 16mm or more | 0.7 | 0.44 | 1.4 | 7.63 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | North | 0 | 0 |
| Rear | | External Wall | South | 0 | 0 |
| Side | | External Wall | South East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 77.99 | 21.88 | 56.11 | 0.15 | 0 | False | 14 |
| Corridor Wall | 3.6 | 0 | 3.6 | 0.15 | 0.43 | False | 14 |
| Riser Wall | 4.8 | 0 | 4.8 | 0.15 | 0 | False | 14 |
| Ground Floor | 100.24 | | | 0.11 | | | 110 |
| Internal Elements | | | | | | | |
| Stud Walls | 144 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 22.8 | | | | | | 20 |
| Party Ceiling | 100.24 | | | | | | 30 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0654

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 23.4 | 0.05 | E4 | Jamb |
| [Approved] | 35.99 | 0.16 | E5 | Ground floor (normal) |
| [Approved] | 35.99 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 9.5 | 0.16 | P1 | Ground floor |
| | 9.5 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from boilers – mains gas<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | Photovoltaic 1<br>Installed Peak power: 0.492<br>Tilt of collector: Horizontal<br>Overshading: None or very little<br>Collector Orientation: South |
| Assess Zero Carbon Home: | No |

# SAP Input

# SAP WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 A-0-06

**Address :** A-0-06, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 100.24 | (1a) | x | 2.4 | (2a) | = | 240.58 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 100.24 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 240.58 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |
| *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | | |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 12.15 | x1/[1/( 1.4 )+ 0.04] | | = | 16.11 | | | (27) |
| Windows Type 2 | | | 7.63 | x1/[1/( 1.4 )+ 0.04] | | = | 10.12 | | | (27) |
| Floor | | | 100.24 | x | 0.11 | = | 11.0264 | 110 | 11026.4 | (28) |
| Walls Type1 | 77.99 | 21.88 | 56.11 | x | 0.15 | = | 8.42 | 14 | 785.54 | (29) |
| Walls Type2 | 3.6 | 0 | 3.6 | x | 0.14 | = | 0.51 | 14 | 50.4 | (29) |
| Walls Type3 | 4.8 | 0 | 4.8 | x | 0.15 | = | 0.72 | 14 | 67.2 | (29) |
| Total area of elements, m² | | | 186.63 | | | | | | | (31) |
| Party wall | | | 22.8 | x | 0 | = | 0 | 20 | 456 | (32) |
| Party ceiling | | | 100.24 | | | | | 30 | 3007.2 | (32b) |
| Internal wall ** | | | 144 | | | | | 9 | 1296 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 49.83 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 16688.74 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 166.49 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 12.2 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 62.04 (37)

# SAP WorkSheet: New dwelling design stage

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 20.88 | 20.63 | 20.38 | 19.11 | 18.86 | 17.59 | 17.59 | 17.34 | 18.1 | 18.86 | 19.37 | 19.87 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 82.92 | 82.67 | 82.42 | 81.15 | 80.9 | 79.63 | 79.63 | 79.38 | 80.14 | 80.9 | 81.4 | 81.91 | |

Average = Sum(39)$_{1…12}$ /12= 81.09 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.83 | 0.82 | 0.82 | 0.81 | 0.81 | 0.79 | 0.79 | 0.79 | 0.8 | 0.81 | 0.81 | 0.82 | |

Average = Sum(40)$_{1…12}$ /12= 0.81 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.74 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 99.32 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)* | | | | | | | | | | | | | |
| (44)m= | 109.25 | 105.28 | 101.3 | 97.33 | 93.36 | 89.38 | 89.38 | 93.36 | 97.33 | 101.3 | 105.28 | 109.25 | |

Total = Sum(44)$_{1…12}$ = 1191.79 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 162.01 | 141.7 | 146.22 | 127.48 | 122.32 | 105.55 | 97.81 | 112.24 | 113.58 | 132.36 | 144.48 | 156.9 | |

Total = Sum(45)$_{1…12}$ = 1562.63 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 24.3 | 21.25 | 21.93 | 19.12 | 18.35 | 15.83 | 14.67 | 16.84 | 17.04 | 19.85 | 21.67 | 23.53 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 217.29 | 191.62 | 201.49 | 180.97 | 177.59 | 159.04 | 153.08 | 167.51 | 167.07 | 187.64 | 197.98 | 212.18 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 217.29 | 191.62 | 201.49 | 180.97 | 177.59 | 159.04 | 153.08 | 167.51 | 167.07 | 187.64 | 197.98 | 212.18 |

Output from water heater (annual)$_{1...12}$ — 2213.47 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 98.09 | 87.06 | 92.84 | 85.18 | 84.89 | 77.89 | 76.74 | 81.54 | 80.56 | 88.23 | 90.84 | 96.39 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | 164.5 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 57.7 | 51.25 | 41.68 | 31.55 | 23.59 | 19.91 | 21.52 | 27.97 | 37.54 | 47.67 | 55.63 | 59.31 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 383.16 | 387.13 | 377.11 | 355.78 | 328.86 | 303.55 | 286.65 | 282.67 | 292.69 | 314.02 | 340.95 | 366.25 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | 54.19 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | -109.67 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 131.84 | 129.55 | 124.78 | 118.31 | 114.1 | 108.18 | 103.15 | 109.6 | 111.89 | 118.59 | 126.16 | 129.56 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 681.73 | 676.96 | 652.6 | 614.67 | 575.57 | 540.67 | 520.34 | 529.26 | 551.14 | 589.3 | 631.77 | 664.14 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | Access Factor Table 6d | Area m² | Flux Table 6a | g_ Table 6b | FF Table 6c | Gains (W) |
|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 36.79 | x | 0.44 | x | 0.7 | = | 59.92 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 62.67 | x | 0.44 | x | 0.7 | = | 102.07 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 85.75 | x | 0.44 | x | 0.7 | = | 139.65 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 106.25 | x | 0.44 | x | 0.7 | = | 173.04 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 119.01 | x | 0.44 | x | 0.7 | = | 193.82 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 118.15 | x | 0.44 | x | 0.7 | = | 192.42 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 113.91 | x | 0.44 | x | 0.7 | = | 185.51 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 104.39 | x | 0.44 | x | 0.7 | = | 170.01 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 92.85 | x | 0.44 | x | 0.7 | = | 151.22 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 69.27 | x | 0.44 | x | 0.7 | = | 112.81 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 44.07 | x | 0.44 | x | 0.7 | = | 71.77 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 31.49 | x | 0.44 | x | 0.7 | = | 51.28 | (77) |
| South | 0.9x | 0.77 | x | 12.15 | x | 46.75 | x | 0.44 | x | 0.7 | = | 121.24 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 76.57 | x | 0.44 | x | 0.7 | = | 198.57 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 97.53 | x | 0.44 | x | 0.7 | = | 252.94 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 110.23 | x | 0.44 | x | 0.7 | = | 285.88 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 114.87 | x | 0.44 | x | 0.7 | = | 297.9 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 110.55 | x | 0.44 | x | 0.7 | = | 286.69 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 108.01 | x | 0.44 | x | 0.7 | = | 280.11 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 104.89 | x | 0.44 | x | 0.7 | = | 272.03 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 101.89 | x | 0.44 | x | 0.7 | = | 264.22 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 82.59 | x | 0.44 | x | 0.7 | = | 214.17 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 55.42 | x | 0.44 | x | 0.7 | = | 143.72 | (78) |
| South | 0.9x | 0.77 | x | 12.15 | x | 40.4 | x | 0.44 | x | 0.7 | = | 104.77 | (78) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 181.17 | 300.64 | 392.59 | 458.91 | 491.72 | 479.11 | 465.62 | 442.04 | 415.44 | 326.98 | 215.49 | 156.05 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 862.89 | 977.59 | 1045.2 | 1073.59 | 1067.29 | 1019.78 | 985.96 | 971.3 | 966.59 | 916.28 | 847.25 | 820.19 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.96 | 0.93 | 0.88 | 0.79 | 0.66 | 0.49 | 0.35 | 0.37 | 0.56 | 0.79 | 0.92 | 0.96 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.23 | 20.41 | 20.61 | 20.81 | 20.93 | 20.99 | 21 | 21 | 20.98 | 20.84 | 20.51 | 20.19 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.23 | 20.23 | 20.23 | 20.25 | 20.25 | 20.26 | 20.26 | 20.26 | 20.25 | 20.25 | 20.24 | 20.24 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.95 | 0.91 | 0.86 | 0.76 | 0.62 | 0.44 | 0.29 | 0.31 | 0.5 | 0.76 | 0.91 | 0.96 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.21 | 19.47 | 19.76 | 20.03 | 20.18 | 20.25 | 20.26 | 20.26 | 20.23 | 20.07 | 19.63 | 19.16 | | (90) |
| | | | | | | | | | | fLA = Living area ÷ (4) = | | | 0.37 | (91) |

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.59 | 19.82 | 20.08 | 20.32 | 20.46 | 20.53 | 20.53 | 20.54 | 20.51 | 20.36 | 19.96 | 19.55 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.59 | 19.82 | 20.08 | 20.32 | 20.46 | 20.53 | 20.53 | 20.54 | 20.51 | 20.36 | 19.96 | 19.55 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.94 | 0.91 | 0.85 | 0.76 | 0.63 | 0.46 | 0.32 | 0.34 | 0.52 | 0.76 | 0.9 | 0.95 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 812.67 | 886.16 | 891.54 | 818.05 | 672.39 | 465.88 | 312.5 | 327.17 | 502.41 | 697.44 | 764.41 | 779.61 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 1268.05 | 1233.74 | 1118.92 | 926.91 | 708.88 | 471.83 | 313.3 | 328.25 | 513.89 | 789.25 | 1047.02 | 1257.12 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 338.8 | 233.57 | 169.17 | 78.39 | 27.15 | 0 | 0 | 0 | 0 | 68.31 | 203.47 | 355.27 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1474.12 | (98) |
| Space heating requirement in kWh/m²/year | 14.71 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1474.12 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 928.7 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 619.13 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2213.47 | |

If DHW from community scheme:

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1394.49 | (310a) |
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 929.66 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 38.72 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 194.45 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 194.45 | (331) |
| Energy for lighting (calculated in Appendix L) | | 407.62 | (332) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | -374.16 | (333) |
| Electricity generated by wind turbine (Appendix M) (negative quantity) | | 0 | (334) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 2.97 | x 0.01 = | 27.58 | (340a) |
| Space heating from heat source 2 | (307b) x | 4.24 | x 0.01 = | 26.25 | (340b) |
| Water heating from CHP | (310a) x | 2.97 | x 0.01 = | 41.42 | (342a) |
| Water heating from heat source 2 | (310b) x | 4.24 | x 0.01 = | 39.42 | (342b) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 25.65 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 53.77 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| Energy saving/generation technologies | | | | | |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 334.08 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 0.97 | (357) |
| **SAP rating (section12)** | | 86.52 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| Electrical efficiency of CHP unit | | | | | 29.8 | (361) |
| Heat efficiency of CHP unit | | | | | 57.6 | (362) |
| | | **Energy** kWh/year | | **Emission factor** kg CO2/kWh | **Emissions** kg CO2/year | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1612.32 | x | 0.22 | 348.26 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 480.47 | x | 0.52 | -249.37 | (364) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2420.98 | x | 0.22 | | 522.93 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 721.45 | x | 0.52 | | -374.43 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 0.22 | = | 367.62 | (368) |
| Electrical energy for heat distribution | [(313) x | | | 0.52 | = | 20.1 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | | = | 635.12 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | | 635.12 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | | 0.52 | = | 100.92 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | | 0.52 | = | 211.56 | (379) |
| Energy saving/generation technologies (333) to (334) as applicable<br>Item 1 | | | | 0.52 | x 0.01 = | -194.19 | (380) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | | 753.4 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | | 7.52 | (384) |
| **EI rating (section 14)** | | | | | | 93.05 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1612.32 | x | 1.22 | | 1967.03 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 480.47 | x | 3.07 | | -1475.05 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2420.98 | x | 1.22 | | 2953.6 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 721.45 | x | 3.07 | | -2214.86 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 2076.4 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 118.87 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 3425.99 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 3425.99 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 3425.99 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 596.95 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 1251.4 | (379) |

# SAP WorkSheet: New dwelling design stage

| | | | | |
|---|---|---|---|---|
| Energy saving/generation technologies | | | | |
| Item 1 | 3.07 | x 0.01 = | -1148.68 | (380) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | 4125.66 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 22 January 2019

## Property Details: 06-18-69419 A-0-06

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | North |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 166.49 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 2 ( Windows open half the time) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 158.78 | **(P1)** |
| **Transmission heat loss coefficient:** | 62 | |
| **Summer heat loss coefficient:** | 220.82 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| South (Rear) | 0 | 1 |
| South East (Side) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| South (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| South East (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| South (Rear) | 0.9 x | 12.15 | 112.21 | 0.44 | 0.7 | 0.76 | 289.1 | |
| South East (Side) | 0.9 x | 7.63 | 119.92 | 0.44 | 0.7 | 0.76 | 194.03 | |
| | | | | | | **Total** | 483.13 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 540.67 | 520.34 | 529.26 | |
| Total summer gains | 1044.04 | 1003.47 | 995.51 | **(P5)** |
| Summer gain/loss ratio | 4.73 | 4.54 | 4.51 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 0.83 | 0.83 | 0.83 | |
| Threshold temperature | 21.56 | 23.28 | 23.14 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 22 January 2019 at 11:30:08*

## Project Information:

| | | | |
|---|---|---|---|
| **Assessed By:** | Matthew Stainrod (STRO023501) | **Building Type:** | Flat |

## Dwelling Details:

| | | | |
|---|---|---|---|
| **NEW DWELLING DESIGN STAGE** | | Total Floor Area: 70.75m² | |
| **Site Reference :** | Bertram Street | **Plot Reference:** | 06-18-69419 A-1-01 |
| **Address :** | A-1-01, Bertram Street, London | | |

## Client Details:

| | |
|---|---|
| **Name:** | McBains |
| **Address :** | 26 Finsbury Square, London, EC2A 1DS |

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 15.86 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 8.08 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 38.8 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 34.4 kWh/m² | |
| | | **OK** |

## 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 | 1.40 (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: | Community heating schemes - CommCHP |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | **OK** |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |

Based on:

| | |
|---|---|
| Overshading: | Average or unknown |
| Windows facing: North | 1.92m² |
| Windows facing: West | 15.96m² |
| Ventilation rate: | 4.00 |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from CHP | |
| Photovoltaic array | |

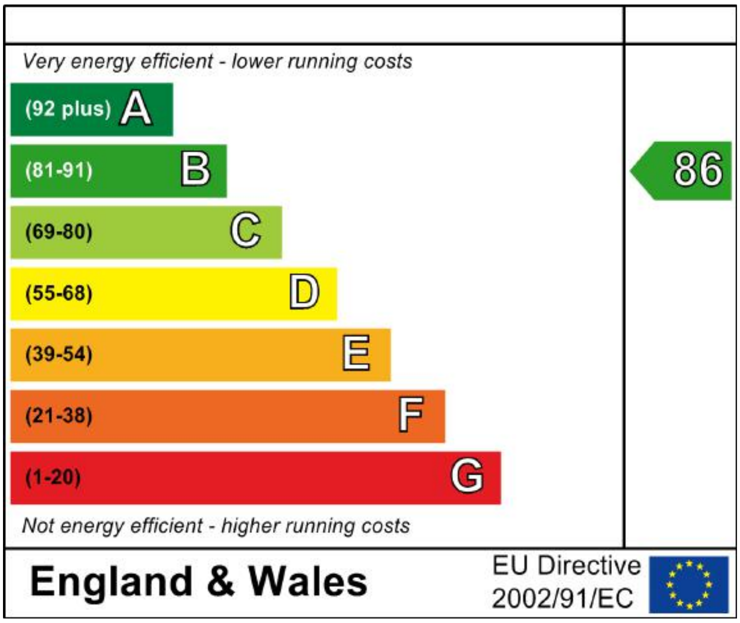
# Predicted Energy Assessment

| | | |
|---|---|---|
| A-1-01 | Dwelling type: | Mid floor Flat |
| Bertram Street | Date of assessment: | 22 January 2019 |
| London | Produced by: | Matthew Stainrod |
| | Total floor area: | 70.75 m² |

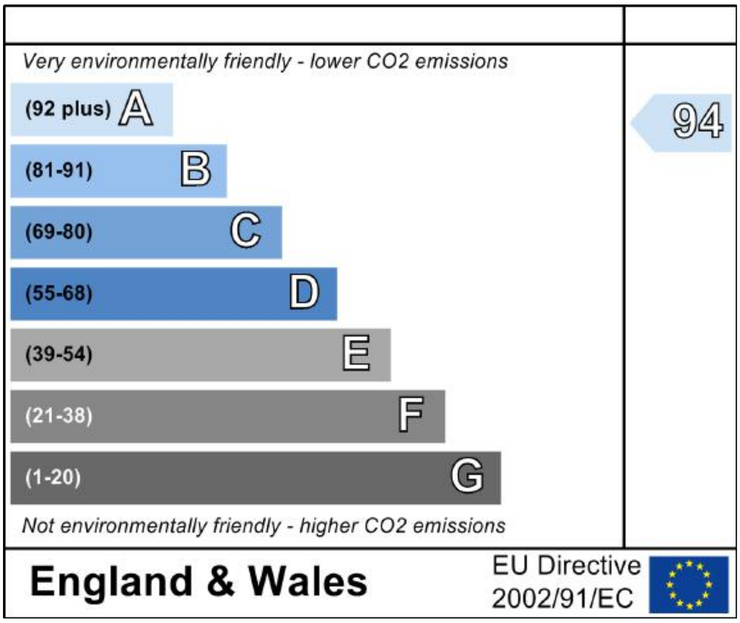
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-1-01

| | |
|---|---|
| Address: | A-1-01, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 22 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 99.4 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 70.75 m² | 2.4 m |
| Living area: | 25.03 m² (fraction 0.354) | |
| Front of dwelling faces: | South | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 1.92 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 15.96 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | South | 0 | 0 |
| Rear | | External Wall | North | 0 | 0 |
| Side | | External Wall | West | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 47.64 | 19.98 | 27.66 | 0.15 | 0 | False | 14 |
| Corridor Wall | 8.02 | 0 | 8.02 | 0.15 | 0.43 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 105.6 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 31.51 | | | | | | 20 |
| Party Ceiling | 70.75 | | | | | | 30 |
| Party Floor | 70.75 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0964

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 23.4 | 0.05 | E4 | Jamb |
| [Approved] | 46.38 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 4.8 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 7.2 | 0.06 | E18 | Party wall between dwellings |
| | 26.26 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 2<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | Photovoltaic 1<br>Installed Peak power: 0.492<br>Tilt of collector: Horizontal<br>Overshading: None or very little<br>Collector Orientation: South |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 A-1-01

**Address :** A-1-01, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 70.75 | (1a) | x | 2.4 | (2a) | = | 169.8 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 70.75 | (4) | | | | | | |
| Dwelling volume | | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) | = | 169.8 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | | |
|---|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = | (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |
| *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | | |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 1.92 | x1/[1/( 1.4 )+ 0.04] | | = | 2.55 | | | (27) |
| Windows Type 2 | | | 15.96 | x1/[1/( 1.4 )+ 0.04] | | = | 21.16 | | | (27) |
| Walls Type1 | 47.64 | 19.98 | 27.66 | x | 0.15 | = | 4.15 | 14 | 387.24 | (29) |
| Walls Type2 | 8.02 | 0 | 8.02 | x | 0.14 | = | 1.13 | 14 | 112.28 | (29) |
| Total area of elements, m² | | | 55.66 | | | | | | | (31) |
| Party wall | | | 31.51 | x | 0 | = | 0 | 20 | 630.2 | (32) |
| Party floor | | | 70.75 | | | | | 40 | 2830 | (32a) |
| Party ceiling | | | 70.75 | | | | | 30 | 2122.5 | (32b) |
| Internal wall ** | | | 105.6 | | | | | 9 | 950.4 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 31.92 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 7032.62 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 99.4 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 5.36 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 37.29 (37)

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 14.74 | 14.56 | 14.38 | 13.49 | 13.31 | 12.42 | 12.42 | 12.24 | 12.78 | 13.31 | 13.67 | 14.03 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 52.03 | 51.85 | 51.67 | 50.78 | 50.6 | 49.71 | 49.71 | 49.53 | 50.06 | 50.6 | 50.96 | 51.31 | |

Average = $Sum(39)_{1...12}$ /12= 50.73 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.74 | 0.73 | 0.73 | 0.72 | 0.72 | 0.7 | 0.7 | 0.7 | 0.71 | 0.72 | 0.72 | 0.73 | |

Average = $Sum(40)_{1...12}$ /12= 0.72 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.26 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 87.97 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

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

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 96.77 | 93.25 | 89.73 | 86.22 | 82.7 | 79.18 | 79.18 | 82.7 | 86.22 | 89.73 | 93.25 | 96.77 |

Total = $Sum(44)_{1...12}$ = 1055.7 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 143.51 | 125.51 | 129.52 | 112.92 | 108.35 | 93.5 | 86.64 | 99.42 | 100.61 | 117.25 | 127.98 | 138.98 |

Total = $Sum(45)_{1...12}$ = 1384.18 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 21.53 | 18.83 | 19.43 | 16.94 | 16.25 | 14.02 | 13 | 14.91 | 15.09 | 17.59 | 19.2 | 20.85 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 198.79 | 175.44 | 184.8 | 166.41 | 163.63 | 146.99 | 141.91 | 154.7 | 154.1 | 172.52 | 181.48 | 194.26 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 198.79 | 175.44 | 184.8 | 166.41 | 163.63 | 146.99 | 141.91 | 154.7 | 154.1 | 172.52 | 181.48 | 194.26 | |

Output from water heater (annual)$_{1...12}$ | 2035.02 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 91.94 | 81.68 | 87.29 | 80.34 | 80.25 | 73.88 | 73.03 | 77.28 | 76.25 | 83.21 | 85.35 | 90.43 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

### 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= | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | 135.85 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 44.36 | 39.4 | 32.04 | 24.26 | 18.13 | 15.31 | 16.54 | 21.5 | 28.86 | 36.64 | 42.77 | 45.59 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 297.08 | 300.16 | 292.39 | 275.85 | 254.98 | 235.36 | 222.25 | 219.17 | 226.93 | 243.47 | 264.35 | 283.97 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | 50.85 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | -90.57 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 123.57 | 121.54 | 117.32 | 111.58 | 107.86 | 102.61 | 98.16 | 103.87 | 105.9 | 111.84 | 118.54 | 121.55 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 561.14 | 557.24 | 537.89 | 507.83 | 477.1 | 449.41 | 433.08 | 440.67 | 457.83 | 488.09 | 521.79 | 547.25 | (73) |

### 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 1.92 | x | 10.63 | x | 0.558 | x | 0.7 | = | 5.53 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 20.32 | x | 0.558 | x | 0.7 | = | 10.56 | (74) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 1.92 | x | 34.53 | x | 0.558 | x | 0.7 | = | 17.95 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 55.46 | x | 0.558 | x | 0.7 | = | 28.83 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 74.72 | x | 0.558 | x | 0.7 | = | 38.83 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 79.99 | x | 0.558 | x | 0.7 | = | 41.57 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 74.68 | x | 0.558 | x | 0.7 | = | 38.81 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 59.25 | x | 0.558 | x | 0.7 | = | 30.79 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 41.52 | x | 0.558 | x | 0.7 | = | 21.58 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 24.19 | x | 0.558 | x | 0.7 | = | 12.57 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 13.12 | x | 0.558 | x | 0.7 | = | 6.82 | (74) |
| North | 0.9x | 0.77 | x | 1.92 | x | 8.86 | x | 0.558 | x | 0.7 | = | 4.61 | (74) |
| West | 0.9x | 0.77 | x | 15.96 | x | 19.64 | x | 0.56 | x | 0.7 | = | 84.85 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 38.42 | x | 0.56 | x | 0.7 | = | 165.98 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 63.27 | x | 0.56 | x | 0.7 | = | 273.35 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 92.28 | x | 0.56 | x | 0.7 | = | 398.66 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 113.09 | x | 0.56 | x | 0.7 | = | 488.58 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 115.77 | x | 0.56 | x | 0.7 | = | 500.15 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 110.22 | x | 0.56 | x | 0.7 | = | 476.16 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 94.68 | x | 0.56 | x | 0.7 | = | 409.01 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 73.59 | x | 0.56 | x | 0.7 | = | 317.92 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 45.59 | x | 0.56 | x | 0.7 | = | 196.95 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 24.49 | x | 0.56 | x | 0.7 | = | 105.8 | (80) |
| West | 0.9x | 0.77 | x | 15.96 | x | 16.15 | x | 0.56 | x | 0.7 | = | 69.78 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 90.38 | 176.54 | 291.3 | 427.49 | 527.41 | 541.72 | 514.97 | 439.8 | 339.49 | 209.52 | 112.61 | 74.38 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 651.52 | 733.78 | 829.18 | 935.32 | 1004.51 | 991.13 | 948.05 | 880.47 | 797.32 | 697.61 | 634.41 | 621.63 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.87 | 0.83 | 0.74 | 0.6 | 0.45 | 0.32 | 0.23 | 0.26 | 0.42 | 0.66 | 0.82 | 0.89 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.11 | 20.32 | 20.59 | 20.84 | 20.95 | 20.99 | 21 | 21 | 20.97 | 20.81 | 20.44 | 20.08 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.31 | 20.31 | 20.31 | 20.33 | 20.33 | 20.34 | 20.34 | 20.34 | 20.33 | 20.33 | 20.32 | 20.32 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.86 | 0.81 | 0.72 | 0.57 | 0.42 | 0.29 | 0.2 | 0.22 | 0.38 | 0.63 | 0.8 | 0.88 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.13 | 19.42 | 19.8 | 20.13 | 20.27 | 20.33 | 20.34 | 20.34 | 20.31 | 20.1 | 19.61 | 19.09 | (90) |

fLA = Living area ÷ (4) = 0.35 (91)

# SAP WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.48 | 19.74 | 20.08 | 20.38 | 20.51 | 20.56 | 20.57 | 20.57 | 20.54 | 20.35 | 19.9 | 19.44 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.48 | 19.74 | 20.08 | 20.38 | 20.51 | 20.56 | 20.57 | 20.57 | 20.54 | 20.35 | 19.9 | 19.44 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.85 | 0.8 | 0.71 | 0.57 | 0.43 | 0.3 | 0.21 | 0.23 | 0.4 | 0.63 | 0.79 | 0.86 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 551.26 | 584.45 | 588.51 | 536.83 | 431.89 | 293.74 | 196.83 | 205.75 | 314.96 | 440.63 | 501.98 | 534.12 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 789.82 | 769.53 | 701.59 | 582.83 | 445.83 | 296.37 | 197.36 | 206.57 | 322.44 | 493.29 | 652.36 | 781.84 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 177.49 | 124.37 | 84.13 | 33.12 | 10.37 | 0 | 0 | 0 | 0 | 39.18 | 108.28 | 184.3 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 761.25 (98)

Space heating requirement in kWh/m²/year 10.76 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 761.25 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 479.59 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 319.73 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2035.02 | |
| If DHW from community scheme: Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1282.06 | (310a) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 854.71 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 29.36 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 137.24 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 137.24 | (331) |
| Energy for lighting (calculated in Appendix L) | | 313.38 | (332) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | -374.16 | (333) |
| Electricity generated by wind turbine (Appendix M) (negative quantity) | | 0 | (334) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 2.97 | x 0.01 = | 14.24 | (340a) |
| Space heating from heat source 2 | (307b) | x | 4.24 | x 0.01 = | 13.56 | (340b) |
| Water heating from CHP | (310a) | x | 2.97 | x 0.01 = | 38.08 | (342a) |
| Water heating from heat source 2 | (310b) | x | 4.24 | x 0.01 = | 36.24 | (342b) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 18.1 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 41.33 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| Energy saving/generation technologies | | | | | | |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 281.55 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.02 | (357) |
| **SAP rating (section12)** | | 85.75 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | |
|---|---|---|---|
| Electrical efficiency of CHP unit | | 29.8 | (361) |
| Heat efficiency of CHP unit | | 57.6 | (362) |

| | | **Energy** kWh/year | | **Emission factor** kg CO2/kWh | **Emissions** kg CO2/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 832.62 | x | 0.22 | 179.85 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 248.12 | x | 0.52 | -128.77 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2225.81 | x | 0.22 | 480.77 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 663.29 | x | 0.52 | -344.25 | (366) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | 0.22 | = | 278.77 | (368) |
| Electrical energy for heat distribution | [(313) x | 0.52 | = | 15.24 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 481.6 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 481.6 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 71.23 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 162.64 | (379) |
| Energy saving/generation technologies (333) to (334) as applicable<br>Item 1 | | 0.52 | x 0.01 = | -194.19 | (380) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 521.28 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 7.37 | (384) |
| **EI rating (section 14)** | | | | 93.97 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | |
|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | 57.6 | (362) |

| | | Energy kWh/year | | Primary factor | P.Energy kWh/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 832.62 | x | 1.22 | 1015.8 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 248.12 | x | 3.07 | -761.73 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2225.81 | x | 1.22 | 2715.48 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 663.29 | x | 3.07 | -2036.3 | (366) |

| | | | | | |
|---|---|---|---|---|---|
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | 1.22 | = | 1574.52 | (368) |
| Electrical energy for heat distribution | [(313) x | | = | 90.14 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | = | 2597.9 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | 2597.9 | (373) |
| Energy associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | 2597.9 | (376) |
| Energy associated with space cooling | (315) x | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | 3.07 | = | 421.33 | (378) |
| Energy associated with electricity for lighting | (332))) x | 3.07 | = | 962.07 | (379) |
| Energy saving/generation technologies<br>Item 1 | | 3.07 | x 0.01 = | -1148.68 | (380) |

| | | | |
|---|---|---|---|
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | 2832.62 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 22 January 2019

## Property Details: 06-18-69419 A-1-01

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | South |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 99.4 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 224.14 | **(P1)** |
| **Transmission heat loss coefficient:** | 37.3 | |
| **Summer heat loss coefficient:** | 261.42 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| North (Rear) | 0 | 1 |
| West (Side) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| North (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| West (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| North (Rear) | 0.9 x | 1.92 | 81.19 | 0.56 | 0.7 | 0.76 | 41.92 | |
| West (Side) | 0.9 x | 15.96 | 117.51 | 0.56 | 0.7 | 0.76 | 504.35 | |
| | | | | | | **Total** | 546.27 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 449.41 | 433.08 | 440.67 | |
| Total summer gains | 1030.15 | 979.35 | 918.46 | **(P5)** |
| Summer gain/loss ratio | 3.94 | 3.75 | 3.51 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.3 | 1.3 | 1.3 | |
| Threshold temperature | 21.24 | 22.95 | 22.62 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 22 January 2019 at 11:29:59*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 53.39m²
**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 A-1-07
**Address :** A-1-07, Bertram Street, London

## Client Details:

**Name:** McBains
**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 21.9 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 12.18 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 62.0 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 59.4 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.14 (max. 0.30) | 0.15 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | 0.20 (max. 0.25) | 0.20 (max. 0.70) | **OK** |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | **OK** |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: East | 15.96m² | |
| Windows facing: North | 2.4m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| External Walls U-value | 0.13 W/m²K | |
| Party Walls U-value | 0 W/m²K | |
| Community heating, heat from CHP | | |
| Photovoltaic array | | |

# Predicted Energy Assessment

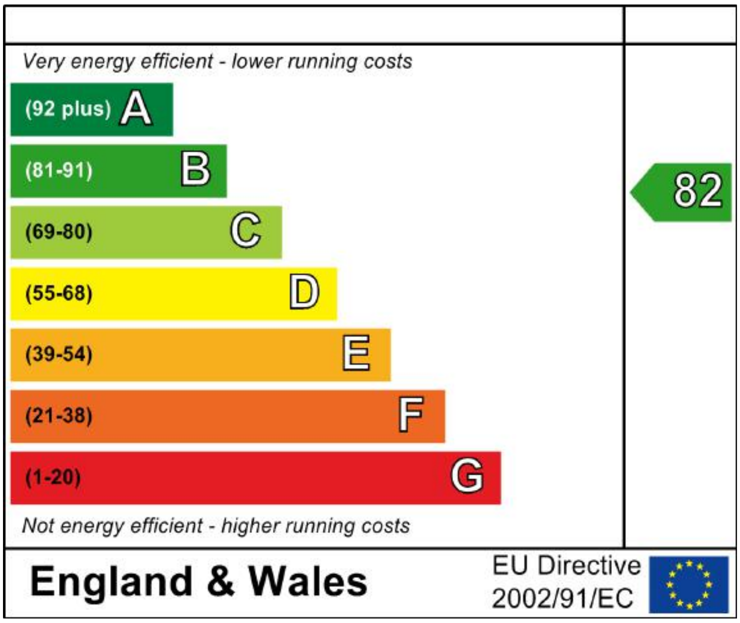
A-1-07
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Mid floor Flat |
| Date of assessment: | 22 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 53.39 m² |

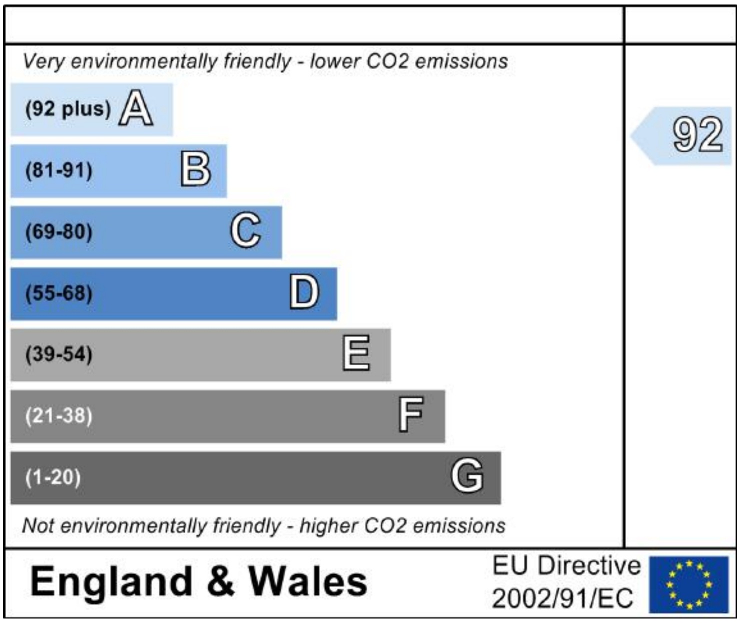
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-1-07

| | |
|---|---|
| Address: | A-1-07, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 22 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 136.43 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 53.39 m² | 2.4 m |
| Living area: | 24.42 m² (fraction 0.457) | |
| Front of dwelling faces: | West | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 15.96 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 2.4 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | West | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |
| Side | | External Wall | North | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 27.89 | 20.46 | 7.43 | 0.15 | 0 | False | 14 |
| Corridor Wall | 15.07 | 0 | 15.07 | 0.15 | 0.43 | False | 14 |
| Lift Wall | 14.57 | 0 | 14.57 | 0.15 | 0 | False | 14 |
| Stair Wall | 7.03 | 0 | 7.03 | 0.15 | 0.9 | False | 14 |
| Exposed Floor | 53.39 | | | 0.2 | | | 75 |
| Internal Elements | | | | | | | |
| Stud Walls | 81.6 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 16.32 | | | | | | 20 |
| Party Ceiling | 53.39 | | | | | | 30 |

# SAP Input

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1167

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 23.4 | 0.05 | E4 | Jamb |
| [Approved] | 26.9 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 4.8 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 26.9 | 0.32 | E20 | Exposed floor (normal) |
| | 6.8 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 6.8 | 0.16 | P7 | Exposed floor (normal) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 3 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | Photovoltaic 1<br>Installed Peak power: 0.492 |

# SAP Input

| | |
|---|---|
| | Tilt of collector: Horizontal<br>Overshading: None or very little<br>Collector Orientation: South |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 A-1-07

**Address :** A-1-07, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 53.39 | (1a) | x | 2.4 | (2a) | = | 128.14 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 53.39 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) | | = | 128.14 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | |
|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 ÷ (5) = | 0 | (8) |
| *If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)* | | | |
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |
| *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | | |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 3 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.78 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.12 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.15 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.12 | 0.12 | 0.13 | 0.14 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 15.96 | x1/[1/( 1.4 )+ 0.04] | | = | 21.16 | | | (27) |
| Windows Type 2 | | | 2.4 | x1/[1/( 1.4 )+ 0.04] | | = | 3.18 | | | (27) |
| Floor | | | 53.39 | x | 0.2 | = | 10.678 | 75 | 4004.25 | (28) |
| Walls Type1 | 27.89 | 20.46 | 7.43 | x | 0.15 | = | 1.11 | 14 | 104.02 | (29) |
| Walls Type2 | 15.07 | 0 | 15.07 | x | 0.14 | = | 2.12 | 14 | 210.98 | (29) |
| Walls Type3 | 14.57 | 0 | 14.57 | x | 0.15 | = | 2.19 | 14 | 203.98 | (29) |
| Walls Type4 | 7.03 | 0 | 7.03 | x | 0.13 | = | 0.93 | 14 | 98.42 | (29) |
| Total area of elements, m² | | | 117.95 | | | | | | | (31) |
| Party wall | | | 16.32 | x | 0 | = | 0 | 20 | 326.4 | (32) |
| Party ceiling | | | 53.39 | | | | | 30 | 1601.7 | (32b) |
| Internal wall ** | | | 81.6 | | | | | 9 | 734.4 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 44.31 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 7284.15 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 136.43 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 13.77 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Total fabric heat loss | (33) + (36) = | 58.08 | (37) |

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.52 | 10.39 | 10.27 | 9.66 | 9.53 | 8.92 | 8.92 | 8.8 | 9.17 | 9.53 | 9.78 | 10.03 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 68.6 | 68.47 | 68.35 | 67.74 | 67.61 | 67 | 67 | 66.88 | 67.25 | 67.61 | 67.86 | 68.11 | |

Average = $Sum(39)_{1\ldots12}$ /12= 67.71 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.28 | 1.28 | 1.28 | 1.27 | 1.27 | 1.25 | 1.25 | 1.25 | 1.26 | 1.27 | 1.27 | 1.28 | |

Average = $Sum(40)_{1\ldots12}$ /12= 1.27 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.79 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 76.71 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 84.39 | 81.32 | 78.25 | 75.18 | 72.11 | 69.04 | 69.04 | 72.11 | 75.18 | 78.25 | 81.32 | 84.39 | |

Total = $Sum(44)_{1\ldots12}$ = 920.56 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 125.14 | 109.45 | 112.94 | 98.47 | 94.48 | 81.53 | 75.55 | 86.69 | 87.73 | 102.24 | 111.6 | 121.19 | |

Total = $Sum(45)_{1\ldots12}$ = 1207.01 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.77 | 16.42 | 16.94 | 14.77 | 14.17 | 12.23 | 11.33 | 13 | 13.16 | 15.34 | 16.74 | 18.18 | (46) |

Water storage loss:

| | | | |
|---|---|---|---|
| Storage volume (litres) including any solar or WWHRS storage within same vessel | | 0 | (47) |

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

| | | | |
|---|---|---|---|
| a) If manufacturer’s declared loss factor is known (kWh/day): | | 0 | (48) |
| Temperature factor from Table 2b | | 0 | (49) |
| Energy lost from water storage, kWh/year | (48) x (49) = | 110 | (50) |
| b) If manufacturer’s declared cylinder loss factor is not known: | | | |
| Hot water storage loss factor from Table 2 (kWh/litre/day) | | 0.02 | (51) |
| If community heating see section 4.3 | | | |
| Volume factor from Table 2a | | 1.03 | (52) |
| Temperature factor from Table 2b | | 0.6 | (53) |
| Energy lost from water storage, kWh/year | (47) x (51) x (52) x (53) = | 1.03 | (54) |
| Enter (50) or (54) in (55) | | 1.03 | (55) |

# SAP WorkSheet: New dwelling design stage

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 180.42 | 159.38 | 168.22 | 151.96 | 149.76 | 135.02 | 130.83 | 141.97 | 141.22 | 157.52 | 165.1 | 176.47 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 180.42 | 159.38 | 168.22 | 151.96 | 149.76 | 135.02 | 130.83 | 141.97 | 141.22 | 157.52 | 165.1 | 176.47 |

Output from water heater (annual)$_{1...12}$ | 1857.85 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 85.83 | 76.33 | 81.77 | 75.53 | 75.64 | 69.9 | 69.34 | 73.05 | 71.96 | 78.22 | 79.9 | 84.52 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | 107.4 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 34.77 | 30.89 | 25.12 | 19.02 | 14.22 | 12 | 12.97 | 16.86 | 22.62 | 28.73 | 33.53 | 35.74 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 232.88 | 235.29 | 229.2 | 216.24 | 199.87 | 184.49 | 174.22 | 171.8 | 177.89 | 190.86 | 207.22 | 222.6 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | 47.53 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | -71.6 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 115.36 | 113.59 | 109.91 | 104.91 | 101.66 | 97.09 | 93.2 | 98.18 | 99.95 | 105.13 | 110.98 | 113.6 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 466.35 | 463.1 | 447.57 | 423.5 | 399.08 | 376.91 | 363.72 | 370.17 | 383.8 | 408.04 | 435.06 | 455.27 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 2.4 | x | 10.63 | x | 0.558 | x | 0.7 | = | 6.91 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 20.32 | x | 0.558 | x | 0.7 | = | 13.2 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 34.53 | x | 0.558 | x | 0.7 | = | 22.43 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 55.46 | x | 0.558 | x | 0.7 | = | 36.03 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 74.72 | x | 0.558 | x | 0.7 | = | 48.54 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 79.99 | x | 0.558 | x | 0.7 | = | 51.96 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 74.68 | x | 0.558 | x | 0.7 | = | 48.51 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 59.25 | x | 0.558 | x | 0.7 | = | 38.49 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 41.52 | x | 0.558 | x | 0.7 | = | 26.97 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 24.19 | x | 0.558 | x | 0.7 | = | 15.71 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 13.12 | x | 0.558 | x | 0.7 | = | 8.52 | (74) |
| North | 0.9x | 0.77 | x | 2.4 | x | 8.86 | x | 0.558 | x | 0.7 | = | 5.76 | (74) |
| East | 0.9x | 1 | x | 15.96 | x | 19.64 | x | 0.56 | x | 0.7 | = | 84.85 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 38.42 | x | 0.56 | x | 0.7 | = | 165.98 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 63.27 | x | 0.56 | x | 0.7 | = | 273.35 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 92.28 | x | 0.56 | x | 0.7 | = | 398.66 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 113.09 | x | 0.56 | x | 0.7 | = | 488.58 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 115.77 | x | 0.56 | x | 0.7 | = | 500.15 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 110.22 | x | 0.56 | x | 0.7 | = | 476.16 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 94.68 | x | 0.56 | x | 0.7 | = | 409.01 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 73.59 | x | 0.56 | x | 0.7 | = | 317.92 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 45.59 | x | 0.56 | x | 0.7 | = | 196.95 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 24.49 | x | 0.56 | x | 0.7 | = | 105.8 | (76) |
| East | 0.9x | 1 | x | 15.96 | x | 16.15 | x | 0.56 | x | 0.7 | = | 69.78 | (76) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 91.76 | 179.18 | 295.78 | 434.7 | 537.12 | 552.11 | 524.67 | 447.5 | 344.89 | 212.67 | 114.32 | 75.53 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 558.1 | 642.29 | 743.35 | 858.19 | 936.2 | 929.02 | 888.39 | 817.67 | 728.69 | 620.71 | 549.37 | 530.81 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.94 | 0.9 | 0.84 | 0.73 | 0.59 | 0.44 | 0.32 | 0.36 | 0.57 | 0.79 | 0.91 | 0.94 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.35 | 19.62 | 20.04 | 20.49 | 20.79 | 20.94 | 20.98 | 20.97 | 20.86 | 20.44 | 19.82 | 19.29 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 19.85 | 19.85 | 19.86 | 19.87 | 19.87 | 19.88 | 19.88 | 19.88 | 19.87 | 19.87 | 19.86 | 19.86 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.92 | 0.89 | 0.82 | 0.69 | 0.53 | 0.37 | 0.24 | 0.28 | 0.49 | 0.75 | 0.89 | 0.93 | (89) |

# SAP WorkSheet: New dwelling design stage

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 17.72 | 18.1 | 18.68 | 19.29 | 19.66 | 19.83 | 19.87 | 19.86 | 19.76 | 19.25 | 18.39 | 17.64 | | (90) |
| | | | | | | | | | | fLA = Living area ÷ (4) = | | | 0.46 | (91) |

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.47 | 18.8 | 19.3 | 19.84 | 20.18 | 20.34 | 20.38 | 20.37 | 20.26 | 19.79 | 19.04 | 18.4 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.47 | 18.8 | 19.3 | 19.84 | 20.18 | 20.34 | 20.38 | 20.37 | 20.26 | 19.79 | 19.04 | 18.4 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.91 | 0.87 | 0.81 | 0.69 | 0.55 | 0.4 | 0.28 | 0.32 | 0.52 | 0.75 | 0.87 | 0.92 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 506.54 | 560.05 | 598.89 | 593.94 | 513.69 | 368.07 | 248.88 | 259.46 | 377.81 | 465.69 | 479.1 | 486.69 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 971.77 | 951.53 | 874.89 | 741.02 | 573.21 | 384.3 | 253.01 | 265.55 | 414.39 | 621.66 | 810.58 | 966.98 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 346.13 | 263.07 | 205.35 | 105.89 | 44.29 | 0 | 0 | 0 | 0 | 116.04 | 238.67 | 357.33 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1676.77 | (98) |
| Space heating requirement in kWh/m²/year | 31.41 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1676.77 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 1056.36 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 704.24 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |

**Water heating**

| | | | |
|---|---|---|---|
| Annual water heating requirement | | 1857.85 | |
| If DHW from community scheme: Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1170.44 | (310a) |
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 780.3 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 37.11 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 103.57 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 103.57 | (331) |
| Energy for lighting (calculated in Appendix L) | | 245.65 | (332) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | -374.16 | (333) |
| Electricity generated by wind turbine (Appendix M) (negative quantity) | | 0 | (334) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 2.97 | x 0.01 = | 31.37 | (340a) |
| Space heating from heat source 2 | (307b) x | 4.24 | x 0.01 = | 29.86 | (340b) |
| Water heating from CHP | (310a) x | 2.97 | x 0.01 = | 34.76 | (342a) |
| Water heating from heat source 2 | (310b) x | 4.24 | x 0.01 = | 33.08 | (342b) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 13.66 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 32.4 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| Energy saving/generation technologies | | | | | |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 295.14 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.26 | (357) |
| **SAP rating (section12)** | | 82.42 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | |
|---|---|---|
| Electrical efficiency of CHP unit | 29.8 | (361) |
| Heat efficiency of CHP unit | 57.6 | (362) |

# SAP WorkSheet: New dwelling design stage

| | | Energy kWh/year | | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1833.97 | x | 0.22 | | 396.14 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 546.52 | x | 0.52 | | -283.64 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2032.02 | x | 0.22 | | 438.92 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 605.54 | x | 0.52 | | -314.28 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 0.22 | = | 352.37 | (368) |
| Electrical energy for heat distribution | [(313) x | | | 0.52 | = | 19.26 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | | = | 608.77 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | | 608.77 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | | 0.52 | = | 53.75 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | | 0.52 | = | 127.49 | (379) |
| Energy saving/generation technologies (333) to (334) as applicable<br>Item 1 | | | | 0.52 | x 0.01 = | -194.19 | (380) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | | 595.82 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | | 11.16 | (384) |
| **EI rating (section 14)** | | | | | | 91.89 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | |
|---|---|---|
| **Electrical efficiency of CHP unit** | 29.8 | (361) |
| **Heat efficiency of CHP unit** | 57.6 | (362) |

| | | Energy kWh/year | | Primary factor | | P.Energy kWh/year | |
|---|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1833.97 | x | 1.22 | | 2237.44 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 546.52 | x | 3.07 | | -1677.82 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2032.02 | x | 1.22 | | 2479.06 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 605.54 | x | 3.07 | | -1859.01 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1990.26 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 113.94 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 3283.87 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 3283.87 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 3283.87 | (376) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Energy associated with space cooling | (315) x | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | 3.07 | = | 317.95 | (378) |
| Energy associated with electricity for lighting | (332))) x | 3.07 | = | 754.16 | (379) |
| Energy saving/generation technologies<br>Item 1 | | 3.07 | x 0.01 = | -1148.68 | (380) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | 3207.29 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 22 January 2019

## Property Details: 06-18-69419 A-1-07

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | West |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 136.43 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 169.14 | **(P1)** |
| **Transmission heat loss coefficient:** | 58.1 | |
| **Summer heat loss coefficient:** | 227.22 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| East (Rear) | 0 | 1 |
| North (Side) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| North (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| East (Rear) | 0.9 x | 15.96 | 117.51 | 0.56 | 0.7 | 0.76 | 504.35 | |
| North (Side) | 0.9 x | 2.4 | 81.19 | 0.56 | 0.7 | 0.76 | 52.4 | |
| | | | | | | **Total** | 556.75 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 376.91 | 363.72 | 370.17 | |
| Total summer gains | 968.99 | 920.47 | 856.49 | **(P5)** |
| Summer gain/loss ratio | 4.26 | 4.05 | 3.77 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.04 | 1.04 | 1.04 | |
| Threshold temperature | 21.31 | 23 | 22.61 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 22 January 2019 at 11:29:49*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 50.87m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 A-2-04

**Address :** A-2-04, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c) | | |
| Fuel factor: 1.00 (mains gas (c), mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 18.94 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 9.13 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 45.1 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 40.2 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.14 (max. 0.30) | 0.15 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: East | 12.17m² | |
| Windows facing: North | 1.68m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| External  Walls U-value | 0.13 W/m²K | |
| Party  Walls U-value | 0 W/m²K | |
| Community heating, heat from CHP | | |
| Photovoltaic array | | |

# Predicted Energy Assessment

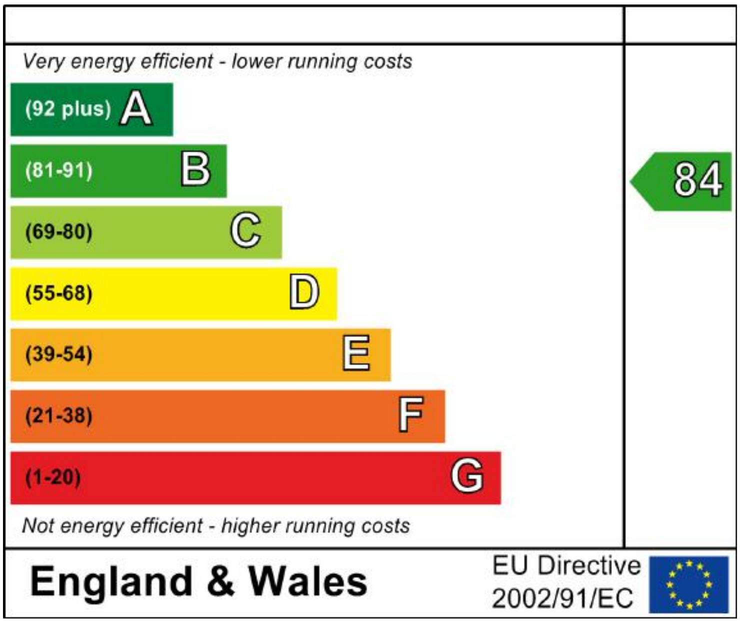
A-2-04
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Mid floor Flat |
| Date of assessment: | 22 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 50.87 m² |

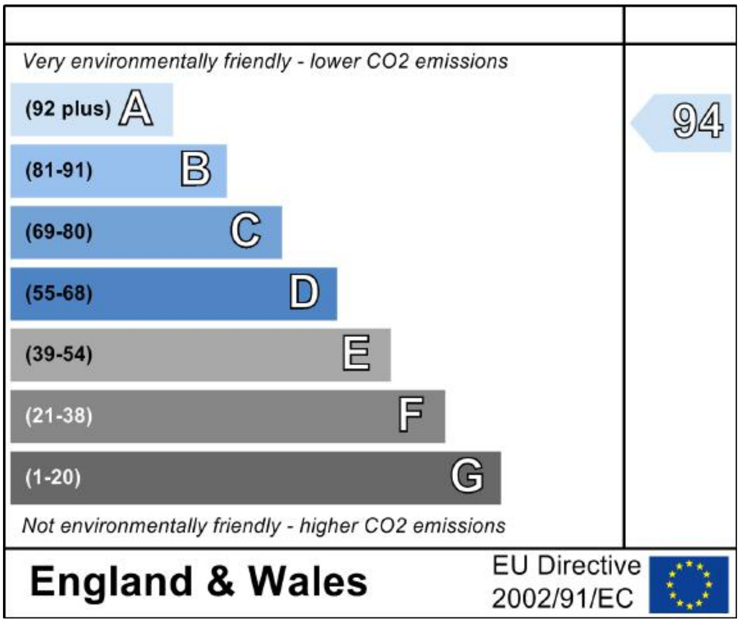
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-2-04

| | |
|---|---|
| Address: | A-2-04, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 22 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 98.75 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 50.87 m² | 2.4 m |
| Living area: | 26.6 m² (fraction 0.523) | |
| Front of dwelling faces: | West | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 12.17 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 1.68 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | West | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |
| Side | | External Wall | North | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 27.03 | 15.95 | 11.08 | 0.15 | 0 | False | 14 |
| Corridor Wall | 24.7 | 0 | 24.7 | 0.15 | 0.43 | False | 14 |
| Stair Wall | 12.64 | 0 | 12.64 | 0.15 | 0.9 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 62.4 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 11.16 | | | | | | 20 |
| Party Ceiling | 50.87 | | | | | | 30 |
| Party Floor | 50.87 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0897

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 18.6 | 0.05 | E4 | Jamb |
| [Approved] | 53.64 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 2.4 | 0.06 | E18 | Party wall between dwellings |
| | 9.3 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 3 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | Photovoltaic 1<br>Installed Peak power: 0.492<br>Tilt of collector: Horizontal<br>Overshading: None or very little<br>Collector Orientation: South |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

## Property Address: 06-18-69419 A-2-04

**Address :** A-2-04, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 50.87 | (1a) | x | 2.4 | (2a) | = | 122.09 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 50.87 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 122.09 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 3 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.78 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.12 | (21) |

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.15 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.12 | 0.12 | 0.13 | 0.14 |

*Calculate effective air change rate for the applicable case*

| | | |
|---|---|---|
| If mechanical ventilation: | 0.5 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0.5 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 79.9 | (23c) |

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 12.17 | x1/[1/( 1.4 )+ 0.04] | | = | 16.13 | | | (27) |
| Windows Type 2 | | | 1.68 | x1/[1/( 1.4 )+ 0.04] | | = | 2.23 | | | (27) |
| Walls Type1 | 27.03 | 15.95 | 11.08 | x | 0.15 | = | 1.66 | 14 | 155.12 | (29) |
| Walls Type2 | 24.7 | 0 | 24.7 | x | 0.14 | = | 3.48 | 14 | 345.8 | (29) |
| Walls Type3 | 12.64 | 0 | 12.64 | x | 0.13 | = | 1.67 | 14 | 176.96 | (29) |
| Total area of elements, m² | | | 64.37 | | | | | | | (31) |
| Party wall | | | 11.16 | x | 0 | = | 0 | 20 | 223.2 | (32) |
| Party floor | | | 50.87 | | | | | 40 | 2034.8 | (32a) |
| Party ceiling | | | 50.87 | | | | | 30 | 1526.1 | (32b) |
| Internal wall ** | | | 62.4 | | | | | 9 | 561.6 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

| | | | |
|---|---|---|---|
| Fabric heat loss, W/K = S (A x U) | (26)…(30) + (32) = | 28.11 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 5023.58 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 98.75 | (35) |

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

| | | | |
|---|---|---|---|
| Thermal bridges : S (L x Y) calculated using Appendix K | | 5.78 | (36) |

*if details of thermal bridging are not known (36) = 0.15 x (31)*

| | | | |
|---|---|---|---|
| Total fabric heat loss | (33) + (36) = | 33.89 | (37) |

# SAP WorkSheet: New dwelling design stage

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.02 | 9.9 | 9.79 | 9.2 | 9.08 | 8.5 | 8.5 | 8.38 | 8.73 | 9.08 | 9.32 | 9.55 | (38) |

Heat transfer coefficient, W/K — (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 43.91 | 43.8 | 43.68 | 43.09 | 42.98 | 42.39 | 42.39 | 42.27 | 42.62 | 42.98 | 43.21 | 43.44 | |

Average = $Sum(39)_{1…12}$ /12= 43.06 (39)

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.86 | 0.86 | 0.86 | 0.85 | 0.84 | 0.83 | 0.83 | 0.83 | 0.84 | 0.84 | 0.85 | 0.85 | |

Average = $Sum(40)_{1…12}$ /12= 0.85 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 1.72 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 74.95 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 82.44 | 79.45 | 76.45 | 73.45 | 70.45 | 67.45 | 67.45 | 70.45 | 73.45 | 76.45 | 79.45 | 82.44 | |

Total = $Sum(44)_{1…12}$ = 899.39 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 122.26 | 106.93 | 110.34 | 96.2 | 92.31 | 79.65 | 73.81 | 84.7 | 85.71 | 99.89 | 109.03 | 118.4 |

Total = $Sum(45)_{1…12}$ = 1179.24 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.34 | 16.04 | 16.55 | 14.43 | 13.85 | 11.95 | 11.07 | 12.7 | 12.86 | 14.98 | 16.36 | 17.76 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 177.54 | 156.86 | 165.62 | 149.69 | 147.58 | 133.15 | 129.09 | 139.98 | 139.2 | 155.16 | 162.53 | 173.68 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 177.54 | 156.86 | 165.62 | 149.69 | 147.58 | 133.15 | 129.09 | 139.98 | 139.2 | 155.16 | 162.53 | 173.68 |

Output from water heater (annual)$_{1...12}$ | 1830.08 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.87 | 75.5 | 80.91 | 74.78 | 74.91 | 69.28 | 68.76 | 72.38 | 71.29 | 77.43 | 79.05 | 83.59 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | 102.94 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 33.32 | 29.59 | 24.07 | 18.22 | 13.62 | 11.5 | 12.42 | 16.15 | 21.68 | 27.52 | 32.12 | 34.24 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 223.12 | 225.44 | 219.61 | 207.18 | 191.5 | 176.77 | 166.92 | 164.61 | 170.44 | 182.86 | 198.54 | 213.28 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | 47.01 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | -68.63 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 114.08 | 112.35 | 108.75 | 103.86 | 100.69 | 96.22 | 92.42 | 97.29 | 99.02 | 104.08 | 109.79 | 112.35 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 451.84 | 448.7 | 433.75 | 410.59 | 387.14 | 365.81 | 353.1 | 359.37 | 372.46 | 395.79 | 421.78 | 441.2 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | Access Factor Table 6d | Area m² | Flux Table 6a | g_ Table 6b | FF Table 6c | Gains (W) |
|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 1.68 | x | 10.63 | x | 0.558 | x | 0.7 | = | 4.84 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 20.32 | x | 0.558 | x | 0.7 | = | 9.24 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 34.53 | x | 0.558 | x | 0.7 | = | 15.7 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 55.46 | x | 0.558 | x | 0.7 | = | 25.22 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 74.72 | x | 0.558 | x | 0.7 | = | 33.98 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 79.99 | x | 0.558 | x | 0.7 | = | 36.37 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 74.68 | x | 0.558 | x | 0.7 | = | 33.96 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 59.25 | x | 0.558 | x | 0.7 | = | 26.94 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 41.52 | x | 0.558 | x | 0.7 | = | 18.88 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 24.19 | x | 0.558 | x | 0.7 | = | 11 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 13.12 | x | 0.558 | x | 0.7 | = | 5.97 | (74) |
| North | 0.9x | 0.77 | x | 1.68 | x | 8.86 | x | 0.558 | x | 0.7 | = | 4.03 | (74) |
| East | 0.9x | 1 | x | 12.17 | x | 19.64 | x | 0.56 | x | 0.7 | = | 64.7 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 38.42 | x | 0.56 | x | 0.7 | = | 126.57 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 63.27 | x | 0.56 | x | 0.7 | = | 208.44 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 92.28 | x | 0.56 | x | 0.7 | = | 303.99 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 113.09 | x | 0.56 | x | 0.7 | = | 372.56 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 115.77 | x | 0.56 | x | 0.7 | = | 381.38 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 110.22 | x | 0.56 | x | 0.7 | = | 363.09 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 94.68 | x | 0.56 | x | 0.7 | = | 311.89 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 73.59 | x | 0.56 | x | 0.7 | = | 242.42 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 45.59 | x | 0.56 | x | 0.7 | = | 150.18 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 24.49 | x | 0.56 | x | 0.7 | = | 80.67 | (76) |
| East | 0.9x | 1 | x | 12.17 | x | 16.15 | x | 0.56 | x | 0.7 | = | 53.21 | (76) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 69.54 | 135.81 | 224.14 | 329.22 | 406.53 | 417.75 | 397.05 | 338.83 | 261.3 | 161.18 | 86.64 | 57.24 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 521.38 | 584.51 | 657.89 | 739.81 | 793.67 | 783.56 | 750.14 | 698.2 | 633.76 | 556.97 | 508.42 | 498.44 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.87 | 0.82 | 0.74 | 0.61 | 0.47 | 0.34 | 0.25 | 0.28 | 0.44 | 0.67 | 0.82 | 0.88 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.9 | 20.12 | 20.43 | 20.74 | 20.9 | 20.98 | 20.99 | 20.99 | 20.94 | 20.71 | 20.27 | 19.85 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.2 | 20.2 | 20.2 | 20.21 | 20.21 | 20.22 | 20.22 | 20.23 | 20.22 | 20.21 | 20.21 | 20.21 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.85 | 0.81 | 0.72 | 0.59 | 0.44 | 0.3 | 0.2 | 0.23 | 0.4 | 0.64 | 0.8 | 0.87 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.74 | 19.06 | 19.49 | 19.9 | 20.11 | 20.2 | 20.22 | 20.22 | 20.17 | 19.88 | 19.28 | 18.69 | (90) |

fLA = Living area ÷ (4) = 0.52 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.35 | 19.61 | 19.98 | 20.34 | 20.53 | 20.61 | 20.62 | 20.62 | 20.57 | 20.31 | 19.8 | 19.29 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.35 | 19.61 | 19.98 | 20.34 | 20.53 | 20.61 | 20.62 | 20.62 | 20.57 | 20.31 | 19.8 | 19.29 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.84 | 0.79 | 0.71 | 0.59 | 0.45 | 0.32 | 0.23 | 0.25 | 0.42 | 0.64 | 0.79 | 0.85 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 437.05 | 463.55 | 469.93 | 436.93 | 359.25 | 249.86 | 169.43 | 176.82 | 264.5 | 357.36 | 400.29 | 424.03 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 660.7 | 644.3 | 588.79 | 492.86 | 379.33 | 254.64 | 170.6 | 178.51 | 275.89 | 417.39 | 548.69 | 655.75 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 166.39 | 121.46 | 88.43 | 40.27 | 14.93 | 0 | 0 | 0 | 0 | 44.66 | 106.85 | 172.4 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 755.41 (98)

Space heating requirement in kWh/m²/year 14.85 (99)

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 755.41 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 475.91 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 317.27 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1830.08 | |
| If DHW from community scheme: | | | |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1152.95 | (310a) |
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 768.63 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 27.15 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 98.68 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 98.68 | (331) |
| Energy for lighting (calculated in Appendix L) | | 235.37 | (332) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | -374.16 | (333) |
| Electricity generated by wind turbine (Appendix M) (negative quantity) | | 0 | (334) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 2.97 | x 0.01 = | 14.13 | (340a) |
| Space heating from heat source 2 | (307b) x | 4.24 | x 0.01 = | 13.45 | (340b) |
| Water heating from CHP | (310a) x | 2.97 | x 0.01 = | 34.24 | (342a) |
| Water heating from heat source 2 | (310b) x | 4.24 | x 0.01 = | 32.59 | (342b) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 13.02 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 31.04 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| Energy saving/generation technologies | | | | | |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 258.48 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.13 | (357) |
| **SAP rating (section12)** | | 84.2 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | |
|---|---|---|---|
| Electrical efficiency of CHP unit | | 29.8 | (361) |
| Heat efficiency of CHP unit | | 57.6 | (362) |

| | | **Energy** kWh/year | | **Emission factor** kg CO2/kWh | **Emissions** kg CO2/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 826.23 | x | 0.22 | 178.47 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 246.22 | x | 0.52 | -127.79 | (364) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2001.65 | x | 0.22 | | 432.36 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 596.49 | x | 0.52 | | -309.58 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 0.22 | = | 257.75 | (368) |
| Electrical energy for heat distribution | [(313) x | | | 0.52 | = | 14.09 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | | = | 445.3 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | | 445.3 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | | 0.52 | = | 51.21 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | | 0.52 | = | 122.16 | (379) |
| Energy saving/generation technologies (333) to (334) as applicable<br>Item 1 | | | | 0.52 | x 0.01 = | -194.19 | (380) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | | 424.48 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | | 8.34 | (384) |
| **EI rating (section 14)** | | | | | | 94.07 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 826.23 | x | 1.22 | | 1008 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 246.22 | x | 3.07 | | -755.88 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2001.65 | x | 1.22 | | 2442.01 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 596.49 | x | 3.07 | | -1831.23 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1455.83 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 83.34 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 2402.07 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 2402.07 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 2402.07 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 302.94 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 722.58 | (379) |

| | | | | |
|---|---|---|---|---|
| Energy saving/generation technologies<br>Item 1 | | 3.07 | x 0.01 = | -1148.68 (380) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | 2278.9 (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 22 January 2019

## Property Details: 06-18-69419 A-2-04

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | West |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 98.75 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 161.16 | **(P1)** |
| **Transmission heat loss coefficient:** | 33.9 | |
| **Summer heat loss coefficient:** | 195.05 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| East (Rear) | 0 | 1 |
| North (Side) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| North (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| East (Rear) | 0.9 x | 12.17 | 117.51 | 0.56 | 0.7 | 0.76 | 384.58 | |
| North (Side) | 0.9 x | 1.68 | 81.19 | 0.56 | 0.7 | 0.76 | 36.68 | |
| | | | | | | **Total** | 421.26 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 365.81 | 353.1 | 359.37 | |
| Total summer gains | 813.74 | 774.36 | 727.54 | **(P5)** |
| Summer gain/loss ratio | 4.17 | 3.97 | 3.73 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.31 | 1.31 | 1.31 | |
| Threshold temperature | 21.48 | 23.18 | 22.84 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 22 January 2019 at 11:29:39*

## Project Information:

| | | | |
|---|---|---|---|
| **Assessed By:** | Matthew Stainrod (STRO023501) | **Building Type:** | Flat |

## Dwelling Details:

| | | | |
|---|---|---|---|
| **NEW DWELLING DESIGN STAGE** | | Total Floor Area: 81.07m² | |
| **Site Reference :** | Bertram Street | **Plot Reference:** | 06-18-69419 A-2-05 |
| **Address :** | A-2-05, Bertram Street, London | | |

## Client Details:

| | |
|---|---|
| **Name:** | McBains |
| **Address :** | 26 Finsbury Square, London, EC2A 1DS |

**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 system: Mains gas (c), Mains gas (c) | | |
| Fuel factor: 1.00 (mains gas (c), mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 15.58 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 8.20 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 40.9 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 35.9 kWh/m² | |
| | | **OK** |

## 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 | 1.40 (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: | Community heating schemes - CommCHP |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | **OK** |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: West | 20.76m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party  Walls U-value | 0 W/m²K | |
| Community heating, heat from CHP | | |
| Photovoltaic array | | |

# Predicted Energy Assessment

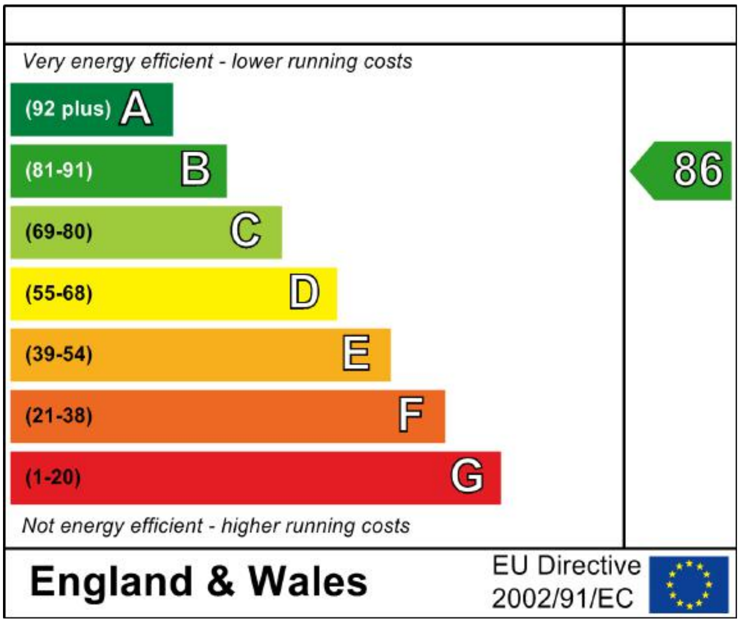
A-2-05
Bertram Street
London

Dwelling type: Mid floor Flat
Date of assessment: 22 January 2019
Produced by: Matthew Stainrod
Total floor area: 81.07 m²

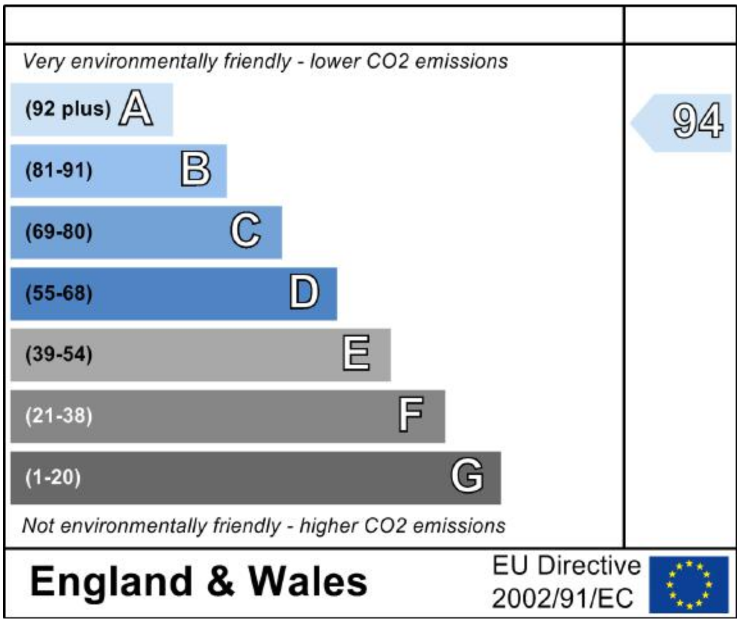
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-2-05

| | |
|---|---|
| Address: | A-2-05, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 22 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 100.03 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | |
|---|---|
| Dwelling type: | Flat |
| Detachment: | |
| Year Completed: | 2018 |

| Floor Location: | Floor area: | Storey height: |
|---|---|---|
| Floor 0 | 81.07 m² | 2.4 m |

| | |
|---|---|
| Living area: | 34.57 m² (fraction 0.426) |
| Front of dwelling faces: | East |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 20.76 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | East | 0 | 0 |
| Rear | | External Wall | West | 0 | 0 |

| | |
|---|---|
| Overshading: | Average or unknown |

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 45.29 | 22.86 | 22.43 | 0.15 | 0 | False | 14 |
| Corridor Wall | 10.7 | 0 | 10.7 | 0.15 | 0.43 | False | 14 |
| Riser Wall | 24.31 | 0 | 24.31 | 0.15 | 0 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 120 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 27.5 | | | | | | 20 |
| Party Ceiling | 81.07 | | | | | | 30 |
| Party Floor | 81.07 | | | | | | 40 |

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.082

| | **Length** | **Psi-value** | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |

# SAP Input

| | | | | |
|---|---|---|---|---|
| [Approved] | 23.4 | 0.05 | E4 | Jamb |
| [Approved] | 66.92 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 9.6 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 7.2 | 0.06 | E18 | Party wall between dwellings |
| | 22.92 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 2<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 3 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | Photovoltaic 1<br>Installed Peak power: 0.492<br>Tilt of collector: Horizontal<br>Overshading: None or very little<br>Collector Orientation: South |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 A-2-05

**Address :** A-2-05, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 81.07 | (1a) x | 2.4 | (2a) = | 194.57 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 81.07 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 194.57 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 3 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.78 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.12 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.15 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.12 | 0.12 | 0.13 | 0.14 |

*Calculate effective air change rate for the applicable case*

| | | |
|---|---|---|
| If mechanical ventilation: | 0.5 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0.5 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 79.9 | (23c) |

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows | | | 20.76 | x1/[1/( 1.4 )+ 0.04] | | = | 27.52 | | | (27) |
| Walls Type1 | 45.29 | 22.86 | 22.43 | x | 0.15 | = | 3.36 | 14 | 314.02 | (29) |
| Walls Type2 | 10.7 | 0 | 10.7 | x | 0.14 | = | 1.51 | 14 | 149.8 | (29) |
| Walls Type3 | 24.31 | 0 | 24.31 | x | 0.15 | = | 3.65 | 14 | 340.34 | (29) |
| Total area of elements, m² | | | 80.3 | | | | | | | (31) |
| Party wall | | | 27.5 | x | 0 | = | 0 | 20 | 550 | (32) |
| Party floor | | | 81.07 | | | | | 40 | 3242.8 | (32a) |
| Party ceiling | | | 81.07 | | | | | 30 | 2432.1 | (32b) |
| Internal wall ** | | | 120 | | | | | 9 | 1080 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

| | | | |
|---|---|---|---|
| Fabric heat loss, W/K = S (A x U) | (26)…(30) + (32) = | 38.98 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 8109.06 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 100.03 | (35) |

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

| | | | |
|---|---|---|---|
| Thermal bridges : S (L x Y) calculated using Appendix K | | 6.59 | (36) |

*if details of thermal bridging are not known (36) = 0.15 x (31)*

| | | | |
|---|---|---|---|
| Total fabric heat loss | (33) + (36) = | 45.57 | (37) |

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 15.97 | 15.78 | 15.6 | 14.66 | 14.48 | 13.54 | 13.54 | 13.36 | 13.92 | 14.48 | 14.85 | 15.22 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 61.54 | 61.35 | 61.16 | 60.23 | 60.04 | 59.11 | 59.11 | 58.93 | 59.48 | 60.04 | 60.42 | 60.79 | |

Average = Sum(39)$_{1…12}$ /12= 60.18 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.76 | 0.76 | 0.75 | 0.74 | 0.74 | 0.73 | 0.73 | 0.73 | 0.73 | 0.74 | 0.75 | 0.75 | |

Average = Sum(40)$_{1…12}$ /12= 0.74 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.48 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 93.17 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

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

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 102.48 | 98.76 | 95.03 | 91.3 | 87.58 | 83.85 | 83.85 | 87.58 | 91.3 | 95.03 | 98.76 | 102.48 |

Total = Sum(44)$_{1…12}$ = 1118.01 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 151.98 | 132.92 | 137.17 | 119.58 | 114.74 | 99.02 | 91.75 | 105.29 | 106.54 | 124.17 | 135.54 | 147.19 |

Total = Sum(45)$_{1…12}$ = 1465.89 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 22.8 | 19.94 | 20.57 | 17.94 | 17.21 | 14.85 | 13.76 | 15.79 | 15.98 | 18.63 | 20.33 | 22.08 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 207.26 | 182.85 | 192.44 | 173.08 | 170.02 | 152.51 | 147.03 | 160.56 | 160.04 | 179.44 | 189.03 | 202.46 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 207.26 | 182.85 | 192.44 | 173.08 | 170.02 | 152.51 | 147.03 | 160.56 | 160.04 | 179.44 | 189.03 | 202.46 |

Output from water heater (annual)$_{1…12}$ | 2116.73 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 94.76 | 84.14 | 89.83 | 82.56 | 82.37 | 75.72 | 74.73 | 79.23 | 78.22 | 85.51 | 87.86 | 93.16 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | 148.97 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 49.4 | 43.88 | 35.69 | 27.02 | 20.19 | 17.05 | 18.42 | 23.95 | 32.14 | 40.81 | 47.63 | 50.78 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 330.84 | 334.27 | 325.62 | 307.2 | 283.95 | 262.1 | 247.51 | 244.07 | 252.72 | 271.14 | 294.39 | 316.24 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | 52.38 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | -99.31 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 127.36 | 125.21 | 120.74 | 114.66 | 110.72 | 105.16 | 100.44 | 106.49 | 108.64 | 114.93 | 122.03 | 125.22 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 609.64 | 605.4 | 584.08 | 550.92 | 516.9 | 486.35 | 468.41 | 476.55 | 495.54 | 528.92 | 566.09 | 594.27 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 0.9x | 0.77 | x | 20.76 | x | 19.64 | x | 0.56 | x | 0.7 | = | 110.37 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 38.42 | x | 0.56 | x | 0.7 | = | 215.9 | (80) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 0.9x | 0.77 | x | 20.76 | x | 63.27 | x | 0.56 | x | 0.7 | = | 355.56 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 92.28 | x | 0.56 | x | 0.7 | = | 518.56 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 113.09 | x | 0.56 | x | 0.7 | = | 635.52 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 115.77 | x | 0.56 | x | 0.7 | = | 650.57 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 110.22 | x | 0.56 | x | 0.7 | = | 619.36 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 94.68 | x | 0.56 | x | 0.7 | = | 532.03 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 73.59 | x | 0.56 | x | 0.7 | = | 413.53 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 45.59 | x | 0.56 | x | 0.7 | = | 256.19 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 24.49 | x | 0.56 | x | 0.7 | = | 137.61 | (80) |
| West | 0.9x | 0.77 | x | 20.76 | x | 16.15 | x | 0.56 | x | 0.7 | = | 90.76 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 110.37 | 215.9 | 355.56 | 518.56 | 635.52 | 650.57 | 619.36 | 532.03 | 413.53 | 256.19 | 137.61 | 90.76 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 720.01 | 821.3 | 939.64 | 1069.48 | 1152.42 | 1136.92 | 1087.77 | 1008.57 | 909.07 | 785.1 | 703.7 | 685.03 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.89 | 0.84 | 0.75 | 0.61 | 0.46 | 0.33 | 0.24 | 0.27 | 0.44 | 0.68 | 0.84 | 0.9 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.01 | 20.24 | 20.54 | 20.81 | 20.94 | 20.99 | 21 | 21 | 20.96 | 20.77 | 20.36 | 19.97 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.29 | 20.29 | 20.29 | 20.3 | 20.31 | 20.32 | 20.32 | 20.32 | 20.31 | 20.31 | 20.3 | 20.3 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.88 | 0.83 | 0.73 | 0.59 | 0.43 | 0.29 | 0.2 | 0.23 | 0.4 | 0.65 | 0.82 | 0.89 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.98 | 19.3 | 19.71 | 20.08 | 20.24 | 20.3 | 20.31 | 20.31 | 20.28 | 20.04 | 19.48 | 18.92 | (90) |

fLA = Living area ÷ (4) = 0.43 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.42 | 19.7 | 20.06 | 20.39 | 20.54 | 20.59 | 20.6 | 20.6 | 20.57 | 20.35 | 19.86 | 19.36 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.42 | 19.7 | 20.06 | 20.39 | 20.54 | 20.59 | 20.6 | 20.6 | 20.57 | 20.35 | 19.86 | 19.36 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.86 | 0.81 | 0.73 | 0.59 | 0.44 | 0.31 | 0.22 | 0.24 | 0.41 | 0.65 | 0.81 | 0.88 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 620.81 | 667.19 | 681.29 | 629.81 | 511.09 | 350.39 | 235.87 | 246.45 | 373.87 | 512.71 | 570.71 | 599.57 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |

# SAP WorkSheet: New dwelling design stage

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (97)m= | 930.31 | 907.99 | 829.68 | 691.98 | 530.64 | 354.34 | 236.71 | 247.73 | 384.82 | 585.39 | 770.76 | 921.87 | (97) |

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (98)m= | 230.27 | 161.82 | 110.4 | 44.76 | 14.54 | 0 | 0 | 0 | 0 | 54.07 | 144.04 | 239.79 |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 999.69 (98)

Space heating requirement in kWh/m²/year 12.33 (99)

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme.<br>Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 999.69 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 629.81 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 419.87 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2116.73 | |
| If DHW from community scheme:<br>Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1333.54 | (310a) |
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 889.03 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 32.72 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 157.26 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 157.26 | (331) |
| Energy for lighting (calculated in Appendix L) | | 348.99 | (332) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Electricity generated by PVs (Appendix M) (negative quantity) | | -374.16 | (333) |
| Electricity generated by wind turbine (Appendix M) (negative quantity) | | 0 | (334) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 2.97 | x 0.01 = | 18.71 | (340a) |
| Space heating from heat source 2 | (307b) | x | 4.24 | x 0.01 = | 17.8 | (340b) |
| Water heating from CHP | (310a) | x | 2.97 | x 0.01 = | 39.61 | (342a) |
| Water heating from heat source 2 | (310b) | x | 4.24 | x 0.01 = | 37.69 | (342b) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 20.74 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 46.03 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| Energy saving/generation technologies | | | | | | |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 300.58 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1 | (357) |
| **SAP rating (section12)** | | 86.03 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Electrical efficiency of CHP unit | | | | | | 29.8 | (361) |
| Heat efficiency of CHP unit | | | | | | 57.6 | (362) |
| | | **Energy** kWh/year | | **Emission factor** kg CO2/kWh | | **Emissions** kg CO2/year | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1093.41 | x | 0.22 | | 236.18 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 325.84 | x | 0.52 | | -169.11 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2315.17 | x | 0.22 | | 500.08 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 689.92 | x | 0.52 | | -358.07 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 0.22 | = | 310.68 | (368) |
| Electrical energy for heat distribution | [(313) x | | | 0.52 | = | 16.98 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | | = | 536.74 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | | 536.74 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | | 0.52 | = | 81.62 | (378) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | |
|---|---|---|---|---|---|---|
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 181.13 | (379) |
| Energy saving/generation technologies (333) to (334) as applicable<br>Item 1 | | | 0.52 | x 0.01 = | -194.19 | (380) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 605.3 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 7.47 | (384) |
| **EI rating (section 14)** | | | | | 93.57 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1093.41 | x | 1.22 | | 1333.96 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 325.84 | x | 3.07 | | -1000.32 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2315.17 | x | 1.22 | | 2824.51 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 689.92 | x | 3.07 | | -2118.06 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1754.79 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 100.46 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 2895.34 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 2895.34 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 2895.34 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 482.79 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 1071.4 | (379) |
| Energy saving/generation technologies<br>Item 1 | | | | 3.07 | x 0.01 = | -1148.68 | (380) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | | 3300.85 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 22 January 2019

## Property Details: 06-18-69419 A-2-05

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | East |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 100.03 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 256.83 | **(P1)** |
| **Transmission heat loss coefficient:** | 45.6 | |
| **Summer heat loss coefficient:** | 302.4 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Rear) | 0.9 x | 20.76 | 117.51 | 0.56 | 0.7 | 0.76 | 656.04 | |
| | | | | | | **Total** | 656.04 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 486.35 | 468.41 | 476.55 | |
| Total summer gains | 1182.75 | 1124.44 | 1053.7 | **(P5)** |
| Summer gain/loss ratio | 3.91 | 3.72 | 3.48 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.3 | 1.3 | 1.3 | |
| Threshold temperature | 21.21 | 22.92 | 22.58 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 22 January 2019 at 11:29:27*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 57.93m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 A-3-03

**Address :** A-3-03, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c) | | |
| Fuel factor: 1.00 (mains gas (c), mains gas (c)) | | |
| Target Carbon Dioxide Emission Rate (TER) | 17.4 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 8.33 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 41.2 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 35.0 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.14 (max. 0.30) | 0.15 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| 7 Low energy lights | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: West | 12.15m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

| 10 Key features | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from CHP | |
| Photovoltaic array | |

# Predicted Energy Assessment

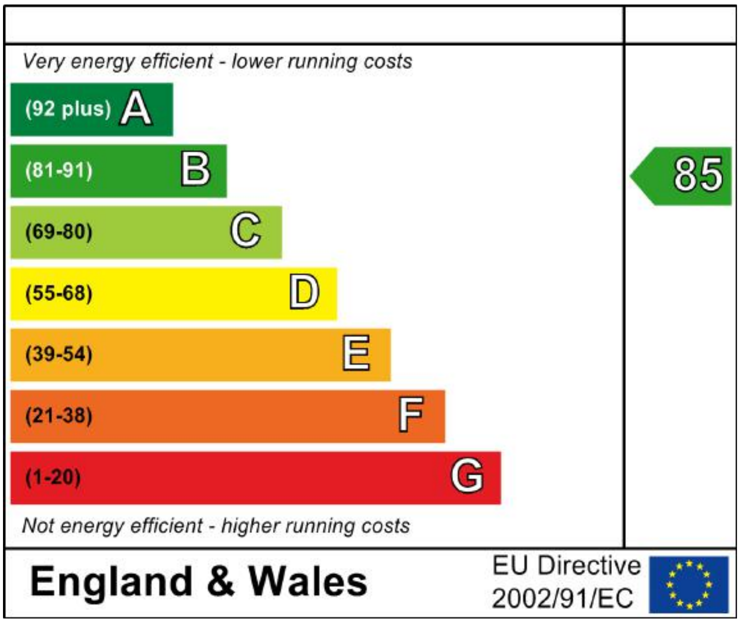
A-3-03
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Mid floor Flat |
| Date of assessment: | 22 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 57.93 m² |

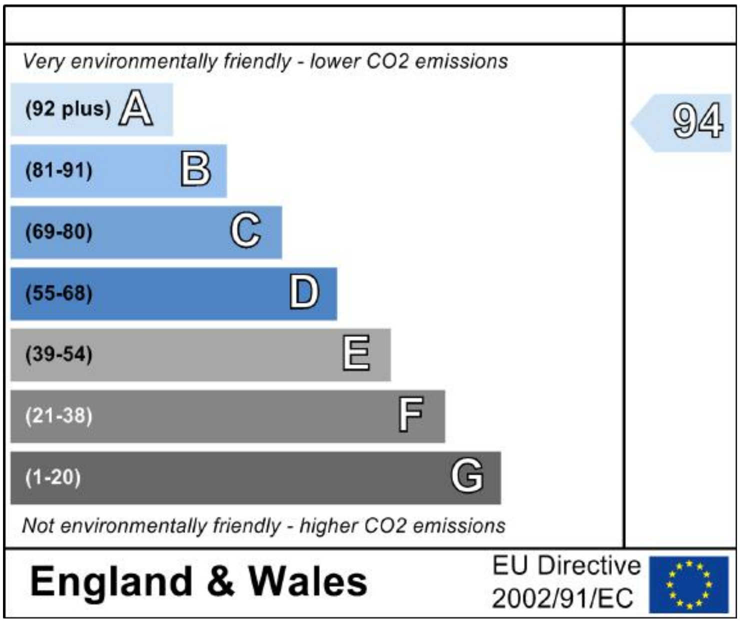
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-3-03

| | |
|---|---|
| Address: | A-3-03, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 22 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 98.76 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 57.93 m² | 2.4 m |
| Living area: | 27.94 m² (fraction 0.482) | |
| Front of dwelling faces: | East | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 12.15 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | East | 0 | 0 |
| Rear | | External Wall | West | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 35.93 | 14.25 | 21.68 | 0.15 | 0 | False | 14 |
| Corridor Wall | 24.82 | 0 | 24.82 | 0.15 | 0.43 | False | 14 |
| Riser Wall | 2.23 | 0 | 2.23 | 0.15 | 0 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 72 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 16.8 | | | | | | 20 |
| Party Ceiling | 57.93 | | | | | | 30 |
| Party Floor | 57.93 | | | | | | 40 |

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0866

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |

# SAP Input

| | | | | |
|---|---|---|---|---|
| [Approved] | 13.8 | 0.05 | E4 | Jamb |
| [Approved] | 52.48 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 2.4 | 0.06 | E18 | Party wall between dwellings |
| | 14 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 3 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | <u>Photovoltaic 1</u><br>Installed Peak power: 0.492<br>Tilt of collector: Horizontal<br>Overshading: None or very little<br>Collector Orientation: South |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 A-3-03

**Address :** A-3-03, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 57.93 | (1a) | x | 2.4 | (2a) | = | 139.03 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 57.93 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 139.03 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |
| *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | | |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 3 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.78 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.12 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.15 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.12 | 0.12 | 0.13 | 0.14 |

*Calculate effective air change rate for the applicable case*

| | | |
|---|---|---|
| If mechanical ventilation: | 0.5 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0.5 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 79.9 | (23c) |

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows | | | 12.15 | x1/[1/( 1.4 )+ 0.04] | | = | 16.11 | | | (27) |
| Walls Type1 | 35.93 | 14.25 | 21.68 | x | 0.15 | = | 3.25 | 14 | 303.52 | (29) |
| Walls Type2 | 24.82 | 0 | 24.82 | x | 0.14 | = | 3.5 | 14 | 347.48 | (29) |
| Walls Type3 | 2.23 | 0 | 2.23 | x | 0.15 | = | 0.33 | 14 | 31.22 | (29) |
| Total area of elements, m² | | | 62.98 | | | | | | | (31) |
| Party wall | | | 16.8 | x | 0 | = | 0 | 20 | 336 | (32) |
| Party floor | | | 57.93 | | | | | 40 | 2317.2 | (32a) |
| Party ceiling | | | 57.93 | | | | | 30 | 1737.9 | (32b) |
| Internal wall ** | | | 72 | | | | | 9 | 648 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

| | | | |
|---|---|---|---|
| Fabric heat loss, W/K = S (A x U) | (26)…(30) + (32) = | 26.13 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 5721.32 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 98.76 | (35) |

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

| | | | |
|---|---|---|---|
| Thermal bridges : S (L x Y) calculated using Appendix K | | 5.46 | (36) |

*if details of thermal bridging are not known (36) = 0.15 x (31)*

| | | | |
|---|---|---|---|
| Total fabric heat loss | (33) + (36) = | 31.59 | (37) |

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 11.41 | 11.28 | 11.14 | 10.48 | 10.34 | 9.68 | 9.68 | 9.54 | 9.94 | 10.34 | 10.61 | 10.88 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 43 | 42.87 | 42.73 | 42.07 | 41.93 | 41.27 | 41.27 | 41.13 | 41.53 | 41.93 | 42.2 | 42.47 | |

Average = $Sum(39)_{1...12}$ /12= 42.03 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.74 | 0.74 | 0.74 | 0.73 | 0.72 | 0.71 | 0.71 | 0.71 | 0.72 | 0.72 | 0.73 | 0.73 | |

Average = $Sum(40)_{1...12}$ /12= 0.73 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.92 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 79.86 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

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

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 87.85 | 84.65 | 81.46 | 78.26 | 75.07 | 71.87 | 71.87 | 75.07 | 78.26 | 81.46 | 84.65 | 87.85 | |

Total = $Sum(44)_{1...12}$ = 958.32 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 130.27 | 113.94 | 117.57 | 102.5 | 98.35 | 84.87 | 78.65 | 90.25 | 91.33 | 106.43 | 116.18 | 126.16 | |

Total = $Sum(45)_{1...12}$ = 1256.52 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 19.54 | 17.09 | 17.64 | 15.38 | 14.75 | 12.73 | 11.8 | 13.54 | 13.7 | 15.96 | 17.43 | 18.92 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 185.55 | 163.87 | 172.85 | 156 | 153.63 | 138.37 | 133.92 | 145.53 | 144.82 | 161.71 | 169.67 | 181.44 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 185.55 | 163.87 | 172.85 | 156 | 153.63 | 138.37 | 133.92 | 145.53 | 144.82 | 161.71 | 169.67 | 181.44 |

Output from water heater (annual)$_{1...12}$ | 1907.35 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 87.54 | 77.83 | 83.31 | 76.88 | 76.92 | 71.02 | 70.37 | 74.23 | 73.16 | 79.61 | 81.42 | 86.17 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | 115.35 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 37.48 | 33.29 | 27.07 | 20.5 | 15.32 | 12.94 | 13.98 | 18.17 | 24.38 | 30.96 | 36.14 | 38.52 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 250.3 | 252.89 | 246.35 | 232.41 | 214.83 | 198.29 | 187.25 | 184.65 | 191.2 | 205.13 | 222.72 | 239.25 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | 48.46 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | -76.9 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 117.66 | 115.81 | 111.98 | 106.77 | 103.39 | 98.63 | 94.59 | 99.77 | 101.61 | 107 | 113.09 | 115.82 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 492.34 | 488.91 | 472.31 | 446.59 | 420.45 | 396.77 | 382.72 | 389.5 | 404.1 | 430.01 | 458.86 | 480.5 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 0.9x | 0.77 | x | 12.15 | x | 19.64 | x | 0.56 | x | 0.7 | = | 64.59 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 38.42 | x | 0.56 | x | 0.7 | = | 126.36 | (80) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 0.9x | 0.77 | x | 12.15 | x | 63.27 | x | 0.56 | x | 0.7 | = | 208.09 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 92.28 | x | 0.56 | x | 0.7 | = | 303.49 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 113.09 | x | 0.56 | x | 0.7 | = | 371.94 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 115.77 | x | 0.56 | x | 0.7 | = | 380.75 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 110.22 | x | 0.56 | x | 0.7 | = | 362.49 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 94.68 | x | 0.56 | x | 0.7 | = | 311.37 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 73.59 | x | 0.56 | x | 0.7 | = | 242.02 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 45.59 | x | 0.56 | x | 0.7 | = | 149.94 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 24.49 | x | 0.56 | x | 0.7 | = | 80.54 | (80) |
| West | 0.9x | 0.77 | x | 12.15 | x | 16.15 | x | 0.56 | x | 0.7 | = | 53.12 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 64.59 | 126.36 | 208.09 | 303.49 | 371.94 | 380.75 | 362.49 | 311.37 | 242.02 | 149.94 | 80.54 | 53.12 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 556.94 | 615.26 | 680.41 | 750.09 | 792.39 | 777.52 | 745.21 | 700.87 | 646.13 | 579.94 | 539.4 | 533.62 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.86 | 0.82 | 0.74 | 0.61 | 0.47 | 0.33 | 0.24 | 0.27 | 0.43 | 0.66 | 0.81 | 0.87 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.14 | 20.32 | 20.58 | 20.82 | 20.94 | 20.99 | 21 | 21 | 20.97 | 20.8 | 20.45 | 20.1 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.3 | 20.31 | 20.31 | 20.32 | 20.32 | 20.33 | 20.33 | 20.33 | 20.33 | 20.32 | 20.32 | 20.31 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.85 | 0.8 | 0.72 | 0.58 | 0.44 | 0.3 | 0.21 | 0.23 | 0.39 | 0.63 | 0.79 | 0.86 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.16 | 19.42 | 19.77 | 20.1 | 20.25 | 20.32 | 20.33 | 20.33 | 20.29 | 20.09 | 19.62 | 19.12 | (90) |

fLA = Living area ÷ (4) = | 0.48 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.63 | 19.86 | 20.16 | 20.44 | 20.58 | 20.64 | 20.65 | 20.65 | 20.62 | 20.43 | 20.02 | 19.59 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.63 | 19.86 | 20.16 | 20.44 | 20.58 | 20.64 | 20.65 | 20.65 | 20.62 | 20.43 | 20.02 | 19.59 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.84 | 0.79 | 0.71 | 0.59 | 0.45 | 0.32 | 0.22 | 0.25 | 0.41 | 0.63 | 0.78 | 0.85 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 465.87 | 487.34 | 485.72 | 442.45 | 358.24 | 246.3 | 166.51 | 173.9 | 263.41 | 366.76 | 422.07 | 453.04 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |

# SAP WorkSheet: New dwelling design stage

Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (97)m= | 659.37 | 641.15 | 583.67 | 485.56 | 372.48 | 249.24 | 167.14 | 174.81 | 270.71 | 412.22 | 545.24 | 653.71 | (97) |

Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (98)m= | 143.97 | 103.36 | 72.87 | 31.04 | 10.6 | 0 | 0 | 0 | 0 | 33.82 | 88.68 | 149.3 |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 633.64 (98)

Space heating requirement in kWh/m²/year 10.94 (99)

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 633.64 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 399.2 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 266.13 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1907.35 | |
| If DHW from community scheme: Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1201.63 | (310a) |
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 801.09 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 26.68 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 112.37 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 112.37 | (331) |
| Energy for lighting (calculated in Appendix L) | | 264.78 | (332) |

# SAP WorkSheet: New dwelling design stage

| | | | | |
|---|---|---|---|---|
| Electricity generated by PVs (Appendix M) (negative quantity) | | | -374.16 | (333) |
| Electricity generated by wind turbine (Appendix M) (negative quantity) | | | 0 | (334) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 2.97 | x 0.01 = | 11.86 | (340a) |
| Space heating from heat source 2 | (307b) x | 4.24 | x 0.01 = | 11.28 | (340b) |
| Water heating from CHP | (310a) x | 2.97 | x 0.01 = | 35.69 | (342a) |
| Water heating from heat source 2 | (310b) x | 4.24 | x 0.01 = | 33.97 | (342b) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 14.82 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 34.92 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| Energy saving/generation technologies | | | | | |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 262.54 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.07 | (357) |
| **SAP rating (section12)** | | 85.06 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| Electrical efficiency of CHP unit | | | | | 29.8 | (361) |
| Heat efficiency of CHP unit | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Emission factor kg CO2/kWh** | **Emissions kg CO2/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 693.05 | x | 0.22 | 149.7 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 206.53 | x | 0.52 | -107.19 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2086.17 | x | 0.22 | 450.61 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 621.68 | x | 0.52 | -322.65 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 0.22 = | 253.32 | (368) |
| Electrical energy for heat distribution | [(313) x | | | 0.52 = | 13.85 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 437.64 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | | 0 = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | | 0.22 = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 437.64 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | | 0.52 = | 58.32 | (378) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 137.42 | (379) |
| Energy saving/generation technologies (333) to (334) as applicable<br>Item 1 | | 0.52 | x 0.01 = | -194.19 | (380) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 439.19 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 7.58 | (384) |
| **EI rating (section 14)** | | | | 94.28 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 693.05 | x | 1.22 | | 845.52 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 206.53 | x | 3.07 | | -634.04 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2086.17 | x | 1.22 | | 2545.13 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 621.68 | x | 3.07 | | -1908.55 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1430.78 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 81.91 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 2360.74 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 2360.74 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 2360.74 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 344.98 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 812.86 | (379) |
| Energy saving/generation technologies<br>Item 1 | | | | 3.07 | x 0.01 = | -1148.68 | (380) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | | 2369.91 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 22 January 2019

## Property Details: 06-18-69419 A-3-03

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | East |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 98.76 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 183.52 | **(P1)** |
| **Transmission heat loss coefficient:** | 31.6 | |
| **Summer heat loss coefficient:** | 215.11 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Rear) | 0.9 x | 12.15 | 117.51 | 0.56 | 0.7 | 0.76 | 383.95 | |
| | | | | | | **Total** | 383.95 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 396.77 | 382.72 | 389.5 | |
| Total summer gains | 804.34 | 766.67 | 727.29 | **(P5)** |
| Summer gain/loss ratio | 3.74 | 3.56 | 3.38 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.31 | 1.31 | 1.31 | |
| Threshold temperature | 21.05 | 22.77 | 22.49 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 22 January 2019 at 11:29:18*

## Project Information:

| | | | |
|---|---|---|---|
| **Assessed By:** | Matthew Stainrod (STRO023501) | **Building Type:** | Flat |

## Dwelling Details:

| | | | |
|---|---|---|---|
| **NEW DWELLING DESIGN STAGE** | | Total Floor Area: 66.7m² | |
| **Site Reference :** | Bertram Street | **Plot Reference:** | 06-18-69419 A-3-06 |
| **Address :** | A-3-06, Bertram Street, London | | |

## Client Details:

| | |
|---|---|
| **Name:** | McBains |
| **Address :** | 26 Finsbury Square, London, EC2A 1DS |

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 15.45 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 8.14 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 34.8 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 33.8 kWh/m² | |
| | | OK |

## 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 | 1.40 (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: | Community heating schemes - CommCHP |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South | 3.82m² | |
| Windows facing: West | 8.35m² | |
| Windows facing: South East | 7.63m² | |
| Ventilation rate: | 6.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Party  Walls U-value | 0 W/m²K | |
| Community heating, heat from CHP | | |
| Photovoltaic array | | |

# Predicted Energy Assessment

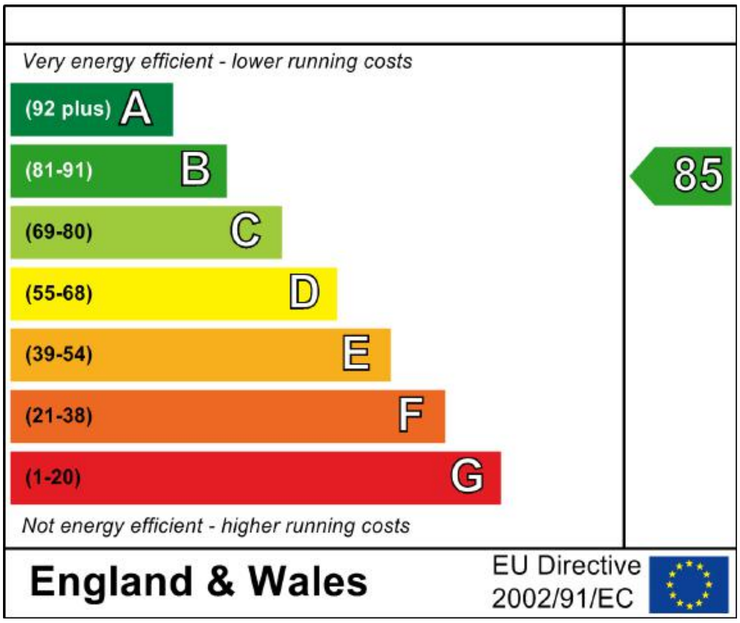
A-3-06
Bertram Street
London

Dwelling type: Mid floor Flat
Date of assessment: 22 January 2019
Produced by: Matthew Stainrod
Total floor area: 66.7 m²

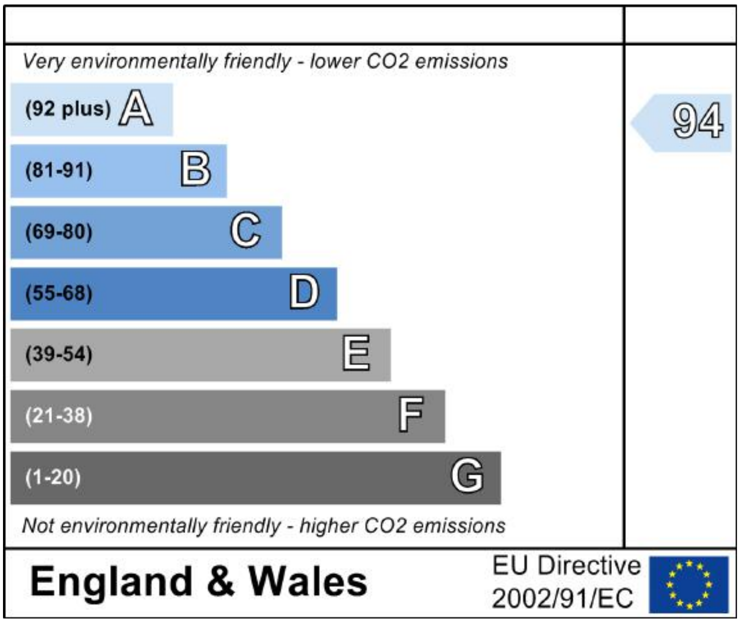
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-3-06

| | |
|---|---|
| Address: | A-3-06, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 22 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 98.32 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | |
|---|---|
| Dwelling type: | Flat |
| Detachment: | |
| Year Completed: | 2018 |

| Floor Location: | Floor area: | Storey height: |
|---|---|---|
| Floor 0 | 66.7 m² | 2.4 m |

| | |
|---|---|
| Living area: | 30.23 m² (fraction 0.453) |
| Front of dwelling faces: | North |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 3.82 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 8.35 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 7.63 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | North | 0 | 0 |
| Rear | | External Wall | South | 0 | 0 |
| Side | | External Wall | West | 0 | 0 |
| Side | | External Wall | South East | 0 | 0 |

| | |
|---|---|
| Overshading: | Average or unknown |

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 52.8 | 21.9 | 30.9 | 0.15 | 0 | False | 14 |
| Corridor Wall | 4.32 | 0 | 4.32 | 0.15 | 0.43 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 96 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 26.6 | | | | | | 20 |
| Party Ceiling | 66.7 | | | | | | 30 |

# SAP Input

| | | |
|---|---|---|
| Party Floor | 66.7 | 40 |

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0948

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 23.4 | 0.05 | E4 | Jamb |
| [Approved] | 44 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 4.8 | 0.09 | E16 | Corner (normal) |
| [Approved] | 7.2 | 0.06 | E18 | Party wall between dwellings |
| | 25.76 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

Main heating system: Community heating schemes
Heat source: Community CHP
heat from CHP, heat fraction 0.6, efficiency 57.6
Heat source: Community boilers
heat from boilers – mains gas, heat fraction 0.4, efficiency 91
Piping>=1991, pre-insulated, low temp, variable flow

## Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and TRVs
Control code: 2306

## Secondary heating system:

Secondary heating system: None

## Water heating:

Water heating: From main heating system
Water code: 901
Fuel :heat from CHP
No hot water cylinder
Solar panel: False

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | Photovoltaic 1<br>Installed Peak power: 0.492<br>Tilt of collector: Horizontal<br>Overshading: None or very little |

# SAP Input

| | |
|---|---|
| | Collector Orientation: South |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 A-3-06

**Address :** A-3-06, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 66.7 | (1a) | x | 2.4 | (2a) | = | 160.08 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 66.7 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 160.08 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 3.82 | x1/[1/( 1.4 )+ 0.04] | | = | 5.06 | | | (27) |
| Windows Type 2 | | | 8.35 | x1/[1/( 1.4 )+ 0.04] | | = | 11.07 | | | (27) |
| Windows Type 3 | | | 7.63 | x1/[1/( 1.4 )+ 0.04] | | = | 10.12 | | | (27) |
| Walls Type1 | 52.8 | 21.9 | 30.9 | x | 0.15 | = | 4.64 | 14 | 432.6 | (29) |
| Walls Type2 | 4.32 | 0 | 4.32 | x | 0.14 | = | 0.61 | 14 | 60.48 | (29) |
| Total area of elements, m² | | | 57.12 | | | | | | | (31) |
| Party wall | | | 26.6 | x | 0 | = | 0 | 20 | 532 | (32) |
| Party floor | | | 66.7 | | | | | 40 | 2668 | (32a) |
| Party ceiling | | | 66.7 | | | | | 30 | 2001 | (32b) |
| Internal wall ** | | | 96 | | | | | 9 | 864 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 34.43 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 6558.08 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 98.32 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 5.41 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 39.85 (37)

# SAP WorkSheet: New dwelling design stage

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 13.9 | 13.73 | 13.56 | 12.72 | 12.55 | 11.71 | 11.71 | 11.54 | 12.04 | 12.55 | 12.89 | 13.22 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 53.74 | 53.58 | 53.41 | 52.57 | 52.4 | 51.56 | 51.56 | 51.39 | 51.89 | 52.4 | 52.73 | 53.07 | |

Average = Sum(39)$_{1\ldots12}$ /12= 52.52 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.81 | 0.8 | 0.8 | 0.79 | 0.79 | 0.77 | 0.77 | 0.77 | 0.78 | 0.79 | 0.79 | 0.8 | |

Average = Sum(40)$_{1\ldots12}$ /12= 0.79 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.16 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 85.58 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

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

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 94.14 | 90.72 | 87.29 | 83.87 | 80.45 | 77.02 | 77.02 | 80.45 | 83.87 | 87.29 | 90.72 | 94.14 | |

Total = Sum(44)$_{1\ldots12}$ = 1026.98 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 139.61 | 122.1 | 126 | 109.85 | 105.4 | 90.95 | 84.28 | 96.71 | 97.87 | 114.06 | 124.5 | 135.2 | |

Total = Sum(45)$_{1\ldots12}$ = 1346.53 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 20.94 | 18.32 | 18.9 | 16.48 | 15.81 | 13.64 | 12.64 | 14.51 | 14.68 | 17.11 | 18.68 | 20.28 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 194.88 | 172.03 | 181.27 | 163.34 | 160.68 | 144.45 | 139.56 | 151.99 | 151.36 | 169.33 | 178 | 190.48 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 194.88 | 172.03 | 181.27 | 163.34 | 160.68 | 144.45 | 139.56 | 151.99 | 151.36 | 169.33 | 178 | 190.48 |

Output from water heater (annual)$_{1...12}$ | 1997.37 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 90.64 | 80.54 | 86.12 | 79.32 | 79.27 | 73.04 | 72.24 | 76.38 | 75.34 | 82.15 | 84.19 | 89.18 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | 129.81 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 42.23 | 37.51 | 30.5 | 23.09 | 17.26 | 14.57 | 15.75 | 20.47 | 27.47 | 34.88 | 40.71 | 43.4 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 282.8 | 285.73 | 278.34 | 262.6 | 242.72 | 224.05 | 211.57 | 208.63 | 216.03 | 231.77 | 251.64 | 270.32 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | 50.14 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | -86.54 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 121.83 | 119.85 | 115.75 | 110.17 | 106.54 | 101.44 | 97.1 | 102.66 | 104.63 | 110.41 | 116.93 | 119.86 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 540.27 | 536.51 | 518 | 489.27 | 459.94 | 433.47 | 417.83 | 425.17 | 441.55 | 470.48 | 502.7 | 527 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | Access Factor Table 6d | Area m² | Flux Table 6a | g_ Table 6b | FF Table 6c | Gains (W) |
|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 36.79 | x | 0.56 | x | 0.7 | = | 75.99 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 62.67 | x | 0.56 | x | 0.7 | = | 129.44 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 85.75 | x | 0.56 | x | 0.7 | = | 177.11 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 106.25 | x | 0.56 | x | 0.7 | = | 219.44 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 119.01 | x | 0.56 | x | 0.7 | = | 245.8 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 118.15 | x | 0.56 | x | 0.7 | = | 244.02 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 113.91 | x | 0.56 | x | 0.7 | = | 235.26 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 104.39 | x | 0.56 | x | 0.7 | = | 215.6 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 92.85 | x | 0.56 | x | 0.7 | = | 191.77 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 69.27 | x | 0.56 | x | 0.7 | = | 143.06 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 44.07 | x | 0.56 | x | 0.7 | = | 91.02 | (77) |
| Southeast | 0.9x | 0.77 | x | 7.63 | x | 31.49 | x | 0.56 | x | 0.7 | = | 65.03 | (77) |
| South | 0.9x | 0.77 | x | 3.82 | x | 46.75 | x | 0.56 | x | 0.7 | = | 48.34 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 76.57 | x | 0.56 | x | 0.7 | = | 79.17 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 97.53 | x | 0.56 | x | 0.7 | = | 100.85 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 110.23 | x | 0.56 | x | 0.7 | = | 113.98 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 114.87 | x | 0.56 | x | 0.7 | = | 118.78 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 110.55 | x | 0.56 | x | 0.7 | = | 114.31 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 108.01 | x | 0.56 | x | 0.7 | = | 111.69 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 104.89 | x | 0.56 | x | 0.7 | = | 108.46 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 101.89 | x | 0.56 | x | 0.7 | = | 105.35 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 82.59 | x | 0.56 | x | 0.7 | = | 85.4 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 55.42 | x | 0.56 | x | 0.7 | = | 57.3 | (78) |
| South | 0.9x | 0.77 | x | 3.82 | x | 40.4 | x | 0.56 | x | 0.7 | = | 41.77 | (78) |
| West | 0.9x | 0.77 | x | 8.35 | x | 19.64 | x | 0.56 | x | 0.7 | = | 44.39 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 38.42 | x | 0.56 | x | 0.7 | = | 86.84 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 63.27 | x | 0.56 | x | 0.7 | = | 143.01 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 92.28 | x | 0.56 | x | 0.7 | = | 208.57 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 113.09 | x | 0.56 | x | 0.7 | = | 255.62 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 115.77 | x | 0.56 | x | 0.7 | = | 261.67 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 110.22 | x | 0.56 | x | 0.7 | = | 249.12 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 94.68 | x | 0.56 | x | 0.7 | = | 213.99 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 73.59 | x | 0.56 | x | 0.7 | = | 166.33 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 45.59 | x | 0.56 | x | 0.7 | = | 103.04 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 24.49 | x | 0.56 | x | 0.7 | = | 55.35 | (80) |
| West | 0.9x | 0.77 | x | 8.35 | x | 16.15 | x | 0.56 | x | 0.7 | = | 36.51 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 168.73 | 295.45 | 420.97 | 542 | 620.19 | 620 | 596.07 | 538.05 | 463.45 | 331.5 | 203.67 | 143.31 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 709 | 831.96 | 938.97 | 1031.27 | 1080.13 | 1053.47 | 1013.9 | 963.23 | 905 | 801.98 | 706.38 | 670.31 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.85 | 0.78 | 0.69 | 0.56 | 0.43 | 0.31 | 0.22 | 0.24 | 0.38 | 0.61 | 0.78 | 0.86 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 20.08 | 20.34 | 20.6 | 20.83 | 20.94 | 20.99 | 21 | 21 | 20.97 | 20.81 | 20.44 | 20.03 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.25 | 20.25 | 20.25 | 20.26 | 20.27 | 20.28 | 20.28 | 20.28 | 20.27 | 20.27 | 20.26 | 20.26 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.83 | 0.76 | 0.66 | 0.54 | 0.4 | 0.28 | 0.19 | 0.21 | 0.35 | 0.57 | 0.76 | 0.85 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 19.04 | 19.4 | 19.76 | 20.06 | 20.2 | 20.26 | 20.27 | 20.28 | 20.24 | 20.05 | 19.55 | 18.98 | (90) |

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.52 | 19.82 | 20.14 | 20.41 | 20.53 | 20.59 | 20.6 | 20.6 | 20.57 | 20.4 | 19.95 | 19.45 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.52 | 19.82 | 20.14 | 20.41 | 20.53 | 20.59 | 20.6 | 20.6 | 20.57 | 20.4 | 19.95 | 19.45 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.82 | 0.75 | 0.66 | 0.54 | 0.41 | 0.29 | 0.2 | 0.22 | 0.36 | 0.58 | 0.75 | 0.83 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 579 | 624.16 | 621.02 | 557.28 | 446.59 | 305.29 | 205.52 | 214.81 | 328.03 | 464.14 | 530.87 | 558.62 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 817.77 | 799.61 | 728.46 | 604.79 | 462.92 | 308.86 | 206.3 | 215.91 | 335.84 | 513.37 | 677.85 | 809.59 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 177.64 | 117.9 | 79.94 | 34.21 | 12.15 | 0 | 0 | 0 | 0 | 36.63 | 105.83 | 186.73 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 751.01 (98)

Space heating requirement in kWh/m²/year 11.26 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 751.01 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 473.14 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 315.43 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1997.37 | |
| If DHW from community scheme: Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1258.34 | (310a) |
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 838.89 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 28.86 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 129.38 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 129.38 | (331) |
| Energy for lighting (calculated in Appendix L) | | 298.32 | (332) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | -374.16 | (333) |
| Electricity generated by wind turbine (Appendix M) (negative quantity) | | 0 | (334) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 2.97 | x 0.01 = | 14.05 | (340a) |
| Space heating from heat source 2 | (307b) x | 4.24 | x 0.01 = | 13.37 | (340b) |
| Water heating from CHP | (310a) x | 2.97 | x 0.01 = | 37.37 | (342a) |
| Water heating from heat source 2 | (310b) x | 4.24 | x 0.01 = | 35.57 | (342b) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 17.07 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 39.35 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| Energy saving/generation technologies | | | | | |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 276.78 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| Energy cost deflator (Table 12) | | | | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | | | | 1.04 | (357) |
| **SAP rating (section12)** | | | | | 85.48 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Electrical efficiency of CHP unit | | | | | | 29.8 | (361) |
| Heat efficiency of CHP unit | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Emission factor kg CO2/kWh** | | **Emissions kg CO2/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 821.42 | x | 0.22 | | 177.43 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 244.78 | x | 0.52 | | -127.04 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2184.62 | x | 0.22 | | 471.88 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 651.02 | x | 0.52 | | -337.88 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 0.22 | = | 273.99 | (368) |
| Electrical energy for heat distribution | [(313) x | | | 0.52 | = | 14.98 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | | = | 473.35 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | | 473.35 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | | 0.52 | = | 67.15 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | | 0.52 | = | 154.83 | (379) |
| Energy saving/generation technologies (333) to (334) as applicable<br>Item 1 | | | | 0.52 | x 0.01 = | -194.19 | (380) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | | 501.14 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | | 7.51 | (384) |
| **EI rating (section 14)** | | | | | | 93.99 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 821.42 | x | 1.22 | | 1002.14 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 244.78 | x | 3.07 | | -751.49 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2184.62 | x | 1.22 | | 2665.24 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 651.02 | x | 3.07 | | -1998.62 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1547.55 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 88.59 | (372) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | = | 2553.41 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | 2553.41 | (373) |
| Energy associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | 2553.41 | (376) |
| Energy associated with space cooling | (315) x | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | 3.07 | = | 397.21 | (378) |
| Energy associated with electricity for lighting | (332))) x | 3.07 | = | 915.83 | (379) |
| Energy saving/generation technologies<br>Item 1 | | 3.07 | x 0.01 = | -1148.68 | (380) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | 2717.77 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 22 January 2019

## Property Details: 06-18-69419 A-3-06

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | Yes |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | North |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 98.32 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 6 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 316.96 | **(P1)** |
| **Transmission heat loss coefficient:** | 39.8 | |
| **Summer heat loss coefficient:** | 356.81 | **(P2)** |

## Overhangs:

| Orientation: | Ratio: | Z_overhangs: |
|---|---|---|
| South (Rear) | 0 | 1 |
| West (Side) | 0 | 1 |
| South East (Side) | 0 | 1 |

## Solar shading:

| Orientation: | Z blinds: | Solar access: | Overhangs: | Z summer: | |
|---|---|---|---|---|---|
| South (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| West (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| South East (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| Orientation | | Area | Flux | g_ | FF | Shading | Gains | |
|---|---|---|---|---|---|---|---|---|
| South (Rear) | 0.9 x | 3.82 | 112.21 | 0.56 | 0.7 | 0.76 | 115.27 | |
| West (Side) | 0.9 x | 8.35 | 117.51 | 0.56 | 0.7 | 0.76 | 263.87 | |
| South East (Side) | 0.9 x | 7.63 | 119.92 | 0.56 | 0.7 | 0.76 | 246.07 | |
| | | | | | | **Total** | 625.21 | **(P3/P4)** |

## Internal gains:

| | June | July | August | |
|---|---|---|---|---|
| Internal gains | 433.47 | 417.83 | 425.17 | |
| Total summer gains | 1091.38 | 1043.04 | 1000.6 | **(P5)** |
| Summer gain/loss ratio | 3.06 | 2.92 | 2.8 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.31 | 1.31 | 1.31 | |
| Threshold temperature | 20.37 | 22.14 | 21.92 | **(P7)** |
| **Likelihood of high internal temperature** | **Not significant** | **Medium** | **Slight** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 22 January 2019 at 11:29:09*

## Project Information:

| | | | |
|---|---|---|---|
| **Assessed By:** | Matthew Stainrod (STRO023501) | **Building Type:** | Flat |

## Dwelling Details:

| | | | |
|---|---|---|---|
| **NEW DWELLING DESIGN STAGE** | | Total Floor Area: 86.19m² | |
| **Site Reference :** | Bertram Street | **Plot Reference:** | 06-18-69419 A-4-01 |
| **Address :** | A-4-01, Bertram Street, London | | |

## Client Details:

| | |
|---|---|
| **Name:** | McBains |
| **Address :** | 26 Finsbury Square, London, EC2A 1DS |

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 18.24 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 9.45 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 56.1 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 43.1 kWh/m² | |
| | | OK |

## 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 | 0.11 (max. 0.20) | 0.11 (max. 0.35) | OK |
| Openings | 1.40 (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: | Community heating schemes - CommCHP |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| 7 Low energy lights | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

| 8 Mechanical ventilation | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

| 9 Summertime temperature | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: West | 17.05m² | |
| Windows facing: North | 6m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

| 10 Key features | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Roofs U-value | 0.11 W/m²K |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from CHP | |
| Photovoltaic array | |

# Predicted Energy Assessment

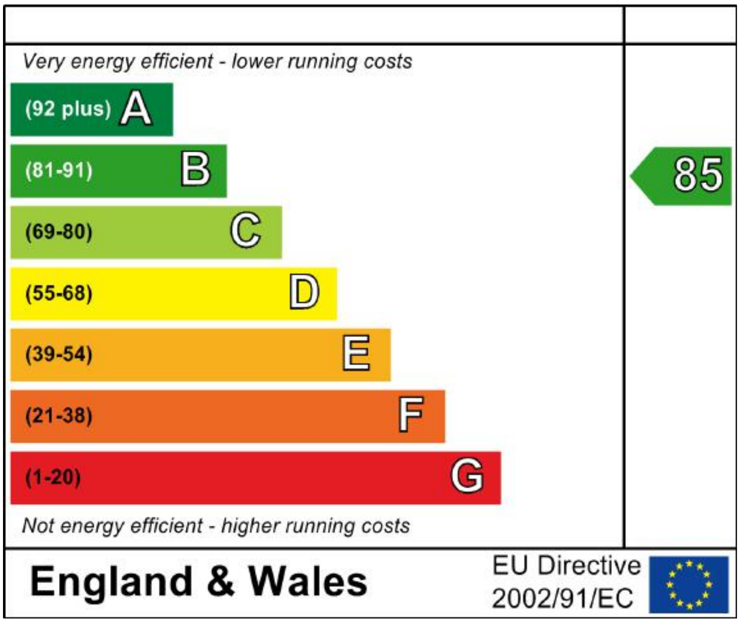
A-4-01
Bertram Street
London

Dwelling type: Top floor Flat
Date of assessment: 22 January 2019
Produced by: Matthew Stainrod
Total floor area: 86.19 m²

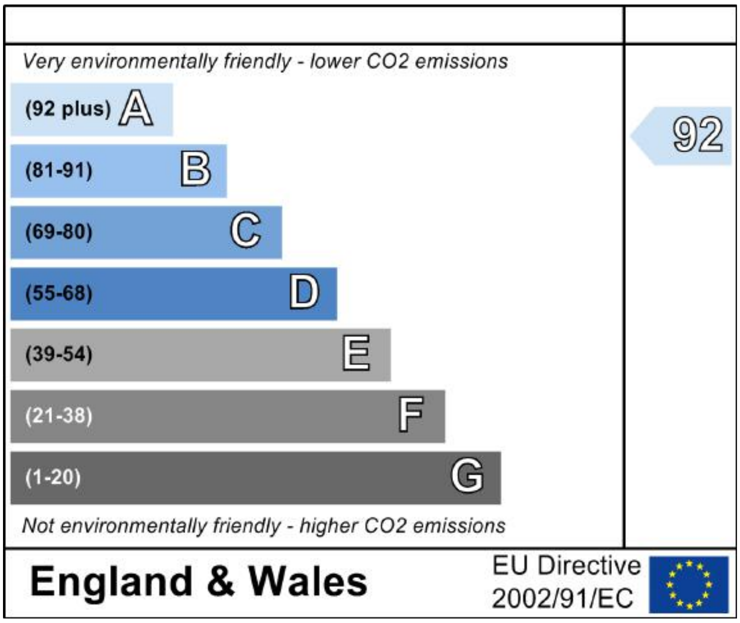
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide ($CO_2$) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide ($CO_2$) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-4-01

| | |
|---|---|
| Address: | A-4-01, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 22 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 81.19 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 86.19 m² | 2.4 m |
| Living area: | 24.1 m² (fraction 0.278) | |
| Front of dwelling faces: | South | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 17.05 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 6 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | South | 0 | 0 |
| Side | | External Wall | West | 0 | 0 |
| Rear | | External Wall | North | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| <u>External Elements</u> | | | | | | | |
| External Wall | 55.68 | 25.15 | 30.53 | 0.15 | 0 | False | 14 |
| Corridor Wall | 8.9 | 0 | 8.9 | 0.15 | 0.43 | False | 14 |
| Roof | 86.19 | 0 | 86.19 | 0.11 | 0 | | 9 |
| <u>Internal Elements</u> | | | | | | | |
| Stud Walls | 163.2 | | | | | | 9 |
| <u>Party Elements</u> | | | | | | | |
| Party Wall | 37.7 | | | | | | 20 |
| Party Floor | 86.19 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0817

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 28.2 | 0.05 | E4 | Jamb |
| [Approved] | 26.91 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 4.8 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 7.2 | 0.06 | E18 | Party wall between dwellings |
| | 5.6 | 0.04 | E14 | Flat roof |
| | 21.31 | 0.28 | E15 | Flat roof with parapet |
| | 15.71 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 15.71 | 0.12 | P4 | Roof (insulation at ceiling level) |

## Ventilation:

Pressure test: Yes (As designed)
Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 2
Ductwork: Insulation, Rigid
Approved Installation Scheme: True
Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 3

## Main heating system:

Main heating system: Community heating schemes
Heat source: Community CHP
heat from CHP, heat fraction 0.6, efficiency 57.6
Heat source: Community boilers
heat from boilers – mains gas, heat fraction 0.4, efficiency 91
Piping>=1991, pre-insulated, low temp, variable flow

## Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and TRVs
Control code: 2306

## Secondary heating system:

Secondary heating system: None

## Water heating:

Water heating: From main heating system
Water code: 901
Fuel :heat from CHP
No hot water cylinder
Solar panel: False

## Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Dense urban
EPC language: English
Wind turbine: No
Photovoltaics: Photovoltaic 1
Installed Peak power: 0.492
Tilt of collector: Horizontal
Overshading: None or very little

# SAP Input

| | |
|---|---|
| | Collector Orientation: South |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 A-4-01

**Address :** A-4-01, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 86.19 | (1a) | x | 2.4 | (2a) | = | 206.86 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 86.19 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 206.86 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 17.05 | x1/[1/( 1.4 )+ 0.04] | | = | 22.6 | | | (27) |
| Windows Type 2 | | | 6 | x1/[1/( 1.4 )+ 0.04] | | = | 7.95 | | | (27) |
| Walls Type1 | 55.68 | 25.15 | 30.53 | x | 0.15 | = | 4.58 | 14 | 427.42 | (29) |
| Walls Type2 | 8.9 | 0 | 8.9 | x | 0.14 | = | 1.25 | 14 | 124.6 | (29) |
| Roof | 86.19 | 0 | 86.19 | x | 0.11 | = | 9.48 | 9 | 775.71 | (30) |
| Total area of elements, m² | | | 150.77 | | | | | | | (31) |
| Party wall | | | 37.7 | x | 0 | = | 0 | 20 | 754 | (32) |
| Party floor | | | 86.19 | | | | | 40 | 3447.6 | (32a) |
| Internal wall ** | | | 163.2 | | | | | 9 | 1468.8 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

| | | | |
|---|---|---|---|
| Fabric heat loss, W/K = S (A x U) | (26)…(30) + (32) = | 48.81 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 6998.13 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 81.19 | (35) |

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 12.32 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 61.13 (37)

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 17.96 | 17.74 | 17.52 | 16.43 | 16.22 | 15.13 | 15.13 | 14.91 | 15.56 | 16.22 | 16.65 | 17.09 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 79.09 | 78.87 | 78.65 | 77.57 | 77.35 | 76.26 | 76.26 | 76.04 | 76.69 | 77.35 | 77.78 | 78.22 | |

Average = Sum(39)$_{1…12}$ /12= 77.51 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.92 | 0.92 | 0.91 | 0.9 | 0.9 | 0.88 | 0.88 | 0.88 | 0.89 | 0.9 | 0.9 | 0.91 |

Average = Sum(40)$_{1…12}$ /12= 0.9 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.57 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 95.24 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 104.76 | 100.95 | 97.14 | 93.33 | 89.52 | 85.71 | 85.71 | 89.52 | 93.33 | 97.14 | 100.95 | 104.76 |

Total = Sum(44)$_{1…12}$ = 1142.82 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 155.35 | 135.87 | 140.21 | 122.24 | 117.29 | 101.21 | 93.79 | 107.62 | 108.91 | 126.92 | 138.55 | 150.45 |

Total = Sum(45)$_{1…12}$ = 1498.42 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 23.3 | 20.38 | 21.03 | 18.34 | 17.59 | 15.18 | 14.07 | 16.14 | 16.34 | 19.04 | 20.78 | 22.57 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 210.63 | 185.8 | 195.49 | 175.73 | 172.57 | 154.71 | 149.07 | 162.9 | 162.4 | 182.2 | 192.04 | 205.73 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 210.63 | 185.8 | 195.49 | 175.73 | 172.57 | 154.71 | 149.07 | 162.9 | 162.4 | 182.2 | 192.04 | 205.73 |

Output from water heater (annual)$_{1...12}$ | 2149.26 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 95.88 | 85.12 | 90.84 | 83.44 | 83.22 | 76.45 | 75.41 | 80.01 | 79.01 | 86.42 | 88.86 | 94.25 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | 154.19 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 51.68 | 45.9 | 37.33 | 28.26 | 21.13 | 17.84 | 19.27 | 25.05 | 33.62 | 42.69 | 49.83 | 53.12 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 346.11 | 349.7 | 340.65 | 321.38 | 297.06 | 274.2 | 258.93 | 255.34 | 264.39 | 283.65 | 307.98 | 330.84 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | 52.99 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | -102.8 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 128.87 | 126.67 | 122.1 | 115.89 | 111.86 | 106.18 | 101.35 | 107.54 | 109.73 | 116.16 | 123.42 | 126.68 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 631.04 | 626.66 | 604.46 | 569.92 | 534.43 | 502.6 | 483.94 | 492.31 | 512.13 | 546.9 | 585.61 | 615.02 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 6 | x | 10.63 | x | 0.558 | x | 0.7 | = | 17.27 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 20.32 | x | 0.558 | x | 0.7 | = | 33 | (74) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 6 | x | 34.53 | x | 0.558 | x | 0.7 | = | 56.08 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 55.46 | x | 0.558 | x | 0.7 | = | 90.08 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 74.72 | x | 0.558 | x | 0.7 | = | 121.35 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 79.99 | x | 0.558 | x | 0.7 | = | 129.91 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 74.68 | x | 0.558 | x | 0.7 | = | 121.28 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 59.25 | x | 0.558 | x | 0.7 | = | 96.22 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 41.52 | x | 0.558 | x | 0.7 | = | 67.43 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 24.19 | x | 0.558 | x | 0.7 | = | 39.29 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 13.12 | x | 0.558 | x | 0.7 | = | 21.3 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 8.86 | x | 0.558 | x | 0.7 | = | 14.4 | (74) |
| West | 0.9x | 0.77 | x | 17.05 | x | 19.64 | x | 0.56 | x | 0.7 | = | 90.64 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 38.42 | x | 0.56 | x | 0.7 | = | 177.32 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 63.27 | x | 0.56 | x | 0.7 | = | 292.02 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 92.28 | x | 0.56 | x | 0.7 | = | 425.89 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 113.09 | x | 0.56 | x | 0.7 | = | 521.94 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 115.77 | x | 0.56 | x | 0.7 | = | 534.3 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 110.22 | x | 0.56 | x | 0.7 | = | 508.68 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 94.68 | x | 0.56 | x | 0.7 | = | 436.95 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 73.59 | x | 0.56 | x | 0.7 | = | 339.63 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 45.59 | x | 0.56 | x | 0.7 | = | 210.4 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 24.49 | x | 0.56 | x | 0.7 | = | 113.02 | (80) |
| West | 0.9x | 0.77 | x | 17.05 | x | 16.15 | x | 0.56 | x | 0.7 | = | 74.54 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 107.91 | 210.32 | 348.1 | 515.97 | 643.29 | 664.21 | 629.96 | 533.17 | 407.06 | 249.69 | 134.33 | 88.94 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 738.96 | 836.98 | 952.56 | 1085.89 | 1177.72 | 1166.81 | 1113.9 | 1025.48 | 919.19 | 796.58 | 719.94 | 703.96 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.89 | 0.85 | 0.79 | 0.67 | 0.53 | 0.39 | 0.29 | 0.33 | 0.51 | 0.73 | 0.85 | 0.9 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.3 | 19.57 | 19.99 | 20.46 | 20.77 | 20.93 | 20.98 | 20.97 | 20.85 | 20.43 | 19.79 | 19.25 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.15 | 20.15 | 20.16 | 20.17 | 20.17 | 20.18 | 20.18 | 20.18 | 20.18 | 20.17 | 20.17 | 20.16 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.88 | 0.84 | 0.77 | 0.64 | 0.5 | 0.35 | 0.24 | 0.27 | 0.46 | 0.7 | 0.84 | 0.89 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 17.88 | 18.27 | 18.86 | 19.51 | 19.91 | 20.11 | 20.16 | 20.16 | 20.02 | 19.48 | 18.6 | 17.81 | (90) |

fLA = Living area ÷ (4) = | 0.28 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.28 | 18.64 | 19.18 | 19.77 | 20.15 | 20.34 | 20.39 | 20.38 | 20.25 | 19.74 | 18.93 | 18.21 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.28 | 18.64 | 19.18 | 19.77 | 20.15 | 20.34 | 20.39 | 20.38 | 20.25 | 19.74 | 18.93 | 18.21 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.85 | 0.81 | 0.74 | 0.63 | 0.5 | 0.36 | 0.25 | 0.29 | 0.47 | 0.68 | 0.81 | 0.86 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 628.91 | 679.06 | 707.09 | 684.8 | 585.58 | 417.75 | 283.38 | 294.92 | 430.15 | 544.31 | 582.74 | 607.12 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 1105.55 | 1083.42 | 997.32 | 843.47 | 653.56 | 437.66 | 289.02 | 302.9 | 471.94 | 707.19 | 920.47 | 1096.13 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 354.62 | 271.73 | 215.93 | 114.24 | 50.58 | 0 | 0 | 0 | 0 | 121.18 | 243.16 | 363.83 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1735.28 | (98) |
| Space heating requirement in kWh/m²/year | 20.13 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1735.28 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 1093.22 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 728.82 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2149.26 | |
| If DHW from community scheme:<br>Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1354.03 | (310a) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 902.69 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 40.79 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 167.19 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 167.19 | (331) |
| Energy for lighting (calculated in Appendix L) | | 365.1 | (332) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | -374.16 | (333) |
| Electricity generated by wind turbine (Appendix M) (negative quantity) | | 0 | (334) |

## 10b. Fuel costs – Community heating scheme

| | Fuel kWh/year | | Fuel Price (Table 12) | | Fuel Cost £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 2.97 | x 0.01 = | 32.47 | (340a) |
| Space heating from heat source 2 | (307b) | x | 4.24 | x 0.01 = | 30.9 | (340b) |
| Water heating from CHP | (310a) | x | 2.97 | x 0.01 = | 40.21 | (342a) |
| Water heating from heat source 2 | (310b) | x | 4.24 | x 0.01 = | 38.27 | (342b) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 22.05 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 48.16 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| Energy saving/generation technologies | | | | | | |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 332.07 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.06 | (357) |
| **SAP rating (section12)** | | 85.17 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | |
|---|---|---|---|
| Electrical efficiency of CHP unit | | 29.8 | (361) |
| Heat efficiency of CHP unit | | 57.6 | (362) |

| | | Energy kWh/year | | Emission factor kg CO2/kWh | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1897.96 | x | 0.22 | 409.96 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 565.59 | x | 0.52 | -293.54 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2350.75 | x | 0.22 | 507.76 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 700.52 | x | 0.52 | -363.57 | (366) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | |
|---|---|---|---|---|---|---|
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 387.26 | (368) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 21.17 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 669.03 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 669.03 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 86.77 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 189.49 | (379) |
| Energy saving/generation technologies (333) to (334) as applicable<br>Item 1 | | | 0.52 | x 0.01 = | -194.19 | (380) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 751.1 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 8.71 | (384) |
| **EI rating (section 14)** | | | | | 92.33 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1897.96 | x | 1.22 | 2315.51 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 565.59 | x | 3.07 | -1736.37 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2350.75 | x | 1.22 | 2867.92 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 700.52 | x | 3.07 | -2150.61 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 = | 2187.29 | (368) |
| Electrical energy for heat distribution | [(313) x | | | = | 125.22 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | = | 3608.96 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | 3608.96 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | 3608.96 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 = | 513.28 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 = | 1120.85 | (379) |
| Energy saving/generation technologies<br>Item 1 | | | | 3.07 x 0.01 = | -1148.68 | (380) |

| | | | |
|---|---|---|---|
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | 4094.41 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 22 January 2019

## Property Details: 06-18-69419 A-4-01

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | South |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 81.19 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 273.05 | **(P1)** |
| **Transmission heat loss coefficient:** | 61.1 | |
| **Summer heat loss coefficient:** | 334.18 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Side) | 0 | 1 |
| North (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| North (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Side) | 0.9 x | 17.05 | 117.51 | 0.56 | 0.7 | 0.76 | 538.8 | |
| North (Rear) | 0.9 x | 6 | 81.19 | 0.56 | 0.7 | 0.76 | 131 | |
| | | | | | | **Total** | 669.79 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 502.6 | 483.94 | 492.31 | |
| Total summer gains | 1216.27 | 1153.73 | 1072.84 | **(P5)** |
| Summer gain/loss ratio | 3.64 | 3.45 | 3.21 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.43 | 1.43 | 1.43 | |
| Threshold temperature | 21.07 | 22.78 | 22.44 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** <u>Medium</u>

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 22 January 2019 at 11:28:58*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 88.69m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 A-4-02

**Address :** A-4-02, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 17.96 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 9.30 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 55.4 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 42.3 kWh/m² | |
| | | **OK** |

## 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 | 0.11 (max. 0.20) | 0.11 (max. 0.35) | **OK** |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | **OK** |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: East | 17.05m² | |
| Windows facing: North | 6m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Roofs U-value | 0.11 W/m²K | |
| Party  Walls U-value | 0 W/m²K | |
| Community heating, heat from CHP | | |
| Photovoltaic array | | |

# Predicted Energy Assessment

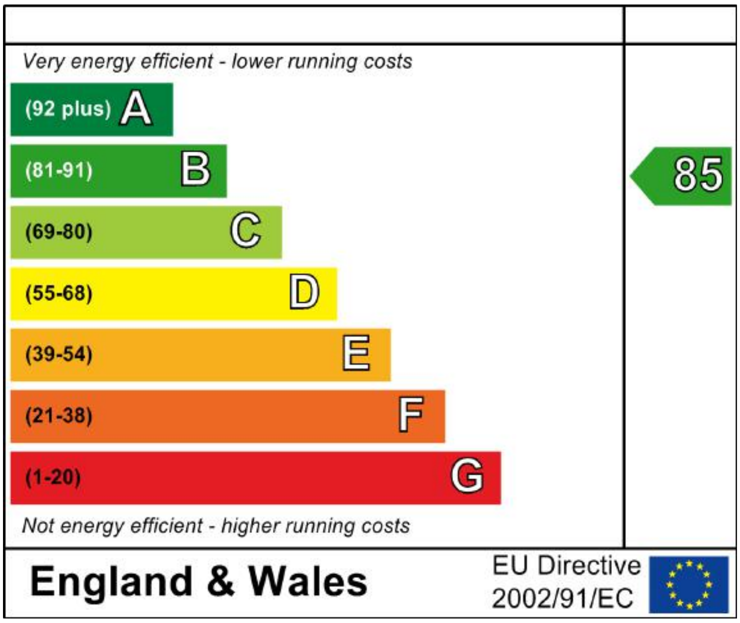
A-4-02
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Top floor Flat |
| Date of assessment: | 22 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 88.69 m² |

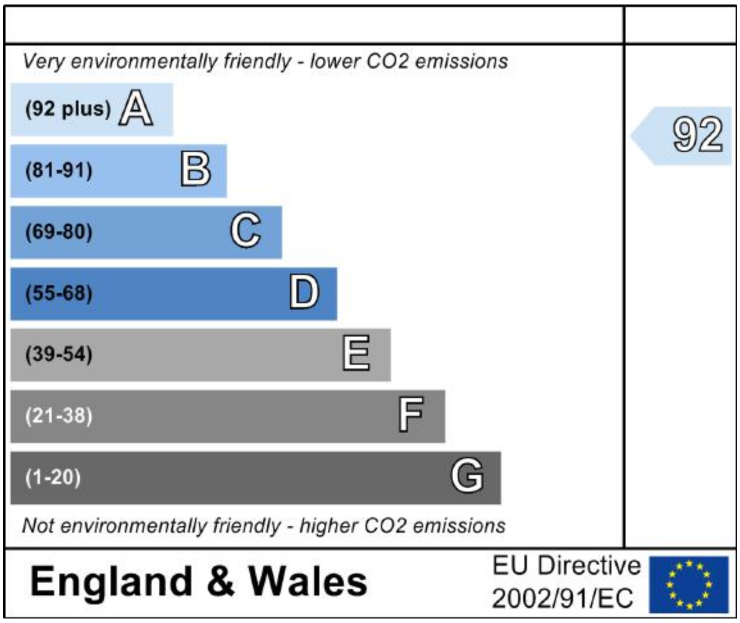
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home’s impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 A-4-02

| | |
|---|---|
| Address: | A-4-02, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 22 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 78.39 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 88.69 m² | 2.4 m |
| Living area: | 25.61 m² (fraction 0.289) | |
| Front of dwelling faces: | South | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 17.05 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 6 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | South | 0 | 0 |
| Side | | External Wall | East | 0 | 0 |
| Rear | | External Wall | North | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 51.58 | 25.15 | 26.43 | 0.15 | 0 | False | 14 |
| Corridor Wall | 9.22 | 0 | 9.22 | 0.15 | 0.43 | False | 14 |
| Roof | 88.69 | 0 | 88.69 | 0.11 | 0 | | 9 |
| Internal Elements | | | | | | | |
| Stud Walls | 163.2 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 31.94 | | | | | | 20 |
| Party Floor | 88.69 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0833

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 28.2 | 0.05 | E4 | Jamb |
| [Approved] | 29.67 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 8.18 | 0.04 | E14 | Flat roof |
| | 21.49 | 0.28 | E15 | Flat roof with parapet |
| | 13.31 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 13.31 | 0.12 | P4 | Roof (insulation at ceiling level) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 2<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | Photovoltaic 1<br>Installed Peak power: 0.492<br>Tilt of collector: Horizontal<br>Overshading: None or very little |

# SAP Input

| | |
|---|---|
| | Collector Orientation: South |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

## Property Address: 06-18-69419 A-4-02

**Address :** A-4-02, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 88.69 | (1a) x | 2.4 | (2a) = | 212.86 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 88.69 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 212.86 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 17.05 | x1/[1/( 1.4 )+ 0.04] | | = | 22.6 | | | (27) |
| Windows Type 2 | | | 6 | x1/[1/( 1.4 )+ 0.04] | | = | 7.95 | | | (27) |
| Walls Type1 | 51.58 | 25.15 | 26.43 | x | 0.15 | = | 3.96 | 14 | 370.02 | (29) |
| Walls Type2 | 9.22 | 0 | 9.22 | x | 0.14 | = | 1.3 | 14 | 129.08 | (29) |
| Roof | 88.69 | 0 | 88.69 | x | 0.11 | = | 9.76 | 9 | 798.21 | (30) |
| Total area of elements, m² | | | 149.49 | | | | | | | (31) |
| Party wall | | | 31.94 | x | 0 | = | 0 | 20 | 638.8 | (32) |
| Party floor | | | 88.69 | | | | | 40 | 3547.6 | (32a) |
| Internal wall ** | | | 163.2 | | | | | 9 | 1468.8 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 48.52 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 6952.51 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 78.39 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 12.45 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 60.97 (37)

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 18.48 | 18.25 | 18.03 | 16.91 | 16.69 | 15.57 | 15.57 | 15.34 | 16.02 | 16.69 | 17.13 | 17.58 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 79.44 | 79.22 | 79 | 77.88 | 77.65 | 76.53 | 76.53 | 76.31 | 76.98 | 77.65 | 78.1 | 78.55 | |

Average = $Sum(39)_{1...12}$ /12= 77.82 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.9 | 0.89 | 0.89 | 0.88 | 0.88 | 0.86 | 0.86 | 0.86 | 0.87 | 0.88 | 0.88 | 0.89 | |

Average = $Sum(40)_{1...12}$ /12= 0.88 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 2.61 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 96.12 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 105.74 | 101.89 | 98.05 | 94.2 | 90.36 | 86.51 | 86.51 | 90.36 | 94.2 | 98.05 | 101.89 | 105.74 | |

Total = $Sum(44)_{1...12}$ = 1153.5 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 156.81 | 137.14 | 141.52 | 123.38 | 118.39 | 102.16 | 94.66 | 108.63 | 109.93 | 128.11 | 139.84 | 151.86 | |

Total = $Sum(45)_{1...12}$ = 1512.42 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 23.52 | 20.57 | 21.23 | 18.51 | 17.76 | 15.32 | 14.2 | 16.29 | 16.49 | 19.22 | 20.98 | 22.78 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 212.08 | 187.07 | 196.8 | 176.87 | 173.66 | 155.65 | 149.94 | 163.91 | 163.42 | 183.39 | 193.33 | 207.13 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 212.08 | 187.07 | 196.8 | 176.87 | 173.66 | 155.65 | 149.94 | 163.91 | 163.42 | 183.39 | 193.33 | 207.13 |

Output from water heater (annual)$_{1...12}$ | 2163.26 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 96.36 | 85.54 | 91.28 | 83.82 | 83.58 | 76.76 | 75.7 | 80.34 | 79.35 | 86.82 | 89.29 | 94.71 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | 156.44 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 52.74 | 46.85 | 38.1 | 28.84 | 21.56 | 18.2 | 19.67 | 25.56 | 34.31 | 43.57 | 50.85 | 54.21 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 353.2 | 356.87 | 347.63 | 327.97 | 303.15 | 279.82 | 264.24 | 260.57 | 269.81 | 289.47 | 314.29 | 337.62 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | 53.25 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | -104.29 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 129.52 | 127.29 | 122.68 | 116.41 | 112.35 | 106.61 | 101.74 | 107.98 | 110.2 | 116.69 | 124.02 | 127.3 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 640.86 | 636.41 | 613.81 | 578.63 | 542.45 | 510.04 | 491.05 | 499.52 | 519.72 | 555.13 | 594.56 | 624.53 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 6 | x | 10.63 | x | 0.558 | x | 0.7 | = | 17.27 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 20.32 | x | 0.558 | x | 0.7 | = | 33 | (74) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| North | 0.9x | 0.77 | x | 6 | x | 34.53 | x | 0.558 | x | 0.7 | = | 56.08 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 55.46 | x | 0.558 | x | 0.7 | = | 90.08 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 74.72 | x | 0.558 | x | 0.7 | = | 121.35 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 79.99 | x | 0.558 | x | 0.7 | = | 129.91 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 74.68 | x | 0.558 | x | 0.7 | = | 121.28 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 59.25 | x | 0.558 | x | 0.7 | = | 96.22 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 41.52 | x | 0.558 | x | 0.7 | = | 67.43 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 24.19 | x | 0.558 | x | 0.7 | = | 39.29 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 13.12 | x | 0.558 | x | 0.7 | = | 21.3 | (74) |
| North | 0.9x | 0.77 | x | 6 | x | 8.86 | x | 0.558 | x | 0.7 | = | 14.4 | (74) |
| East | 0.9x | 1 | x | 17.05 | x | 19.64 | x | 0.56 | x | 0.7 | = | 90.64 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 38.42 | x | 0.56 | x | 0.7 | = | 177.32 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 63.27 | x | 0.56 | x | 0.7 | = | 292.02 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 92.28 | x | 0.56 | x | 0.7 | = | 425.89 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 113.09 | x | 0.56 | x | 0.7 | = | 521.94 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 115.77 | x | 0.56 | x | 0.7 | = | 534.3 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 110.22 | x | 0.56 | x | 0.7 | = | 508.68 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 94.68 | x | 0.56 | x | 0.7 | = | 436.95 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 73.59 | x | 0.56 | x | 0.7 | = | 339.63 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 45.59 | x | 0.56 | x | 0.7 | = | 210.4 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 24.49 | x | 0.56 | x | 0.7 | = | 113.02 | (76) |
| East | 0.9x | 1 | x | 17.05 | x | 16.15 | x | 0.56 | x | 0.7 | = | 74.54 | (76) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 107.91 | 210.32 | 348.1 | 515.97 | 643.29 | 664.21 | 629.96 | 533.17 | 407.06 | 249.69 | 134.33 | 88.94 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 748.77 | 846.73 | 961.91 | 1094.6 | 1185.75 | 1174.25 | 1121.01 | 1032.69 | 926.78 | 804.82 | 728.89 | 713.47 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.89 | 0.85 | 0.78 | 0.67 | 0.53 | 0.39 | 0.29 | 0.33 | 0.51 | 0.73 | 0.85 | 0.9 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.3 | 19.57 | 19.99 | 20.46 | 20.77 | 20.93 | 20.98 | 20.97 | 20.85 | 20.42 | 19.79 | 19.24 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.17 | 20.17 | 20.18 | 20.19 | 20.19 | 20.2 | 20.2 | 20.2 | 20.19 | 20.19 | 20.18 | 20.18 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.88 | 0.84 | 0.77 | 0.64 | 0.5 | 0.35 | 0.24 | 0.27 | 0.46 | 0.7 | 0.83 | 0.89 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 17.89 | 18.28 | 18.87 | 19.52 | 19.92 | 20.13 | 20.18 | 20.17 | 20.04 | 19.49 | 18.61 | 17.83 | (90) |

fLA = Living area ÷ (4) = | 0.29 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.3 | 18.65 | 19.2 | 19.79 | 20.17 | 20.36 | 20.41 | 20.4 | 20.27 | 19.76 | 18.95 | 18.23 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.3 | 18.65 | 19.2 | 19.79 | 20.17 | 20.36 | 20.41 | 20.4 | 20.27 | 19.76 | 18.95 | 18.23 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.85 | 0.81 | 0.74 | 0.63 | 0.5 | 0.36 | 0.25 | 0.29 | 0.47 | 0.68 | 0.81 | 0.86 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 634.81 | 684.27 | 711.29 | 688.01 | 588.38 | 420.26 | 285.73 | 297.24 | 432.64 | 547.61 | 587.51 | 613.01 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 1112.12 | 1089.66 | 1002.94 | 848.08 | 657.45 | 440.68 | 291.6 | 305.48 | 475.12 | 711.37 | 925.79 | 1102.43 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 355.12 | 272.42 | 216.98 | 115.25 | 51.39 | 0 | 0 | 0 | 0 | 121.84 | 243.56 | 364.12 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1740.69 (98)

Space heating requirement in kWh/m²/year 19.63 (99)

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme.<br>Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1740.69 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 1096.64 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 731.09 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 2163.26 | |
| If DHW from community scheme:<br>Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1362.85 | (310a) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 908.57 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 40.99 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 172.04 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 172.04 | (331) |
| Energy for lighting (calculated in Appendix L) | | 372.58 | (332) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | -374.16 | (333) |
| Electricity generated by wind turbine (Appendix M) (negative quantity) | | 0 | (334) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 2.97 | x 0.01 = | 32.57 | (340a) |
| Space heating from heat source 2 | (307b) | x | 4.24 | x 0.01 = | 31 | (340b) |
| Water heating from CHP | (310a) | x | 2.97 | x 0.01 = | 40.48 | (342a) |
| Water heating from heat source 2 | (310b) | x | 4.24 | x 0.01 = | 38.52 | (342b) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 22.69 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 49.14 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| Energy saving/generation technologies | | | | | | |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 334.4 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.05 | (357) |
| **SAP rating (section12)** | | 85.34 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | |
|---|---|---|
| Electrical efficiency of CHP unit | 29.8 | (361) |
| Heat efficiency of CHP unit | 57.6 | (362) |

| | | **Energy** kWh/year | | **Emission factor** kg CO2/kWh | **Emissions** kg CO2/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1903.88 | x | 0.22 | 411.24 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 567.36 | x | 0.52 | -294.46 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2366.06 | x | 0.22 | 511.07 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 705.09 | x | 0.52 | -365.94 | (366) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | 0.22 | = | 389.19 | (368) |
| Electrical energy for heat distribution | [(313) x | 0.52 | = | 21.27 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 672.38 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 672.38 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 89.29 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 193.37 | (379) |
| Energy saving/generation technologies (333) to (334) as applicable<br>Item 1 | | 0.52 | x 0.01 = | -194.19 | (380) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 760.85 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 8.58 | (384) |
| **EI rating (section 14)** | | | | 92.37 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1903.88 | x | 1.22 | 2322.74 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 567.36 | x | 3.07 | -1741.79 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2366.06 | x | 1.22 | 2886.6 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 705.09 | x | 3.07 | -2164.62 | (366) |

| | | | | | |
|---|---|---|---|---|---|
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | 1.22 | = | 2198.22 | (368) |
| Electrical energy for heat distribution | [(313) x | | = | 125.84 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | = | 3627 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | 3627 | (373) |
| Energy associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | 3627 | (376) |
| Energy associated with space cooling | (315) x | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | 3.07 | = | 528.17 | (378) |
| Energy associated with electricity for lighting | (332))) x | 3.07 | = | 1143.83 | (379) |
| Energy saving/generation technologies<br>Item 1 | | 3.07 | x 0.01 = | -1148.68 | (380) |

| | | | |
|---|---|---|---|
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | 4150.32 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 22 January 2019

## Property Details: 06-18-69419 A-4-02

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | South |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 78.39 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 280.97 | **(P1)** |
| **Transmission heat loss coefficient:** | 61 | |
| **Summer heat loss coefficient:** | 341.94 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| East (Side) | 0 | 1 |
| North (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| East (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| North (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| East (Side) | 0.9 x | 17.05 | 117.51 | 0.56 | 0.7 | 0.76 | 538.8 | |
| North (Rear) | 0.9 x | 6 | 81.19 | 0.56 | 0.7 | 0.76 | 131 | |
| | | | | | | **Total** | 669.79 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 510.04 | 491.05 | 499.52 | |
| Total summer gains | 1223.71 | 1160.84 | 1080.05 | **(P5)** |
| Summer gain/loss ratio | 3.58 | 3.39 | 3.16 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.45 | 1.45 | 1.45 | |
| Threshold temperature | 21.03 | 22.75 | 22.41 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 22 January 2019 at 11:28:29*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501)  **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE**  Total Floor Area: 44.29m²

**Site Reference :** Bertram Street  **Plot Reference:** 06-18-69419 D-0-01

**Address :** D-0-01, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 24.05 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 11.17 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 64.4 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 53.6 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.15 (max. 0.30) | 0.15 (max. 0.70) | OK |
| Floor | 0.11 (max. 0.25) | 0.11 (max. 0.70) | OK |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: West | $7.63m^2$ | |
| Ventilation rate: | 2.00 | |
| Blinds/curtains: | Light-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

## 10 Key features

| | |
|---|---|
| Air permeablility | $3.0\ m^3/m^2h$ |
| Floors U-value | $0.11\ W/m^2K$ |
| Community heating, heat from CHP | |
| Photovoltaic array | |

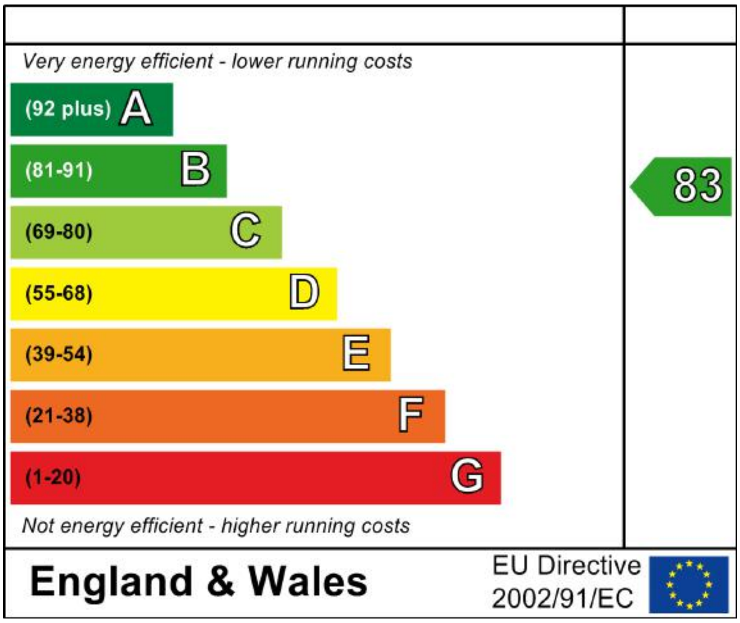
# Predicted Energy Assessment

| | | |
|---|---|---|
| D-0-01 | Dwelling type: | Ground floor Flat |
| Bertram Street | Date of assessment: | 22 January 2019 |
| London | Produced by: | Matthew Stainrod |
| | Total floor area: | 44.29 m² |

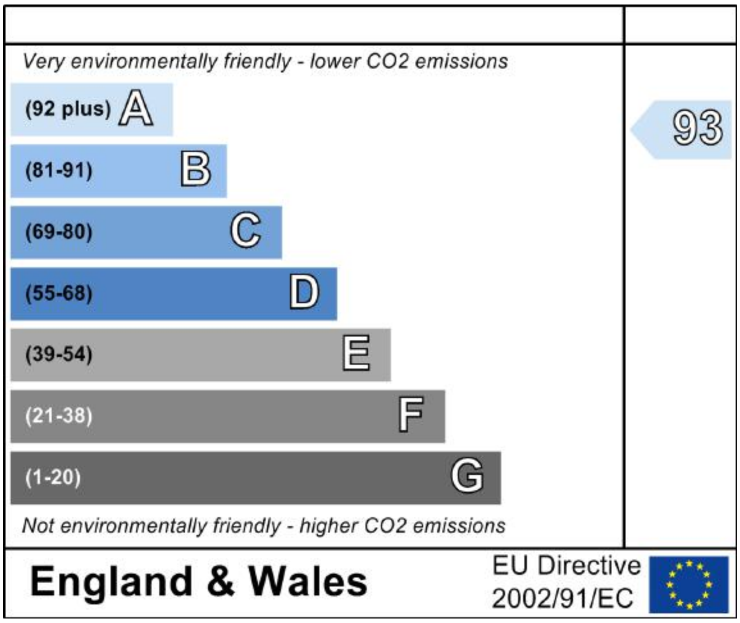
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-0-01

| | |
|---|---|
| Address: | D-0-01, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 22 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 163.84 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 44.29 m² | 2.4 m |
| Living area: | 37.16 m² (fraction 0.839) | |
| Front of dwelling faces: | West | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Front | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Front | 16mm or more | 0.7 | 0.558 | 1.4 | 7.63 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | External Wall | West | 0 | 0 |
| Front | | External Wall | West | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 65.09 | 9.73 | 55.36 | 0.15 | 0 | False | 14 |
| Ground Floor | 44.29 | | | 0.11 | | | 110 |
| Internal Elements | | | | | | | |
| Stud Walls | 31.2 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Ceiling | 44.29 | | | | | | 30 |

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0966

| | **Length** | **Psi-value** | | |
|---|---|---|---|---|
| [Approved] | 13.8 | 0.05 | E4 | Jamb |
| [Approved] | 27.12 | 0.16 | E5 | Ground floor (normal) |

# SAP Input

| | | | | |
|---|---|---|---|---|
| [Approved] | 27.12 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| | 15.47 | 0.16 | P1 | Ground floor |
| | 15.47 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from boilers – mains gas<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | Photovoltaic 1<br>Installed Peak power: 0.5<br>Tilt of collector: Horizontal<br>Overshading: None or very little<br>Collector Orientation: South |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

## Property Address: 06-18-69419 D-0-01

**Address :** D-0-01, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 44.29 | (1a) | x | 2.4 | (2a) | = | 106.3 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 44.29 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 106.3 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows | | | 7.63 | x1/[1/( 1.4 )+ 0.04] | | = | 10.12 | | | (27) |
| Floor | | | 44.29 | x | 0.11 | = | 4.8719 | 110 | 4871.9 | (28) |
| Walls | 65.09 | 9.73 | 55.36 | x | 0.15 | = | 8.3 | 14 | 775.04 | (29) |
| Total area of elements, m² | | | 109.38 | | | | | | | (31) |
| Party ceiling | | | 44.29 | | | | | 30 | 1328.7 | (32b) |
| Internal wall ** | | | 31.2 | | | | | 9 | 280.8 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 26.23 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 7256.44 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 163.84 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 10.57 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 36.8 (37)

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 9.23 | 9.12 | 9 | 8.44 | 8.33 | 7.77 | 7.77 | 7.66 | 8 | 8.33 | 8.56 | 8.78 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 46.03 | 45.91 | 45.8 | 45.24 | 45.13 | 44.57 | 44.57 | 44.46 | 44.8 | 45.13 | 45.35 | 45.58 | |

Average = Sum(39)$_{1…12}$ /12= 45.22 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.04 | 1.04 | 1.03 | 1.02 | 1.02 | 1.01 | 1.01 | 1 | 1.01 | 1.02 | 1.02 | 1.03 |

Average = Sum(40)1…12 /12= 1.02 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.52 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 70.41 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

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

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 77.45 | 74.63 | 71.81 | 69 | 66.18 | 63.37 | 63.37 | 66.18 | 69 | 71.81 | 74.63 | 77.45 |

Total = Sum(44)1…12 = 844.87 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 114.85 | 100.45 | 103.65 | 90.37 | 86.71 | 74.82 | 69.34 | 79.56 | 80.51 | 93.83 | 102.42 | 111.23 |

Total = Sum(45)1…12 = 1107.75 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 17.23 | 15.07 | 15.55 | 13.56 | 13.01 | 11.22 | 10.4 | 11.93 | 12.08 | 14.07 | 15.36 | 16.68 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

# SAP WorkSheet: New dwelling design stage

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 170.13 | 150.38 | 158.93 | 143.86 | 141.99 | 128.32 | 124.61 | 134.84 | 134.01 | 149.11 | 155.92 | 166.5 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 170.13 | 150.38 | 158.93 | 143.86 | 141.99 | 128.32 | 124.61 | 134.84 | 134.01 | 149.11 | 155.92 | 166.5 | |

Output from water heater (annual)1…12 | 1758.59 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 82.41 | 73.34 | 78.69 | 72.84 | 73.05 | 67.67 | 67.28 | 70.68 | 69.57 | 75.42 | 76.85 | 81.2 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | 91.47 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 30.37 | 26.98 | 21.94 | 16.61 | 12.42 | 10.48 | 11.33 | 14.72 | 19.76 | 25.09 | 29.28 | 31.22 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 197.69 | 199.74 | 194.57 | 183.57 | 169.68 | 156.62 | 147.9 | 145.85 | 151.01 | 162.02 | 175.91 | 188.97 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | 45.67 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | -60.98 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 110.77 | 109.14 | 105.76 | 101.17 | 98.19 | 93.99 | 90.42 | 95 | 96.62 | 101.37 | 106.74 | 109.15 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 414.99 | 412.02 | 398.44 | 377.51 | 356.44 | 337.25 | 325.81 | 331.72 | 343.56 | 364.64 | 388.09 | 405.49 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 0.9x | 0.77 | x | 7.63 | x | 19.64 | x | 0.56 | x | 0.7 | = | 40.56 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 38.42 | x | 0.56 | x | 0.7 | = | 79.35 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 63.27 | x | 0.56 | x | 0.7 | = | 130.68 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 92.28 | x | 0.56 | x | 0.7 | = | 190.59 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 113.09 | x | 0.56 | x | 0.7 | = | 233.57 | (80) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| West | 0.9x | 0.77 | x | 7.63 | x | 115.77 | x | 0.56 | x | 0.7 | = | 239.1 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 110.22 | x | 0.56 | x | 0.7 | = | 227.64 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 94.68 | x | 0.56 | x | 0.7 | = | 195.54 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 73.59 | x | 0.56 | x | 0.7 | = | 151.99 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 45.59 | x | 0.56 | x | 0.7 | = | 94.16 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 24.49 | x | 0.56 | x | 0.7 | = | 50.58 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 16.15 | x | 0.56 | x | 0.7 | = | 33.36 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 40.56 | 79.35 | 130.68 | 190.59 | 233.57 | 239.1 | 227.64 | 195.54 | 151.99 | 94.16 | 50.58 | 33.36 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 455.55 | 491.37 | 529.12 | 568.1 | 590.02 | 576.36 | 553.44 | 527.26 | 495.54 | 458.8 | 438.67 | 438.85 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.94 | 0.92 | 0.88 | 0.78 | 0.65 | 0.48 | 0.35 | 0.38 | 0.58 | 0.81 | 0.91 | 0.95 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.98 | 20.14 | 20.4 | 20.69 | 20.88 | 20.97 | 20.99 | 20.99 | 20.94 | 20.7 | 20.31 | 19.95 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.05 | 20.05 | 20.05 | 20.07 | 20.07 | 20.08 | 20.08 | 20.08 | 20.07 | 20.07 | 20.06 | 20.06 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.93 | 0.91 | 0.86 | 0.75 | 0.6 | 0.42 | 0.28 | 0.31 | 0.52 | 0.77 | 0.9 | 0.94 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.73 | 18.96 | 19.32 | 19.72 | 19.95 | 20.06 | 20.08 | 20.08 | 20.03 | 19.74 | 19.2 | 18.69 | (90) |

fLA = Living area ÷ (4) = 0.84 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.78 | 19.95 | 20.22 | 20.53 | 20.73 | 20.83 | 20.85 | 20.84 | 20.79 | 20.55 | 20.13 | 19.75 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.78 | 19.95 | 20.22 | 20.53 | 20.73 | 20.83 | 20.85 | 20.84 | 20.79 | 20.55 | 20.13 | 19.75 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.93 | 0.91 | 0.86 | 0.77 | 0.63 | 0.47 | 0.34 | 0.37 | 0.57 | 0.79 | 0.9 | 0.94 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 423.56 | 445.64 | 454.86 | 435.88 | 373.3 | 269.66 | 187.57 | 195.19 | 282.58 | 362.61 | 393.74 | 411.07 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 712.61 | 691.06 | 628.61 | 526.4 | 407.75 | 277.51 | 189.26 | 197.59 | 299.86 | 448.96 | 591.02 | 708.67 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 215.05 | 164.92 | 129.27 | 65.17 | 25.63 | 0 | 0 | 0 | 0 | 64.25 | 142.04 | 221.42 | |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = $Sum(98)_{1...5,9...12}$ = | 1027.75 | (98) |
| Space heating requirement in kWh/m²/year | | 23.2 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1027.75 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 647.48 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 431.65 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1758.59 | |
| If DHW from community scheme: Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1107.91 | (310a) |
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 738.61 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 29.26 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f): mechanical ventilation - balanced, extract or positive input from outside | | 85.91 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 85.91 | (331) |
| Energy for lighting (calculated in Appendix L) | | 214.57 | (332) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | -380.25 | (333) |
| Electricity generated by wind turbine (Appendix M) (negative quantity) | | 0 | (334) |

## 10b. Fuel costs – Community heating scheme

# SAP WorkSheet: New dwelling design stage

| | | Fuel kWh/year | Fuel Price (Table 12) | | Fuel Cost £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | | (307a) x | 2.97 | x 0.01 = | 19.23 | (340a) |
| Space heating from heat source 2 | | (307b) x | 4.24 | x 0.01 = | 18.3 | (340b) |
| Water heating from CHP | | (310a) x | 2.97 | x 0.01 = | 32.91 | (342a) |
| Water heating from heat source 2 | | (310b) x | 4.24 | x 0.01 = | 31.32 | (342b) |
| | | | **Fuel Price** | | | |
| Pumps and fans | | (331) | 13.19 | x 0.01 = | 11.33 | (349) |
| Energy for lighting | | (332) | 13.19 | x 0.01 = | 28.3 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| Energy saving/generation technologies | | | | | | |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 261.39 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.23 | (357) |
| **SAP rating (section12)** | | 82.85 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Electrical efficiency of CHP unit | | | | | | 29.8 | (361) |
| Heat efficiency of CHP unit | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Emission factor kg CO2/kWh** | | **Emissions kg CO2/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1124.1 | x | 0.22 | | 242.81 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 334.98 | x | 0.52 | | -173.86 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 1923.46 | x | 0.22 | | 415.47 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 573.19 | x | 0.52 | | -297.49 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 0.22 | = | 277.78 | (368) |
| Electrical energy for heat distribution | [(313) x | | | 0.52 | = | 15.18 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | | = | 479.89 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | | 479.89 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | | 0.52 | = | 44.59 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | | 0.52 | = | 111.36 | (379) |
| Energy saving/generation technologies (333) to (334) as applicable<br>Item 1 | | | | 0.52 | x 0.01 = | -197.35 | (380) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | | 438.5 | (383) |

# SAP WorkSheet: New dwelling design stage

**Dwelling CO2 Emission Rate** (383) ÷ (4) = 9.9 (384)

**EI rating (section 14)** 93.42 (385)

## 13b. Primary Energy – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1124.1 | x | 1.22 | | 1371.4 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 334.98 | x | 3.07 | | -1028.39 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 1923.46 | x | 1.22 | | 2346.62 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 573.19 | x | 3.07 | | -1759.7 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1568.93 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 89.82 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 2588.68 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 2588.68 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 2588.68 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 263.76 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 658.73 | (379) |
| Energy saving/generation technologies<br>Item 1 | | | | 3.07 | x 0.01 = | -1167.36 | (380) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | | 2343.81 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 22 January 2019

## Property Details: 06-18-69419 D-0-01

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | West |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 163.84 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Light-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 2 ( Windows open half the time) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 70.16 | **(P1)** |
| **Transmission heat loss coefficient:** | 36.8 | |
| **Summer heat loss coefficient:** | 106.95 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Front) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Front) | 0.6 | 0.9 | 1 | 0.54 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Front) | 0.9 x | 7.63 | 117.51 | 0.56 | 0.7 | 0.54 | 170.2 | |
| | | | | | | **Total** | 170.2 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 337.25 | 325.81 | 331.72 | |
| Total summer gains | 517.92 | 496.01 | 481.46 | **(P5)** |
| Summer gain/loss ratio | 4.84 | 4.64 | 4.5 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 0.85 | 0.85 | 0.85 | |
| Threshold temperature | 21.7 | 23.39 | 23.15 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 22 January 2019 at 11:28:19*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 51.14m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 D-1-01

**Address :** D-1-01, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 20.04 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 9.59 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 51.1 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 48.1 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.17 (max. 0.30) | 0.18 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | 0.25 (max. 0.25) | 0.25 (max. 0.70) | OK |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: West | 7.63m² | |
| Windows facing: East | 8.4m² | |
| Ventilation rate: | 6.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from CHP | |
| Photovoltaic array | |

# Predicted Energy Assessment

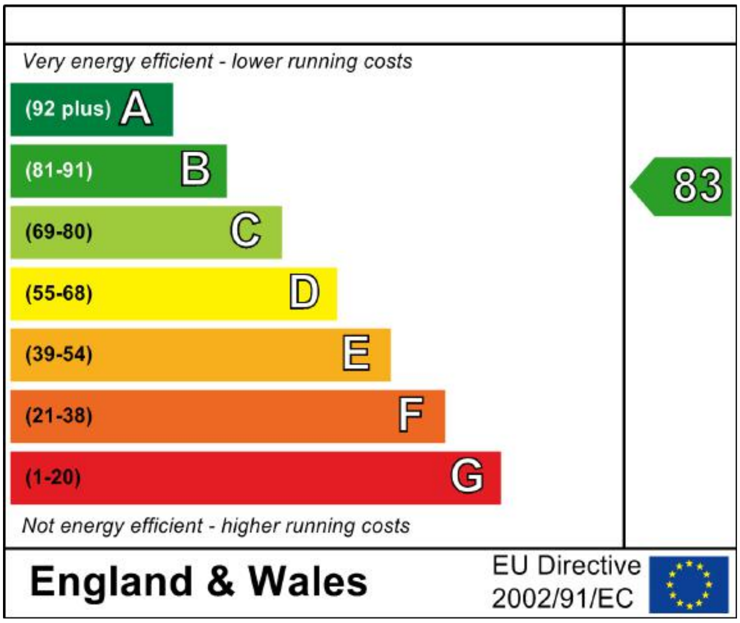
D-1-01
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Mid floor Flat |
| Date of assessment: | 22 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 51.14 m² |

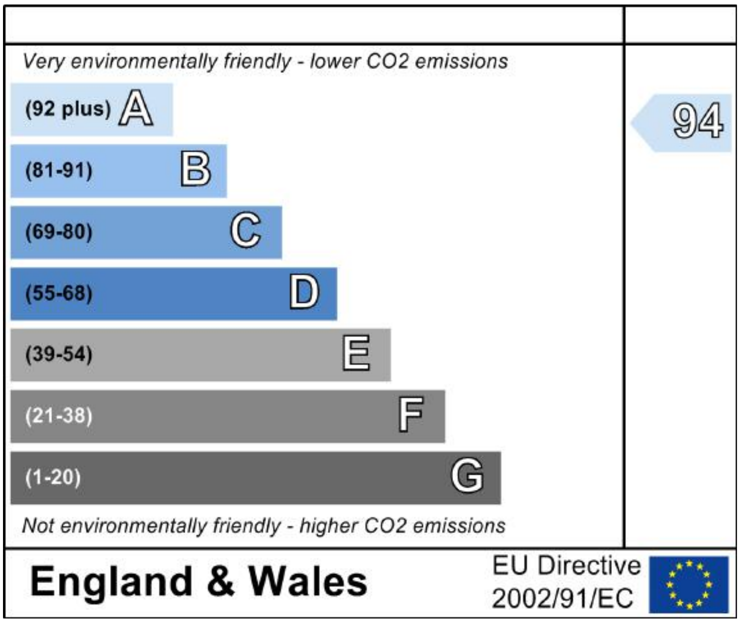
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-1-01

| | |
|---|---|
| Address: | D-1-01, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 22 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 102.37 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 51.14 m² | 2.4 m |
| Living area: | 24.52 m² (fraction 0.479) | |
| Front of dwelling faces: | South | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Front | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Front | 16mm or more | 0.7 | 0.558 | 1.4 | 7.63 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 8.4 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | Stair Wall | South | 0 | 0 |
| Front | | External Wall | West | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 53.01 | 16.03 | 36.98 | 0.18 | 0 | False | 14 |
| Stair Wall | 20.97 | 2.1 | 18.87 | 0.18 | 0.9 | False | 14 |
| Exposed Floor | 6.3 | | | 0.25 | | | 75 |
| Internal Elements | | | | | | | |
| Stud Walls | 60 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 5.64 | | | | | | 20 |
| Party Ceiling | 51.14 | | | | | | 30 |
| Party Floor | 44.84 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1004

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 18.6 | 0.05 | E4 | Jamb |
| [Approved] | 55.98 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 5.67 | 0.32 | E20 | Exposed floor (normal) |
| | 2.35 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 2.35 | 0.16 | P7 | Exposed floor (normal) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | Photovoltaic 1<br>Installed Peak power: 0.6<br>Tilt of collector: Horizontal<br>Overshading: None or very little<br>Collector Orientation: South |

# SAP Input

Assess Zero Carbon Home: No

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 D-1-01

**Address :** D-1-01, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 51.14 | (1a) x | 2.4 | (2a) = | 122.74 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 51.14 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 122.74 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | | |
|---|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = | (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

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

Monthly average wind speed from Table 7

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 7.63 | x1/[1/( 1.4 )+ 0.04] | | = | 10.12 | | | (27) |
| Windows Type 2 | | | 8.4 | x1/[1/( 1.4 )+ 0.04] | | = | 11.14 | | | (27) |
| Floor | | | 6.3 | x | 0.25 | = | 1.575 | 75 | 472.5 | (28) |
| Walls Type1 | 53.01 | 16.03 | 36.98 | x | 0.18 | = | 6.66 | 14 | 517.72 | (29) |
| Walls Type2 | 20.97 | 2.1 | 18.87 | x | 0.15 | = | 2.92 | 14 | 264.18 | (29) |
| Total area of elements, m² | | | 80.28 | | | | | | | (31) |
| Party wall | | | 5.64 | x | 0 | = | 0 | 20 | 112.8 | (32) |
| Party floor | | | 44.84 | | | | | 40 | 1793.6 | (32a) |
| Party ceiling | | | 51.14 | | | | | 30 | 1534.2 | (32b) |
| Internal wall ** | | | 60 | | | | | 9 | 540 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 35.35 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 5235 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 102.37 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 8.06 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 43.41 (37)

# SAP WorkSheet: New dwelling design stage

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.65 | 10.53 | 10.4 | 9.75 | 9.62 | 8.98 | 8.98 | 8.85 | 9.23 | 9.62 | 9.88 | 10.14 | | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 54.06 | 53.93 | 53.8 | 53.16 | 53.03 | 52.38 | 52.38 | 52.25 | 52.64 | 53.03 | 53.29 | 53.54 | | |
| | | | | | | | | | | Average = $Sum(39)_{1...12}$ /12= | | | 53.12 | (39) |

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.06 | 1.05 | 1.05 | 1.04 | 1.04 | 1.02 | 1.02 | 1.02 | 1.03 | 1.04 | 1.04 | 1.05 | | |
| | | | | | | | | | | Average = $Sum(40)_{1...12}$ /12= | | | 1.04 | (40) |

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.72 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.14 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)* | | | | | | | | | | | | | | |
| (44)m= | 82.65 | 79.65 | 76.64 | 73.64 | 70.63 | 67.62 | 67.62 | 70.63 | 73.64 | 76.64 | 79.65 | 82.65 | | |
| | | | | | | | | | | Total = $Sum(44)_{1...12}$ = | | | 901.65 | (44) |
| *Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)* | | | | | | | | | | | | | | |
| (45)m= | 122.57 | 107.2 | 110.62 | 96.44 | 92.54 | 79.85 | 74 | 84.91 | 85.93 | 100.14 | 109.31 | 118.7 | | |
| | | | | | | | | | | Total = $Sum(45)_{1...12}$ = | | | 1182.21 | (45) |
| *If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)* | | | | | | | | | | | | | | |
| (46)m= | 18.39 | 16.08 | 16.59 | 14.47 | 13.88 | 11.98 | 11.1 | 12.74 | 12.89 | 15.02 | 16.4 | 17.81 | | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter ‘0’ in (47)

Water storage loss:

a) If manufacturer’s declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer’s declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 177.85 | 157.13 | 165.9 | 149.94 | 147.82 | 133.35 | 129.27 | 140.19 | 139.42 | 155.42 | 162.8 | 173.98 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 177.85 | 157.13 | 165.9 | 149.94 | 147.82 | 133.35 | 129.27 | 140.19 | 139.42 | 155.42 | 162.8 | 173.98 |

Output from water heater (annual)$_{1...12}$ — 1833.05 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.98 | 75.59 | 81 | 74.86 | 74.99 | 69.35 | 68.83 | 72.45 | 71.37 | 77.52 | 79.14 | 83.69 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | (66) |
| Lighting gains (calculated in Appendix L, equation L9 or L9a), also see Table 5 | | | | | | | | | | | | | |
| (67)m= | 33.47 | 29.73 | 24.18 | 18.31 | 13.68 | 11.55 | 12.48 | 16.23 | 21.78 | 27.65 | 32.27 | 34.41 | (67) |
| Appliances gains (calculated in Appendix L, equation L13 or L13a), also see Table 5 | | | | | | | | | | | | | |
| (68)m= | 224.17 | 226.5 | 220.63 | 208.16 | 192.4 | 177.6 | 167.71 | 165.38 | 171.24 | 183.72 | 199.47 | 214.28 | (68) |
| Cooking gains (calculated in Appendix L, equation L15 or L15a), also see Table 5 | | | | | | | | | | | | | |
| (69)m= | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | (69) |
| Pumps and fans gains (Table 5a) | | | | | | | | | | | | | |
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |
| Losses e.g. evaporation (negative values) (Table 5) | | | | | | | | | | | | | |
| (71)m= | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | (71) |
| Water heating gains (Table 5) | | | | | | | | | | | | | |
| (72)m= | 114.22 | 112.48 | 108.88 | 103.98 | 100.79 | 96.31 | 92.51 | 97.39 | 99.12 | 104.19 | 109.92 | 112.49 | (72) |
| **Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m | | | | | | | | | | | | | |
| (73)m= | 453.4 | 450.25 | 435.23 | 411.98 | 388.42 | 367 | 354.24 | 360.53 | 373.68 | 397.1 | 423.2 | 442.71 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | Access Factor Table 6d | Area m² | Flux Table 6a | g_ Table 6b | FF Table 6c | Gains (W) |
|---|---|---|---|---|---|---|

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 8.4 | x | 19.64 | x | 0.56 | x | 0.7 | = | 44.66 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 38.42 | x | 0.56 | x | 0.7 | = | 87.36 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 63.27 | x | 0.56 | x | 0.7 | = | 143.87 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 92.28 | x | 0.56 | x | 0.7 | = | 209.82 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 113.09 | x | 0.56 | x | 0.7 | = | 257.15 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 115.77 | x | 0.56 | x | 0.7 | = | 263.23 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 110.22 | x | 0.56 | x | 0.7 | = | 250.61 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 94.68 | x | 0.56 | x | 0.7 | = | 215.27 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 73.59 | x | 0.56 | x | 0.7 | = | 167.32 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 45.59 | x | 0.56 | x | 0.7 | = | 103.66 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 24.49 | x | 0.56 | x | 0.7 | = | 55.68 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 16.15 | x | 0.56 | x | 0.7 | = | 36.72 | (76) |
| West | 0.9x | 0.77 | x | 7.63 | x | 19.64 | x | 0.56 | x | 0.7 | = | 40.56 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 38.42 | x | 0.56 | x | 0.7 | = | 79.35 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 63.27 | x | 0.56 | x | 0.7 | = | 130.68 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 92.28 | x | 0.56 | x | 0.7 | = | 190.59 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 113.09 | x | 0.56 | x | 0.7 | = | 233.57 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 115.77 | x | 0.56 | x | 0.7 | = | 239.1 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 110.22 | x | 0.56 | x | 0.7 | = | 227.64 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 94.68 | x | 0.56 | x | 0.7 | = | 195.54 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 73.59 | x | 0.56 | x | 0.7 | = | 151.99 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 45.59 | x | 0.56 | x | 0.7 | = | 94.16 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 24.49 | x | 0.56 | x | 0.7 | = | 50.58 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 16.15 | x | 0.56 | x | 0.7 | = | 33.36 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 85.22 | 166.71 | 274.55 | 400.41 | 490.72 | 502.34 | 478.25 | 410.81 | 319.31 | 197.82 | 106.26 | 70.08 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 538.62 | 616.96 | 709.78 | 812.39 | 879.14 | 869.34 | 832.48 | 771.34 | 692.99 | 594.92 | 529.47 | 512.79 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.89 | 0.85 | 0.77 | 0.65 | 0.51 | 0.37 | 0.27 | 0.3 | 0.48 | 0.71 | 0.85 | 0.9 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.49 | 19.77 | 20.17 | 20.58 | 20.83 | 20.95 | 20.98 | 20.98 | 20.89 | 20.54 | 19.95 | 19.44 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.04 | 20.04 | 20.04 | 20.05 | 20.05 | 20.06 | 20.06 | 20.07 | 20.06 | 20.05 | 20.05 | 20.04 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.88 | 0.83 | 0.75 | 0.61 | 0.47 | 0.32 | 0.22 | 0.24 | 0.43 | 0.67 | 0.83 | 0.89 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.06 | 18.45 | 19 | 19.56 | 19.87 | 20.02 | 20.05 | 20.05 | 19.96 | 19.52 | 18.73 | 17.99 | (90) |

fLA = Living area ÷ (4) = | 0.48 | (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.75 | 19.08 | 19.56 | 20.05 | 20.33 | 20.47 | 20.5 | 20.5 | 20.41 | 20.01 | 19.32 | 18.68 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.75 | 19.08 | 19.56 | 20.05 | 20.33 | 20.47 | 20.5 | 20.5 | 20.41 | 20.01 | 19.32 | 18.68 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.85 | 0.81 | 0.73 | 0.61 | 0.48 | 0.34 | 0.24 | 0.27 | 0.45 | 0.67 | 0.81 | 0.87 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 460.28 | 499.72 | 520.49 | 498.7 | 420 | 296.82 | 201.46 | 210 | 309.27 | 399.08 | 428.31 | 444.3 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 781.02 | 764.86 | 702.78 | 592.59 | 457.75 | 307.26 | 204.28 | 214.01 | 331.97 | 498.95 | 650.92 | 775.41 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 238.63 | 178.17 | 135.63 | 67.6 | 28.09 | 0 | 0 | 0 | 0 | 74.3 | 160.28 | 246.35 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 1129.03 | (98)

Space heating requirement in kWh/m²/year | 22.08 | (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1129.03 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 711.29 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 474.19 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |

**Water heating**

Annual water heating requirement | 1833.05

If DHW from community scheme:

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1154.82 | (310a) |
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 769.88 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 31.1 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 99.2 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 99.2 | (331) |
| Energy for lighting (calculated in Appendix L) | | 236.47 | (332) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | -456.3 | (333) |
| Electricity generated by wind turbine (Appendix M) (negative quantity) | | 0 | (334) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 2.97 | x 0.01 = | 21.13 | (340a) |
| Space heating from heat source 2 | (307b) x | 4.24 | x 0.01 = | 20.11 | (340b) |
| Water heating from CHP | (310a) x | 2.97 | x 0.01 = | 34.3 | (342a) |
| Water heating from heat source 2 | (310b) x | 4.24 | x 0.01 = | 32.64 | (342b) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 13.08 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 31.19 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| Energy saving/generation technologies | | | | | |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 272.45 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.19 | (357) |
| **SAP rating (section12)** | | 83.4 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | |
|---|---|---|---|
| Electrical efficiency of CHP unit | | 29.8 | (361) |
| Heat efficiency of CHP unit | | 57.6 | (362) |

| | | **Energy** kWh/year | | **Emission factor** kg CO2/kWh | **Emissions** kg CO2/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1234.88 | x | 0.22 | 266.73 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 367.99 | x | 0.52 | -190.99 | (364) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2004.9 | x | 0.22 | | 433.06 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 597.46 | x | 0.52 | | -310.08 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 0.22 | = | 295.3 | (368) |
| Electrical energy for heat distribution | [(313) x | | | 0.52 | = | 16.14 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | | = | 510.16 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | | 510.16 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | | 0.52 | = | 51.49 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | | 0.52 | = | 122.73 | (379) |
| Energy saving/generation technologies (333) to (334) as applicable<br>Item 1 | | | | 0.52 | x 0.01 = | -236.82 | (380) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | | 447.56 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | | 8.75 | (384) |
| **EI rating (section 14)** | | | | | | 93.76 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1234.88 | x | 1.22 | | 1506.56 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 367.99 | x | 3.07 | | -1129.74 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2004.9 | x | 1.22 | | 2445.98 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 597.46 | x | 3.07 | | -1834.2 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1667.88 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 95.48 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 2751.95 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 2751.95 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 2751.95 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 304.55 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 725.96 | (379) |

# SAP WorkSheet: New dwelling design stage

| | | | | |
|---|---|---|---|---|
| Energy saving/generation technologies<br>Item 1 | | 3.07 | x 0.01 = | -1400.83 (380) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | 2381.64 (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 22 January 2019

## Property Details: 06-18-69419 D-1-01

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | Yes |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | South |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 102.37 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 6 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 243.02 | **(P1)** |
| **Transmission heat loss coefficient:** | 43.4 | |
| **Summer heat loss coefficient:** | 286.42 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Front) | 0 | 1 |
| East (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Front) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Front) | 0.9 x | 7.63 | 117.51 | 0.56 | 0.7 | 0.76 | 241.12 | |
| East (Rear) | 0.9 x | 8.4 | 117.51 | 0.56 | 0.7 | 0.76 | 265.45 | |
| | | | | | | **Total** | 506.56 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 367 | 354.24 | 360.53 | |
| Total summer gains | 904.73 | 860.8 | 806.19 | **(P5)** |
| Summer gain/loss ratio | 3.16 | 3.01 | 2.81 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.28 | 1.28 | 1.28 | |
| Threshold temperature | 20.44 | 22.19 | 21.9 | **(P7)** |
| **Likelihood of high internal temperature** | **Not significant** | **Medium** | **Slight** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 22 January 2019 at 11:28:10*

## Project Information:

| | | | |
|---|---|---|---|
| **Assessed By:** | Matthew Stainrod (STRO023501) | **Building Type:** | Flat |

## Dwelling Details:

| | | | |
|---|---|---|---|
| **NEW DWELLING DESIGN STAGE** | | Total Floor Area: 50.27m² | |
| **Site Reference :** | Bertram Street | **Plot Reference:** | 06-18-69419 D-1-02 |
| **Address :** | D-1-02, Bertram Street, London | | |

## Client Details:

| | |
|---|---|
| **Name:** | McBains |
| **Address :** | 26 Finsbury Square, London, EC2A 1DS |

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 18.15 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 8.93 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 39.9 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 38.3 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.14 (max. 0.30) | 0.15 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (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: | Community heating schemes - CommCHP |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | **OK** |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South | 16.03m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| External Walls U-value | 0.13 W/m²K |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from CHP | |
| Photovoltaic array | |

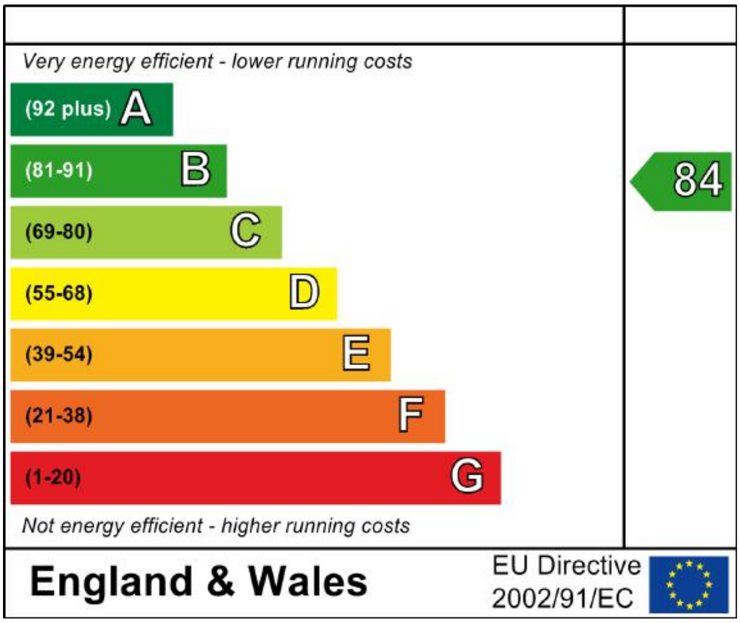
# Predicted Energy Assessment

| | | |
|---|---|---|
| D-1-02<br>Bertram Street<br>London | Dwelling type:<br>Date of assessment:<br>Produced by:<br>Total floor area: | Mid floor Flat<br>22 January 2019<br>Matthew Stainrod<br>50.27 m² |

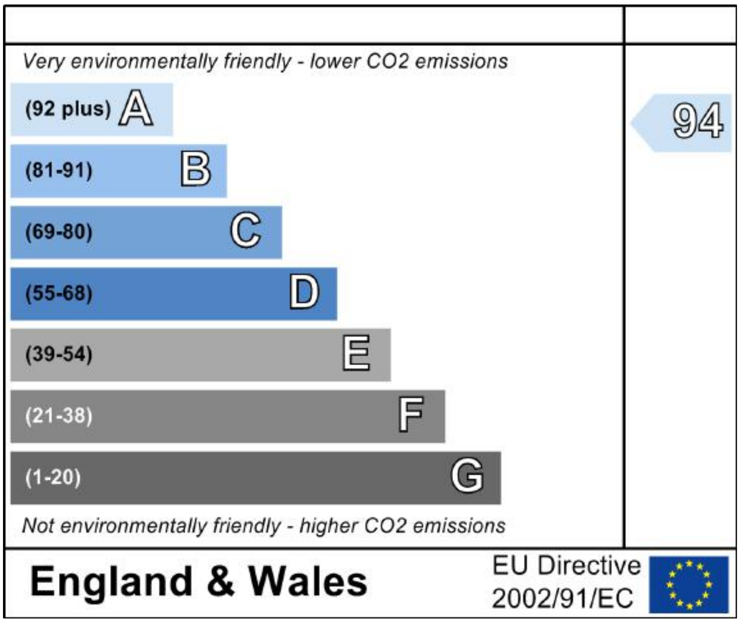
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-1-02

| | |
|---|---|
| Address: | D-1-02, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 22 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 98.25 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 50.27 m² | 2.4 m |
| Living area: | 22.61 m² (fraction 0.45) | |
| Front of dwelling faces: | North | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 16.03 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | Stair Wall | North | 0 | 0 |
| Side | | External Wall | South | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 53.18 | 16.03 | 37.15 | 0.15 | 0 | False | 14 |
| Stair Wall | 15.06 | 2.1 | 12.96 | 0.15 | 0.9 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 67.2 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 5.7 | | | | | | 20 |
| Party Ceiling | 50.27 | | | | | | 30 |
| Party Floor | 50.27 | | | | | | 40 |

## Thermal bridges:

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.1181

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |

# SAP Input

| | | | | |
|---|---|---|---|---|
| [Approved] | 18.6 | 0.05 | E4 | Jamb |
| [Approved] | 55.98 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 5.67 | 0.32 | E20 | Exposed floor (normal) |
| | 2.35 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 2.35 | 0.16 | P7 | Exposed floor (normal) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 3 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | <u>Photovoltaic 1</u><br>Installed Peak power: 0.5<br>Tilt of collector: Horizontal<br>Overshading: None or very little<br>Collector Orientation: South |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 D-1-02

**Address :** D-1-02, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 50.27 | (1a) x | 2.4 | (2a) = | 120.65 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 50.27 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 120.65 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 3 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.78 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.12 | (21) |

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |

Wind Factor (22a)m = (22)m ÷ 4

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.15 | 0.15 | 0.14 | 0.13 | 0.12 | 0.11 | 0.11 | 0.11 | 0.12 | 0.12 | 0.13 | 0.14 |

*Calculate effective air change rate for the applicable case*

| | | |
|---|---|---|
| If mechanical ventilation: | 0.5 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0.5 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 79.9 | (23c) |

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.25 | 0.25 | 0.24 | 0.23 | 0.23 | 0.21 | 0.21 | 0.21 | 0.22 | 0.23 | 0.23 | 0.24 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows | | | 16.03 | x1/[1/( 1.4 )+ 0.04] | | = | 21.25 | | | (27) |
| Walls Type1 | 53.18 | 16.03 | 37.15 | x | 0.15 | = | 5.57 | 14 | 520.1 | (29) |
| Walls Type2 | 15.06 | 2.1 | 12.96 | x | 0.13 | = | 1.71 | 14 | 181.44 | (29) |
| Total area of elements, m² | | | 68.24 | | | | | | | (31) |
| Party wall | | | 5.7 | x | 0 | = | 0 | 20 | 114 | (32) |
| Party floor | | | 50.27 | | | | | 40 | 2010.8 | (32a) |
| Party ceiling | | | 50.27 | | | | | 30 | 1508.1 | (32b) |
| Internal wall ** | | | 67.2 | | | | | 9 | 604.8 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

| | | | |
|---|---|---|---|
| Fabric heat loss, W/K = S (A x U) | (26)…(30) + (32) = | 31.48 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 4939.24 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 98.25 | (35) |

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

| | | | |
|---|---|---|---|
| Thermal bridges : S (L x Y) calculated using Appendix K | | 8.06 | (36) |

*if details of thermal bridging are not known (36) = 0.15 x (31)*

| | | | |
|---|---|---|---|
| Total fabric heat loss | (33) + (36) = | 39.54 | (37) |

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

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 9.9 | 9.79 | 9.67 | 9.09 | 8.98 | 8.4 | 8.4 | 8.28 | 8.63 | 8.98 | 9.21 | 9.44 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 49.44 | 49.32 | 49.21 | 48.63 | 48.51 | 47.93 | 47.93 | 47.82 | 48.17 | 48.51 | 48.74 | 48.98 | |

Average = Sum(39)$_{1…12}$ /12= 48.6 (39)

# SAP WorkSheet: New dwelling design stage

Heat loss parameter (HLP), W/m²K — (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.98 | 0.98 | 0.98 | 0.97 | 0.97 | 0.95 | 0.95 | 0.95 | 0.96 | 0.97 | 0.97 | 0.97 |

Average = Sum(40)$_{1…12}$ /12= 0.97 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N — 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 — 74.53 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 81.98 | 79 | 76.02 | 73.04 | 70.06 | 67.08 | 67.08 | 70.06 | 73.04 | 76.02 | 79 | 81.98 |

Total = Sum(44)$_{1…12}$ = 894.34 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 121.58 | 106.33 | 109.72 | 95.66 | 91.79 | 79.21 | 73.4 | 84.22 | 85.23 | 99.33 | 108.42 | 117.74 |

Total = Sum(45)$_{1…12}$ = 1172.63 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.24 | 15.95 | 16.46 | 14.35 | 13.77 | 11.88 | 11.01 | 12.63 | 12.78 | 14.9 | 16.26 | 17.66 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel — 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): — 0 (48)

Temperature factor from Table 2b — 0 (49)

Energy lost from water storage, kWh/year — (48) x (49) = — 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) — 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a — 1.03 (52)

Temperature factor from Table 2b — 0.6 (53)

Energy lost from water storage, kWh/year — (47) x (51) x (52) x (53) = — 1.03 (54)

Enter (50) or (54) in (55) — 1.03 (55)

Water storage loss calculated for each month — ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 — 0 (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 176.85 | 156.26 | 165 | 149.15 | 147.07 | 132.7 | 128.67 | 139.5 | 138.72 | 154.6 | 161.92 | 173.02 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 176.85 | 156.26 | 165 | 149.15 | 147.07 | 132.7 | 128.67 | 139.5 | 138.72 | 154.6 | 161.92 | 173.02 | |

Output from water heater (annual)$_{1...12}$ 1823.47 (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.65 | 75.3 | 80.7 | 74.6 | 74.74 | 69.13 | 68.63 | 72.23 | 71.13 | 77.25 | 78.85 | 83.37 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 32.97 | 29.28 | 23.82 | 18.03 | 13.48 | 11.38 | 12.29 | 15.98 | 21.45 | 27.24 | 31.79 | 33.89 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 220.8 | 223.09 | 217.32 | 205.02 | 189.51 | 174.93 | 165.18 | 162.89 | 168.67 | 180.96 | 196.47 | 211.06 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 113.77 | 112.05 | 108.47 | 103.61 | 100.46 | 96.02 | 92.24 | 97.08 | 98.8 | 103.83 | 109.51 | 112.06 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 448.39 | 445.27 | 430.45 | 407.52 | 384.29 | 363.17 | 350.56 | 356.8 | 369.76 | 392.87 | 418.62 | 437.85 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South | 0.9x | 0.77 | x | 16.03 | x | 46.75 | x | 0.56 | x | 0.7 | = | 202.86 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 76.57 | x | 0.56 | x | 0.7 | = | 332.24 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 97.53 | x | 0.56 | x | 0.7 | = | 423.21 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 110.23 | x | 0.56 | x | 0.7 | = | 478.32 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 114.87 | x | 0.56 | x | 0.7 | = | 498.44 | (78) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| South | 0.9x | 0.77 | x | 16.03 | x | 110.55 | x | 0.56 | x | 0.7 | = | 479.68 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 108.01 | x | 0.56 | x | 0.7 | = | 468.67 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 104.89 | x | 0.56 | x | 0.7 | = | 455.15 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 101.89 | x | 0.56 | x | 0.7 | = | 442.09 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 82.59 | x | 0.56 | x | 0.7 | = | 358.35 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 55.42 | x | 0.56 | x | 0.7 | = | 240.46 | (78) |
| South | 0.9x | 0.77 | x | 16.03 | x | 40.4 | x | 0.56 | x | 0.7 | = | 175.29 | (78) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 202.86 | 332.24 | 423.21 | 478.32 | 498.44 | 479.68 | 468.67 | 455.15 | 442.09 | 358.35 | 240.46 | 175.29 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 651.25 | 777.51 | 853.66 | 885.83 | 882.73 | 842.84 | 819.24 | 811.95 | 811.85 | 751.22 | 659.08 | 613.14 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.82 | 0.75 | 0.67 | 0.58 | 0.47 | 0.35 | 0.25 | 0.27 | 0.39 | 0.58 | 0.75 | 0.84 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.89 | 20.19 | 20.46 | 20.71 | 20.87 | 20.96 | 20.99 | 20.99 | 20.94 | 20.74 | 20.3 | 19.82 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.1 | 20.1 | 20.1 | 20.11 | 20.11 | 20.12 | 20.12 | 20.12 | 20.12 | 20.11 | 20.11 | 20.1 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.8 | 0.73 | 0.65 | 0.55 | 0.43 | 0.31 | 0.2 | 0.22 | 0.35 | 0.55 | 0.73 | 0.82 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.66 | 19.07 | 19.44 | 19.77 | 19.97 | 20.09 | 20.11 | 20.11 | 20.06 | 19.82 | 19.24 | 18.57 | (90) |

fLA = Living area ÷ (4) = 0.45 (91)

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.21 | 19.57 | 19.9 | 20.19 | 20.38 | 20.48 | 20.51 | 20.51 | 20.46 | 20.24 | 19.72 | 19.13 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.21 | 19.57 | 19.9 | 20.19 | 20.38 | 20.48 | 20.51 | 20.51 | 20.46 | 20.24 | 19.72 | 19.13 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.78 | 0.71 | 0.64 | 0.55 | 0.45 | 0.33 | 0.23 | 0.24 | 0.36 | 0.55 | 0.72 | 0.8 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 510.73 | 554.7 | 545.67 | 486.67 | 393.33 | 273.95 | 185.32 | 193.98 | 294.72 | 414.14 | 471.82 | 492.16 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 737.18 | 723.68 | 659.35 | 549.02 | 420.86 | 281.81 | 187.3 | 196.37 | 306.28 | 467.54 | 615.08 | 731.17 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 168.48 | 113.55 | 84.58 | 44.89 | 20.48 | 0 | 0 | 0 | 0 | 39.73 | 103.15 | 177.82 | |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| | Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 752.68 | (98) |
| Space heating requirement in kWh/m²/year | | 14.97 | (99) |

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme.<br>Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 752.68 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 474.19 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 316.13 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1823.47 | |
| If DHW from community scheme:<br>Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1148.78 | (310a) |
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 765.86 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 27.05 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 97.51 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 97.51 | (331) |
| Energy for lighting (calculated in Appendix L) | | 232.91 | (332) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | -380.25 | (333) |
| Electricity generated by wind turbine (Appendix M) (negative quantity) | | 0 | (334) |

## 10b. Fuel costs – Community heating scheme

# SAP WorkSheet: New dwelling design stage

| | | Fuel kWh/year | | Fuel Price (Table 12) | | Fuel Cost £/year | |
|---|---|---|---|---|---|---|---|
| Space heating from CHP | | (307a) | x | 2.97 | x 0.01 = | 14.08 | (340a) |
| Space heating from heat source 2 | | (307b) | x | 4.24 | x 0.01 = | 13.4 | (340b) |
| Water heating from CHP | | (310a) | x | 2.97 | x 0.01 = | 34.12 | (342a) |
| Water heating from heat source 2 | | (310b) | x | 4.24 | x 0.01 = | 32.47 | (342b) |
| | | | | **Fuel Price** | | | |
| Pumps and fans | | (331) | | 13.19 | x 0.01 = | 12.86 | (349) |
| Energy for lighting | | (332) | | 13.19 | x 0.01 = | 30.72 | (350) |
| Additional standing charges (Table 12) | | | | | | 120 | (351) |
| Energy saving/generation technologies | | | | | | | |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | | 257.66 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.14 | (357) |
| **SAP rating (section12)** | | 84.15 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | |
|---|---|---|---|
| Electrical efficiency of CHP unit | | 29.8 | (361) |
| Heat efficiency of CHP unit | | 57.6 | (362) |

| | | Energy kWh/year | | Emission factor kg CO2/kWh | | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 823.24 | x | 0.22 | | 177.82 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 245.33 | x | 0.52 | | -127.32 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 1994.42 | x | 0.22 | | 430.79 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 594.34 | x | 0.52 | | -308.46 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 0.22 | = | 256.82 | (368) |
| Electrical energy for heat distribution | [(313) x | | | 0.52 | = | 14.04 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | | = | 443.69 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | | 443.69 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | | 0.52 | = | 50.61 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | | 0.52 | = | 120.88 | (379) |
| Energy saving/generation technologies (333) to (334) as applicable<br>Item 1 | | | | 0.52 | x 0.01 = | -197.35 | (380) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | | 417.83 | (383) |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 8.31 | (384) |
| **EI rating (section 14)** | | | | | 94.12 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 823.24 | x | 1.22 | | 1004.36 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 245.33 | x | 3.07 | | -753.15 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 1994.42 | x | 1.22 | | 2433.19 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 594.34 | x | 3.07 | | -1824.61 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1450.57 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 83.04 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 2393.39 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 2393.39 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 2393.39 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 299.37 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 715.04 | (379) |
| Energy saving/generation technologies<br>Item 1 | | | | 3.07 | x 0.01 = | -1167.36 | (380) |
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | | | | | 2240.45 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 22 January 2019

## Property Details: 06-18-69419 D-1-02

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | North |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 98.25 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 159.26 | **(P1)** |
| **Transmission heat loss coefficient:** | 39.5 | |
| **Summer heat loss coefficient:** | 198.79 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| South (Side) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| South (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| South (Side) | 0.9 x | 16.03 | 112.21 | 0.56 | 0.7 | 0.76 | 483.71 | |
| | | | | | | **Total** | 483.71 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 363.17 | 350.56 | 356.8 | |
| Total summer gains | 864.57 | 834.28 | 834.05 | **(P5)** |
| Summer gain/loss ratio | 4.35 | 4.2 | 4.2 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.31 | 1.31 | 1.31 | |
| Threshold temperature | 21.66 | 23.41 | 23.31 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 22 January 2019 at 11:28:00*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 51.14m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 D-2-01

**Address :** D-2-01, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 19.4 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 9.61 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 47.8 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 43.5 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.14 (max. 0.30) | 0.15 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

## 7 Low energy lights

| | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |

## 8 Mechanical ventilation

| | | |
|---|---|---|
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |

## 9 Summertime temperature

| | | |
|---|---|---|
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: West | 7.63m² | |
| Windows facing: East | 8.4m² | |
| Ventilation rate: | 6.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

## 10 Key features

| | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| External Walls U-value | 0.13 W/m²K |
| Party Walls U-value | 0 W/m²K |
| Community heating, heat from CHP | |
| Photovoltaic array | |

# Predicted Energy Assessment

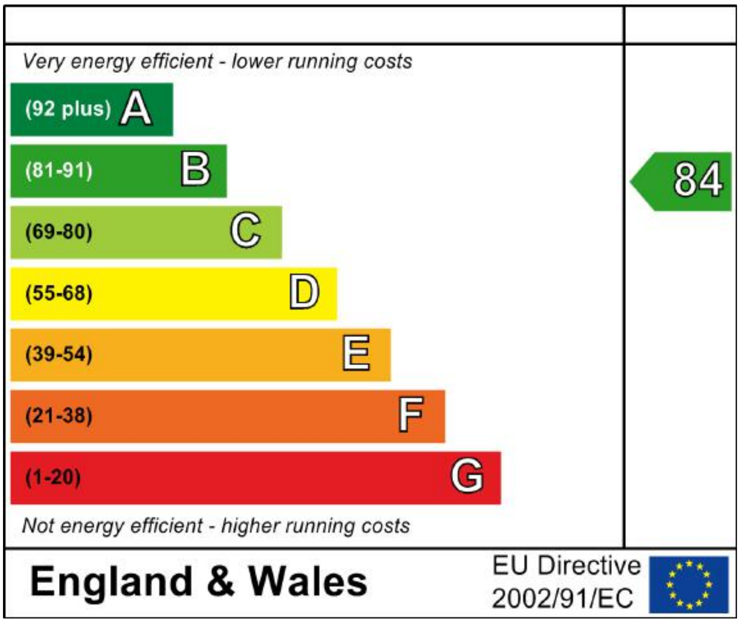
D-2-01
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Mid floor Flat |
| Date of assessment: | 22 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 51.14 m² |

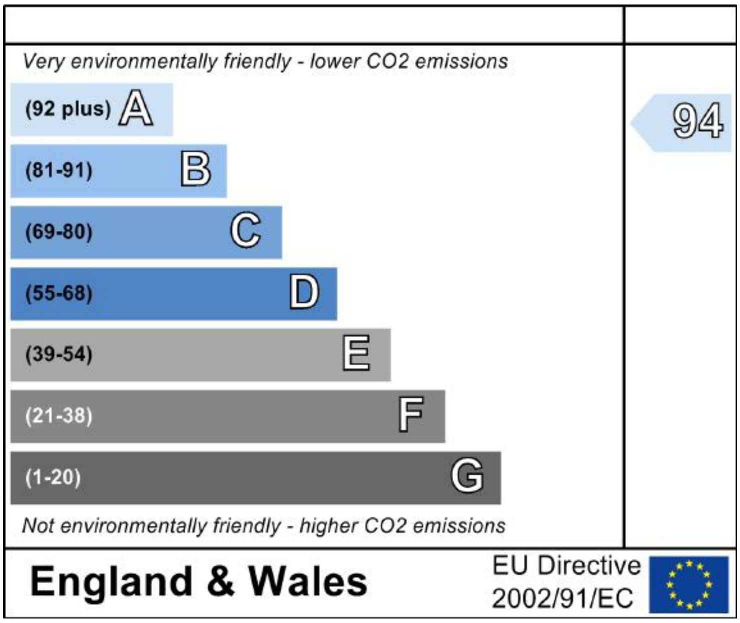
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-2-01

| | |
|---|---|
| Address: | D-2-01, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 22 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 98.05 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | |
|---|---|
| Dwelling type: | Flat |
| Detachment: | |
| Year Completed: | 2018 |

| Floor Location: | Floor area: | Storey height: |
|---|---|---|
| Floor 0 | 51.14 m² | 2.4 m |

| | |
|---|---|
| Living area: | 24.52 m² (fraction 0.479) |
| Front of dwelling faces: | South |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Front | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Front | 16mm or more | 0.7 | 0.558 | 1.4 | 7.63 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 8.4 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | Stair Wall | South | 0 | 0 |
| Front | | External Wall | West | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 53.01 | 16.03 | 36.98 | 0.15 | 0 | False | 14 |
| Stair Wall | 20.97 | 2.1 | 18.87 | 0.15 | 0.9 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 60 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 5.64 | | | | | | 20 |
| Party Ceiling | 51.14 | | | | | | 30 |
| Party Floor | 51.14 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0847

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 18.6 | 0.05 | E4 | Jamb |
| [Approved] | 61.65 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 4.7 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, Rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 3

## Main heating system:

Main heating system: Community heating schemes
Heat source: Community CHP
heat from CHP, heat fraction 0.6, efficiency 57.6
Heat source: Community boilers
heat from boilers – mains gas, heat fraction 0.4, efficiency 91
Piping>=1991, pre-insulated, low temp, variable flow

## Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and TRVs
Control code: 2306

## Secondary heating system:

Secondary heating system: None

## Water heating:

Water heating: From main heating system
Water code: 901
Fuel :heat from CHP
No hot water cylinder
Solar panel: False

## Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Dense urban
EPC language: English
Wind turbine: No

Photovoltaics: Photovoltaic 1
Installed Peak power: 0.5
Tilt of collector: Horizontal
Overshading: None or very little
Collector Orientation: South

Assess Zero Carbon Home: No

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 D-2-01

**Address :** D-2-01, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 51.14 | (1a) | x | 2.4 | (2a) | = | 122.74 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 51.14 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 122.74 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 7.63 | x1/[1/( 1.4 )+ 0.04] | | = | 10.12 | | | (27) |
| Windows Type 2 | | | 8.4 | x1/[1/( 1.4 )+ 0.04] | | = | 11.14 | | | (27) |
| Walls Type1 | 53.01 | 16.03 | 36.98 | x | 0.15 | = | 5.55 | 14 | 517.72 | (29) |
| Walls Type2 | 20.97 | 2.1 | 18.87 | x | 0.13 | = | 2.49 | 14 | 264.18 | (29) |
| Total area of elements, m² | | | 73.98 | | | | | | | (31) |
| Party wall | | | 5.64 | x | 0 | = | 0 | 20 | 112.8 | (32) |
| Party floor | | | 51.14 | | | | | 40 | 2045.6 | (32a) |
| Party ceiling | | | 51.14 | | | | | 30 | 1534.2 | (32b) |
| Internal wall ** | | | 60 | | | | | 9 | 540 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 32.23 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 5014.5 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 98.05 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 6.27 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 38.5 (37)

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.65 | 10.53 | 10.4 | 9.75 | 9.62 | 8.98 | 8.98 | 8.85 | 9.23 | 9.62 | 9.88 | 10.14 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 49.15 | 49.02 | 48.89 | 48.25 | 48.12 | 47.47 | 47.47 | 47.35 | 47.73 | 48.12 | 48.38 | 48.64 | |

Average = Sum(39)1…12 /12= 48.22 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.96 | 0.96 | 0.96 | 0.94 | 0.94 | 0.93 | 0.93 | 0.93 | 0.93 | 0.94 | 0.95 | 0.95 | |

Average = Sum(40)1…12 /12= 0.94 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.72 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.14 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 82.65 | 79.65 | 76.64 | 73.64 | 70.63 | 67.62 | 67.62 | 70.63 | 73.64 | 76.64 | 79.65 | 82.65 | |

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

Total = Sum(44)1…12 = 901.65 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 122.57 | 107.2 | 110.62 | 96.44 | 92.54 | 79.85 | 74 | 84.91 | 85.93 | 100.14 | 109.31 | 118.7 | |

Total = Sum(45)1…12 = 1182.21 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.39 | 16.08 | 16.59 | 14.47 | 13.88 | 11.98 | 11.1 | 12.74 | 12.89 | 15.02 | 16.4 | 17.81 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 177.85 | 157.13 | 165.9 | 149.94 | 147.82 | 133.35 | 129.27 | 140.19 | 139.42 | 155.42 | 162.8 | 173.98 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 177.85 | 157.13 | 165.9 | 149.94 | 147.82 | 133.35 | 129.27 | 140.19 | 139.42 | 155.42 | 162.8 | 173.98 |

Output from water heater (annual)$_{1...12}$ | 1833.05 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.98 | 75.59 | 81 | 74.86 | 74.99 | 69.35 | 68.83 | 72.45 | 71.37 | 77.52 | 79.14 | 83.69 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 33.47 | 29.73 | 24.18 | 18.31 | 13.68 | 11.55 | 12.48 | 16.23 | 21.78 | 27.65 | 32.27 | 34.41 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 224.17 | 226.5 | 220.63 | 208.16 | 192.4 | 177.6 | 167.71 | 165.38 | 171.24 | 183.72 | 199.47 | 214.28 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 114.22 | 112.48 | 108.88 | 103.98 | 100.79 | 96.31 | 92.51 | 97.39 | 99.12 | 104.19 | 109.92 | 112.49 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 453.4 | 450.25 | 435.23 | 411.98 | 388.42 | 367 | 354.24 | 360.53 | 373.68 | 397.1 | 423.2 | 442.71 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 8.4 | x | 19.64 | x | 0.56 | x | 0.7 | = | 44.66 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 38.42 | x | 0.56 | x | 0.7 | = | 87.36 | (76) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 8.4 | x | 63.27 | x | 0.56 | x | 0.7 | = | 143.87 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 92.28 | x | 0.56 | x | 0.7 | = | 209.82 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 113.09 | x | 0.56 | x | 0.7 | = | 257.15 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 115.77 | x | 0.56 | x | 0.7 | = | 263.23 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 110.22 | x | 0.56 | x | 0.7 | = | 250.61 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 94.68 | x | 0.56 | x | 0.7 | = | 215.27 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 73.59 | x | 0.56 | x | 0.7 | = | 167.32 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 45.59 | x | 0.56 | x | 0.7 | = | 103.66 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 24.49 | x | 0.56 | x | 0.7 | = | 55.68 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 16.15 | x | 0.56 | x | 0.7 | = | 36.72 | (76) |
| West | 0.9x | 0.77 | x | 7.63 | x | 19.64 | x | 0.56 | x | 0.7 | = | 40.56 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 38.42 | x | 0.56 | x | 0.7 | = | 79.35 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 63.27 | x | 0.56 | x | 0.7 | = | 130.68 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 92.28 | x | 0.56 | x | 0.7 | = | 190.59 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 113.09 | x | 0.56 | x | 0.7 | = | 233.57 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 115.77 | x | 0.56 | x | 0.7 | = | 239.1 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 110.22 | x | 0.56 | x | 0.7 | = | 227.64 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 94.68 | x | 0.56 | x | 0.7 | = | 195.54 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 73.59 | x | 0.56 | x | 0.7 | = | 151.99 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 45.59 | x | 0.56 | x | 0.7 | = | 94.16 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 24.49 | x | 0.56 | x | 0.7 | = | 50.58 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 16.15 | x | 0.56 | x | 0.7 | = | 33.36 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 85.22 | 166.71 | 274.55 | 400.41 | 490.72 | 502.34 | 478.25 | 410.81 | 319.31 | 197.82 | 106.26 | 70.08 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 538.62 | 616.96 | 709.78 | 812.39 | 879.14 | 869.34 | 832.48 | 771.34 | 692.99 | 594.92 | 529.47 | 512.79 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.87 | 0.83 | 0.74 | 0.61 | 0.47 | 0.34 | 0.25 | 0.28 | 0.45 | 0.68 | 0.83 | 0.89 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.67 | 19.94 | 20.31 | 20.67 | 20.88 | 20.97 | 20.99 | 20.99 | 20.92 | 20.63 | 20.1 | 19.62 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.12 | 20.12 | 20.12 | 20.13 | 20.13 | 20.14 | 20.14 | 20.15 | 20.14 | 20.13 | 20.13 | 20.12 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.86 | 0.81 | 0.72 | 0.58 | 0.43 | 0.3 | 0.2 | 0.23 | 0.4 | 0.64 | 0.81 | 0.87 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.37 | 18.75 | 19.26 | 19.74 | 20 | 20.11 | 20.14 | 20.14 | 20.07 | 19.7 | 18.99 | 18.3 | (90) |

fLA = Living area ÷ (4) = | 0.48 | (91)

# SAP WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19 | 19.32 | 19.76 | 20.19 | 20.42 | 20.52 | 20.55 | 20.54 | 20.48 | 20.15 | 19.53 | 18.94 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19 | 19.32 | 19.76 | 20.19 | 20.42 | 20.52 | 20.55 | 20.54 | 20.48 | 20.15 | 19.53 | 18.94 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.84 | 0.79 | 0.71 | 0.58 | 0.45 | 0.32 | 0.22 | 0.25 | 0.42 | 0.64 | 0.79 | 0.85 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 452.43 | 488.27 | 503.28 | 474.26 | 393.02 | 274.3 | 185.56 | 193.62 | 288.62 | 382.51 | 418.31 | 437.31 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 722.42 | 706.93 | 648.48 | 544.68 | 419.59 | 281.14 | 187.33 | 196.17 | 304.36 | 459.46 | 601.15 | 716.69 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 200.87 | 146.94 | 108.03 | 50.7 | 19.77 | 0 | 0 | 0 | 0 | 57.25 | 131.65 | 207.85 | |

| | | |
|---|---|---|
| Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = | 923.05 | (98) |
| Space heating requirement in kWh/m²/year | 18.05 | (99) |

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 923.05 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 581.52 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 387.68 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1833.05 | |
| If DHW from community scheme:<br>Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1154.82 | (310a) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 769.88 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 28.94 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 99.2 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 99.2 | (331) |
| Energy for lighting (calculated in Appendix L) | | 236.47 | (332) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | -380.25 | (333) |
| Electricity generated by wind turbine (Appendix M) (negative quantity) | | 0 | (334) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 2.97 | x 0.01 = | 17.27 | (340a) |
| Space heating from heat source 2 | (307b) | x | 4.24 | x 0.01 = | 16.44 | (340b) |
| Water heating from CHP | (310a) | x | 2.97 | x 0.01 = | 34.3 | (342a) |
| Water heating from heat source 2 | (310b) | x | 4.24 | x 0.01 = | 32.64 | (342b) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 13.08 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 31.19 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| Energy saving/generation technologies | | | | | | |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 264.93 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.16 | (357) |
| **SAP rating (section12)** | | 83.85 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | |
|---|---|---|---|
| Electrical efficiency of CHP unit | | 29.8 | (361) |
| Heat efficiency of CHP unit | | 57.6 | (362) |

| | | **Energy** kWh/year | | **Emission factor** kg CO2/kWh | **Emissions** kg CO2/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1009.59 | x | 0.22 | 218.07 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 300.86 | x | 0.52 | -156.14 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2004.9 | x | 0.22 | 433.06 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 597.46 | x | 0.52 | -310.08 | (366) |

# SAP WorkSheet: New dwelling design stage

| | | | | | | |
|---|---|---|---|---|---|---|
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | 0.22 | = | 274.76 | (368) |
| Electrical energy for heat distribution | [(313) x | | 0.52 | = | 15.02 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | | = | 474.68 | (373) |
| CO2 associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | | 474.68 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | | 0.52 | = | 51.49 | (378) |
| CO2 associated with electricity for lighting | (332))) x | | 0.52 | = | 122.73 | (379) |
| Energy saving/generation technologies (333) to (334) as applicable<br>Item 1 | | | 0.52 | x 0.01 = | -197.35 | (380) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | | 451.55 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | | 8.83 | (384) |
| **EI rating (section 14)** | | | | | 93.71 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1009.59 | x 1.22 | | 1231.7 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 300.86 | x 3.07 | | -923.63 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2004.9 | x 1.22 | | 2445.98 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 597.46 | x 3.07 | | -1834.2 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | 1.22 | = | 1551.9 | (368) |
| Electrical energy for heat distribution | [(313) x | | | = | 88.84 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | = | 2560.58 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | 2560.58 | (373) |
| Energy associated with space heating (secondary) | (309) x | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | 2560.58 | (376) |
| Energy associated with space cooling | (315) x | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | 3.07 | = | 304.55 | (378) |
| Energy associated with electricity for lighting | (332))) x | | 3.07 | = | 725.96 | (379) |
| Energy saving/generation technologies<br>Item 1 | | | 3.07 | x 0.01 = | -1167.36 | (380) |

| | | | |
|---|---|---|---|
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | 2423.74 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 22 January 2019

## Property Details: 06-18-69419 D-2-01

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | Yes |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | South |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 98.05 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 6 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 243.02 | **(P1)** |
| **Transmission heat loss coefficient:** | 38.5 | |
| **Summer heat loss coefficient:** | 281.52 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Front) | 0 | 1 |
| East (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Front) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Front) | 0.9 x | 7.63 | 117.51 | 0.56 | 0.7 | 0.76 | 241.12 | |
| East (Rear) | 0.9 x | 8.4 | 117.51 | 0.56 | 0.7 | 0.76 | 265.45 | |
| | | | | | | **Total** | 506.56 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 367 | 354.24 | 360.53 | |
| Total summer gains | 904.73 | 860.8 | 806.19 | **(P5)** |
| Summer gain/loss ratio | 3.21 | 3.06 | 2.86 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.31 | 1.31 | 1.31 | |
| Threshold temperature | 20.53 | 22.27 | 21.98 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Slight** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 22 January 2019 at 11:27:49*

## Project Information:

| | | | |
|---|---|---|---|
| **Assessed By:** | Matthew Stainrod (STRO023501) | **Building Type:** | Flat |

## Dwelling Details:

| | | | |
|---|---|---|---|
| **NEW DWELLING DESIGN STAGE** | | Total Floor Area: 50.27m² | |
| **Site Reference :** | Bertram Street | **Plot Reference:** | 06-18-69419 D-2-02 |
| **Address :** | D-2-02, Bertram Street, London | | |

## Client Details:

| | |
|---|---|
| **Name:** | McBains |
| **Address :** | 26 Finsbury Square, London, EC2A 1DS |

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 18.03 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 8.77 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 39.5 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 37.3 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.14 (max. 0.30) | 0.15 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | (no floor) | | |
| Roof | (no roof) | | |
| Openings | 1.40 (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: | Community heating schemes - CommCHP |
| Secondary heating system: | None |

## 5 Cylinder insulation

| | |
|---|---|
| Hot water Storage: | No cylinder |

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | **OK** |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| 7 Low energy lights | | |
|---|---|---|
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South | 12.22m² | |
| Windows facing: East | 2.38m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |

| 10 Key features | |
|---|---|
| Air permeablility | 3.0 m³/m²h |
| External  Walls U-value | 0.13 W/m²K |
| Party  Walls U-value | 0 W/m²K |
| Community heating, heat from CHP | |
| Photovoltaic array | |

# Predicted Energy Assessment

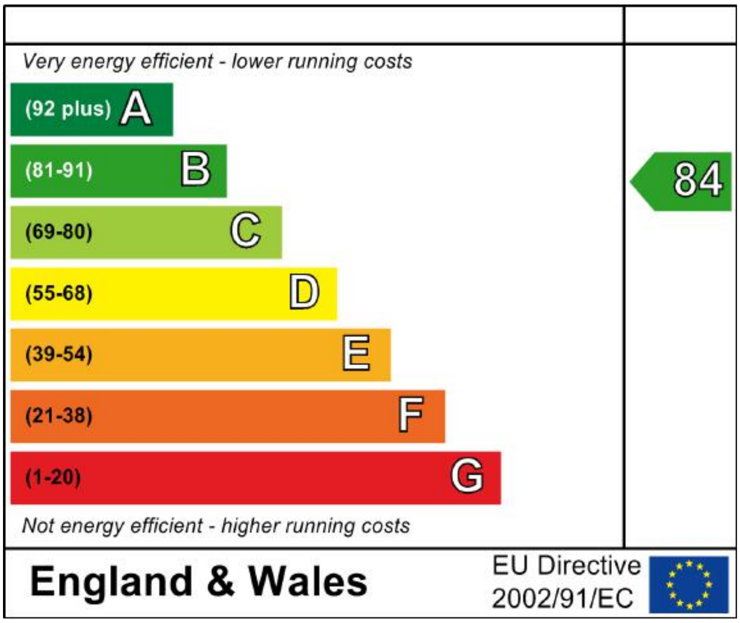
D-2-02
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Mid floor Flat |
| Date of assessment: | 22 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 50.27 m² |

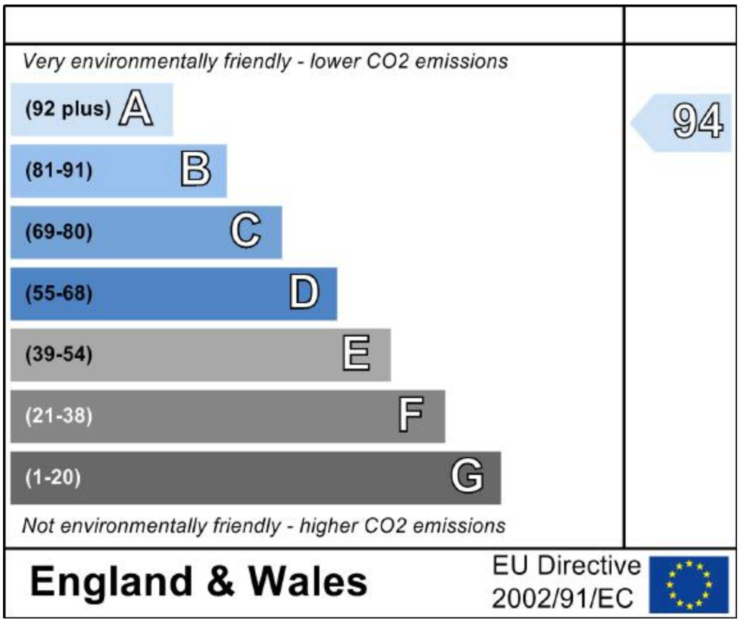
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-2-02

| | |
|---|---|
| Address: | D-2-02, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 22 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 98.65 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 50.27 m² | 2.4 m |
| Living area: | 22.61 m² (fraction 0.45) | |
| Front of dwelling faces: | North | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 12.22 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 2.38 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | Stair Wall | North | 0 | 0 |
| Side | | External Wall | South | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 53.18 | 14.6 | 38.58 | 0.15 | 0 | False | 14 |
| Stair Wall | 15.06 | 2.1 | 12.96 | 0.15 | 0.9 | False | 14 |
| Internal Elements | | | | | | | |
| Stud Walls | 67.2 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 5.7 | | | | | | 20 |
| Party Ceiling | 50.27 | | | | | | 30 |
| Party Floor | 50.27 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0946

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 2.59 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 16.8 | 0.05 | E4 | Jamb |
| [Approved] | 56.87 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 2.4 | 0.06 | E18 | Party wall between dwellings |
| [Approved] | 1.59 | 0.04 | E3 | Sill |
| | 4.75 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |

## Ventilation:

| | |
|---|---|
| Pressure test: | Yes (As designed) |
| Ventilation: | Balanced with heat recovery<br>Number of wet rooms: Kitchen + 1<br>Ductwork: Insulation, Rigid<br>Approved Installation Scheme: True |
| Number of chimneys: | 0 |
| Number of open flues: | 0 |
| Number of fans: | 0 |
| Number of passive stacks: | 0 |
| Number of sides sheltered: | 2 |
| Pressure test: | 3 |

## Main heating system:

| | |
|---|---|
| Main heating system: | Community heating schemes<br>Heat source: Community CHP<br>heat from CHP, heat fraction 0.6, efficiency 57.6<br>Heat source: Community boilers<br>heat from boilers – mains gas, heat fraction 0.4, efficiency 91<br>Piping>=1991, pre-insulated, low temp, variable flow |

## Main heating Control:

| | |
|---|---|
| Main heating Control: | Charging system linked to use of community heating, programmer and TRVs<br>Control code: 2306 |

## Secondary heating system:

| | |
|---|---|
| Secondary heating system: | None |

## Water heating:

| | |
|---|---|
| Water heating: | From main heating system<br>Water code: 901<br>Fuel :heat from CHP<br>No hot water cylinder<br>Solar panel: False |

## Others:

| | |
|---|---|
| Electricity tariff: | Standard Tariff |
| In Smoke Control Area: | Unknown |
| Conservatory: | No conservatory |
| Low energy lights: | 100% |
| Terrain type: | Dense urban |
| EPC language: | English |
| Wind turbine: | No |
| Photovoltaics: | Photovoltaic 1<br>Installed Peak power: 0.5<br>Tilt of collector: Horizontal<br>Overshading: None or very little<br>Collector Orientation: South |
| Assess Zero Carbon Home: | No |

# SAP Input

# SAP WorkSheet: New dwelling design stage

## User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 D-2-02

**Address :** D-2-02, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 50.27 | (1a) x | 2.4 | (2a) = | 120.65 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 50.27 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 120.65 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | | |
|---|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = | (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

Monthly average wind speed from Table 7

Wind Factor (22a)m = (22)m ÷ 4

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| ELEMENT | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 12.22 | x1/[1/( 1.4 )+ 0.04] | | = | 16.2 | | | (27) |
| Windows Type 2 | | | 2.38 | x1/[1/( 1.4 )+ 0.04] | | = | 3.16 | | | (27) |
| Walls Type1 | 53.18 | 14.6 | 38.58 | x | 0.15 | = | 5.79 | 14 | 540.12 | (29) |
| Walls Type2 | 15.06 | 2.1 | 12.96 | x | 0.13 | = | 1.71 | 14 | 181.44 | (29) |
| Total area of elements, m² | | | 68.24 | | | | | | | (31) |
| Party wall | | | 5.7 | x | 0 | = | 0 | 20 | 114 | (32) |
| Party floor | | | 50.27 | | | | | 40 | 2010.8 | (32a) |
| Party ceiling | | | 50.27 | | | | | 30 | 1508.1 | (32b) |
| Internal wall ** | | | 67.2 | | | | | 9 | 604.8 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 29.8 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 4959.26 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 98.65 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 6.45 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 36.25 (37)

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.47 | 10.35 | 10.22 | 9.59 | 9.46 | 8.82 | 8.82 | 8.7 | 9.08 | 9.46 | 9.71 | 9.97 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 46.72 | 46.6 | 46.47 | 45.83 | 45.71 | 45.07 | 45.07 | 44.95 | 45.33 | 45.71 | 45.96 | 46.22 | |

Average = $Sum(39)_{1...12}$ /12= 45.8 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 0.93 | 0.93 | 0.92 | 0.91 | 0.91 | 0.9 | 0.9 | 0.89 | 0.9 | 0.91 | 0.91 | 0.92 | |

Average = $Sum(40)_{1...12}$ /12= 0.91 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)
if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)
if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.53 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

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

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 81.98 | 79 | 76.02 | 73.04 | 70.06 | 67.08 | 67.08 | 70.06 | 73.04 | 76.02 | 79 | 81.98 | |

Total = $Sum(44)_{1...12}$ = 894.34 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 121.58 | 106.33 | 109.72 | 95.66 | 91.79 | 79.21 | 73.4 | 84.22 | 85.23 | 99.33 | 108.42 | 117.74 | |

Total = $Sum(45)_{1...12}$ = 1172.63 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.24 | 15.95 | 16.46 | 14.35 | 13.77 | 11.88 | 11.01 | 12.63 | 12.78 | 14.9 | 16.26 | 17.66 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m
(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 176.85 | 156.26 | 165 | 149.15 | 147.07 | 132.7 | 128.67 | 139.5 | 138.72 | 154.6 | 161.92 | 173.02 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 176.85 | 156.26 | 165 | 149.15 | 147.07 | 132.7 | 128.67 | 139.5 | 138.72 | 154.6 | 161.92 | 173.02 |

Output from water heater (annual)$_{1...12}$ | 1823.47 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.65 | 75.3 | 80.7 | 74.6 | 74.74 | 69.13 | 68.63 | 72.23 | 71.13 | 77.25 | 78.85 | 83.37 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 32.97 | 29.28 | 23.82 | 18.03 | 13.48 | 11.38 | 12.29 | 15.98 | 21.45 | 27.24 | 31.79 | 33.89 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 220.8 | 223.09 | 217.32 | 205.02 | 189.51 | 174.93 | 165.18 | 162.89 | 168.67 | 180.96 | 196.47 | 211.06 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 113.77 | 112.05 | 108.47 | 103.61 | 100.46 | 96.02 | 92.24 | 97.08 | 98.8 | 103.83 | 109.51 | 112.06 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 448.39 | 445.27 | 430.45 | 407.52 | 384.29 | 363.17 | 350.56 | 356.8 | 369.76 | 392.87 | 418.62 | 437.85 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 2.38 | x | 19.64 | x | 0.56 | x | 0.7 | = | 12.65 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 38.42 | x | 0.56 | x | 0.7 | = | 24.75 | (76) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 2.38 | x | 63.27 | x | 0.56 | x | 0.7 | = | 40.76 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 92.28 | x | 0.56 | x | 0.7 | = | 59.45 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 113.09 | x | 0.56 | x | 0.7 | = | 72.86 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 115.77 | x | 0.56 | x | 0.7 | = | 74.58 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 110.22 | x | 0.56 | x | 0.7 | = | 71.01 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 94.68 | x | 0.56 | x | 0.7 | = | 60.99 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 73.59 | x | 0.56 | x | 0.7 | = | 47.41 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 45.59 | x | 0.56 | x | 0.7 | = | 29.37 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 24.49 | x | 0.56 | x | 0.7 | = | 15.78 | (76) |
| East | 0.9x | 1 | x | 2.38 | x | 16.15 | x | 0.56 | x | 0.7 | = | 10.41 | (76) |
| South | 0.9x | 0.77 | x | 12.22 | x | 46.75 | x | 0.56 | x | 0.7 | = | 154.65 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 76.57 | x | 0.56 | x | 0.7 | = | 253.27 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 97.53 | x | 0.56 | x | 0.7 | = | 322.62 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 110.23 | x | 0.56 | x | 0.7 | = | 364.63 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 114.87 | x | 0.56 | x | 0.7 | = | 379.97 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 110.55 | x | 0.56 | x | 0.7 | = | 365.67 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 108.01 | x | 0.56 | x | 0.7 | = | 357.28 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 104.89 | x | 0.56 | x | 0.7 | = | 346.97 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 101.89 | x | 0.56 | x | 0.7 | = | 337.02 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 82.59 | x | 0.56 | x | 0.7 | = | 273.18 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 55.42 | x | 0.56 | x | 0.7 | = | 183.31 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 40.4 | x | 0.56 | x | 0.7 | = | 133.63 | (78) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 167.3 | 278.02 | 363.38 | 424.08 | 452.83 | 440.25 | 428.29 | 407.96 | 384.42 | 302.55 | 199.08 | 144.03 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 615.69 | 723.29 | 793.84 | 831.6 | 837.12 | 803.42 | 778.85 | 764.76 | 754.18 | 695.41 | 617.7 | 581.88 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.83 | 0.76 | 0.68 | 0.58 | 0.47 | 0.35 | 0.25 | 0.27 | 0.4 | 0.6 | 0.76 | 0.85 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.95 | 20.23 | 20.49 | 20.73 | 20.89 | 20.97 | 20.99 | 20.99 | 20.95 | 20.76 | 20.34 | 19.89 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 20.14 | 20.14 | 20.15 | 20.16 | 20.16 | 20.17 | 20.17 | 20.17 | 20.17 | 20.16 | 20.16 | 20.15 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.81 | 0.74 | 0.66 | 0.55 | 0.44 | 0.31 | 0.21 | 0.22 | 0.35 | 0.56 | 0.74 | 0.83 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 18.78 | 19.15 | 19.52 | 19.84 | 20.04 | 20.14 | 20.16 | 20.16 | 20.12 | 19.89 | 19.33 | 18.7 | (90) |

fLA = Living area ÷ (4) = 0.45 (91)

# SAP WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 19.3 | 19.64 | 19.96 | 20.24 | 20.42 | 20.51 | 20.54 | 20.54 | 20.49 | 20.28 | 19.79 | 19.24 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 19.3 | 19.64 | 19.96 | 20.24 | 20.42 | 20.51 | 20.54 | 20.54 | 20.49 | 20.28 | 19.79 | 19.24 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.79 | 0.73 | 0.65 | 0.56 | 0.45 | 0.32 | 0.23 | 0.24 | 0.37 | 0.57 | 0.73 | 0.81 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 488.94 | 526.84 | 518.8 | 463.84 | 374.95 | 260.19 | 175.87 | 183.96 | 279.63 | 393.13 | 449.64 | 472.08 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 701.07 | 686.63 | 625.25 | 519.95 | 398.53 | 266.5 | 177.41 | 185.87 | 289.7 | 442.46 | 583.18 | 694.86 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 157.82 | 107.38 | 79.19 | 40.39 | 17.54 | 0 | 0 | 0 | 0 | 36.7 | 96.15 | 165.75 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 700.93 (98)

Space heating requirement in kWh/m²/year 13.94 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 700.93 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 441.59 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 294.39 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1823.47 | |
| If DHW from community scheme:<br>Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1148.78 | (310a) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 765.86 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 26.51 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 97.51 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 97.51 | (331) |
| Energy for lighting (calculated in Appendix L) | | 232.91 | (332) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | -380.25 | (333) |
| Electricity generated by wind turbine (Appendix M) (negative quantity) | | 0 | (334) |

## 10b. Fuel costs – Community heating scheme

| | Fuel kWh/year | | Fuel Price (Table 12) | | Fuel Cost £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 2.97 | x 0.01 = | 13.12 | (340a) |
| Space heating from heat source 2 | (307b) | x | 4.24 | x 0.01 = | 12.48 | (340b) |
| Water heating from CHP | (310a) | x | 2.97 | x 0.01 = | 34.12 | (342a) |
| Water heating from heat source 2 | (310b) | x | 4.24 | x 0.01 = | 32.47 | (342b) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 12.86 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 30.72 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| Energy saving/generation technologies | | | | | | |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 255.77 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.13 | (357) |
| **SAP rating (section12)** | | 84.27 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | |
|---|---|---|---|
| Electrical efficiency of CHP unit | | 29.8 | (361) |
| Heat efficiency of CHP unit | | 57.6 | (362) |

| | | Energy kWh/year | | Emission factor kg CO2/kWh | Emissions kg CO2/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 766.64 | x | 0.22 | 165.59 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 228.46 | x | 0.52 | -118.57 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 1994.42 | x | 0.22 | 430.79 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 594.34 | x | 0.52 | -308.46 | (366) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | 0.22 | = | 251.66 | (368) |
| Electrical energy for heat distribution | [(313) x | 0.52 | = | 13.76 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 434.78 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 434.78 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 50.61 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 120.88 | (379) |
| Energy saving/generation technologies (333) to (334) as applicable<br>Item 1 | | 0.52 | x 0.01 = | -197.35 | (380) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 408.92 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 8.13 | (384) |
| **EI rating (section 14)** | | | | 94.25 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | |
|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 766.64 | x | 1.22 | 935.3 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 228.46 | x | 3.07 | -701.37 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 1994.42 | x | 1.22 | 2433.19 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 594.34 | x | 3.07 | -1824.61 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 = | 1421.43 | (368) |
| Electrical energy for heat distribution | [(313) x | | | = | 81.37 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | = | 2345.31 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | 2345.31 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | 2345.31 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 = | 299.37 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 = | 715.04 | (379) |
| Energy saving/generation technologies<br>Item 1 | | | | 3.07 x 0.01 = | -1167.36 | (380) |

| | | | |
|---|---|---|---|
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | 2192.37 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 22 January 2019

## Property Details: 06-18-69419 D-2-02

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | North |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 98.65 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 159.26 | **(P1)** |
| **Transmission heat loss coefficient:** | 36.2 | |
| **Summer heat loss coefficient:** | 195.5 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| South (Side) | 0 | 1 |
| East (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| South (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| South (Side) | 0.9 x | 12.22 | 112.21 | 0.56 | 0.7 | 0.76 | 368.74 | |
| East (Rear) | 0.9 x | 2.38 | 117.51 | 0.56 | 0.7 | 0.76 | 75.21 | |
| | | | | | | **Total** | 443.95 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 363.17 | 350.56 | 356.8 | |
| Total summer gains | 825.24 | 794.52 | 786.78 | **(P5)** |
| Summer gain/loss ratio | 4.22 | 4.06 | 4.02 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.31 | 1.31 | 1.31 | |
| Threshold temperature | 21.53 | 23.27 | 23.13 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 22 January 2019 at 11:27:39*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501) **Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE** Total Floor Area: 51.14m²

**Site Reference :** Bertram Street **Plot Reference:** 06-18-69419 D-3-01

**Address :** D-3-01, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 23.76 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 11.21 kg/m² | **OK** |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 70.3 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 52.5 kWh/m² | |
| | | **OK** |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.14 (max. 0.30) | 0.15 (max. 0.70) | **OK** |
| Party wall | 0.00 (max. 0.20) | - | **OK** |
| Floor | (no floor) | | |
| Roof | 0.11 (max. 0.20) | 0.11 (max. 0.35) | **OK** |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | **OK** |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: West | 7.63m² | |
| Windows facing: East | 8.4m² | |
| Ventilation rate: | 6.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Roofs U-value | 0.11 W/m²K | |
| External Walls U-value | 0.13 W/m²K | |
| Party Walls U-value | 0 W/m²K | |
| Community heating, heat from CHP | | |
| Photovoltaic array | | |

# Predicted Energy Assessment

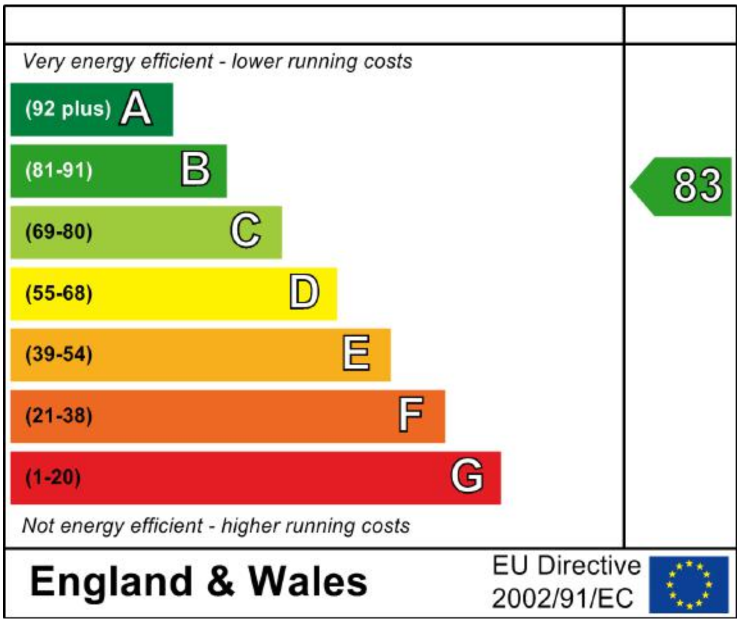
D-3-01
Bertram Street
London

| | |
|---|---|
| Dwelling type: | Top floor Flat |
| Date of assessment: | 22 January 2019 |
| Produced by: | Matthew Stainrod |
| Total floor area: | 51.14 m² |

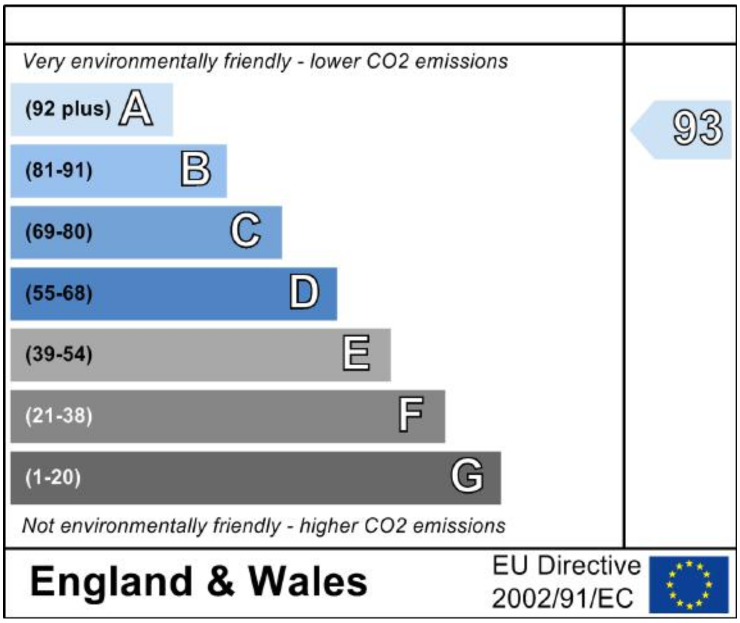
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-3-01

| | |
|---|---|
| Address: | D-3-01, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 22 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 77.05 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 51.14 m² | 2.4 m |
| Living area: | 24.52 m² (fraction 0.479) | |
| Front of dwelling faces: | South | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Front | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| Name: | Gap: | Frame Factor: | g-value: | U-value: | Area: | No. of Openings: |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Front | 16mm or more | 0.7 | 0.558 | 1.4 | 7.63 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 8.4 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | Stair Wall | South | 0 | 0 |
| Front | | External Wall | West | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 53.01 | 16.03 | 36.98 | 0.15 | 0 | False | 14 |
| Stair Wall | 20.97 | 2.1 | 18.87 | 0.15 | 0.9 | False | 14 |
| Flat Roof | 51.14 | 0 | 51.14 | 0.11 | 0 | | 9 |
| Internal Elements | | | | | | | |
| Stud Walls | 60 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 5.64 | | | | | | 20 |
| Party Floor | 51.14 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0873

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 18.6 | 0.05 | E4 | Jamb |
| [Approved] | 30.83 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 7.2 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 4.8 | 0.06 | E18 | Party wall between dwellings |
| | 8.74 | 0.04 | E14 | Flat roof |
| | 22.09 | 0.28 | E15 | Flat roof with parapet |
| | 2.35 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 2.35 | 0.12 | P4 | Roof (insulation at ceiling level) |

## Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, Rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 3

## Main heating system:

Main heating system: Community heating schemes
Heat source: Community CHP
heat from CHP, heat fraction 0.6, efficiency 57.6
Heat source: Community boilers
heat from boilers – mains gas, heat fraction 0.4, efficiency 91
Piping>=1991, pre-insulated, low temp, variable flow

## Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and TRVs
Control code: 2306

## Secondary heating system:

Secondary heating system: None

## Water heating:

Water heating: From main heating system
Water code: 901
Fuel :heat from CHP
No hot water cylinder
Solar panel: False

## Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Dense urban
EPC language: English
Wind turbine: No
Photovoltaics: Photovoltaic 1
Installed Peak power: 0.5
Tilt of collector: Horizontal
Overshading: None or very little

# SAP Input

| | |
|---|---|
| | Collector Orientation: South |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 D-3-01

**Address :** D-3-01, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | Av. Height(m) | | Volume(m³) | |
|---|---|---|---|---|---|---|
| Ground floor | 51.14 | (1a) x | 2.4 | (2a) = | 122.74 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 51.14 | (4) | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | 122.74 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |
| *if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35* | | | |
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |
| *Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used* | | | |
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

| | | |
|---|---|---|
| If mechanical ventilation: | 0.5 | (23a) |
| If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) | 0.5 | (23b) |
| If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = | 79.9 | (23c) |

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside
if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft
if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 7.63 | x1/[1/( 1.4 )+ 0.04] | | = | 10.12 | | | (27) |
| Windows Type 2 | | | 8.4 | x1/[1/( 1.4 )+ 0.04] | | = | 11.14 | | | (27) |
| Walls Type1 | 53.01 | 16.03 | 36.98 | x | 0.15 | = | 5.55 | 14 | 517.72 | (29) |
| Walls Type2 | 20.97 | 2.1 | 18.87 | x | 0.13 | = | 2.49 | 14 | 264.18 | (29) |
| Roof | 51.14 | 0 | 51.14 | x | 0.11 | = | 5.63 | 9 | 460.26 | (30) |
| Total area of elements, m² | | | 125.12 | | | | | | | (31) |
| Party wall | | | 5.64 | x | 0 | = | 0 | 20 | 112.8 | (32) |
| Party floor | | | 51.14 | | | | | 40 | 2045.6 | (32a) |
| Internal wall ** | | | 60 | | | | | 9 | 540 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*
*** include the areas on both sides of internal walls and partitions*

| | | | |
|---|---|---|---|
| Fabric heat loss, W/K = S (A x U) | (26)…(30) + (32) = | 37.86 | (33) |
| Heat capacity Cm = S(A x k ) | ((28)…(30) + (32) + (32a)…(32e) = | 3940.56 | (34) |
| Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K | = (34) ÷ (4) = | 77.05 | (35) |

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

| | | | |
|---|---|---|---|
| Thermal bridges : S (L x Y) calculated using Appendix K | | 10.92 | (36) |

*if details of thermal bridging are not known (36) = 0.15 x (31)*

| | | | |
|---|---|---|---|
| Total fabric heat loss | (33) + (36) = | 48.78 | (37) |

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

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.65 | 10.53 | 10.4 | 9.75 | 9.62 | 8.98 | 8.98 | 8.85 | 9.23 | 9.62 | 9.88 | 10.14 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 59.44 | 59.31 | 59.18 | 58.53 | 58.4 | 57.76 | 57.76 | 57.63 | 58.02 | 58.4 | 58.66 | 58.92 | |

Average = Sum(39)$_{1...12}$ /12= 58.5 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.16 | 1.16 | 1.16 | 1.14 | 1.14 | 1.13 | 1.13 | 1.13 | 1.13 | 1.14 | 1.15 | 1.15 |

Average = Sum(40)$_{1...12}$ /12= 1.14 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.72 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 75.14 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

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

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 82.65 | 79.65 | 76.64 | 73.64 | 70.63 | 67.62 | 67.62 | 70.63 | 73.64 | 76.64 | 79.65 | 82.65 |

Total = Sum(44)$_{1...12}$ = 901.65 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 122.57 | 107.2 | 110.62 | 96.44 | 92.54 | 79.85 | 74 | 84.91 | 85.93 | 100.14 | 109.31 | 118.7 |

Total = Sum(45)$_{1...12}$ = 1182.21 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.39 | 16.08 | 16.59 | 14.47 | 13.88 | 11.98 | 11.1 | 12.74 | 12.89 | 15.02 | 16.4 | 17.81 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# SAP WorkSheet: New dwelling design stage

| | | |
|---|---|---|
| Primary circuit loss (annual) from Table 3 | 0 | (58) |

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 177.85 | 157.13 | 165.9 | 149.94 | 147.82 | 133.35 | 129.27 | 140.19 | 139.42 | 155.42 | 162.8 | 173.98 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 177.85 | 157.13 | 165.9 | 149.94 | 147.82 | 133.35 | 129.27 | 140.19 | 139.42 | 155.42 | 162.8 | 173.98 |

| | | |
|---|---|---|
| Output from water heater (annual)$_{1…12}$ | 1833.05 | (64) |

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.98 | 75.59 | 81 | 74.86 | 74.99 | 69.35 | 68.83 | 72.45 | 71.37 | 77.52 | 79.14 | 83.69 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | 103.42 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 33.47 | 29.73 | 24.18 | 18.31 | 13.68 | 11.55 | 12.48 | 16.23 | 21.78 | 27.65 | 32.27 | 34.41 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 224.17 | 226.5 | 220.63 | 208.16 | 192.4 | 177.6 | 167.71 | 165.38 | 171.24 | 183.72 | 199.47 | 214.28 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | 47.07 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | -68.95 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 114.22 | 112.48 | 108.88 | 103.98 | 100.79 | 96.31 | 92.51 | 97.39 | 99.12 | 104.19 | 109.92 | 112.49 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 453.4 | 450.25 | 435.23 | 411.98 | 388.42 | 367 | 354.24 | 360.53 | 373.68 | 397.1 | 423.2 | 442.71 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 8.4 | x | 19.64 | x | 0.56 | x | 0.7 | = | 44.66 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 38.42 | x | 0.56 | x | 0.7 | = | 87.36 | (76) |

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 8.4 | x | 63.27 | x | 0.56 | x | 0.7 | = | 143.87 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 92.28 | x | 0.56 | x | 0.7 | = | 209.82 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 113.09 | x | 0.56 | x | 0.7 | = | 257.15 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 115.77 | x | 0.56 | x | 0.7 | = | 263.23 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 110.22 | x | 0.56 | x | 0.7 | = | 250.61 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 94.68 | x | 0.56 | x | 0.7 | = | 215.27 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 73.59 | x | 0.56 | x | 0.7 | = | 167.32 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 45.59 | x | 0.56 | x | 0.7 | = | 103.66 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 24.49 | x | 0.56 | x | 0.7 | = | 55.68 | (76) |
| East | 0.9x | 1 | x | 8.4 | x | 16.15 | x | 0.56 | x | 0.7 | = | 36.72 | (76) |
| West | 0.9x | 0.77 | x | 7.63 | x | 19.64 | x | 0.56 | x | 0.7 | = | 40.56 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 38.42 | x | 0.56 | x | 0.7 | = | 79.35 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 63.27 | x | 0.56 | x | 0.7 | = | 130.68 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 92.28 | x | 0.56 | x | 0.7 | = | 190.59 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 113.09 | x | 0.56 | x | 0.7 | = | 233.57 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 115.77 | x | 0.56 | x | 0.7 | = | 239.1 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 110.22 | x | 0.56 | x | 0.7 | = | 227.64 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 94.68 | x | 0.56 | x | 0.7 | = | 195.54 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 73.59 | x | 0.56 | x | 0.7 | = | 151.99 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 45.59 | x | 0.56 | x | 0.7 | = | 94.16 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 24.49 | x | 0.56 | x | 0.7 | = | 50.58 | (80) |
| West | 0.9x | 0.77 | x | 7.63 | x | 16.15 | x | 0.56 | x | 0.7 | = | 33.36 | (80) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 85.22 | 166.71 | 274.55 | 400.41 | 490.72 | 502.34 | 478.25 | 410.81 | 319.31 | 197.82 | 106.26 | 70.08 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 538.62 | 616.96 | 709.78 | 812.39 | 879.14 | 869.34 | 832.48 | 771.34 | 692.99 | 594.92 | 529.47 | 512.79 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) 21 (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.86 | 0.82 | 0.75 | 0.64 | 0.52 | 0.39 | 0.29 | 0.32 | 0.49 | 0.7 | 0.82 | 0.87 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 18.87 | 19.2 | 19.69 | 20.25 | 20.64 | 20.87 | 20.95 | 20.93 | 20.76 | 20.22 | 19.46 | 18.81 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 19.95 | 19.95 | 19.95 | 19.96 | 19.97 | 19.98 | 19.98 | 19.98 | 19.97 | 19.97 | 19.96 | 19.96 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.85 | 0.81 | 0.73 | 0.61 | 0.47 | 0.33 | 0.23 | 0.26 | 0.44 | 0.66 | 0.8 | 0.86 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 17.16 | 17.61 | 18.31 | 19.06 | 19.57 | 19.86 | 19.94 | 19.93 | 19.74 | 19.06 | 18.01 | 17.07 | (90) |

fLA = Living area ÷ (4) = 0.48 (91)

# SAP WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 17.98 | 18.37 | 18.97 | 19.63 | 20.08 | 20.34 | 20.43 | 20.41 | 20.23 | 19.62 | 18.7 | 17.9 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 17.98 | 18.37 | 18.97 | 19.63 | 20.08 | 20.34 | 20.43 | 20.41 | 20.23 | 19.62 | 18.7 | 17.9 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.82 | 0.77 | 0.7 | 0.6 | 0.48 | 0.35 | 0.26 | 0.29 | 0.45 | 0.65 | 0.77 | 0.83 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 439.86 | 477.52 | 499.74 | 486.94 | 421.32 | 307.39 | 212.8 | 220.51 | 312.32 | 386.14 | 409.37 | 424.86 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 813.25 | 799.05 | 738.07 | 628.11 | 489.7 | 331.58 | 220.97 | 231.28 | 355.65 | 526.57 | 680.68 | 807.5 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 277.8 | 216.07 | 177.31 | 101.64 | 50.87 | 0 | 0 | 0 | 0 | 104.48 | 195.35 | 284.69 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1408.22 (98)

Space heating requirement in kWh/m²/year 27.54 (99)

## 9b. Energy requirements – Community heating scheme

| | | | |
|---|---|---|---|
| This part is used for space heating, space cooling or water heating provided by a community scheme. Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1408.22 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 887.18 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 591.45 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |
| **Water heating** | | | |
| Annual water heating requirement | | 1833.05 | |
| If DHW from community scheme: Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1154.82 | (310a) |

# SAP WorkSheet: New dwelling design stage

| | | | |
|---|---|---|---|
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 769.88 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 34.03 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 99.2 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 99.2 | (331) |
| Energy for lighting (calculated in Appendix L) | | 236.47 | (332) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | -380.25 | (333) |
| Electricity generated by wind turbine (Appendix M) (negative quantity) | | 0 | (334) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|
| Space heating from CHP | (307a) x | 2.97 | x 0.01 = | 26.35 | (340a) |
| Space heating from heat source 2 | (307b) x | 4.24 | x 0.01 = | 25.08 | (340b) |
| Water heating from CHP | (310a) x | 2.97 | x 0.01 = | 34.3 | (342a) |
| Water heating from heat source 2 | (310b) x | 4.24 | x 0.01 = | 32.64 | (342b) |
| | | **Fuel Price** | | | |
| Pumps and fans | (331) | 13.19 | x 0.01 = | 13.08 | (349) |
| Energy for lighting | (332) | 13.19 | x 0.01 = | 31.19 | (350) |
| Additional standing charges (Table 12) | | | | 120 | (351) |
| Energy saving/generation technologies | | | | | |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | 282.64 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.23 | (357) |
| **SAP rating (section12)** | | 82.78 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | |
|---|---|---|---|
| Electrical efficiency of CHP unit | | 29.8 | (361) |
| Heat efficiency of CHP unit | | 57.6 | (362) |

| | | **Energy** kWh/year | | **Emission factor** kg CO2/kWh | **Emissions** kg CO2/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1540.24 | x | 0.22 | 332.69 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 458.99 | x | 0.52 | -238.22 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2004.9 | x | 0.22 | 433.06 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 597.46 | x | 0.52 | -310.08 | (366) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 91 | (367b) |
| CO2 associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | 0.22 | = | 323.13 | (368) |
| Electrical energy for heat distribution | [(313) x | 0.52 | = | 17.66 | (372) |
| Total CO2 associated with community systems | (363)…(366) + (368)...(372) | | = | 558.25 | (373) |
| CO2 associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| CO2 associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total CO2 associated with space and water heating | (373) + (374) + (375) = | | | 558.25 | (376) |
| CO2 associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 51.49 | (378) |
| CO2 associated with electricity for lighting | (332))) x | 0.52 | = | 122.73 | (379) |
| Energy saving/generation technologies (333) to (334) as applicable<br>Item 1 | | 0.52 | x 0.01 = | -197.35 | (380) |
| **Total CO2, kg/year** | sum of (376)…(382) = | | | 535.11 | (383) |
| **Dwelling CO2 Emission Rate** | (383) ÷ (4) = | | | 10.46 | (384) |
| **EI rating (section 14)** | | | | 92.54 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1540.24 | x | 1.22 | | 1879.1 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 458.99 | x | 3.07 | | -1409.11 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 2004.9 | x | 1.22 | | 2445.98 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 597.46 | x | 3.07 | | -1834.2 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1825.09 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 104.48 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 3011.33 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 3011.33 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 3011.33 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 304.55 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 725.96 | (379) |
| Energy saving/generation technologies<br>Item 1 | | | | 3.07 | x 0.01 = | -1167.36 | (380) |

| | | | |
|---|---|---|---|
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | 2874.49 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 22 January 2019

## Property Details: 06-18-69419 D-3-01

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | Yes |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | South |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 77.05 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 6 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 243.02 | **(P1)** |
| **Transmission heat loss coefficient:** | 48.8 | |
| **Summer heat loss coefficient:** | 291.8 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| West (Front) | 0 | 1 |
| East (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| West (Front) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| West (Front) | 0.9 x | 7.63 | 117.51 | 0.56 | 0.7 | 0.76 | 241.12 | |
| East (Rear) | 0.9 x | 8.4 | 117.51 | 0.56 | 0.7 | 0.76 | 265.45 | |
| | | | | | | **Total** | 506.56 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 367 | 354.24 | 360.53 | |
| Total summer gains | 904.73 | 860.8 | 806.19 | **(P5)** |
| Summer gain/loss ratio | 3.1 | 2.95 | 2.76 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.46 | 1.46 | 1.46 | |
| Threshold temperature | 20.56 | 22.31 | 22.02 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# Regulations Compliance Report

Approved Document L1A, 2013 Edition, England assessed by Stroma FSAP 2012 program, Version: 1.0.4.16
*Printed on 22 January 2019 at 11:27:28*

## Project Information:

**Assessed By:** Matthew Stainrod (STRO023501)　**Building Type:** Flat

## Dwelling Details:

**NEW DWELLING DESIGN STAGE**　Total Floor Area: 50.27m²

**Site Reference :** Bertram Street　**Plot Reference:** 06-18-69419 D-3-02

**Address :** D-3-02, Bertram Street, London

## Client Details:

**Name:** McBains

**Address :** 26 Finsbury Square, London, EC2A 1DS

**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 system: Mains gas (c), Mains gas (c)
Fuel factor: 1.00 (mains gas (c), mains gas (c))

| | | |
|---|---|---|
| Target Carbon Dioxide Emission Rate (TER) | 22.41 kg/m² | |
| Dwelling Carbon Dioxide Emission Rate (DER) | 10.52 kg/m² | OK |

## 1b TFEE and DFEE

| | | |
|---|---|---|
| Target Fabric Energy Efficiency (TFEE) | 62.4 kWh/m² | |
| Dwelling Fabric Energy Efficiency (DFEE) | 47.7 kWh/m² | |
| | | OK |

## 2 Fabric U-values

| Element | Average | Highest | |
|---|---|---|---|
| External wall | 0.14 (max. 0.30) | 0.15 (max. 0.70) | OK |
| Party wall | 0.00 (max. 0.20) | - | OK |
| Floor | (no floor) | | |
| Roof | 0.11 (max. 0.20) | 0.11 (max. 0.35) | OK |
| Openings | 1.40 (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: Community heating schemes - CommCHP

Secondary heating system: None

## 5 Cylinder insulation

Hot water Storage: No cylinder

## 6 Controls

| | | |
|---|---|---|
| Space heating controls | Charging system linked to use of community heating, programmer and TRVs | OK |
| Hot water controls: | No cylinder | |
| | No cylinder | |

# Regulations Compliance Report

| | | |
|---|---|---|
| **7 Low energy lights** | | |
| Percentage of fixed lights with low-energy fittings | 100.0% | |
| Minimum | 75.0% | **OK** |
| **8 Mechanical ventilation** | | |
| Continuous supply and extract system | | |
| Specific fan power: | 0.53 | |
| Maximum | 1.5 | **OK** |
| MVHR efficiency: | 94% | |
| Minimum | 70% | **OK** |
| **9 Summertime temperature** | | |
| Overheating risk (Thames valley): | Medium | **OK** |
| Based on: | | |
| Overshading: | Average or unknown | |
| Windows facing: South | 12.22m² | |
| Windows facing: East | 3.82m² | |
| Ventilation rate: | 4.00 | |
| Blinds/curtains: | Dark-coloured curtain or roller blind<br>Closed 100% of daylight hours | |
| **10 Key features** | | |
| Air permeablility | 3.0 m³/m²h | |
| Roofs U-value | 0.11 W/m²K | |
| External Walls U-value | 0.13 W/m²K | |
| Party Walls U-value | 0 W/m²K | |
| Community heating, heat from CHP | | |
| Photovoltaic array | | |

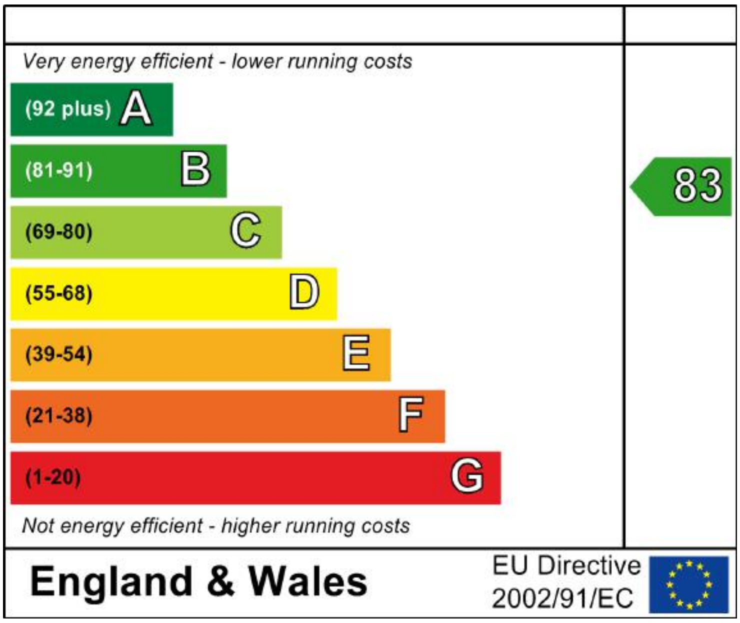
# Predicted Energy Assessment

| | | | |
|---|---|---|---|
| D-3-02 | | Dwelling type: | Top floor Flat |
| Bertram Street | | Date of assessment: | 22 January 2019 |
| London | | Produced by: | Matthew Stainrod |
| | | Total floor area: | 50.27 m² |

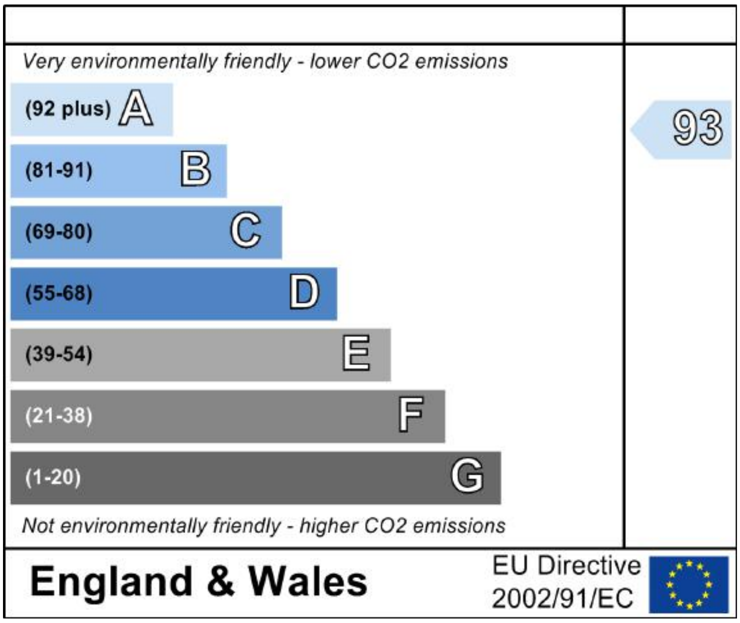
This is a Predicted Energy Assessment for a property which is not yet complete. It includes a predicted energy rating which might not represent the final energy rating of the property on completion. Once the property is completed, an Energy Performance Certificate is required providing information about the energy performance of the completed property.

Energy performance has been assessed using the SAP 2012 methodology and is rated in terms of the energy use per square metre of floor area, energy efficiency based on fuel costs and environmental impact based on carbon dioxide (CO2) emissions.

## Energy Efficiency Rating




## Environmental Impact ($CO_2$) Rating




The energy efficiency rating is a measure of the overall efficiency of a home. The higher the rating the more energy efficient the home is and the lower the fuel bills are likely to be.

The environmental impact rating is a measure of a home's impact on the environment in terms of carbonn dioxide (CO2) emissions. The higher the rating the less impact it has on the environment.

# SAP Input

## Property Details: 06-18-69419 D-3-02

| | |
|---|---|
| Address: | D-3-02, Bertram Street, London |
| Located in: | England |
| Region: | Thames valley |
| UPRN: | |
| Date of assessment: | 22 January 2019 |
| Date of certificate: | 22 January 2019 |
| Assessment type: | New dwelling design stage |
| Transaction type: | New dwelling |
| Tenure type: | Unknown |
| Related party disclosure: | No related party |
| Thermal Mass Parameter: | Calculated 77.25 |
| Water use <= 125 litres/person/day: | True |
| PCDF Version: | 437 |

## Property description:

| | | |
|---|---|---|
| Dwelling type: | Flat | |
| Detachment: | | |
| Year Completed: | 2018 | |
| Floor Location: | Floor area: | Storey height: |
| Floor 0 | 50.27 m² | 2.4 m |
| Living area: | 22.61 m² (fraction 0.45) | |
| Front of dwelling faces: | North | |

## Opening types:

| Name: | Source: | Type: | Glazing: | Argon: | Frame: |
|---|---|---|---|---|---|
| Front Door | Manufacturer | Solid | | | Wood |
| Side | Manufacturer | Windows | double-glazed | Yes | PVC-U |
| Rear | Manufacturer | Windows | double-glazed | Yes | PVC-U |

| **Name:** | **Gap:** | **Frame Factor:** | **g-value:** | **U-value:** | **Area:** | **No. of Openings:** |
|---|---|---|---|---|---|---|
| Front Door | mm | 0.7 | 0 | 1.4 | 2.1 | 1 |
| Side | 16mm or more | 0.7 | 0.558 | 1.4 | 12.22 | 1 |
| Rear | 16mm or more | 0.7 | 0.558 | 1.4 | 3.82 | 1 |

| Name: | Type-Name: | Location: | Orient: | Width: | Height: |
|---|---|---|---|---|---|
| Front Door | | Stair Wall | North | 0 | 0 |
| Side | | External Wall | South | 0 | 0 |
| Rear | | External Wall | East | 0 | 0 |

Overshading: Average or unknown

## Opaque Elements:

| Type: | Gross area: | Openings: | Net area: | U-value: | Ru value: | Curtain wall: | Kappa: |
|---|---|---|---|---|---|---|---|
| External Elements | | | | | | | |
| External Wall | 53.18 | 16.04 | 37.14 | 0.15 | 0 | False | 14 |
| Stair Wall | 15.06 | 2.1 | 12.96 | 0.15 | 0.9 | False | 14 |
| Flat Roof | 50.27 | 0 | 50.27 | 0.11 | 0 | | 9 |
| Internal Elements | | | | | | | |
| Stud Walls | 67.2 | | | | | | 9 |
| Party Elements | | | | | | | |
| Party Wall | 5.7 | | | | | | 20 |
| Party Floor | 50.27 | | | | | | 40 |

## Thermal bridges:

# SAP Input

Thermal bridges: User-defined (individual PSI-values) Y-Value = 0.0907

| | Length | Psi-value | | |
|---|---|---|---|---|
| [Approved] | 1 | 0.3 | E2 | Other lintels (including other steel lintels) |
| [Approved] | 18.6 | 0.05 | E4 | Jamb |
| [Approved] | 28.43 | 0.07 | E7 | Party floor between dwellings (in blocks of flats) |
| [Approved] | 9.6 | 0.09 | E16 | Corner (normal) |
| [Approved] | 2.4 | -0.09 | E17 | Corner (inverted internal area greater than external area) |
| [Approved] | 2.4 | 0.06 | E18 | Party wall between dwellings |
| | 6.27 | 0.04 | E14 | Flat roof |
| | 22.16 | 0.28 | E15 | Flat roof with parapet |
| | 2.35 | 0 | P3 | Intermediate floor between dwellings (in blocks of flats) |
| | 2.35 | 0.12 | P4 | Roof (insulation at ceiling level) |

## Ventilation:

Pressure test: Yes (As designed)

Ventilation: Balanced with heat recovery
Number of wet rooms: Kitchen + 1
Ductwork: Insulation, Rigid
Approved Installation Scheme: True

Number of chimneys: 0
Number of open flues: 0
Number of fans: 0
Number of passive stacks: 0
Number of sides sheltered: 2
Pressure test: 3

## Main heating system:

Main heating system: Community heating schemes
Heat source: Community CHP
heat from CHP, heat fraction 0.6, efficiency 57.6
Heat source: Community boilers
heat from boilers – mains gas, heat fraction 0.4, efficiency 91
Piping>=1991, pre-insulated, low temp, variable flow

## Main heating Control:

Main heating Control: Charging system linked to use of community heating, programmer and TRVs
Control code: 2306

## Secondary heating system:

Secondary heating system: None

## Water heating:

Water heating: From main heating system
Water code: 901
Fuel :heat from CHP
No hot water cylinder
Solar panel: False

## Others:

Electricity tariff: Standard Tariff
In Smoke Control Area: Unknown
Conservatory: No conservatory
Low energy lights: 100%
Terrain type: Dense urban
EPC language: English
Wind turbine: No
Photovoltaics: Photovoltaic 1
Installed Peak power: 0.5
Tilt of collector: Horizontal
Overshading: None or very little

# SAP Input

| | |
|---|---|
| | Collector Orientation: South |
| Assess Zero Carbon Home: | No |

# SAP WorkSheet: New dwelling design stage

User Details:

| | | | |
|---|---|---|---|
| **Assessor Name:** | Matthew Stainrod | **Stroma Number:** | STRO023501 |
| **Software Name:** | Stroma FSAP 2012 | **Software Version:** | Version: 1.0.4.16 |

Property Address: 06-18-69419 D-3-02

**Address :** D-3-02, Bertram Street, London

## 1. Overall dwelling dimensions:

| | Area(m²) | | | Av. Height(m) | | | Volume(m³) | |
|---|---|---|---|---|---|---|---|---|
| Ground floor | 50.27 | (1a) | x | 2.4 | (2a) | = | 120.65 | (3a) |
| Total floor area TFA = (1a)+(1b)+(1c)+(1d)+(1e)+.....(1n) | 50.27 | (4) | | | | | | |
| Dwelling volume | | | | (3a)+(3b)+(3c)+(3d)+(3e)+.....(3n) = | | | 120.65 | (5) |

## 2. Ventilation rate:

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

**Air changes per hour**

| | | | | |
|---|---|---|---|---|
| Infiltration due to chimneys, flues and fans = (6a)+(6b)+(7a)+(7b)+(7c) = | 0 | ÷ (5) = | 0 | (8) |

*If a pressurisation test has been carried out or is intended, proceed to (17), otherwise continue from (9) to (16)*

| | | | |
|---|---|---|---|
| Number of storeys in the dwelling (ns) | | 0 | (9) |
| Additional infiltration | [(9)-1]x0.1 = | 0 | (10) |
| Structural infiltration: 0.25 for steel or timber frame or 0.35 for masonry construction | | 0 | (11) |

*if both types of wall are present, use the value corresponding to the greater wall area (after deducting areas of openings); if equal user 0.35*

| | | | |
|---|---|---|---|
| If suspended wooden floor, enter 0.2 (unsealed) or 0.1 (sealed), else enter 0 | | 0 | (12) |
| If no draught lobby, enter 0.05, else enter 0 | | 0 | (13) |
| Percentage of windows and doors draught stripped | | 0 | (14) |
| Window infiltration | 0.25 - [0.2 x (14) ÷ 100] = | 0 | (15) |
| Infiltration rate | (8) + (10) + (11) + (12) + (13) + (15) = | 0 | (16) |
| Air permeability value, q50, expressed in cubic metres per hour per square metre of envelope area | | 3 | (17) |
| If based on air permeability value, then | (18) = [(17) ÷ 20]+(8), otherwise (18) = (16) | 0.15 | (18) |

*Air permeability value applies if a pressurisation test has been done or a degree air permeability is being used*

| | | | |
|---|---|---|---|
| Number of sides sheltered | | 2 | (19) |
| Shelter factor | (20) = 1 - [0.075 x (19)] = | 0.85 | (20) |
| Infiltration rate incorporating shelter factor | (21) = (18) x (20) = | 0.13 | (21) |

Infiltration rate modified for monthly wind speed

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Monthly average wind speed from Table 7 | | | | | | | | | | | | |
| (22)m= | 5.1 | 5 | 4.9 | 4.4 | 4.3 | 3.8 | 3.8 | 3.7 | 4 | 4.3 | 4.5 | 4.7 |
| Wind Factor (22a)m = (22)m ÷ 4 | | | | | | | | | | | | |
| (22a)m= | 1.27 | 1.25 | 1.23 | 1.1 | 1.08 | 0.95 | 0.95 | 0.92 | 1 | 1.08 | 1.12 | 1.18 |

# SAP WorkSheet: New dwelling design stage

Adjusted infiltration rate (allowing for shelter and wind speed) = (21a) x (22a)m

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.16 | 0.16 | 0.16 | 0.14 | 0.14 | 0.12 | 0.12 | 0.12 | 0.13 | 0.14 | 0.14 | 0.15 |

*Calculate effective air change rate for the applicable case*

If mechanical ventilation: 0.5 (23a)

If exhaust air heat pump using Appendix N, (23b) = (23a) × Fmv (equation (N5)) , otherwise (23b) = (23a) 0.5 (23b)

If balanced with heat recovery: efficiency in % allowing for in-use factor (from Table 4h) = 79.9 (23c)

a) If balanced mechanical ventilation with heat recovery (MVHR) (24a)m = (22b)m + (23b) × [1 – (23c) ÷ 100]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24a)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (24a) |

b) If balanced mechanical ventilation without heat recovery (MV) (24b)m = (22b)m + (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24b)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24b) |

c) If whole house extract ventilation or positive input ventilation from outside

if (22b)m < 0.5 × (23b), then (24c) = (23b); otherwise (24c) = (22b) m + 0.5 × (23b)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24c)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24c) |

d) If natural ventilation or whole house positive input ventilation from loft

if (22b)m = 1, then (24d)m = (22b)m otherwise (24d)m = 0.5 + [(22b)m² x 0.5]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (24d)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (24d) |

Effective air change rate - enter (24a) or (24b) or (24c) or (24d) in box (25)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (25)m= | 0.26 | 0.26 | 0.26 | 0.24 | 0.24 | 0.22 | 0.22 | 0.22 | 0.23 | 0.24 | 0.24 | 0.25 | (25) |

## 3. Heat losses and heat loss parameter:

| **ELEMENT** | Gross area (m²) | Openings m² | Net Area A ,m² | | U-value W/m2K | | A X U (W/K) | k-value kJ/m²·K | A X k kJ/K | |
|---|---|---|---|---|---|---|---|---|---|---|
| Doors | | | 2.1 | x | 1.4 | = | 2.94 | | | (26) |
| Windows Type 1 | | | 12.22 | x1/[1/( 1.4 )+ 0.04] | | = | 16.2 | | | (27) |
| Windows Type 2 | | | 3.82 | x1/[1/( 1.4 )+ 0.04] | | = | 5.06 | | | (27) |
| Walls Type1 | 53.18 | 16.04 | 37.14 | x | 0.15 | = | 5.57 | 14 | 519.96 | (29) |
| Walls Type2 | 15.06 | 2.1 | 12.96 | x | 0.13 | = | 1.71 | 14 | 181.44 | (29) |
| Roof | 50.27 | 0 | 50.27 | x | 0.11 | = | 5.53 | 9 | 452.43 | (30) |
| Total area of elements, m² | | | 118.51 | | | | | | | (31) |
| Party wall | | | 5.7 | x | 0 | = | 0 | 20 | 114 | (32) |
| Party floor | | | 50.27 | | | | | 40 | 2010.8 | (32a) |
| Internal wall ** | | | 67.2 | | | | | 9 | 604.8 | (32c) |

** for windows and roof windows, use effective window U-value calculated using formula 1/[(1/U-value)+0.04] as given in paragraph 3.2*

*** include the areas on both sides of internal walls and partitions*

Fabric heat loss, W/K = S (A x U) (26)…(30) + (32) = 37.02 (33)

Heat capacity Cm = S(A x k ) ((28)…(30) + (32) + (32a)…(32e) = 3883.43 (34)

Thermal mass parameter (TMP = Cm ÷ TFA) in kJ/m²K = (34) ÷ (4) = 77.25 (35)

*For design assessments where the details of the construction are not known precisely the indicative values of TMP in Table 1f can be used instead of a detailed calculation.*

Thermal bridges : S (L x Y) calculated using Appendix K 10.75 (36)

*if details of thermal bridging are not known (36) = 0.15 x (31)*

Total fabric heat loss (33) + (36) = 47.77 (37)

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

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

# SAP WorkSheet: New dwelling design stage

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (38)m= | 10.47 | 10.35 | 10.22 | 9.59 | 9.46 | 8.82 | 8.82 | 8.7 | 9.08 | 9.46 | 9.71 | 9.97 | (38) |

Heat transfer coefficient, W/K (39)m = (37) + (38)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (39)m= | 58.24 | 58.11 | 57.99 | 57.35 | 57.23 | 56.59 | 56.59 | 56.47 | 56.85 | 57.23 | 57.48 | 57.73 | |

Average = $Sum(39)_{1...12}$ /12= 57.32 (39)

Heat loss parameter (HLP), W/m²K (40)m = (39)m ÷ (4)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (40)m= | 1.16 | 1.16 | 1.15 | 1.14 | 1.14 | 1.13 | 1.13 | 1.12 | 1.13 | 1.14 | 1.14 | 1.15 | |

Average = $Sum(40)_{1...12}$ /12= 1.14 (40)

Number of days in month (Table 1a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (41)m= | 31 | 28 | 31 | 30 | 31 | 30 | 31 | 31 | 30 | 31 | 30 | 31 | (41) |

## 4. Water heating energy requirement: kWh/year:

Assumed occupancy, N 1.7 (42)

if TFA > 13.9, N = 1 + 1.76 x [1 - exp(-0.000349 x (TFA -13.9)2)] + 0.0013 x (TFA -13.9)

if TFA £ 13.9, N = 1

Annual average hot water usage in litres per day Vd,average = (25 x N) + 36 74.53 (43)

*Reduce the annual average hot water usage by 5% if the dwelling is designed to achieve a water use target of not more that 125 litres per person per day (all water use, hot and cold)*

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

*Hot water usage in litres per day for each month Vd,m = factor from Table 1c x (43)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (44)m= | 81.98 | 79 | 76.02 | 73.04 | 70.06 | 67.08 | 67.08 | 70.06 | 73.04 | 76.02 | 79 | 81.98 | |

Total = $Sum(44)_{1...12}$ = 894.34 (44)

*Energy content of hot water used - calculated monthly = 4.190 x Vd,m x nm x DTm / 3600 kWh/month (see Tables 1b, 1c, 1d)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (45)m= | 121.58 | 106.33 | 109.72 | 95.66 | 91.79 | 79.21 | 73.4 | 84.22 | 85.23 | 99.33 | 108.42 | 117.74 | |

Total = $Sum(45)_{1...12}$ = 1172.63 (45)

*If instantaneous water heating at point of use (no hot water storage), enter 0 in boxes (46) to (61)*

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (46)m= | 18.24 | 15.95 | 16.46 | 14.35 | 13.77 | 11.88 | 11.01 | 12.63 | 12.78 | 14.9 | 16.26 | 17.66 | (46) |

Water storage loss:

Storage volume (litres) including any solar or WWHRS storage within same vessel 0 (47)

If community heating and no tank in dwelling, enter 110 litres in (47)

Otherwise if no stored hot water (this includes instantaneous combi boilers) enter '0' in (47)

Water storage loss:

a) If manufacturer's declared loss factor is known (kWh/day): 0 (48)

Temperature factor from Table 2b 0 (49)

Energy lost from water storage, kWh/year (48) x (49) = 110 (50)

b) If manufacturer's declared cylinder loss factor is not known:

Hot water storage loss factor from Table 2 (kWh/litre/day) 0.02 (51)

If community heating see section 4.3

Volume factor from Table 2a 1.03 (52)

Temperature factor from Table 2b 0.6 (53)

Energy lost from water storage, kWh/year (47) x (51) x (52) x (53) = 1.03 (54)

Enter (50) or (54) in (55) 1.03 (55)

Water storage loss calculated for each month ((56)m = (55) × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (56)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (56) |

If cylinder contains dedicated solar storage, (57)m = (56)m x [(50) – (H11)] ÷ (50), else (57)m = (56)m where (H11) is from Appendix H

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (57)m= | 32.01 | 28.92 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | 32.01 | 30.98 | 32.01 | 30.98 | 32.01 | (57) |

# SAP WorkSheet: New dwelling design stage

Primary circuit loss (annual) from Table 3 | 0 | (58)

Primary circuit loss calculated for each month (59)m = (58) ÷ 365 × (41)m

(modified by factor from Table H5 if there is solar water heating and a cylinder thermostat)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (59)m= | 23.26 | 21.01 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | 23.26 | 22.51 | 23.26 | 22.51 | 23.26 | (59) |

Combi loss calculated for each month (61)m = (60) ÷ 365 × (41)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (61)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (61) |

Total heat required for water heating calculated for each month (62)m = 0.85 × (45)m + (46)m + (57)m + (59)m + (61)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (62)m= | 176.85 | 156.26 | 165 | 149.15 | 147.07 | 132.7 | 128.67 | 139.5 | 138.72 | 154.6 | 161.92 | 173.02 | (62) |

Solar DHW input calculated using Appendix G or Appendix H (negative quantity) (enter '0' if no solar contribution to water heating)

(add additional lines if FGHRS and/or WWHRS applies, see Appendix G)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (63)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (63) |

Output from water heater

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (64)m= | 176.85 | 156.26 | 165 | 149.15 | 147.07 | 132.7 | 128.67 | 139.5 | 138.72 | 154.6 | 161.92 | 173.02 |

Output from water heater (annual)$_{1…12}$ | 1823.47 | (64)

Heat gains from water heating, kWh/month 0.25 ´ [0.85 × (45)m + (61)m] + 0.8 x [(46)m + (57)m + (59)m ]

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (65)m= | 84.65 | 75.3 | 80.7 | 74.6 | 74.74 | 69.13 | 68.63 | 72.23 | 71.13 | 77.25 | 78.85 | 83.37 | (65) |

include (57)m in calculation of (65)m only if cylinder is in the dwelling or hot water is from community heating

## 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= | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | 101.88 | (66) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (67)m= | 32.97 | 29.28 | 23.82 | 18.03 | 13.48 | 11.38 | 12.29 | 15.98 | 21.45 | 27.24 | 31.79 | 33.89 | (67) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (68)m= | 220.8 | 223.09 | 217.32 | 205.02 | 189.51 | 174.93 | 165.18 | 162.89 | 168.67 | 180.96 | 196.47 | 211.06 | (68) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (69)m= | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | 46.89 | (69) |

Pumps and fans gains (Table 5a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (70)m= | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | (70) |

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

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (71)m= | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | -67.92 | (71) |

Water heating gains (Table 5)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (72)m= | 113.77 | 112.05 | 108.47 | 103.61 | 100.46 | 96.02 | 92.24 | 97.08 | 98.8 | 103.83 | 109.51 | 112.06 | (72) |

**Total internal gains =** (66)m + (67)m + (68)m + (69)m + (70)m + (71)m + (72)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (73)m= | 448.39 | 445.27 | 430.45 | 407.52 | 384.29 | 363.17 | 350.56 | 356.8 | 369.76 | 392.87 | 418.62 | 437.85 | (73) |

## 6. Solar gains:

Solar gains are calculated using solar flux from Table 6a and associated equations to convert to the applicable orientation.

| Orientation: | | Access Factor Table 6d | | Area m² | | Flux Table 6a | | g_ Table 6b | | FF Table 6c | | Gains (W) | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 3.82 | x | 19.64 | x | 0.56 | x | 0.7 | = | 20.31 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 38.42 | x | 0.56 | x | 0.7 | = | 39.73 | (76) |

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| East | 0.9x | 1 | x | 3.82 | x | 63.27 | x | 0.56 | x | 0.7 | = | 65.43 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 92.28 | x | 0.56 | x | 0.7 | = | 95.42 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 113.09 | x | 0.56 | x | 0.7 | = | 116.94 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 115.77 | x | 0.56 | x | 0.7 | = | 119.71 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 110.22 | x | 0.56 | x | 0.7 | = | 113.97 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 94.68 | x | 0.56 | x | 0.7 | = | 97.9 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 73.59 | x | 0.56 | x | 0.7 | = | 76.09 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 45.59 | x | 0.56 | x | 0.7 | = | 47.14 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 24.49 | x | 0.56 | x | 0.7 | = | 25.32 | (76) |
| East | 0.9x | 1 | x | 3.82 | x | 16.15 | x | 0.56 | x | 0.7 | = | 16.7 | (76) |
| South | 0.9x | 0.77 | x | 12.22 | x | 46.75 | x | 0.56 | x | 0.7 | = | 154.65 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 76.57 | x | 0.56 | x | 0.7 | = | 253.27 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 97.53 | x | 0.56 | x | 0.7 | = | 322.62 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 110.23 | x | 0.56 | x | 0.7 | = | 364.63 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 114.87 | x | 0.56 | x | 0.7 | = | 379.97 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 110.55 | x | 0.56 | x | 0.7 | = | 365.67 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 108.01 | x | 0.56 | x | 0.7 | = | 357.28 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 104.89 | x | 0.56 | x | 0.7 | = | 346.97 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 101.89 | x | 0.56 | x | 0.7 | = | 337.02 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 82.59 | x | 0.56 | x | 0.7 | = | 273.18 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 55.42 | x | 0.56 | x | 0.7 | = | 183.31 | (78) |
| South | 0.9x | 0.77 | x | 12.22 | x | 40.4 | x | 0.56 | x | 0.7 | = | 133.63 | (78) |

Solar gains in watts, calculated for each month (83)m = Sum(74)m …(82)m

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (83)m= | 174.95 | 293 | 388.05 | 460.05 | 496.91 | 485.38 | 471.25 | 444.86 | 413.11 | 320.32 | 208.63 | 150.33 | (83) |

Total gains – internal and solar (84)m = (73)m + (83)m , watts

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (84)m= | 623.34 | 738.27 | 818.5 | 867.57 | 881.2 | 848.54 | 821.81 | 801.66 | 782.87 | 713.18 | 627.25 | 588.18 | (84) |

## 7. Mean internal temperature (heating season)

Temperature during heating periods in the living area from Table 9, Th1 (°C) | 21 | (85)

Utilisation factor for gains for living area, h1,m (see Table 9a)

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (86)m= | 0.83 | 0.77 | 0.7 | 0.61 | 0.51 | 0.39 | 0.29 | 0.31 | 0.44 | 0.63 | 0.77 | 0.84 | (86) |

Mean internal temperature in living area T1 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (87)m= | 19.12 | 19.49 | 19.9 | 20.33 | 20.65 | 20.87 | 20.95 | 20.94 | 20.81 | 20.39 | 19.7 | 19.04 | (87) |

Temperature during heating periods in rest of dwelling from Table 9, Th2 (°C)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (88)m= | 19.95 | 19.96 | 19.96 | 19.97 | 19.97 | 19.98 | 19.98 | 19.98 | 19.98 | 19.97 | 19.97 | 19.96 | (88) |

Utilisation factor for gains for rest of dwelling, h2,m (see Table 9a)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (89)m= | 0.81 | 0.75 | 0.67 | 0.58 | 0.47 | 0.34 | 0.23 | 0.24 | 0.39 | 0.59 | 0.75 | 0.82 | (89) |

Mean internal temperature in the rest of dwelling T2 (follow steps 3 to 7 in Table 9c)

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (90)m= | 17.51 | 18.01 | 18.58 | 19.17 | 19.59 | 19.86 | 19.95 | 19.94 | 19.8 | 19.27 | 18.33 | 17.4 | (90) |

fLA = Living area ÷ (4) = | 0.45 | (91)

# SAP WorkSheet: New dwelling design stage

Mean internal temperature (for the whole dwelling) = fLA × T1 + (1 – fLA) × T2

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (92)m= | 18.23 | 18.68 | 19.18 | 19.69 | 20.07 | 20.31 | 20.4 | 20.39 | 20.25 | 19.77 | 18.94 | 18.14 | (92) |

Apply adjustment to the mean internal temperature from Table 4e, where appropriate

| | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (93)m= | 18.23 | 18.68 | 19.18 | 19.69 | 20.07 | 20.31 | 20.4 | 20.39 | 20.25 | 19.77 | 18.94 | 18.14 | (93) |

## 8. Space heating requirement

Set Ti to the mean internal temperature obtained at step 11 of Table 9b, so that Ti,m=(76)m and re-calculate the utilisation factor for gains using Table 9a

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Utilisation factor for gains, hm: | | | | | | | | | | | | | |
| (94)m= | 0.78 | 0.72 | 0.65 | 0.57 | 0.47 | 0.35 | 0.25 | 0.27 | 0.4 | 0.58 | 0.72 | 0.79 | (94) |
| Useful gains, hmGm , W = (94)m x (84)m | | | | | | | | | | | | | |
| (95)m= | 483.69 | 530.53 | 534.87 | 494.62 | 414.97 | 299.93 | 207.32 | 216.18 | 316.11 | 415.09 | 451.8 | 465.55 | (95) |
| Monthly average external temperature from Table 8 | | | | | | | | | | | | | |
| (96)m= | 4.3 | 4.9 | 6.5 | 8.9 | 11.7 | 14.6 | 16.6 | 16.4 | 14.1 | 10.6 | 7.1 | 4.2 | (96) |
| Heat loss rate for mean internal temperature, Lm , W =[(39)m x [(93)m– (96)m ] | | | | | | | | | | | | | |
| (97)m= | 811.48 | 800.58 | 735.1 | 618.87 | 479.01 | 323.3 | 214.97 | 225.38 | 349.72 | 525.02 | 680.85 | 804.69 | (97) |
| Space heating requirement for each month, kWh/month = 0.024 x [(97)m – (95)m] x (41)m | | | | | | | | | | | | | |
| (98)m= | 243.88 | 181.47 | 148.97 | 89.46 | 47.65 | 0 | 0 | 0 | 0 | 81.79 | 164.92 | 252.32 | |

Total per year (kWh/year) = Sum(98)$_{1...5,9...12}$ = 1210.45 (98)

Space heating requirement in kWh/m²/year 24.08 (99)

## 9b. Energy requirements – Community heating scheme

This part is used for space heating, space cooling or water heating provided by a community scheme.

| | | | |
|---|---|---|---|
| Fraction of space heat from secondary/supplementary heating (Table 11) '0' if none | | 0 | (301) |
| Fraction of space heat from community system 1 – (301) = | | 1 | (302) |

*The community scheme may obtain heat from several sources. The procedure allows for CHP and up to four other heat sources; the latter includes boilers, heat pumps, geothermal and waste heat from power stations. See Appendix C.*

| | | | |
|---|---|---|---|
| Fraction of heat from Community CHP | | 0.6 | (303a) |
| Fraction of community heat from heat source 2 | | 0.4 | (303b) |
| Fraction of total space heat from Community CHP | (302) x (303a) = | 0.6 | (304a) |
| Fraction of total space heat from community heat source 2 | (302) x (303b) = | 0.4 | (304b) |
| Factor for control and charging method (Table 4c(3)) for community heating system | | 1 | (305) |
| Distribution loss factor (Table 12c) for community heating system | | 1.05 | (306) |
| **Space heating** | | **kWh/year** | |
| Annual space heating requirement | | 1210.45 | |
| Space heat from Community CHP | (98) x (304a) x (305) x (306) = | 762.58 | (307a) |
| Space heat from heat source 2 | (98) x (304b) x (305) x (306) = | 508.39 | (307b) |
| Efficiency of secondary/supplementary heating system in % (from Table 4a or Appendix E) | | 0 | (308 |
| Space heating requirement from secondary/supplementary system | (98) x (301) x 100 ÷ (308) = | 0 | (309) |

**Water heating**

| | | | |
|---|---|---|---|
| Annual water heating requirement | | 1823.47 | |
| If DHW from community scheme:<br>Water heat from Community CHP | (64) x (303a) x (305) x (306) = | 1148.78 | (310a) |

| | | | |
|---|---|---|---|
| Water heat from heat source 2 | (64) x (303b) x (305) x (306) = | 765.86 | (310b) |
| Electricity used for heat distribution | 0.01 × [(307a)…(307e) + (310a)…(310e)] = | 31.86 | (313) |
| Cooling System Energy Efficiency Ratio | | 0 | (314) |
| Space cooling (if there is a fixed cooling system, if not enter 0) | = (107) ÷ (314) = | 0 | (315) |
| Electricity for pumps and fans within dwelling (Table 4f):<br>mechanical ventilation - balanced, extract or positive input from outside | | 97.51 | (330a) |
| warm air heating system fans | | 0 | (330b) |
| pump for solar water heating | | 0 | (330g) |
| Total electricity for the above, kWh/year | =(330a) + (330b) + (330g) = | 97.51 | (331) |
| Energy for lighting (calculated in Appendix L) | | 232.91 | (332) |
| Electricity generated by PVs (Appendix M) (negative quantity) | | -380.25 | (333) |
| Electricity generated by wind turbine (Appendix M) (negative quantity) | | 0 | (334) |

## 10b. Fuel costs – Community heating scheme

| | **Fuel** kWh/year | | **Fuel Price** (Table 12) | | **Fuel Cost** £/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP | (307a) | x | 2.97 | x 0.01 = | 22.65 | (340a) |
| Space heating from heat source 2 | (307b) | x | 4.24 | x 0.01 = | 21.56 | (340b) |
| Water heating from CHP | (310a) | x | 2.97 | x 0.01 = | 34.12 | (342a) |
| Water heating from heat source 2 | (310b) | x | 4.24 | x 0.01 = | 32.47 | (342b) |
| | | | **Fuel Price** | | | |
| Pumps and fans | (331) | | 13.19 | x 0.01 = | 12.86 | (349) |
| Energy for lighting | (332) | | 13.19 | x 0.01 = | 30.72 | (350) |
| Additional standing charges (Table 12) | | | | | 120 | (351) |
| Energy saving/generation technologies | | | | | | |
| **Total energy cost** | = (340a)…(342e) + (345)…(354) = | | | | 274.38 | (355) |

## 11b. SAP rating - Community heating scheme

| | | | |
|---|---|---|---|
| Energy cost deflator (Table 12) | | 0.42 | (356) |
| Energy cost factor (ECF) | [(355) x (356)] ÷ [(4) + 45.0] = | 1.21 | (357) |
| **SAP rating (section12)** | | 83.13 | (358) |

## 12b. CO2 Emissions – Community heating scheme

| | | | |
|---|---|---|---|
| Electrical efficiency of CHP unit | | 29.8 | (361) |
| Heat efficiency of CHP unit | | 57.6 | (362) |

| | | **Energy** kWh/year | | **Emission factor** kg CO2/kWh | **Emissions** kg CO2/year | |
|---|---|---|---|---|---|---|
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1323.93 | x | 0.22 | 285.97 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 394.53 | x | 0.52 | -204.76 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 1994.42 | x | 0.22 | 430.79 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 594.34 | x | 0.52 | -308.46 | (366) |

# SAP WorkSheet: New dwelling design stage

| | | | | | |
|---|---|---|---|---|---|
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | 91 | (367b) |
| $CO_2$ associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | 0.22 | = | 302.46 | (368) |
| Electrical energy for heat distribution | [(313) x | 0.52 | = | 16.53 | (372) |
| Total $CO_2$ associated with community systems | (363)…(366) + (368)...(372) | | = | 522.53 | (373) |
| $CO_2$ associated with space heating (secondary) | (309) x | 0 | = | 0 | (374) |
| $CO_2$ associated with water from immersion heater or instantaneous heater | (312) x | 0.22 | = | 0 | (375) |
| Total $CO_2$ associated with space and water heating | (373) + (374) + (375) = | | | 522.53 | (376) |
| $CO_2$ associated with electricity for pumps and fans within dwelling | (331)) x | 0.52 | = | 50.61 | (378) |
| $CO_2$ associated with electricity for lighting | (332))) x | 0.52 | = | 120.88 | (379) |
| Energy saving/generation technologies (333) to (334) as applicable<br>Item 1 | | 0.52 | x 0.01 = | -197.35 | (380) |
| **Total $CO_2$, kg/year** | sum of (376)…(382) = | | | 496.68 | (383) |
| **Dwelling $CO_2$ Emission Rate** | (383) ÷ (4) = | | | 9.88 | (384) |
| **EI rating (section 14)** | | | | 93.01 | (385) |

## 13b. Primary Energy – Community heating scheme

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Electrical efficiency of CHP unit** | | | | | | 29.8 | (361) |
| **Heat efficiency of CHP unit** | | | | | | 57.6 | (362) |
| | | **Energy kWh/year** | | **Primary factor** | | **P.Energy kWh/year** | |
| Space heating from CHP) | (307a) × 100 ÷ (362) = | 1323.93 | x | 1.22 | | 1615.2 | (363) |
| less credit emissions for electricity | –(307a) × (361) ÷ (362) = | 394.53 | x | 3.07 | | -1211.21 | (364) |
| Water heated by CHP | (310a) × 100 ÷ (362) = | 1994.42 | x | 1.22 | | 2433.19 | (365) |
| less credit emissions for electricity | –(310a) × (361) ÷ (362) = | 594.34 | x | 3.07 | | -1824.61 | (366) |
| Efficiency of heat source 2 (%) | If there is CHP using two fuels repeat (363) to (366) for the second fuel | | | | | 91 | (367b) |
| Energy associated with heat source 2 | [(307b)+(310b)] x 100 ÷ (367b) x | | | 1.22 | = | 1708.33 | (368) |
| Electrical energy for heat distribution | [(313) x | | | | = | 97.8 | (372) |
| Total Energy associated with community systems | (363)…(366) + (368)...(372) | | | | = | 2818.69 | (373) |
| *if it is negative set (373) to zero (unless specified otherwise, see C7 in Appendix C)* | | | | | | 2818.69 | (373) |
| Energy associated with space heating (secondary) | (309) x | | | 0 | = | 0 | (374) |
| Energy associated with water from immersion heater or instantaneous heater | (312) x | | | 1.22 | = | 0 | (375) |
| Total Energy associated with space and water heating | (373) + (374) + (375) = | | | | | 2818.69 | (376) |
| Energy associated with space cooling | (315) x | | | 3.07 | = | 0 | (377) |
| Energy associated with electricity for pumps and fans within dwelling | (331)) x | | | 3.07 | = | 299.37 | (378) |
| Energy associated with electricity for lighting | (332))) x | | | 3.07 | = | 715.04 | (379) |
| Energy saving/generation technologies<br>Item 1 | | | | 3.07 | x 0.01 = | -1167.36 | (380) |

| | | | |
|---|---|---|---|
| **Total Primary Energy, kWh/year** | sum of (376)…(382) = | 2665.74 | (383) |

# SAP 2012 Overheating Assessment

Calculated by Stroma FSAP 2012 program, produced and printed on 22 January 2019

## Property Details: 06-18-69419 D-3-02

| | |
|---|---|
| **Dwelling type:** | Flat |
| **Located in:** | England |
| **Region:** | Thames valley |
| **Cross ventilation possible:** | No |
| **Number of storeys:** | 1 |
| **Front of dwelling faces:** | North |
| **Overshading:** | Average or unknown |
| **Overhangs:** | None |
| **Thermal mass parameter:** | Calculated 77.25 |
| **Night ventilation:** | False |
| **Blinds, curtains, shutters:** | Dark-coloured curtain or roller blind |
| **Ventilation rate during hot weather (ach):** | 4 ( Windows fully open) |

## Overheating Details:

| | | |
|---|---|---|
| **Summer ventilation heat loss coefficient:** | 159.26 | **(P1)** |
| **Transmission heat loss coefficient:** | 47.8 | |
| **Summer heat loss coefficient:** | 207.02 | **(P2)** |

## Overhangs:

| **Orientation:** | **Ratio:** | **Z_overhangs:** |
|---|---|---|
| South (Side) | 0 | 1 |
| East (Rear) | 0 | 1 |

## Solar shading:

| **Orientation:** | **Z blinds:** | **Solar access:** | **Overhangs:** | **Z summer:** | |
|---|---|---|---|---|---|
| South (Side) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |
| East (Rear) | 0.85 | 0.9 | 1 | 0.76 | **(P8)** |

## Solar gains:

| **Orientation** | | **Area** | **Flux** | **g_** | **FF** | **Shading** | **Gains** | |
|---|---|---|---|---|---|---|---|---|
| South (Side) | 0.9 x | 12.22 | 112.21 | 0.56 | 0.7 | 0.76 | 368.74 | |
| East (Rear) | 0.9 x | 3.82 | 117.51 | 0.56 | 0.7 | 0.76 | 120.72 | |
| | | | | | | **Total** | 489.46 | **(P3/P4)** |

## Internal gains:

| | **June** | **July** | **August** | |
|---|---|---|---|---|
| Internal gains | 363.17 | 350.56 | 356.8 | |
| Total summer gains | 873.54 | 840.02 | 826.81 | **(P5)** |
| Summer gain/loss ratio | 4.22 | 4.06 | 3.99 | **(P6)** |
| Mean summer external temperature (Thames valley) | 16 | 17.9 | 17.8 | |
| Thermal mass temperature increment | 1.46 | 1.46 | 1.46 | |
| Threshold temperature | 21.68 | 23.42 | 23.25 | **(P7)** |
| **Likelihood of high internal temperature** | **Slight** | **Medium** | **Medium** | |

**Assessment of likelihood of high internal temperature:** Medium

# APPENDIX C1 - COMMUNITY CENTRE – PART L RESULTS “LEAN”

# BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

**Project name**

## Highgate Newton Community Centre

As designed

**Date:** Fri Jan 25 12:56:34 2019

## Administrative information

### Building Details

**Address:** Highgate Newton Community Centre, London,

### Certification tool

**Calculation engine:** TAS

**Calculation engine version:** "v9.4.3"

**Interface to calculation engine:** TAS

**Interface to calculation engine version:** v9.4.3

**BRUKL compliance check version:** v5.4.b.0

### Owner Details

**Name:**

**Telephone number:**

**Address:** , ,

### Certifier details

**Name:** Paul Bacon

**Telephone number:** 01908 261461

**Address:** 13-14 Cofferidge Close, Stony Stratford, Milton Keynes, MK11 1BY

## Criterion 1: The calculated $CO_2$ emission rate for the building must not exceed the target

The building does not comply with England Building Regulations Part L 2013

| | |
|---|---|
| $CO_2$ emission rate from the notional building, $kgCO_2/m^2$.annum | 22 |
| Target $CO_2$ emission rate (TER), $kgCO_2/m^2$.annum | 22 |
| Building $CO_2$ emission rate (BER), $kgCO_2/m^2$.annum | 25.4 |
| 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 | 0.15 | 0.15 | External Wall |
| Floor | 0.25 | 0.11 | 0.11 | Ground Floor |
| Roof | 0.25 | 0.11 | 0.11 | Roof |
| Windows***, roof windows, and rooflights | 2.2 | 1.59 | 1.83 | Hall Rooflight |
| Personnel doors | 2.2 | 1.65 | 1.66 | D10 B.0.02 part 1 |
| Vehicle access & similar large doors | 1.5 | - | - | No vehicle doors in project |
| High usage entrance doors | 3.5 | - | - | No high usage entrance doors in project |

$U_{a\text{-}Limit}$ = 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 | 3 |

**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- Gym (2 Zones)

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0.94 | 5.44 | - | 0.77 | 0.83 |
| **Standard value** | 0.91* | 2.6 | N/A | 1.6^ | 0.5 |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

^ 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.

2- NV + UFH

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0.94 | - | - | - | - |
| **Standard value** | N/A | N/A | N/A | N/A | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

3- NV + Rads

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0.94 | - | - | - | - |
| **Standard value** | N/A | N/A | N/A | N/A | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

4- Recording Studio (B.3.06 Recording Studio)

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0 | - | - | 1.6 | 0.5 |
| **Standard value** | N/A | N/A | N/A | 1.6^ | 0.5 |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

^ 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.

5- B.0.01 Office - UFH + Supply only (B.0.01 Office)

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0.94 | - | - | 0.51 | - |
| **Standard value** | N/A | N/A | N/A | 1.1^ | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

^ 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.

6- Kitchen (2 Zones)

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0 | - | - | 0.78 | - |
| **Standard value** | N/A | N/A | N/A | 1.1^ | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

^ 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.

7- Extract Only Local (B.0.06 Laundrette)

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0 | - | - | - | - |
| **Standard value** | N/A | N/A | N/A | N/A | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

8- Extract Only Central (10 Zones)

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0.94 | - | - | - | - |
| **Standard value** | N/A | N/A | N/A | N/A | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

1- New HWS Circuit

| | Water heating efficiency | Storage loss factor [kWh/litre per day] |
|---|---|---|
| **This building** | 0.94 | 0 |
| **Standard value** | 0.9* | N/A |
| * Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73. | | |

**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** |
| B.0.05 Toilets - Lobby | - | - | 0.4 | - | - | - | - | - | - | - | N/A |
| B.0.05 Toilets - Dis WC | - | - | 0.4 | - | - | - | - | - | - | - | N/A |
| B.0.05 Toilets - WCs | - | - | 0.4 | - | - | - | - | - | - | - | N/A |
| B.0.05 Toilets - Serperate WC | - | - | 0.4 | - | - | - | - | - | - | - | N/A |
| B.0.06 Laundrette | 0.4 | - | - | - | - | - | - | - | - | - | N/A |
| B.1.0X WC | - | - | 0.5 | - | - | - | - | - | - | - | N/A |
| B.1.0X Dis WC | - | - | 0.3 | - | - | - | - | - | - | - | N/A |
| B.2.0X Dis WC | - | - | 0.5 | - | - | - | - | - | - | - | N/A |
| B.2.0X WC | - | - | 0.5 | - | - | - | - | - | - | - | N/A |
| B.3.0X WC | - | - | 0.5 | - | - | - | - | - | - | - | N/A |
| B.3.0X Dis WC | - | - | 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 | |
| Hall A | - | 60 | - | 632 |

| General lighting and display lighting | Luminous efficacy [lm/W] | | | |
|---|---|---|---|---|
| **Zone name** | **Luminaire** | **Lamp** | **Display lamp** | **General lighting [W]** |
| **Standard value** | 60 | 60 | 22 | |
| B.0.01 Office | 60 | - | - | 185 |
| B.0.02 Cafe Seating | - | 60 | - | 234 |
| B.0.03 Seating | - | 60 | - | 92 |
| B.0.04 Activity Room | 60 | - | - | 962 |
| B.0.05 Toilets - Lobby | - | 60 | - | 57 |
| B.0.05 Toilets - Dis WC | - | 60 | - | 40 |
| B.0.05 Toilets - WCs | - | 60 | - | 116 |
| B.0.05 Toilets - Serperate WC | - | 60 | - | 28 |
| B.0.06 Laundrette | - | 60 | - | 72 |
| B.0.07 Kitchen | - | 60 | - | 273 |
| B.0.08 Servery | - | 60 | - | 159 |
| B.0.0X Stairs 1 | - | 60 | - | 73 |
| B.0.0X Stairs 2 | - | 60 | - | 72 |
| B.0.0X Second entrance | - | 60 | - | 48 |
| B.0.0X Entrance Circ A | - | 60 | - | 316 |
| B.0.09 Main Hall Store | 60 | - | - | 58 |
| B.0.10 Gym | - | 60 | - | 195 |
| B.0.10 Gym WC | - | 60 | - | 35 |
| B.1.01 Office | 60 | - | - | 504 |
| B.1.02 Office | 60 | - | - | 374 |
| B.1.03 Activity Room | 60 | - | - | 781 |
| B.1.04 Activity Room | 60 | - | - | 742 |
| B.1.0X Stair 1 | - | 60 | - | 221 |
| B.1.0X Stair 2 | - | 60 | - | 103 |
| B.1.0X Circulation | - | 60 | - | 76 |
| B.1.0X WC | - | 60 | - | 41 |
| B.1.0X Dis WC | - | 60 | - | 41 |
| B.1.0X Store | 60 | - | - | 9 |
| B.2.01 Activity Room | 60 | - | - | 436 |
| B.2.02 Activity Room | 60 | - | - | 400 |
| B.2.03 Activity Room | 60 | - | - | 780 |
| B.2.04 Activity Room | 60 | - | - | 742 |
| B.2.05 Office | 60 | - | - | 374 |
| B.2.0X Circulation | - | 60 | - | 77 |
| B.2.0X Stairs 1 | - | 60 | - | 221 |
| B.2.0X Stairs 2 | - | 60 | - | 103 |
| B.2.0X Dis WC | - | 60 | - | 41 |
| B.2.0X WC | - | 60 | - | 41 |
| B.2.0X Store | 60 | - | - | 9 |
| B.3.01 Activity Space | 60 | - | - | 778 |
| B.3.02 Juice Bar | - | 60 | - | 216 |
| B.3.03 Office | 60 | - | - | 458 |
| B.3.04 1 to 1 | 60 | - | - | 131 |

| General lighting and display lighting | Luminous efficacy [lm/W] | | | |
|---|---|---|---|---|
| Zone name | Luminaire | Lamp | Display lamp | General lighting [W] |
| Standard value | 60 | 60 | 22 | |
| B.3.05 Large 1 to 1 | 60 | - | - | 158 |
| B.3.06 Recording Studio | 60 | - | - | 182 |
| B.3.07 Open Plan Classroom | - | 60 | - | 265 |
| B.3.0X Stairs 1 | - | 60 | - | 313 |
| B.3.0X Stairs 2 | - | 60 | - | 104 |
| B.3.0X WC | - | 60 | - | 42 |
| B.3.0X Dis WC | - | 60 | - | 44 |
| B.3.0X Circulation | - | 60 | - | 113 |
| B.3.02 Juice Bar - Seating area | - | 60 | - | 43 |
| B.0.0X Entrance Circ B | - | 60 | - | 231 |
| Hall B | - | 60 | - | 1589 |

## 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? |
|---|---|---|
| Hall A | YES (+61%) | NO |
| B.0.01 Office | N/A | N/A |
| B.0.02 Cafe Seating | YES (+17%) | NO |
| B.0.04 Activity Room | NO (-21%) | NO |
| B.0.10 Gym | NO (-37%) | NO |
| B.0.10 Gym WC | N/A | N/A |
| B.1.01 Office | NO (-40%) | NO |
| B.1.02 Office | NO (-70%) | NO |
| B.1.03 Activity Room | NO (-67%) | NO |
| B.1.04 Activity Room | NO (-87%) | NO |
| B.2.01 Activity Room | NO (-72%) | NO |
| B.2.02 Activity Room | NO (-66%) | NO |
| B.2.03 Activity Room | NO (-69%) | NO |
| B.2.04 Activity Room | NO (-81%) | NO |
| B.2.05 Office | NO (-55%) | NO |
| B.3.01 Activity Space | NO (-68%) | NO |
| B.3.03 Office | NO (-74%) | NO |
| B.3.04 1 to 1 | NO (-68%) | NO |
| B.3.05 Large 1 to 1 | NO (-75%) | NO |
| B.3.06 Recording Studio | N/A | N/A |
| B.3.07 Open Plan Classroom | NO (-65%) | NO |
| B.3.02 Juice Bar - Seating area | NO (-88%) | NO |
| Hall B | NO (-30%) | 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? | YES |

# Technical Data Sheet (Actual vs. Notional Building)

## Building Global Parameters

| | Actual | Notional |
|---|---|---|
| Area [m²] | 1559 | 1559 |
| External area [m²] | 2814 | 2814 |
| Weather | LON | LON |
| Infiltration [m³/hm²@ 50Pa] | 3 | 4 |
| Average conductance [W/K] | 818 | 1144 |
| Average U-value [W/m²K] | 0.29 | 0.41 |
| Alpha value* [%] | 20.8 | 20.8 |

* 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 |
| **97** | **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 |
| **3** | **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 | 6.44 | 16.68 |
| Cooling | 0.17 | 0.28 |
| Auxiliary | 2.01 | 2.18 |
| Lighting | 26.39 | 16.28 |
| Hot water | 42.35 | 41.4 |
| Equipment* | 17.02 | 17.02 |
| **TOTAL**** | **77.37** | **76.82** |

* 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] | 25.31 | 56.16 |
| Primary energy* [kWh/m²] | 147.25 | 126.94 |
| Total emissions [kg/m²] | 25.4 | 22 |

* 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] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | | |
| | **Actual** | 0.2 | 104.5 | 0.1 | 5.3 | 22.7 | 0.89 | 5.44 | 0.94 | 5.44 |
| | **Notional** | 6.9 | 110.7 | 2.4 | 8.5 | 27.3 | 0.82 | 3.6 | ---- | ---- |
| [ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | | |
| | **Actual** | 39.6 | 0 | 12.3 | 0 | 1.1 | 0.89 | 0 | 0.94 | 0 |
| | **Notional** | 109.4 | 0 | 37.1 | 0 | 1 | 0.82 | 0 | ---- | ---- |
| [ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | | |
| | **Actual** | 19.5 | 0 | 6.1 | 0 | 1 | 0.89 | 0 | 0.94 | 0 |
| | **Notional** | 42.8 | 0 | 14.2 | 0 | 0.8 | 0.84 | 0 | ---- | ---- |
| [ST] Split or multi-split system, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | | |
| | **Actual** | 0 | 0 | 0 | 0 | 3.6 | 0 | 0 | 0 | 0 |
| | **Notional** | 11 | 0 | 3.7 | 0 | 2.1 | 0.82 | 0 | ---- | ---- |
| [ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | | |
| | **Actual** | 24.8 | 0 | 7.7 | 0 | 2.8 | 0.89 | 0 | 0.94 | 0 |
| | **Notional** | 23.8 | 0 | 8.1 | 0 | 6.1 | 0.82 | 0 | ---- | ---- |
| [ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | | |
| | **Actual** | 0 | 0 | 0 | 0 | 4.7 | 0 | 0 | 0 | 0 |
| | **Notional** | 0 | 0 | 0 | 0 | 6.5 | 0 | 0 | ---- | ---- |
| [ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | | |
| | **Actual** | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 |
| | **Notional** | 0 | 0 | 0 | 0 | 13.4 | 0 | 0 | ---- | ---- |
| [ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | | |
| | **Actual** | 24.6 | 0 | 7.7 | 0 | 9.1 | 0.89 | 0 | 0.94 | 0 |
| | **Notional** | 67.2 | 0 | 22.8 | 0 | 13 | 0.82 | 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 | $U_{i-Typ}$ | $U_{i-Min}$ | Surface where the minimum value occurs* |
|---|---|---|---|
| Wall | 0.23 | 0.15 | External Wall |
| Floor | 0.2 | 0.11 | Ground Floor |
| Roof | 0.15 | 0.11 | Roof |
| Windows, roof windows, and rooflights | 1.5 | 1.4 | Curtain wall |
| Personnel doors | 1.5 | 1.56 | D14 part 1 |
| Vehicle access & similar large doors | 1.5 | - | No vehicle doors in project |
| High usage entrance doors | 1.5 | - | No high usage entrance doors in project |

$U_{i-Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i-Min}$ = 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 | 3 |

# APPENDIX C2 – COMMUNITY CENTRE – PART L RESULTS "CLEAN"

# BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

**Project name**

## Highgate Newton Community Centre

As designed

**Date:** Fri Jan 25 10:45:50 2019

## Administrative information

### Building Details

**Address:** Highgate Newton Community Centre, London,

### Certification tool

**Calculation engine:** TAS

**Calculation engine version:** "v9.4.3"

**Interface to calculation engine:** TAS

**Interface to calculation engine version:** v9.4.3

**BRUKL compliance check version:** v5.4.b.0

### Owner Details

**Name:**

**Telephone number:**

**Address:** , ,

### Certifier details

**Name:** Paul Bacon

**Telephone number:** 01908 261461

**Address:** 13-14 Cofferidge Close, Stony Stratford, Milton Keynes, MK11 1BY

## 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 | 22 |
| Target $CO_2$ emission rate (TER), $kgCO_2/m^2$.annum | 22 |
| Building $CO_2$ emission rate (BER), $kgCO_2/m^2$.annum | 15.8 |
| 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 | 0.15 | 0.15 | External Wall |
| Floor | 0.25 | 0.11 | 0.11 | Ground Floor |
| Roof | 0.25 | 0.11 | 0.11 | Roof |
| Windows***, roof windows, and rooflights | 2.2 | 1.59 | 1.83 | Hall Rooflight |
| Personnel doors | 2.2 | 1.65 | 1.66 | D10 B.0.02 part 1 |
| Vehicle access & similar large doors | 1.5 | - | - | No vehicle doors in project |
| High usage entrance doors | 3.5 | - | - | No high usage entrance doors in project |

$U_{a\text{-}Limit}$ = 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 |
|---|---|---|
| $m^3/(h.m^2)$ at 50 Pa | 10 | 3 |

## 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- Gym (2 Zones)

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 4.7 | 5.44 | - | 0.77 | 0.83 |
| **Standard value** | 0.91* | 2.6 | N/A | 1.6^ | 0.5 |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

^ 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.

2- NV + UFH

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0.68 | - | - | - | - |
| **Standard value** | N/A | N/A | N/A | N/A | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

3- NV + Rads

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0.68 | - | - | - | - |
| **Standard value** | N/A | N/A | N/A | N/A | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

4- Recording Studio (B.3.06 Recording Studio)

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0 | - | - | 1.6 | 0.5 |
| **Standard value** | N/A | N/A | N/A | 1.6^ | 0.5 |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

^ 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.

5- B.0.01 Office - UFH + Supply only (B.0.01 Office)

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0.68 | - | - | 0.51 | - |
| **Standard value** | N/A | N/A | N/A | 1.1^ | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

^ 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.

6- Kitchen (2 Zones)

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0.68 | - | - | 0.78 | - |
| **Standard value** | N/A | N/A | N/A | 1.1^ | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

^ 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.

7- Extract Only Local (B.0.06 Laundrette)

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0 | - | - | - | - |
| **Standard value** | N/A | N/A | N/A | N/A | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

8- Extract Only Central (10 Zones)

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0.68 | - | - | - | - |
| **Standard value** | N/A | N/A | N/A | N/A | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

1- HWS Circuit

| | Water heating efficiency | Storage loss factor [kWh/litre per day] |
|---|---|---|
| **This building** | 0.94 | 0 |
| **Standard value** | 0.9* | N/A |
| * Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73. | | |

1- CHP Heating Circuit

| | CHPQA quality index | CHP electrical efficiency |
|---|---|---|
| **This building** | 154 | 0.33 |
| **Standard value** | 105 | 0.2 |

**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** |
| B.0.05 Toilets - Lobby | - | - | 0.4 | - | - | - | - | - | - | - | N/A |
| B.0.05 Toilets - Dis WC | - | - | 0.4 | - | - | - | - | - | - | - | N/A |
| B.0.05 Toilets - WCs | - | - | 0.4 | - | - | - | - | - | - | - | N/A |
| B.0.05 Toilets - Serperate WC | - | - | 0.4 | - | - | - | - | - | - | - | N/A |
| B.0.06 Laundrette | 0.4 | - | - | - | - | - | - | - | - | - | N/A |
| B.1.0X WC | - | - | 0.5 | - | - | - | - | - | - | - | N/A |
| B.1.0X Dis WC | - | - | 0.3 | - | - | - | - | - | - | - | N/A |
| B.2.0X Dis WC | - | - | 0.5 | - | - | - | - | - | - | - | N/A |
| B.2.0X WC | - | - | 0.5 | - | - | - | - | - | - | - | N/A |
| B.3.0X WC | - | - | 0.5 | - | - | - | - | - | - | - | N/A |
| B.3.0X Dis WC | - | - | 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 | |
| Hall A | - | 100 | - | 379 |
| B.0.01 Office | 100 | - | - | 111 |
| B.0.02 Cafe Seating | - | 100 | - | 141 |
| B.0.03 Seating | - | 100 | - | 55 |
| B.0.04 Activity Room | 100 | - | - | 578 |
| B.0.05 Toilets - Lobby | - | 100 | - | 34 |
| B.0.05 Toilets - Dis WC | - | 100 | - | 24 |
| B.0.05 Toilets - WCs | - | 100 | - | 70 |
| B.0.05 Toilets - Serperate WC | - | 100 | - | 17 |
| B.0.06 Laundrette | - | 100 | - | 43 |
| B.0.07 Kitchen | - | 100 | - | 164 |
| B.0.08 Servery | - | 100 | - | 95 |
| B.0.0X Stairs 1 | - | 100 | - | 44 |
| B.0.0X Stairs 2 | - | 100 | - | 43 |
| B.0.0X Second entrance | - | 100 | - | 29 |
| B.0.0X Entrance Circ A | - | 100 | - | 190 |
| B.0.09 Main Hall Store | 100 | - | - | 35 |
| B.0.10 Gym | - | 100 | - | 117 |
| B.0.10 Gym WC | - | 100 | - | 21 |
| B.1.01 Office | 100 | - | - | 303 |
| B.1.02 Office | 100 | - | - | 225 |
| B.1.03 Activity Room | 100 | - | - | 469 |
| B.1.04 Activity Room | 100 | - | - | 445 |
| B.1.0X Stair 1 | - | 100 | - | 133 |
| B.1.0X Stair 2 | - | 100 | - | 62 |
| B.1.0X Circulation | - | 100 | - | 46 |
| B.1.0X WC | - | 100 | - | 25 |
| B.1.0X Dis WC | - | 100 | - | 25 |
| B.1.0X Store | 100 | - | - | 6 |
| B.2.01 Activity Room | 100 | - | - | 261 |
| B.2.02 Activity Room | 100 | - | - | 240 |
| B.2.03 Activity Room | 100 | - | - | 468 |
| B.2.04 Activity Room | 100 | - | - | 445 |
| B.2.05 Office | 100 | - | - | 225 |
| B.2.0X Circulation | - | 100 | - | 46 |
| B.2.0X Stairs 1 | - | 100 | - | 133 |
| B.2.0X Stairs 2 | - | 100 | - | 62 |
| B.2.0X Dis WC | - | 100 | - | 25 |
| B.2.0X WC | - | 100 | - | 25 |
| B.2.0X Store | 100 | - | - | 6 |
| B.3.01 Activity Space | 100 | - | - | 467 |
| B.3.02 Juice Bar | - | 100 | - | 130 |

| General lighting and display lighting | Luminous efficacy [lm/W] | | | |
|---|---|---|---|---|
| Zone name | Luminaire | Lamp | Display lamp | General lighting [W] |
| Standard value | 60 | 60 | 22 | |
| B.3.03 Office | 100 | - | - | 275 |
| B.3.04 1 to 1 | 100 | - | - | 79 |
| B.3.05 Large 1 to 1 | 100 | - | - | 95 |
| B.3.06 Recording Studio | 100 | - | - | 109 |
| B.3.07 Open Plan Classroom | - | 100 | - | 159 |
| B.3.0X Stairs 1 | - | 100 | - | 188 |
| B.3.0X Stairs 2 | - | 100 | - | 62 |
| B.3.0X WC | - | 100 | - | 25 |
| B.3.0X Dis WC | - | 100 | - | 26 |
| B.3.0X Circulation | - | 100 | - | 68 |
| B.3.02 Juice Bar - Seating area | - | 100 | - | 26 |
| B.0.0X Entrance Circ B | - | 100 | - | 139 |
| Hall B | - | 100 | - | 953 |

## 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? |
|---|---|---|
| Hall A | YES (+61%) | NO |
| B.0.01 Office | N/A | N/A |
| B.0.02 Cafe Seating | YES (+17%) | NO |
| B.0.04 Activity Room | NO (-21%) | NO |
| B.0.10 Gym | NO (-37%) | NO |
| B.0.10 Gym WC | N/A | N/A |
| B.1.01 Office | NO (-40%) | NO |
| B.1.02 Office | NO (-70%) | NO |
| B.1.03 Activity Room | NO (-67%) | NO |
| B.1.04 Activity Room | NO (-87%) | NO |
| B.2.01 Activity Room | NO (-72%) | NO |
| B.2.02 Activity Room | NO (-66%) | NO |
| B.2.03 Activity Room | NO (-69%) | NO |
| B.2.04 Activity Room | NO (-81%) | NO |
| B.2.05 Office | NO (-55%) | NO |
| B.3.01 Activity Space | NO (-68%) | NO |
| B.3.03 Office | NO (-74%) | NO |
| B.3.04 1 to 1 | NO (-68%) | NO |
| B.3.05 Large 1 to 1 | NO (-75%) | NO |
| B.3.06 Recording Studio | N/A | N/A |
| B.3.07 Open Plan Classroom | NO (-65%) | NO |
| B.3.02 Juice Bar - Seating area | NO (-88%) | NO |
| Hall B | NO (-30%) | 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? | YES |

# Technical Data Sheet (Actual vs. Notional Building)

## Building Global Parameters

| | Actual | Notional |
|---|---|---|
| Area [$m^2$] | 1559 | 1559 |
| External area [$m^2$] | 2814 | 2814 |
| Weather | LON | LON |
| Infiltration [$m^3/hm^2$@ 50Pa] | 3 | 4 |
| Average conductance [W/K] | 818 | 1144 |
| Average U-value [$W/m^2K$] | 0.29 | 0.41 |
| Alpha value* [%] | 20.8 | 20.8 |

* 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 |
| **97** | **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 |
| **3** | **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 | 11.37 | 16.59 |
| Cooling | 0.16 | 0.28 |
| Auxiliary | 2.01 | 2.18 |
| Lighting | 14.25 | 16.28 |
| Hot water | 51.22 | 41.4 |
| Equipment* | 17.02 | 17.02 |
| **TOTAL**** | **66.91** | **76.73** |

* 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 | 12.1 | 0 |
| Solar thermal systems | 0 | 0 |

## Energy & $CO_2$ Emissions Summary

| | Actual | Notional |
|---|---|---|
| Heating + cooling demand [$MJ/m^2$] | 31.03 | 56.16 |
| Primary energy* [$kWh/m^2$] | 89.64 | 126.92 |
| Total emissions [$kg/m^2$] | 15.8 | 22 |

* 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] LTHW boiler, [HFT] Electricity, [CFT] Electricity | | | | | | | | | | |
| | Actual | 0.4 | 98 | 0 | 5 | 22.7 | 4.7 | 5.44 | 4.7 | 5.44 |
| | Notional | 6.9 | 110.7 | 0.8 | 8.5 | 27.3 | 2.43 | 3.6 | ---- | ---- |
| [ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | | |
| | Actual | 46.7 | 0 | 20.2 | 0 | 1.1 | 0.64 | 0 | 0.68 | 0 |
| | Notional | 109.4 | 0 | 37.1 | 0 | 1 | 0.82 | 0 | ---- | ---- |
| [ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | | |
| | Actual | 25.7 | 0 | 11.1 | 0 | 1 | 0.64 | 0 | 0.68 | 0 |
| | Notional | 42.8 | 0 | 14.2 | 0 | 0.8 | 0.84 | 0 | ---- | ---- |
| [ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity | | | | | | | | | | |
| | Actual | 0 | 0 | 0 | 0 | 3.6 | 0 | 0 | 0 | 0 |
| | Notional | 11 | 0 | 1.3 | 0 | 2.1 | 2.43 | 0 | ---- | ---- |
| [ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | | |
| | Actual | 42.3 | 0 | 18.3 | 0 | 2.8 | 0.64 | 0 | 0.68 | 0 |
| | Notional | 23.8 | 0 | 8.1 | 0 | 6.1 | 0.82 | 0 | ---- | ---- |
| [ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | | |
| | Actual | 0 | 0 | 0 | 0 | 4.7 | 0.64 | 0 | 0.68 | 0 |
| | Notional | 0 | 0 | 0 | 0 | 6.5 | 0 | 0 | ---- | ---- |
| [ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | | |
| | Actual | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 |
| | Notional | 0 | 0 | 0 | 0 | 13.4 | 0 | 0 | ---- | ---- |
| [ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | | |
| | Actual | 33.8 | 0 | 14.7 | 0 | 9.1 | 0.64 | 0 | 0.68 | 0 |
| | Notional | 67.2 | 0 | 22.8 | 0 | 13 | 0.82 | 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 | $U_{i-Typ}$ | $U_{i-Min}$ | Surface where the minimum value occurs* |
|---|---|---|---|
| Wall | 0.23 | 0.15 | External Wall |
| Floor | 0.2 | 0.11 | Ground Floor |
| Roof | 0.15 | 0.11 | Roof |
| Windows, roof windows, and rooflights | 1.5 | 1.4 | Curtain wall |
| Personnel doors | 1.5 | 1.56 | D14 part 1 |
| Vehicle access & similar large doors | 1.5 | - | No vehicle doors in project |
| High usage entrance doors | 1.5 | - | No high usage entrance doors in project |

$U_{i-Typ}$ = Typical individual element U-values [W/(m²K)] $U_{i-Min}$ = 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 | 3 |

# APPENDIX C3 – COMMUNITY CENTRE – PART L RESULTS “GREEN”

# BRUKL Output Document

HM Government

Compliance with England Building Regulations Part L 2013

**Project name**

## Highgate Newton Community Centre

As designed

**Date:** Thu Jan 24 16:35:04 2019

## Administrative information

### Building Details

**Address:** Highgate Newton Community Centre, London,

### Certification tool

**Calculation engine:** TAS

**Calculation engine version:** "v9.4.3"

**Interface to calculation engine:** TAS

**Interface to calculation engine version:** v9.4.3

**BRUKL compliance check version:** v5.4.b.0

### Owner Details

**Name:**

**Telephone number:**

**Address:** , ,

### Certifier details

**Name:** Paul Bacon

**Telephone number:** 01908 261461

**Address:** 13-14 Cofferidge Close, Stony Stratford, Milton Keynes, MK11 1BY

## 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 | 22 |
| Target $CO_2$ emission rate (TER), $kgCO_2/m^2$.annum | 22 |
| Building $CO_2$ emission rate (BER), $kgCO_2/m^2$.annum | 14.3 |
| 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 | 0.15 | 0.15 | External Wall |
| Floor | 0.25 | 0.11 | 0.11 | Ground Floor |
| Roof | 0.25 | 0.11 | 0.11 | Roof |
| Windows***, roof windows, and rooflights | 2.2 | 1.59 | 1.83 | Hall Rooflight |
| Personnel doors | 2.2 | 1.65 | 1.66 | D10 B.0.02 part 1 |
| Vehicle access & similar large doors | 1.5 | - | - | No vehicle doors in project |
| High usage entrance doors | 3.5 | - | - | No high usage entrance doors in project |

$U_{a\text{-}Limit}$ = 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 |
|---|---|---|
| $m^3/(h.m^2)$ at 50 Pa | 10 | 3 |

## 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- Gym (2 Zones)

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 4.7 | 5.44 | - | 0.77 | 0.83 |
| **Standard value** | 0.91* | 2.6 | N/A | 1.6^ | 0.5 |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

* Standard shown is for gas single boiler systems <=2 MW output. For single boiler systems >2 MW or multi-boiler systems, (overall) limiting efficiency is 0.86. For any individual boiler in a multi-boiler system, limiting efficiency is 0.82.

^ 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.

2- NV + UFH

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0.68 | - | - | - | - |
| **Standard value** | N/A | N/A | N/A | N/A | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

3- NV + Rads

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0.68 | - | - | - | - |
| **Standard value** | N/A | N/A | N/A | N/A | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

4- Recording Studio (B.3.06 Recording Studio)

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0 | - | - | 1.6 | 0.5 |
| **Standard value** | N/A | N/A | N/A | 1.6^ | 0.5 |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

^ 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.

5- B.0.01 Office - UFH + Supply only (B.0.01 Office)

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0.68 | - | - | 0.51 | - |
| **Standard value** | N/A | N/A | N/A | 1.1^ | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

^ 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.

6- Kitchen (2 Zones)

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0.68 | - | - | 0.78 | - |
| **Standard value** | N/A | N/A | N/A | 1.1^ | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

^ 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.

7- Extract Only Local (B.0.06 Laundrette)

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0 | - | - | - | - |
| **Standard value** | N/A | N/A | N/A | N/A | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

8- Extract Only Central (10 Zones)

| | Heating efficiency | Cooling efficiency | Radiant efficiency | SFP [W/(l/s)] | HR efficiency |
|---|---|---|---|---|---|
| **This system** | 0.68 | - | - | - | - |
| **Standard value** | N/A | N/A | N/A | N/A | N/A |
| **Automatic monitoring & targeting with alarms for out-of-range values for this HVAC system** | | | | | YES |

1- HWS Circuit

| | Water heating efficiency | Storage loss factor [kWh/litre per day] |
|---|---|---|
| **This building** | 0.94 | 0 |
| **Standard value** | 0.9* | N/A |
| * Standard shown is for gas boilers >30 kW output. For boilers <=30 kW output, limiting efficiency is 0.73. | | |

1- CHP Heating Circuit

| | CHPQA quality index | CHP electrical efficiency |
|---|---|---|
| **This building** | 154 | 0.33 |
| **Standard value** | 105 | 0.2 |

**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 |
| B.0.05 Toilets - Lobby | - | - | 0.4 | - | - | - | - | - | - | - | N/A |
| B.0.05 Toilets - Dis WC | - | - | 0.4 | - | - | - | - | - | - | - | N/A |
| B.0.05 Toilets - WCs | - | - | 0.4 | - | - | - | - | - | - | - | N/A |
| B.0.05 Toilets - Serperate WC | - | - | 0.4 | - | - | - | - | - | - | - | N/A |
| B.0.06 Laundrette | 0.4 | - | - | - | - | - | - | - | - | - | N/A |
| B.1.0X WC | - | - | 0.5 | - | - | - | - | - | - | - | N/A |
| B.1.0X Dis WC | - | - | 0.3 | - | - | - | - | - | - | - | N/A |
| B.2.0X Dis WC | - | - | 0.5 | - | - | - | - | - | - | - | N/A |
| B.2.0X WC | - | - | 0.5 | - | - | - | - | - | - | - | N/A |
| B.3.0X WC | - | - | 0.5 | - | - | - | - | - | - | - | N/A |
| B.3.0X Dis WC | - | - | 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 | |
| Hall A | - | 100 | - | 379 |
| B.0.01 Office | 100 | - | - | 111 |
| B.0.02 Cafe Seating | - | 100 | - | 141 |
| B.0.03 Seating | - | 100 | - | 55 |
| B.0.04 Activity Room | 100 | - | - | 578 |
| B.0.05 Toilets - Lobby | - | 100 | - | 34 |
| B.0.05 Toilets - Dis WC | - | 100 | - | 24 |
| B.0.05 Toilets - WCs | - | 100 | - | 70 |
| B.0.05 Toilets - Serperate WC | - | 100 | - | 17 |
| B.0.06 Laundrette | - | 100 | - | 43 |
| B.0.07 Kitchen | - | 100 | - | 164 |
| B.0.08 Servery | - | 100 | - | 95 |
| B.0.0X Stairs 1 | - | 100 | - | 44 |
| B.0.0X Stairs 2 | - | 100 | - | 43 |
| B.0.0X Second entrance | - | 100 | - | 29 |
| B.0.0X Entrance Circ A | - | 100 | - | 190 |
| B.0.09 Main Hall Store | 100 | - | - | 35 |
| B.0.10 Gym | - | 100 | - | 117 |
| B.0.10 Gym WC | - | 100 | - | 21 |
| B.1.01 Office | 100 | - | - | 303 |
| B.1.02 Office | 100 | - | - | 225 |
| B.1.03 Activity Room | 100 | - | - | 469 |
| B.1.04 Activity Room | 100 | - | - | 445 |
| B.1.0X Stair 1 | - | 100 | - | 133 |
| B.1.0X Stair 2 | - | 100 | - | 62 |
| B.1.0X Circulation | - | 100 | - | 46 |
| B.1.0X WC | - | 100 | - | 25 |
| B.1.0X Dis WC | - | 100 | - | 25 |
| B.1.0X Store | 100 | - | - | 6 |
| B.2.01 Activity Room | 100 | - | - | 261 |
| B.2.02 Activity Room | 100 | - | - | 240 |
| B.2.03 Activity Room | 100 | - | - | 468 |
| B.2.04 Activity Room | 100 | - | - | 445 |
| B.2.05 Office | 100 | - | - | 225 |
| B.2.0X Circulation | - | 100 | - | 46 |
| B.2.0X Stairs 1 | - | 100 | - | 133 |
| B.2.0X Stairs 2 | - | 100 | - | 62 |
| B.2.0X Dis WC | - | 100 | - | 25 |
| B.2.0X WC | - | 100 | - | 25 |
| B.2.0X Store | 100 | - | - | 6 |
| B.3.01 Activity Space | 100 | - | - | 467 |
| B.3.02 Juice Bar | - | 100 | - | 130 |

| General lighting and display lighting | Luminous efficacy [lm/W] | | | |
|---|---|---|---|---|
| Zone name | Luminaire | Lamp | Display lamp | General lighting [W] |
| Standard value | 60 | 60 | 22 | |
| B.3.03 Office | 100 | - | - | 275 |
| B.3.04 1 to 1 | 100 | - | - | 79 |
| B.3.05 Large 1 to 1 | 100 | - | - | 95 |
| B.3.06 Recording Studio | 100 | - | - | 109 |
| B.3.07 Open Plan Classroom | - | 100 | - | 159 |
| B.3.0X Stairs 1 | - | 100 | - | 188 |
| B.3.0X Stairs 2 | - | 100 | - | 62 |
| B.3.0X WC | - | 100 | - | 25 |
| B.3.0X Dis WC | - | 100 | - | 26 |
| B.3.0X Circulation | - | 100 | - | 68 |
| B.3.02 Juice Bar - Seating area | - | 100 | - | 26 |
| B.0.0X Entrance Circ B | - | 100 | - | 139 |
| Hall B | - | 100 | - | 953 |

## 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? |
|---|---|---|
| Hall A | YES (+61%) | NO |
| B.0.01 Office | N/A | N/A |
| B.0.02 Cafe Seating | YES (+17%) | NO |
| B.0.04 Activity Room | NO (-21%) | NO |
| B.0.10 Gym | NO (-37%) | NO |
| B.0.10 Gym WC | N/A | N/A |
| B.1.01 Office | NO (-40%) | NO |
| B.1.02 Office | NO (-70%) | NO |
| B.1.03 Activity Room | NO (-67%) | NO |
| B.1.04 Activity Room | NO (-87%) | NO |
| B.2.01 Activity Room | NO (-72%) | NO |
| B.2.02 Activity Room | NO (-66%) | NO |
| B.2.03 Activity Room | NO (-69%) | NO |
| B.2.04 Activity Room | NO (-81%) | NO |
| B.2.05 Office | NO (-55%) | NO |
| B.3.01 Activity Space | NO (-68%) | NO |
| B.3.03 Office | NO (-74%) | NO |
| B.3.04 1 to 1 | NO (-68%) | NO |
| B.3.05 Large 1 to 1 | NO (-75%) | NO |
| B.3.06 Recording Studio | N/A | N/A |
| B.3.07 Open Plan Classroom | NO (-65%) | NO |
| B.3.02 Juice Bar - Seating area | NO (-88%) | NO |
| Hall B | NO (-30%) | 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? | YES |

# Technical Data Sheet (Actual vs. Notional Building)

## Building Global Parameters

| | Actual | Notional |
|---|---|---|
| Area [m$^2$] | 1559 | 1559 |
| External area [m$^2$] | 2814 | 2814 |
| Weather | LON | LON |
| Infiltration [m$^3$/hm$^2$@ 50Pa] | 3 | 4 |
| Average conductance [W/K] | 818 | 1144 |
| Average U-value [W/m$^2$K] | 0.29 | 0.41 |
| Alpha value* [%] | 20.8 | 20.8 |

* 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 |
| **97** | **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 |
| **3** | **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 | 11.37 | 16.59 |
| Cooling | 0.16 | 0.28 |
| Auxiliary | 2.01 | 2.18 |
| Lighting | 14.25 | 16.28 |
| Hot water | 51.22 | 41.4 |
| Equipment* | 17.02 | 17.02 |
| **TOTAL**** | **66.91** | **76.73** |

* 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 | 2.87 | 0 |
| Wind turbines | 0 | 0 |
| CHP generators | 12.1 | 0 |
| Solar thermal systems | 0 | 0 |

## Energy & $CO_2$ Emissions Summary

| | Actual | Notional |
|---|---|---|
| Heating + cooling demand [MJ/m$^2$] | 31.03 | 56.16 |
| Primary energy* [kWh/m$^2$] | 89.64 | 126.92 |
| Total emissions [kg/m$^2$] | 14.3 | 22 |

* 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] LTHW boiler, [HFT] Electricity, [CFT] Electricity | | | | | | | | | |
| Actual | 0.4 | 98 | 0 | 5 | 22.7 | 4.7 | 5.44 | 4.7 | 5.44 |
| Notional | 6.9 | 110.7 | 0.8 | 8.5 | 27.3 | 2.43 | 3.6 | ---- | ---- |
| [ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | |
| Actual | 46.7 | 0 | 20.2 | 0 | 1.1 | 0.64 | 0 | 0.68 | 0 |
| Notional | 109.4 | 0 | 37.1 | 0 | 1 | 0.82 | 0 | ---- | ---- |
| [ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | |
| Actual | 25.7 | 0 | 11.1 | 0 | 1 | 0.64 | 0 | 0.68 | 0 |
| Notional | 42.8 | 0 | 14.2 | 0 | 0.8 | 0.84 | 0 | ---- | ---- |
| [ST] Split or multi-split system, [HS] Heat pump (electric): air source, [HFT] Electricity, [CFT] Electricity | | | | | | | | | |
| Actual | 0 | 0 | 0 | 0 | 3.6 | 0 | 0 | 0 | 0 |
| Notional | 11 | 0 | 1.3 | 0 | 2.1 | 2.43 | 0 | ---- | ---- |
| [ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | |
| Actual | 42.3 | 0 | 18.3 | 0 | 2.8 | 0.64 | 0 | 0.68 | 0 |
| Notional | 23.8 | 0 | 8.1 | 0 | 6.1 | 0.82 | 0 | ---- | ---- |
| [ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | |
| Actual | 0 | 0 | 0 | 0 | 4.7 | 0.64 | 0 | 0.68 | 0 |
| Notional | 0 | 0 | 0 | 0 | 6.5 | 0 | 0 | ---- | ---- |
| [ST] Central heating using water: floor heating, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | |
| Actual | 0 | 0 | 0 | 0 | 14 | 0 | 0 | 0 | 0 |
| Notional | 0 | 0 | 0 | 0 | 13.4 | 0 | 0 | ---- | ---- |
| [ST] Central heating using water: radiators, [HS] LTHW boiler, [HFT] Natural Gas, [CFT] Electricity | | | | | | | | | |
| Actual | 33.8 | 0 | 14.7 | 0 | 9.1 | 0.64 | 0 | 0.68 | 0 |
| Notional | 67.2 | 0 | 22.8 | 0 | 13 | 0.82 | 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 | $U_{i-Typ}$ | $U_{i-Min}$ | Surface where the minimum value occurs* |
|---|---|---|---|
| Wall | 0.23 | 0.15 | External Wall |
| Floor | 0.2 | 0.11 | Ground Floor |
| Roof | 0.15 | 0.11 | Roof |
| Windows, roof windows, and rooflights | 1.5 | 1.4 | Curtain wall |
| Personnel doors | 1.5 | 1.56 | D14 part 1 |
| Vehicle access & similar large doors | 1.5 | - | No vehicle doors in project |
| High usage entrance doors | 1.5 | - | No high usage entrance doors in project |
| $U_{i-Typ}$ = Typical individual element U-values [W/(m²K)] | | $U_{i-Min}$ = 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 | 3 |

# APPENDIX D – TM52 & TM59 RESULTS

Document

# A Study of Residential Overheating Risk (TM59)

Project

## Highgate Newtown Residential and Community Centre Redevelopment

Client

## London Borough of Camden

Date

## January 2019


Contact

Giuseppe Siracusa

gsiracusa@mcbains.co.uk

020 7786 7900

5th Fl, 26 Finsbury Square

London EC2A 1DS

+44 (0)20 7786 7900

mcbains.co.uk


McBains

| DOCUMENT REFERENCE | | | | | | | | STATUS | |
|---|---|---|---|---|---|---|---|---|---|
| 59776 | HNCC | MCB | XX | XX | RP | V | 0003 | S2 | P1 |
| MCB NO. | PROJ. IDEN | ORIGINATOR | ZONE | LEVEL | TYPE | DISCIPLINE | NUMBER | SUITABILITY | REVISION |

# DOCUMENT LOCATION

Ensure that this document is current. Printed documents and locally copied files may become obsolete due to changes to the master document.

The source of the master document can be found on the following:

HNCC-MCB-XX-XX-RP-V-0003-S2-P1.1 - TM59 Report.docx

# REVISION HISTORY

| Suitability | Revision | Version Date | Summary of Changes | Changes marked |
|---|---|---|---|---|
| D5 | P3 | 29-01-2019 | Original issue | |
| | | | | |

# DISTRIBUTION

This document has been distributed to:

| Name | Company |
|---|---|
| Lewis Westhoff | Iceni |
| | |

# APPROVALS

This document requires the following approvals:

| Name | Title |
|---|---|
| Rolfe Jackson | Director |
| | |

# CONTENTS

**ITEM DESCRIPTION** **PAGE**

# 1.0 TM59 METHODOLOGY

TM59 aims to provide a standardised approach to predicting overheating risk for residential building designs using dynamic thermal analysis. The aim is to produce a test that encourages good design that is comfortable within sensible limits, without being so stringent that it over promotes the use of mechanical cooling.

The assessment should follow the following steps:

- A suitable sample of units within a development should be selected
- All sample units should be zoned into the separate rooms including kitchens, living rooms, bedrooms, bathrooms and halls
- Building constructions should be modelled as proposed, accurately reflecting thermal properties such as thermal mass, insulation and solar transmittance for glazing
- Standard profiles should be applied for occupancy, lighting and equipment gains
- Guidance on the treatment of communal corridors from section 3.8 of the TM59 guide should be followed
- Pipework and equipment, e.g. heat interface unit gains from community heating systems, should follow the guidance given in section 3.9 of the TM59 guide
- Openable windows should be included in the model and follow the guidance given in section 3.3 of the TM59 guide
- Any internal or external shading provision should be included in the model and follow the guidance included in section 3.7 of the TM59 guide
- Additional mechanical ventilation including mechanical ventilation with heat recovery (MVHR) or extract systems should be included in the model and follow the guidance given in section 3.5 of the TM59 guide
- Air speed assumptions should be based on the guidance given in section 3.6 of the TM59 guide
- The weather file used for the methodology should be the DSY1 (Design Summer Year) file most appropriate for the site location for the 2020s, high emissions, 50% percentile scenario; see section 3.2 of the TM59 guide

1. The assessment should be undertaken using hourly dynamic simulation modelling, which includes all the relevant features of the building. For homes which are predominantly naturally ventilated: compliance is based on passing *both* of the following two criteria, the first of which is taken from CIBSE TM52 Criterion 1:

a) *For living rooms, kitchens and bedrooms*: the number of hours during which ΔT is greater than or equal to one degree (K) during the period May to September inclusive shall not be more than 3% of occupied hours. (CIBSE TM52 Criterion 1: *Hours of exceedance*).
b) *For bedrooms only*: to guarantee comfort during the sleeping hours the operative temperature in the bedroom from 10pm to 7am shall not exceed 26 °C for more than 1% of annual hours. (*Note*: 1% of the annual hours between 22:00 and 07:00 for bedrooms is 32 hours, so 33 or more hours above 26 °C will be recorded as a fail).

Criteria 2 and 3 of CIBSE TM52 may fail to be met, but both a) and b) above *must* be passed for all relevant rooms.

**For homes predominantly mechanically ventilated:** the CIBSE fixed temperature test must be followed, i.e. all occupied rooms should not exceed an operative temperature of 26 °C for more than 3% of the annual occupied annual hours (CIBSE Guide A (2015a)).

The following three criteria, taken together, provide a robust yet balanced assessment of the risk of overheating of buildings in the UK and Europe. A room or building that fails any two of the three criteria is classed as overheating.

TM52 Criterion definitions:

Criterion 1: Hours of exceedance (H e)
Sets a limit for the number of hours that the operative temperature can exceed the threshold comfort temperature (upper limit of the range of comfort temperature) by 1 K or more during the occupied hours of a typical non-heating season (1 May to 30 September).

Criterion 2: Daily weighted exceedance (W e)
Deals with the severity of overheating within any one day, which can be as important as its frequency, the level of which is a function of both temperature rise and its duration. This criterion sets a daily limit for acceptability.

Criterion 3: Upper limit temperature (T upp)
Sets an absolute maximum daily temperature for a room, beyond which the level of overheating is unacceptable

It is recommended that TM52 and TM59 guides are read in conjunction with this report for calculation methodology and further clarification. A dynamic thermal model of the building has been created using Tas software, which has been used to assess the dynamic response of the building. The simulation uses hourly time steps and covers the whole year, with the period of assessment from 1st May to 30th September.

# 2.0 INPUT DATA AND ASSUMPTIONS

## 2.1 Overview

This report assesses the two flat blocks (blocks A&D) and the house block (block C).

Assessments have been carried out using the London 2020s, high emissions, 50th percentile DSY1 scenario as outlined in the TM59. We have also included results for the London 2020s, high emissions, 50th percentile DSY2 & DSY3 weather files.

The London 2050s, high emissions, 50th percentile DSY1 future weather file has not yet been run.

The majority of bedrooms are double bedrooms and this is denoted in the zone reference as "dbed", the single bedrooms are labelled as "sbed".

The zone labels have been set as follows: 'room usage. Number of bedrooms [Block(Flat number) floor]'. For example the space liv/kit.2 [A6 2F] is a living and kitchen space in a 2 bedroom flat on the 2F of block A, this is also the 6th flat in the zoning system.

For the location of zones please see floor plans the appendices.

## 2.2 Constructions

Construction Information & U values have been provided by the client and are as follows:

**External Wall Block A, U Value = 0.15 W/m²K**

| Layer | M-Code | Width (mm) | Conductivity (W/m.K) | Density (kg/m³) | Specific Heat (J/kg.K) | Description |
|---|---|---|---|---|---|---|
| Inner | am1plast\1 | 26.0 | 0.079 | 400 | 837 | LIGHTWEIGHT PLASTER 1 *4 |
| 2 | am1ins\2 | 100.0 | 0.035 | 25 | 1000 | GLASS FIBRE 2 *3 |
| 3 | Cement particleboard | 13.0 | 0.230 | 1200 | 1500 | Cement particle board |
| 4 | am1ins\2 | 100.0 | 0.035 | 25 | 1000 | GLASS FIBRE 2 *3 |
| 5 | am1cav\5 | 50.0 | 0.000 | 0 | 0 | 50MM AIR (HORIZONTAL FLOW - OP |
| 6 | am1brick\1 | 102.0 | 0.700 | 1700 | 800 | BRICKWORK *4 |

**External Wall Block C, U Value = 0.15 W/m²K**

| Layer | M-Code | Width (mm) | Conductivity (W/m.K) | Density (kg/m³) | Specific Heat (J/kg.K) | Description |
|---|---|---|---|---|---|---|
| Inner | am1plast\1 | 26.0 | 0.079 | 400 | 837 | LIGHTWEIGHT PLASTER 1 *4 |
| 2 | am1cav\5 | 50.0 | 0.000 | 0 | 0 | 50MM AIR (HORIZONTAL FLOW - OP |
| 3 | am1ins\2 | 115.0 | 0.022 | 25 | 1000 | GLASS FIBRE 2 *3 |
| 4 | am1brick\1 | 300.0 | 0.700 | 1700 | 800 | BRICKWORK *4 |

**External Wall Block D, U Value = 0.15 W/m²K**

| Layer | M-Code | Width (mm) | Conductivity (W/m.K) | Density (kg/m$^3$) | Specific Heat (J/kg.K) | Description |
|---|---|---|---|---|---|---|
| Inner | am1plast\1 | 26.0 | 0.079 | 400 | 837 | LIGHTWEIGHT PLASTER 1 *4 |
| 2 | am1block\1 | 140.0 | 0.317 | 1040 | 1050 | FOAMED SLAG CONC. PARTITION BL |
| 3 | am1ins\2 | 115.0 | 0.022 | 25 | 1000 | GLASS FIBRE 2 *3 |
| 4 | am1cav\5 | 50.0 | 0.000 | 0 | 0 | 50MM AIR (HORIZONTAL FLOW - OP |
| 5 | am1brick\1 | 102.0 | 0.700 | 1700 | 800 | BRICKWORK *4 |

**Ground Floor Block A = 0.11 W/m²K**

| Layer | M-Code | Width (mm) | Conductivity (W/m.K) | Density (kg/m$^3$) | Specific Heat (J/kg.K) | Description |
|---|---|---|---|---|---|---|
| Inner | am1fin\3 | 3.0 | 0.060 | 186 | 1360 | CARPET *2 |
| 2 | Screed | 50.0 | 1.150 | 1800 | 1000 | |
| 3 | Insulation 5 | 175.0 | 0.021 | 20 | 1030 | |
| 4 | Reinforced concrete | 250.0 | 2.300 | 2300 | 1000 | |
| 5 | Notional/Reference Soil* | 1000.0 | 1.500 | 1250 | 2500 | |

**Notional/Reference Soil Not included in U value Calc.*

**Ground Floor Block C = 0.13 W/m²K**

| Layer | M-Code | Width (mm) | Conductivity (W/m.K) | Density (kg/m$^3$) | Specific Heat (J/kg.K) | Description |
|---|---|---|---|---|---|---|
| Inner | am1fin\3 | 3.0 | 0.060 | 186 | 1360 | CARPET *2 |
| 2 | Screed | 50.0 | 1.150 | 1800 | 1000 | |
| 3 | Insulation 5 | 155.0 | 0.021 | 20 | 1030 | |
| 4 | Reinforced concrete | 200.0 | 2.300 | 2300 | 1000 | |
| 5 | Notional/Reference Soil* | 1000.0 | 1.500 | 1250 | 2500 | |

**Notional/Reference Soil Not included in U value Calc.*

### Ground Floor Block D = 0.11 W/m²K

| Layer | M-Code | Width (mm) | Conductivity (W/m.K) | Density (kg/m³) | Specific Heat (J/kg.K) | Description |
|---|---|---|---|---|---|---|
| Inner | am1fin\3 | 3.0 | 0.060 | 186 | 1360 | CARPET *2 |
| 2 | Screed | 50.0 | 1.150 | 1800 | 1000 | |
| 3 | Insulation 5 | 180.0 | 0.023 | 20 | 1030 | |
| 4 | am1block\1 | 140.0 | 0.317 | 1040 | 1050 | FOAMED SLAG CONC. PARTITION BL |
| 5 | Notional/Reference Soil* | 1000.0 | 1.500 | 1250 | 2500 | |

**Notional/Reference Soil Not included in U value Calc.*

### Flat Concrete Roof, U Value = 0.11 W/m²K

| Layer | M-Code | Width (mm) | Conductivity (W/m.K) | Density (kg/m³) | Specific Heat (J/kg.K) | Description |
|---|---|---|---|---|---|---|
| Inner | Plasterboard | 12.5 | 0.210 | 700 | 1000 | |
| 2 | am1cav\15 | 100.0 | 0.000 | 0 | 0 | 100MM AIR (UPWARD FLOW - OPAQU |
| 3 | Concrete Deck | 250.0 | 2.000 | 2400 | 1000 | |
| 4 | Insulation 1 | 168.0 | 0.021 | 40 | 1450 | |
| 5 | membrane | 10.0 | 1.000 | 1100 | 1000 | |
| 6 | am1soil\1 | 200.0 | 0.700 | 1280 | 1840 | CLAY 1 (DARK) *2 |

### Pitched House Roof, U Value = 0.11 W/m²K

| Layer | M-Code | Width (mm) | Conductivity (W/m.K) | Density (kg/m³) | Specific Heat (J/kg.K) | Description |
|---|---|---|---|---|---|---|
| Inner | Plasterboard | 12.5 | 0.210 | 700 | 1000 | |
| 2 | am1cav\16 | 200.0 | 0.000 | 0 | 0 | 200MM AIR (UPWARD FLOW - OPAQU |
| 3 | am1ins\1 | 175.0 | 0.021 | 12 | 833 | GLASS FIBRE 1 *3 |
| 4 | am1asph\9 | 3.0 | 0.410 | 960 | 1000 | ROOFING FELT 1 *2 |
| 5 | am1tile\10 | 5.0 | 2.000 | 2700 | 753 | SLATE, GREY *4 |

### Internal Floor Blocks A & C, U Value = 0.53 W/m²K

| Layer | M-Code | Width (mm) | Conductivity (W/m.K) | Density (kg/m³) | Specific Heat (J/kg.K) | Description |
|---|---|---|---|---|---|---|
| Inner | Plasterboard | 12.5 | 0.210 | 700 | 1000 | |
| 2 | am1cav\15 | 100.0 | 0.000 | 0 | 0 | 100MM AIR (UPWARD FLOW - OPAQU |
| 3 | Reinforced concrete | 250.0 | 2.300 | 2300 | 1000 | |
| 4 | Insulation 1 | 25.0 | 0.021 | 40 | 1450 | |
| 5 | Screed | 50.0 | 1.150 | 1800 | 1000 | |
| 6 | am1fin\3 | 4.0 | 0.060 | 186 | 1360 | CARPET *2 |

### Internal Floor Block D, U Value = 0.11 W/m²K

| Layer | M-Code | Width (mm) | Conductivity (W/m.K) | Density (kg/m³) | Specific Heat (J/kg.K) | Description |
|---|---|---|---|---|---|---|
| Inner | Plasterboard | 12.5 | 0.210 | 700 | 1000 | |
| 2 | am1cav\15 | 100.0 | 0.000 | 0 | 0 | 100MM AIR (UPWARD FLOW - OPAQU |
| 3 | Reinforced concrete | 250.0 | 2.300 | 2300 | 1000 | |
| 4 | Insulation 1 | 170.0 | 0.021 | 40 | 1450 | |
| 5 | Screed | 50.0 | 1.150 | 1800 | 1000 | |
| 6 | am1fin\3 | 4.0 | 0.060 | 186 | 1360 | CARPET *2 |

### Stud Internal Wall (for internal walls within dwellings) Blocks A & D, U Value = 0.77 W/m²K

| Layer | M-Code | Width (mm) | Conductivity (W/m.K) | Density (kg/m³) | Specific Heat (J/kg.K) | Description |
|---|---|---|---|---|---|---|
| Inner | Plasterboard | 25.0 | 0.210 | 700 | 1000 | |
| 2 | Air, 50mm wall | 50.0 | 0.010 | 0 | 0 | Horizontal flow |
| 3 | am1ins\1 | 25.0 | 0.040 | 12 | 833 | GLASS FIBRE 1 *3 |
| 4 | Plasterboard | 25.0 | 0.210 | 700 | 1000 | |

### Stud Internal Wall (for internal walls within dwellings) Block C, U Value = 0.31 W/m²K

| Layer | M-Code | Width (mm) | Conductivity (W/m.K) | Density (kg/m³) | Specific Heat (J/kg.K) | Description |
|---|---|---|---|---|---|---|
| Inner | Plasterboard | 25.0 | 0.210 | 700 | 1000 | |
| 2 | Air, 50mm wall | 50.0 | 0.010 | 0 | 0 | Horizontal flow |
| 3 | am1ins\1 | 100.0 | 0.040 | 12 | 833 | GLASS FIBRE 1 *3 |
| 4 | Plasterboard | 25.0 | 0.210 | 700 | 1000 | |

**Block Internal Wall (for internal walls between 2 dwellings or between dwellings and communal corridors), U Value = 0.29 W/m²K**

| Layer | M-Code | Width (mm) | Conductivity (W/m.K) | Density (kg/m³) | Specific Heat (J/kg.K) | Description |
|---|---|---|---|---|---|---|
| Inner | am1plast\1 | 26.0 | 0.079 | 400 | 837 | LIGHTWEIGHT PLASTER 1 *4 |
| 2 | am1block\1 | 100.0 | 0.317 | 1040 | 1050 | FOAMED SLAG CONC. PARTITION BL |
| 3 | am1ins\1 | 75.0 | 0.040 | 12 | 833 | GLASS FIBRE 1 *3 |
| 4 | am1block\1 | 100.0 | 0.317 | 1040 | 1050 | FOAMED SLAG CONC. PARTITION BL |
| 5 | am1plast\1 | 26.0 | 0.079 | 400 | 837 | LIGHTWEIGHT PLASTER 1 *4 |

**Opaque Doors U Values = 2.18 W/m²K**

| Layer | M-Code | Width (mm) | Conductivity (W/m.K) | Density (kg/m³) | Specific Heat (J/kg.K) | Description |
|---|---|---|---|---|---|---|
| Inner | Hardwood | 52.0 | 0.180 | 2100 | 1000 | |

***Glazing:***

**All Glazing:**

| Glazing, U = 1.4 Wm2K | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Light | | Solar Energy (EN410) | | | | Pilkington Shading Coefficients | | |
| Transmittance | Reflectance | Direct Transmittance | Direct Reflectance | Direct Absorptance | Total Transmittance (G-Value) | Short Wavelength | Long Wavelength | Total |
| 0.42 | 0.06 | 0.27 | 0.09 | 0.64 | 0.37 | 0.31 | 0.11 | 0.43 |

No blinds have been modelled at this stage.

All frames have a U value of 2.20 W/m²K

## 2.3 Internal Gains

Occupancy and equipment gains have been modelled as outlined in table 1 found at the end of this section of the report below, this table has been taken directly from TM59. Corridors and WCs have been modelled with no occupancy or equipment gains.

In line with TM59, lighting is modelled as on from 6pm to 11pm every day at a value of 2.0 W/m$^2$ in bedrooms and living rooms/kitchens, WCs and corridors.

Infiltration has been modelled as 0.15ach for all spaces.

No heating has been modelled through the summer period.

Each flat has a heat interface unit in the dwelling corridor, this has been modelled as 39W equipment gains in each flat corridor space, the studio flat has this gain modelled in the living space as it does not have a corridor.

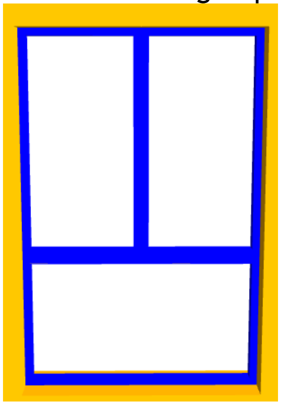
## 2.4 Natural Ventilation

A number of windows have been modelled as openable, they have been modelled with a maximum openable areas depending on the window type (more information on this has been given below) and begin to open when the adjacent space reaches 21°C and are fully open when this spaces reaches 22°C. Windows have been modelled as open when the adjacent space is occupied, this means bedroom windows are always openable and living room/bathroom windows are openable from 9am-10pm. The exception to this is GF bedrooms which have windows modelled as openable from 9am-10pm for security reasons.

Internal doors have been modelled as fully open during waking hours (this has been taken to be 8am-11pm).

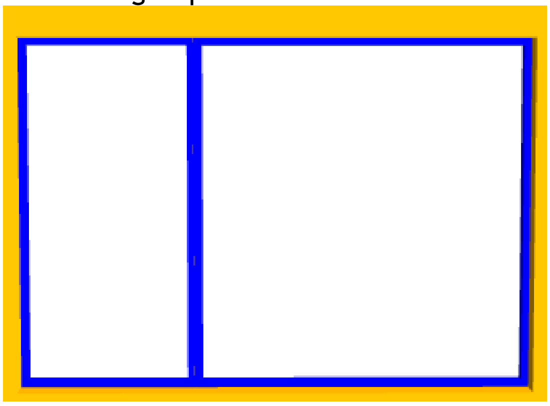
The following windows groups have been modelled as openable in the TM59 assessment:

Flat 3 window group:



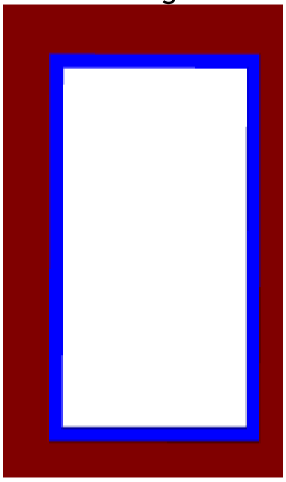
The top 2 windows have been modelled with a maximum openable proportion of 100%, the bottom window has not been modelled as openable.

Flat door group:



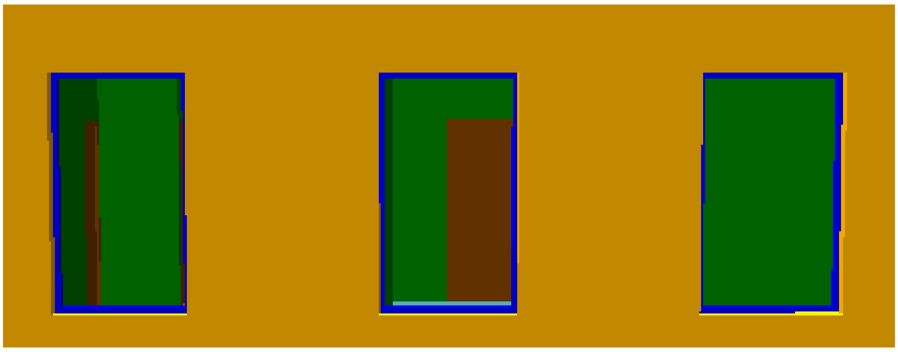
The smaller door has been modelled as fully openable, the larger pane has been not been modelled as openable.

House rooflight window:



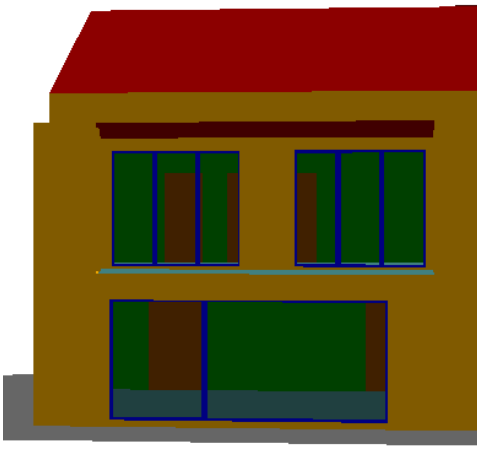
The 1F rooflight windows in the house have been modelled with a maximum openable proportion of 100%.

The 1F House bedroom/corridor windows:



These have been modelled with a maximum openable proportion of 100%.

House Doors:



For the GF the smaller pane has been modelled as fully openable, for the 1F one pane has been modelled as fully openable.

### 2.5 Mechanical ventilation

Living and kitchen and bedroom spaces have 6l/s of air mechanically extracted overnight. Makeup air is assumed to be at outside air conditions. This has been modelled 24/7.

No further mechanical ventilation has been included.

### 2.6 Comfort Cooling

No comfort cooling has been modelled.

### 2.7 Blinds

No blinds have been included in the assessment.

### 2.8 Shading

Only the adjacent buildings have been included as shade buildings.

## Table 1 - Dwelling occupancy and equipment gain

| Unit/ room type | Occupancy | Equipment load |
|---|---|---|
| Studio | 2 people at 70% gains from 11 pm to 8 am<br>2 people at 100% gains from 8 am to 11 pm | Peak load of 450 W from 6 pm to 8 pm*.<br>200 W from 8 pm to 10 pm<br>110 W from 9 am to 6 pm and 10 pm to 12 pm<br>Base load of 85 W for the rest of the day |
| 1-bedroom apartment: living room/kitchen | 1 person from 9 am to 10 pm; room is unoccupied for the rest of the day | Peak load of 450 W from 6 pm to 8 pm<br>200 W from 8 pm to 10 pm<br>110 W from 9 am to 6 pm and from 10 pm to 12 pm<br>Base load of 85 W for the rest of the day |
| 1-bedroom apartment: living room | 1 person at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day | Peak load of 150 W from 6 pm to 10 pm<br>60 W from 9 am to 6 pm and from 10 pm to 12 pm<br>Base load of 35 W for the rest of the day |
| 1-bedroom apartment: kitchen | 1 person at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day | Peak load of 300 W from 6 pm to 8 pm<br>Base load of 50 W for the rest of the day |
| 2-bedroom apartment: living room/kitchen | 2 people from 9 am to 10 pm; room is unoccupied for the rest of the day | Peak load of 450 W from 6 pm to 8 pm<br>200 W from 8 pm to 10 pm<br>110 W from 9 am to 6 pm and from 10 pm to 12 pm<br>Base load of 85 W for the rest of the day |
| 2-bedroom apartment: living room | 2 people at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day | Peak load of 150 W from 6 pm to 10 pm<br>60 W from 9 am to 6 pm and from 10 pm to 12 pm<br>Base load of 35 W for the rest of the day |
| 2-bedroom apartment: kitchen | 2 people at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day | Peak load of 300 W from 6 pm to 8 pm<br>Base load of 50 W for the rest of the day |
| 3-bedroom apartment: living room/kitchen | 3 people from 9 am to 10 pm; room is unoccupied for the rest of the day | Peak load of 450 W from 6 pm to 8 pm<br>200W from 8 pm to 10 pm<br>110 W from 9 am to 6 pm and from 10 pm to 12 pm<br>Base load of 85 W for the rest of the day |
| 3-bedroom apartment: living room | 3 people at 75% gains from 9 am to 10 pm; room is unoccupied for the rest of the day | Peak load of 150 W from 6 pm to 10 pm<br>60 W from 9 am to 6 pm and from 10 pm to 12 pm<br>Base load of 35 W for the rest of the day |
| 3-bedroom apartment: kitchen | 3 people at 25% gains from 9 am to 10 pm; room is unoccupied for the rest of the day | Peak load of 300 W from 6 pm to 8 pm<br>base load of 50 W for the rest of the day |
| Double bedroom | 2 people at 70% gains from 11 pm to 8 am<br>2 people at full gains from 8 am to 9 am and from 10 pm to 11 pm<br>1 person at full gains in the bedroom from 9 am to 10 pm | Peak load of 80 W from 8 am to 11 pm<br>Base load of 10 W during the sleeping hours |
| Single bedroom (too small to accommodate double bed) | 1 person at 70% gains from 11 pm to 8 am<br>1 person at full gains from 8 am to 11 pm | Peak load of 80 W from 8 am to 11 pm<br>Base load of 10 W during sleeping hours |
| Communal corridors | Assumed to be zero | Pipework heat loss only; see section 3.1 above |

* All times in GMT

# 3.0 RESULTS

The thermal comfort category used is category II, in accordance with the CIBSE TM59 guidance.

Results for the weather files used can be as outlined found below

| Result | Weather file (London Heathrow) |
|---|---|
| 3.1 | DSY1 2020 high emission 50percentile |
| 3.2 | DSY2 2020 high emission 50percentile |
| 3.3 | DSY3 2020 high emission 50percentile |

As the building has been modelled with as naturally ventilated we have used the assessment for naturally ventilated buildings, the following criteria must be satisfied:

As there are a large number of rooms included in the analysis please see the appendices for excel files containing the results.

## 3.1 2020 High emissions, 50% percentile (DSY1) Results

Please see Appendix 2.

## 3.2 2020 High emissions, 50% percentile (DSY2) Results

Please see Appendix 3.

## 3.3 2020 High emissions, 50% percentile (DSY3) Results -

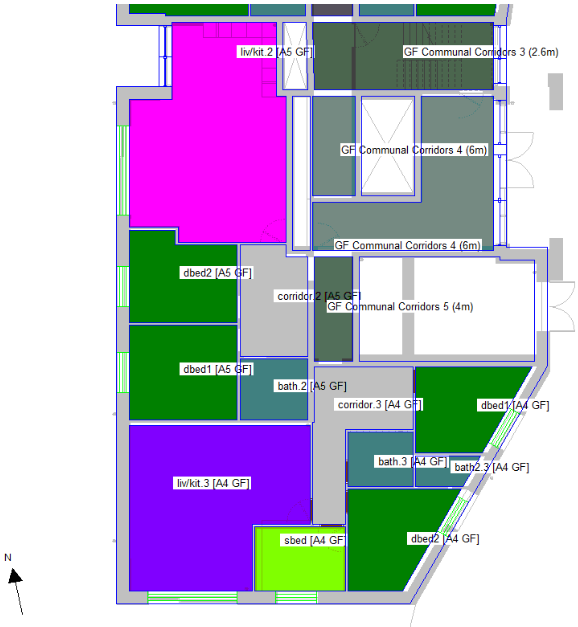
Please see Appendix 4.

.

# 4.0 APPENDICES

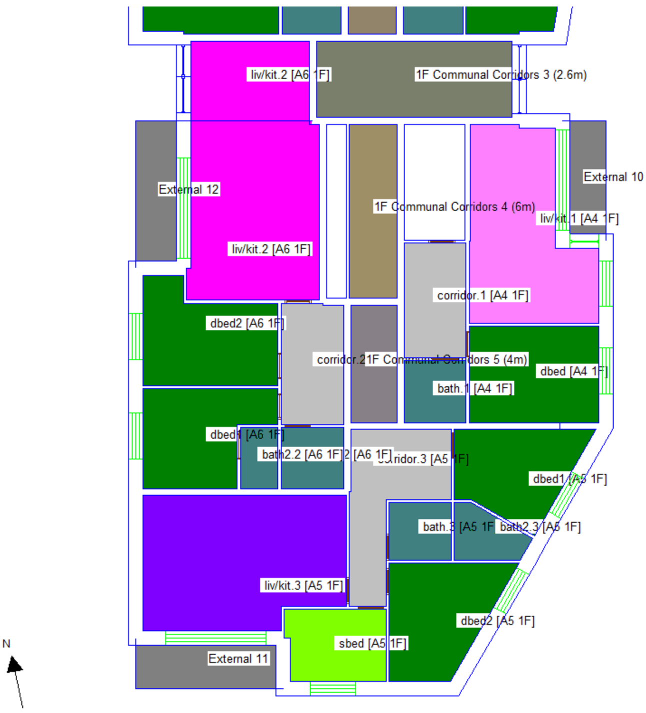
## 4.1 Floor plans from the Tas model

### Block A GF South

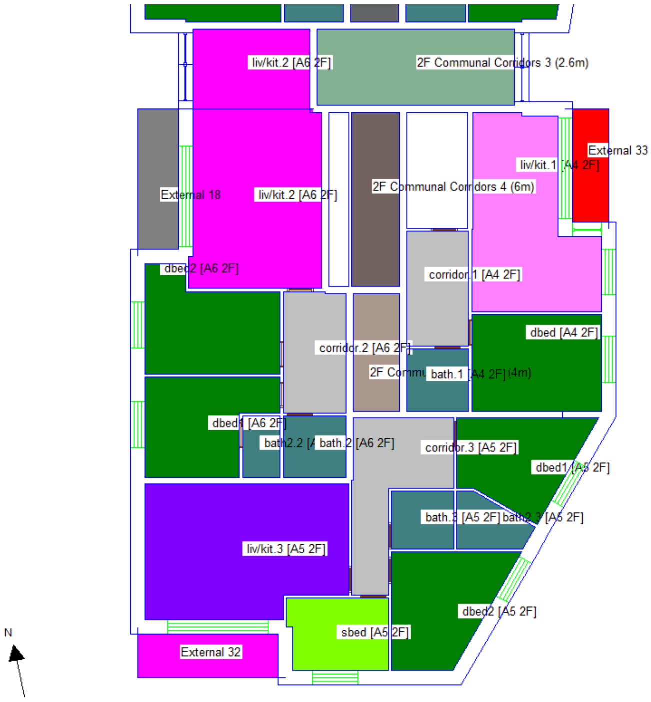



*Please note that only the coloured and labelled spaces were included in this assessment.

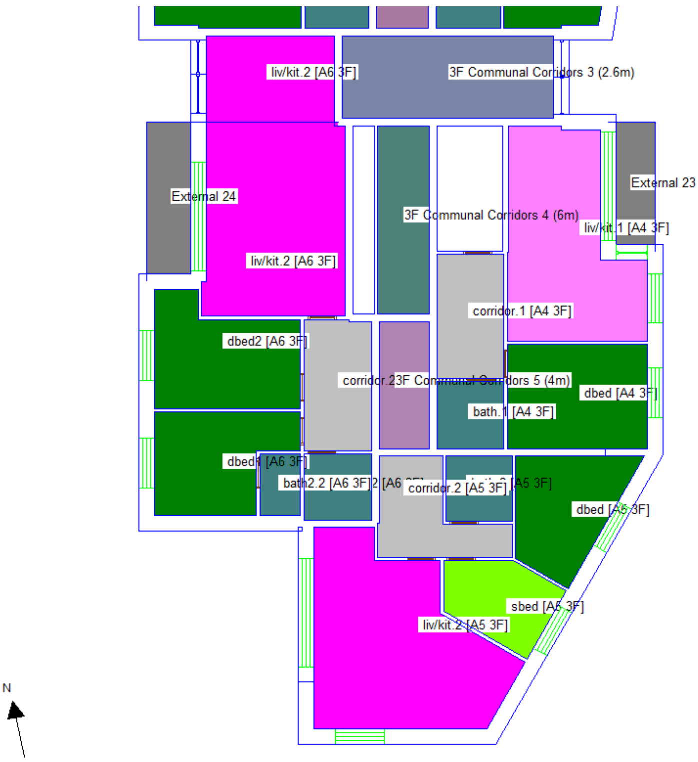
### Block A 1F South



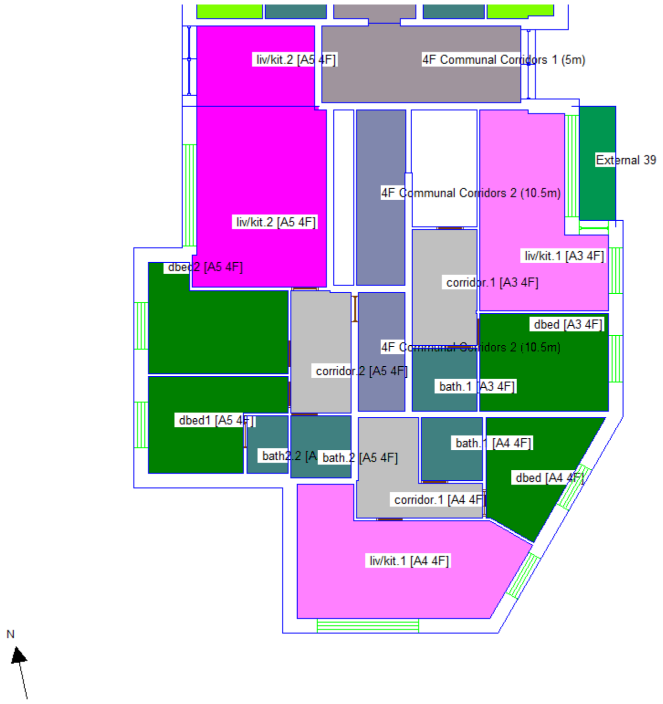
## Block A 2F South



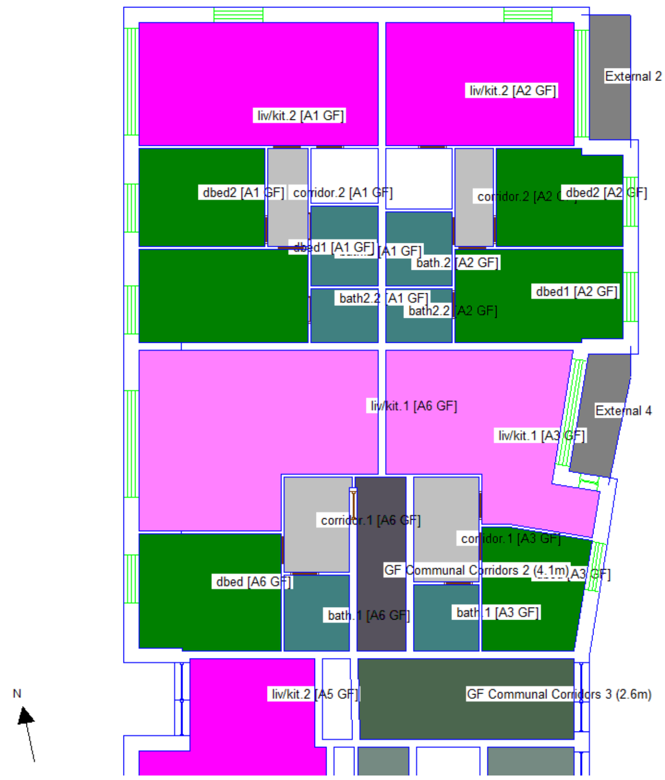

## Block A 3F South



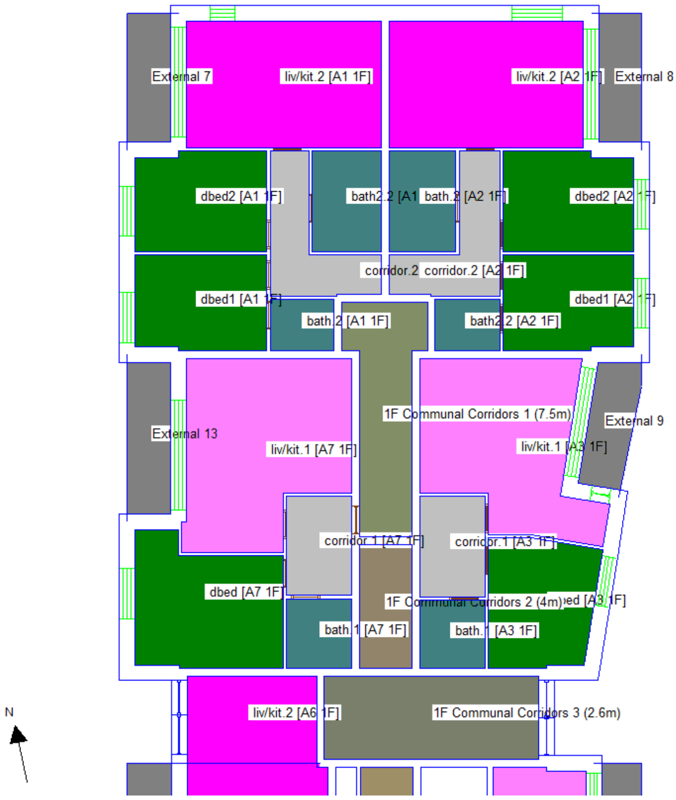
## Block A 4F South



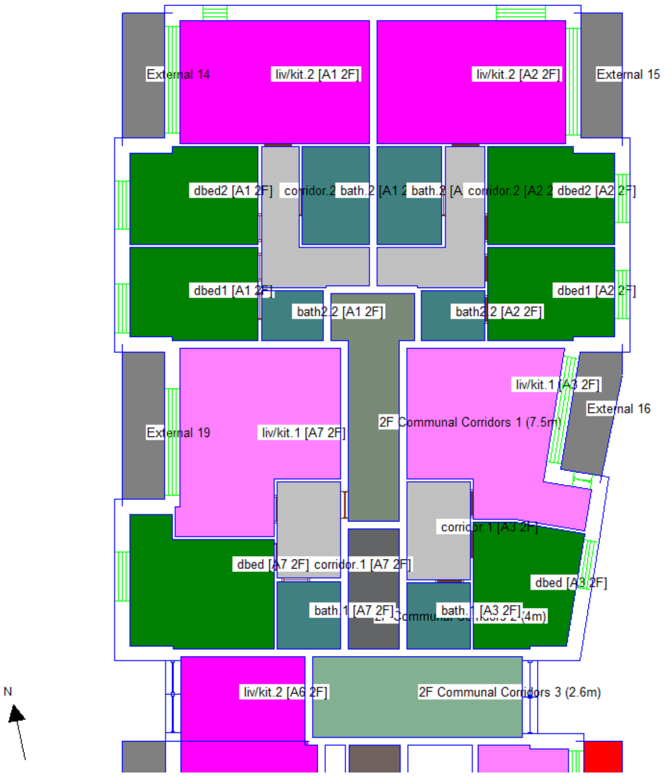

## Block A GF North



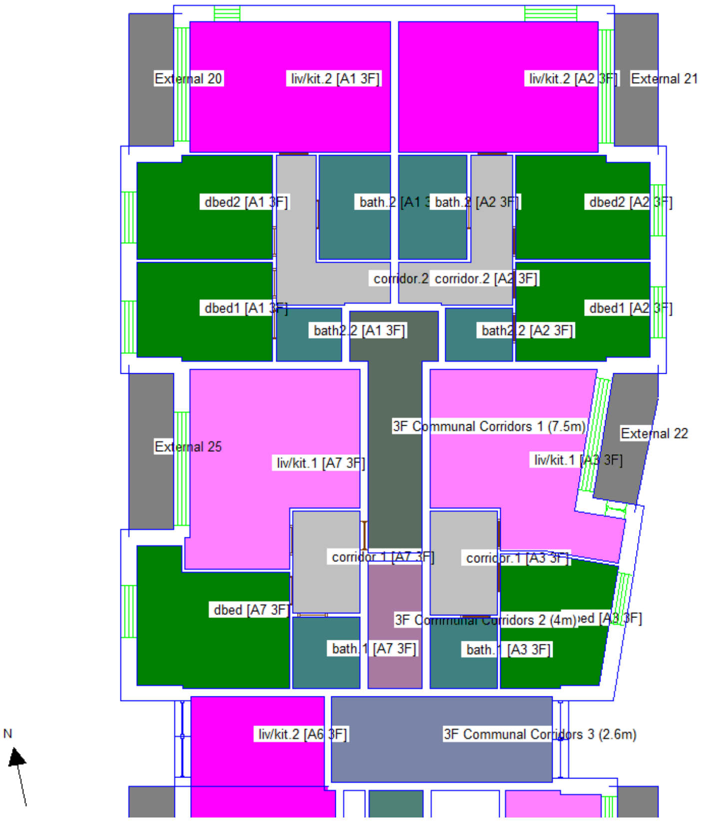
## Block A 1F North




## Block A 2F North

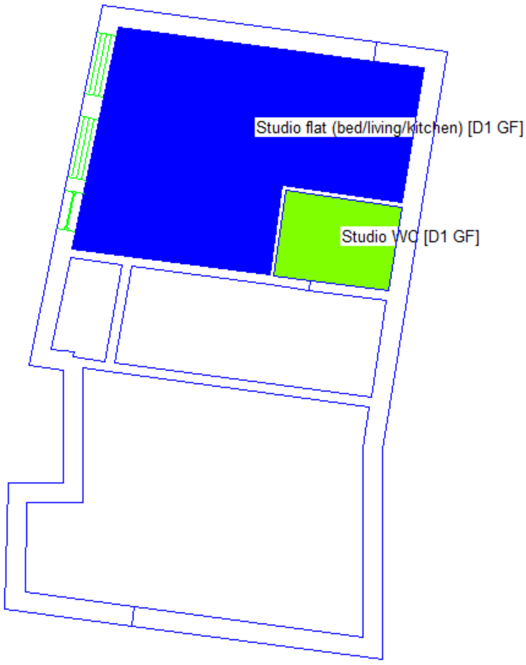


## Block A 3F North

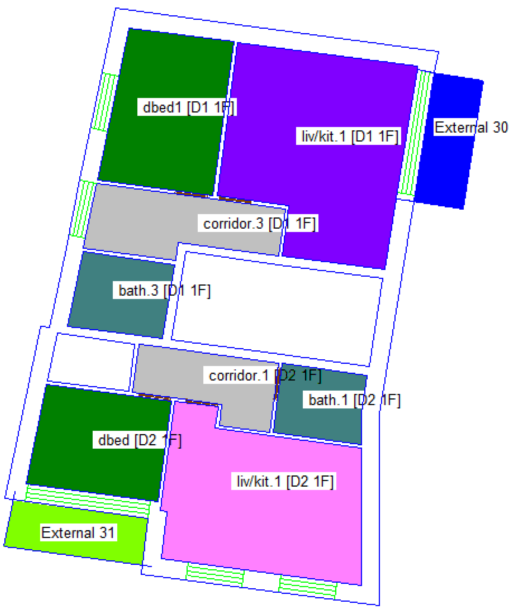



## Block A 4F North

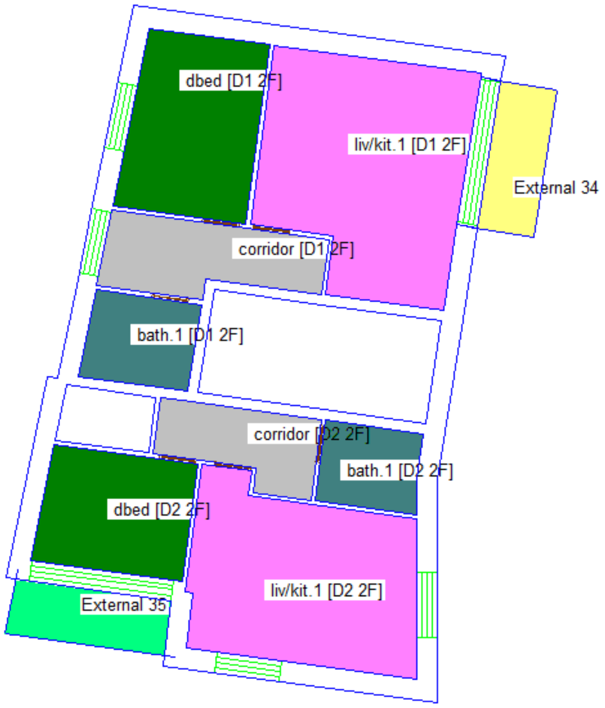
### Block D GF



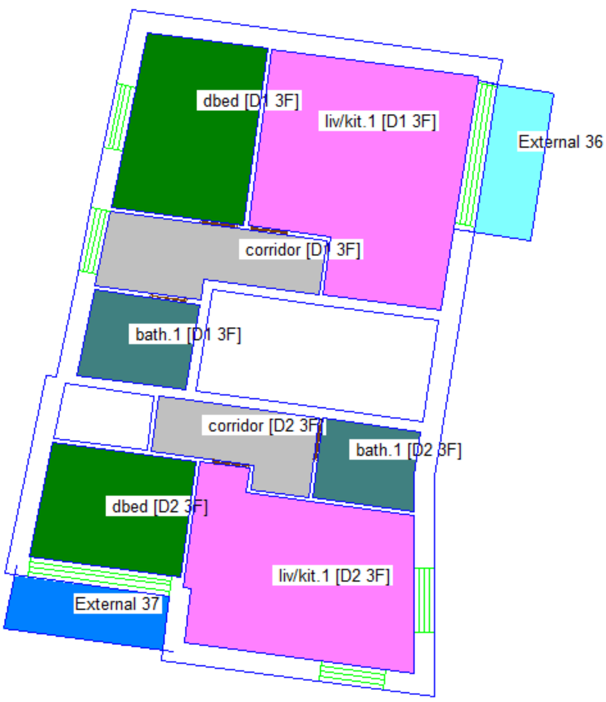

### Block D 1F



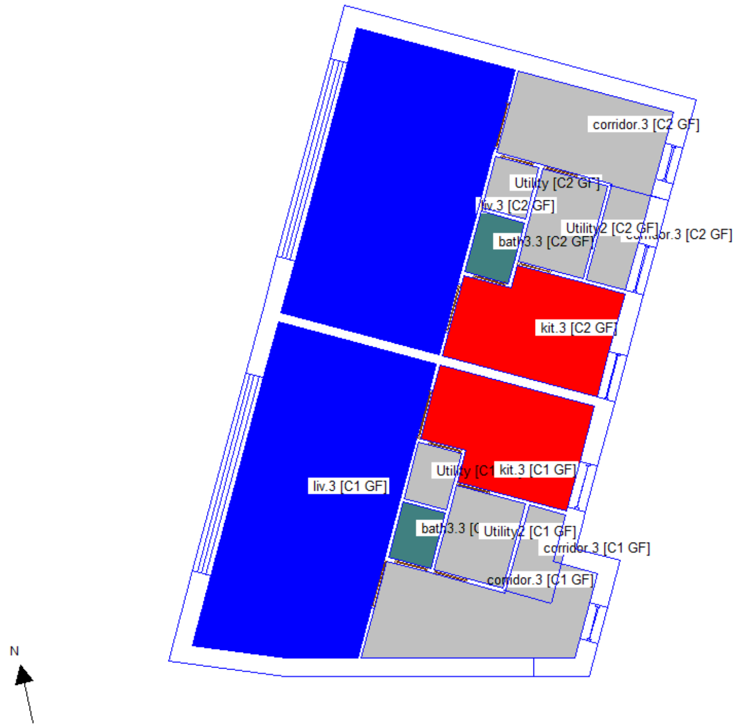
### Block D 2F



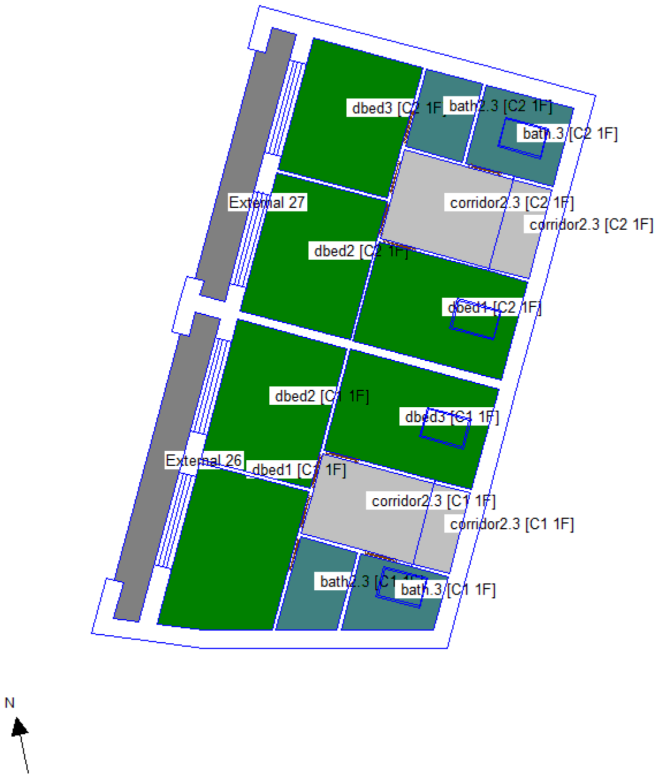

### Block D 3F



**Block C (House) GF**




**Block C (House) 1F**

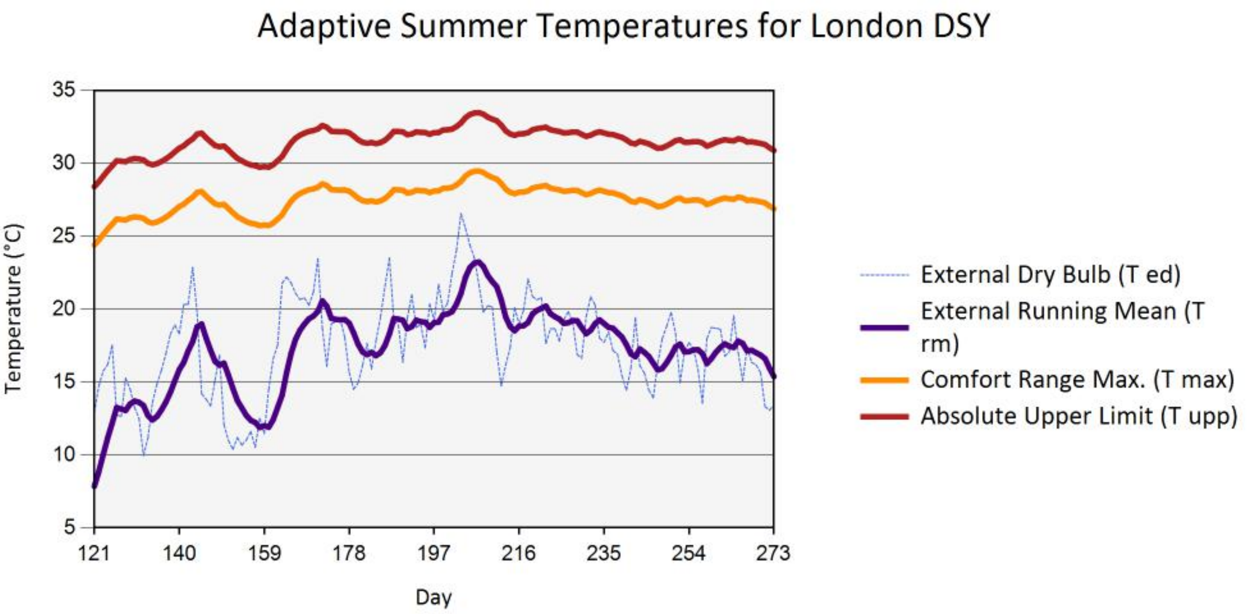


## 4.2 “TM59 DSY1 24hr vent 100% FA windows”

## 4.3 “TM59 DSY2 24hr vent 100% FA windows

## 4.4 “TM59 DSY3 24hr vent 100% FA windows”

# Adaptive Overheating Report (CIBSE TM52)




The adaptive overheating assessment tests rooms against three criteria. If a room fails any two of the three criteria then it is said to overheat.

1. The first criterion sets a limit for the number of hours that the operative temperature exceeds the comfort temperature by 1°C or more during the occupied hours over the summer period (1st May to 30th September).
2. The second criterion deals with the severity of the overheating within any one day. This sets a daily limit for acceptability.
3. The third criterion sets an absolute maximum daily temperature for the room.

## Project Details

**Building Designer File (.tbd):** highgate newtown CC - TM52.tbd

**Simulation Results File (.tsd):** highgate newtown CC - TM52.tsd

**Date:** 29 January 2019

**Building Category:** Category II

**Report Criteria:** TM52

## Results

| Zone Name | Occupied Summer Hours | Max. Exceedable Hours | Criterion 1: #Hours Exceeding Comfort Range | Criterion 2: Peak Daily Weighted Exceedance | Criterion 3: #Hours Exceeding Absolute Limit | Result |
|---|---|---|---|---|---|---|
| Hall | 1836 | 55 | 54 | 5.0 | 5 | Pass |
| B.0.01 Office | 1530 | 45 | 44 | 4.0 | 5 | Pass |
| B.0.02 Cafe Seating | 1530 | 45 | 39 | 4.0 | 5 | Pass |
| B.0.03 Seating | 1530 | 45 | 42 | 5.0 | 3 | Pass |
| B.0.04 Activity Room | 1530 | 45 | 43 | 3.0 | 2 | Pass |
| B.1.01 Office | 1530 | 45 | 39 | 5.0 | 5 | Pass |
| B.1.02 Office | 1530 | 45 | 44 | 4.0 | 4 | Pass |
| B.1.03 Activity Room | 1530 | 45 | 39 | 5.0 | 5 | Pass |
| B.1.04 Activity Room | 1530 | 45 | 44 | 5.0 | 6 | Pass |
| B.2.01 Activity Room | 1530 | 45 | 44 | 5.0 | 5 | Pass |

# Adaptive Overheating Report (CIBSE TM52)

## Results

| Zone Name | Occupied Summer Hours | Max. Exceedable Hours | Criterion 1: #Hours Exceeding Comfort Range | Criterion 2: Peak Daily Weighted Exceedance | Criterion 3: #Hours Exceeding Absolute Limit | Result |
|---|---|---|---|---|---|---|
| B.2.02 Activity Room | 1530 | 45 | 42 | 5.0 | 5 | Pass |
| B.2.03 Activity Room | 1530 | 45 | 42 | 4.0 | 6 | Pass |
| B.2.04 Activity Room | 1530 | 45 | 43 | 4.0 | 6 | Pass |
| B.2.05 Office | 1530 | 45 | 39 | 4.0 | 5 | Pass |
| B.3.01 Activity Space | 1530 | 45 | 40 | 3.0 | 4 | Pass |
| B.3.02 Juice Bar | 1530 | 45 | 40 | 4.0 | 5 | Pass |
| B.3.03 Office | 1530 | 45 | 40 | 4.0 | 5 | Pass |
| B.3.04 1 to 1 | 1530 | 45 | 40 | 4.0 | 5 | Pass |
| B.3.05 Large 1 to 1 | 1530 | 45 | 40 | 4.0 | 6 | Pass |
| B.3.07 Open Plan Classroom | 1530 | 45 | 40 | 4.0 | 6 | Pass |
| B.3.02 Juice Bar - Seating area | 1530 | 45 | 40 | 4.0 | 9 | Pass |